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STUDY AND TREATMENT OF SELECTED DECORATED SHAWL IN APPLIED ART MUSEUM, CAIRO, EGYPT

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ABSTRACT

This paper explores the deterioration aspects were found due to suffering from several degradation factors during the previous museum exhibition for an archaeological Shawl such as: the object was supported on a type of Rigid Acrylic Sheets without porous it and using old adhesives to adhere the supporting fabric from the edges. The textile is dated to the Coptic period, and was exhibited in Applied Art museum in case m.s 509. Also, treatment and conservation method have been done successfully such as old conservation repairs were removed, then the textile objects were supported by stitching on to backing linen fabric stretched on wooden frames. And the museum re-exhibition operations have been done by using a wood frame. But much deterioration, degradation aspects were investigated by using recent technologies such as scanning electron microscopy (SEM) were used to identify the kind of fibers, their condition and surface morphology. The results showed that the textile artifacts studied were very dirty, there are many separated parts, missing area, missing weft threads, separated threads, discoloration of a part of the brown waved wool, inflexibility of some warp and weft threads and yellowing of the lower part from the object. FTIR also was used to identify the kinds of dyes, and Mordant.

KEYWORDS: Degradation Factors, Deterioration, Conservation Methods, Supporting, SEM, FTIR, Surface Morphology, Mordant, Inflexibility.

1. INTRODUCTION

Out of numerous types of historical objects, textiles belong to the group of sensitive ones that react to changeable conditions. The chemical composition and structure of natural fibers is associated with poor resistance to external factors (Lech, 2015). Light, humidity and temperature, as well as the textile's history such as washing, handling, storage and display would all have to be taken into account to predict degradation (Hacke, 2006, Ahmed et al, 2011, Fanti et al, 2013). Many of the materials traditionally used to store and display works of art are harmful to organic materials such as textiles (Myers, 1993). Adhesives are approached with caution in textile conservation because unstable materials can yellow, cross-link, and become brittle or insoluble over time. The adhesives may fail, become tacky, or appear glossy over time, all of which are unacceptable when associated with an artifact, especially textiles. The requirements for adhesives used in textile conservation treatments include: chemical compatibility with the substrate; not cause visual change such as yellowing; flexibility; and resistance to aging. Even if the adhesives tend **not** to be directly applied to textile artifacts in conservation treatments. Instead, the adhesive is typically applied to a support fabric. Even so, if unsuitable adhesives and application methods are used, the support is at risk of blistering, discoloration, stiffness, and tackiness (Kata, 2013). And each chemical reaction contributes to weakening of natural fibers (Lech, 2015) and affects breakdown of the molecular structure, which in turn results in a loss of strength, extensibility and general durability, in discoloration, fading, and deformation of a textile are also investigated, since differences in stress on the threads enhance the macroscopic destruction of the textile. And affects the appearance of the material (Stolow, 1981, NPS Museum Handbook, 2002, Abdel-Kreem et al, 2005, Abdel-Kareem et al, 2008, Degano et al, 2011, Berghe, 2012). All of these Changes occur gradually over a long period of time. However, the changes have required complex treatment to deal with them (Palfreyman, 1989, Ligterink et al, 2007).

This paper introduces a method of protection of historic textile in the Applied Art Museum, Cairo, Egypt by investigation and analysis fibers and dyes to know about case of damage to be able to make a strategic plan for conservation of this historical textile which appear in removing the old treatment and supporting it on a linen fabric by using the silk threads which dyed with natural dyestuffs resembling the original historic objects.

2. DESCRIPTION AND CONDITION

2.1. *Historical Context*

The object was stored in the Applied Art Museum under no. m.s 509. It dated to Coptic period (see Fig. 1). The piece was waved with brown dyed wool and undyed linen threads.

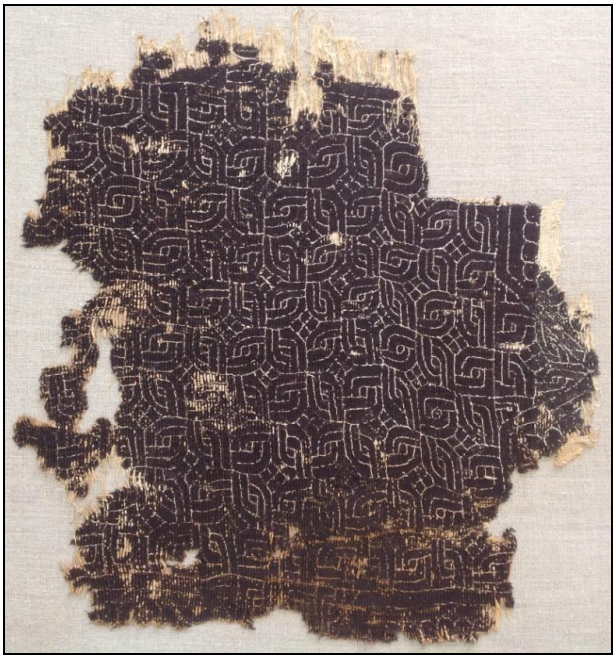


Figure 1. Textile object dates back to Coptic age.

2.2. *Technical Investigation*

This piece is very distinctive of its structure. It is a piece of a shawl, was waved with 3/3 weft rib (see Fig. 1,a) the decoration is consisting of geometric shapes decoration and overlapping together with undyed linen yarn which was embroidered with stem stitch above the brown waved wool (see Fig. 1,b). That kind of decoration led to the emergence of Alibdrchil which is the priestly uniform of priests. The number of warps and wefts in the object in 1 cm^2 is 15 yarns in the warp and 27 yarns in the weft.

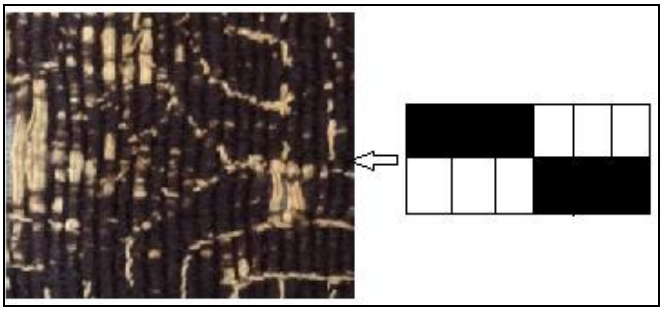


Figure 1,a.

Figure 1,b.

Figure 1,a. The piece was waved with brown dyed wool with 3/3 weft rib
Figure 1,b: the decoration is consisting of geometric shapes

2.3. *Visual Investigation*

The initial visual examinations showed the object suffered from many signs of damage (Fig. 2) such as, many separated parts, missing area, missing weft threads, separated threads, discoloration of a part of the brown waved wool, inflexibility of some warp and weft threads and yellowing of the lower part from the object (Fig. 2,a,b,c,d,e,f,g,h). There is another previous restoration such as using old adhesives to adhere the supporting fabric from the edges (Fig. 3,a) which became yellowing and very hardened (Fig. 3,b), the object was supported on a type of Rigid Acrylic Sheets without porous it (Fig. 3,c). Fibers always retain some amount of moisture in direct relation to the relative humidity and temperature of the environment. Because of this when the textile is placed on it, as glass is non-porous, non-absorbent, and quick to react to temperature changes, if the temperature decreases for a period of time, the interior humidity increases and conversely (Kajyitani et al, 1986). The absorption of moisture beyond the level of equilibrium that the manufactured textile has achieved results in dimensional change and causing some types of dyes to fade (Green, S. W.). Also one side of the Acrylic Sheet (under the supporting linen fabric) was covered by non- woven cloth (Fig. 3,d) and this layer will cause a temperature increase on behind the supporting fiber and the object causing damage. The damage manifests itself in brittleness as well as a brown discoloration caused by the products of polymer breakdown (Bittner, 2004). In the final the object was supported with Herringbone stitch (Fig. 3,e) and it's very sharp on the fabric as it does not maintain the bulk external edges (Fig. 3,f) thread of the piece, allowing for the separation of those threads (Fig. 3,g).

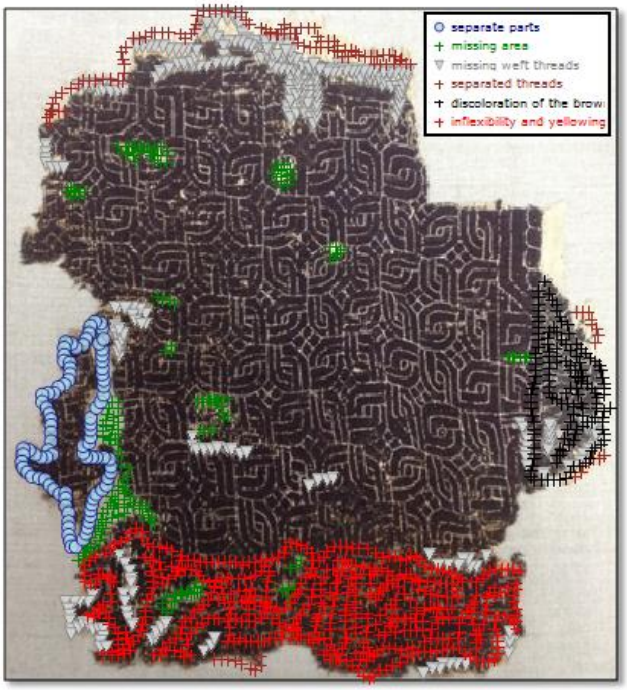


Figure 2: The kinds of the damage on the object


A


B


C


D


E

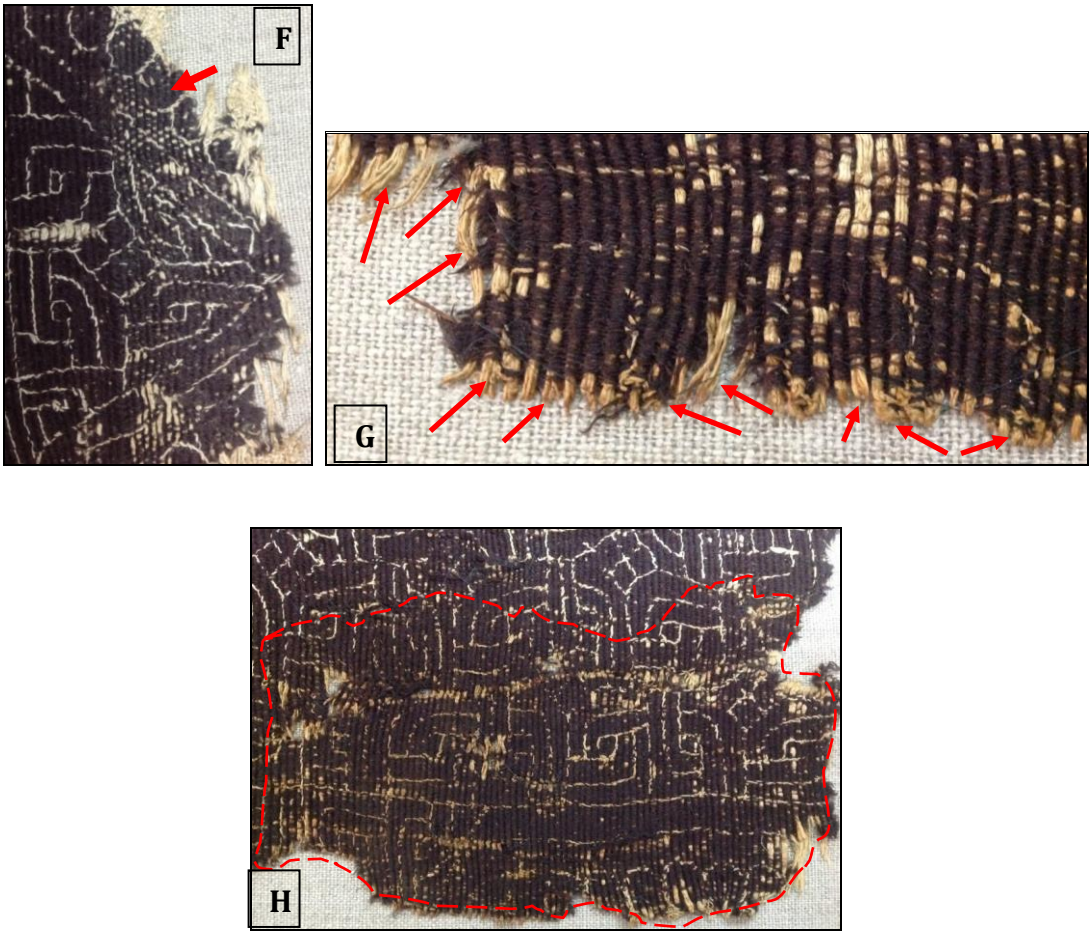
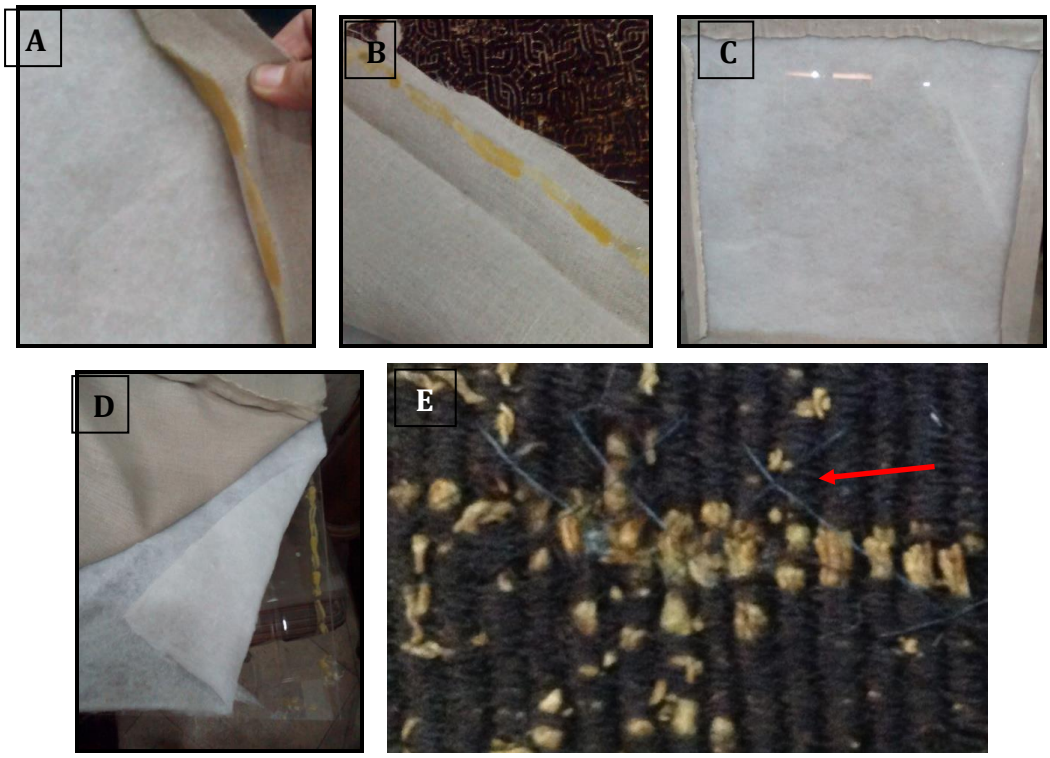


Figure 2,A. many separated parts on the object, B. missing area, C. missing weft threads, D,E. separated threads, F: discoloration of a part of the brown waved wool, G. inflexibility of some warp and weft threads, H. yellowing of the lower part from the object



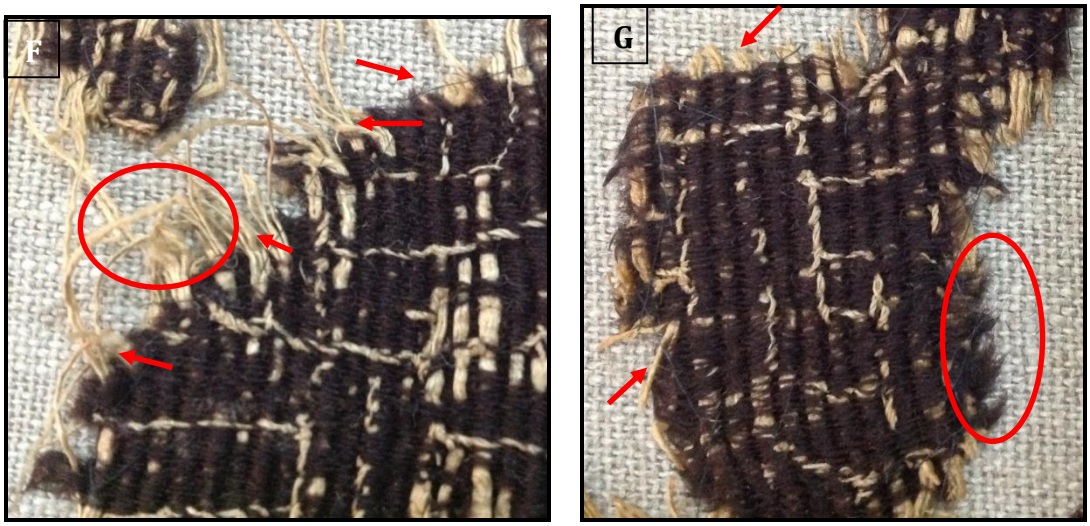
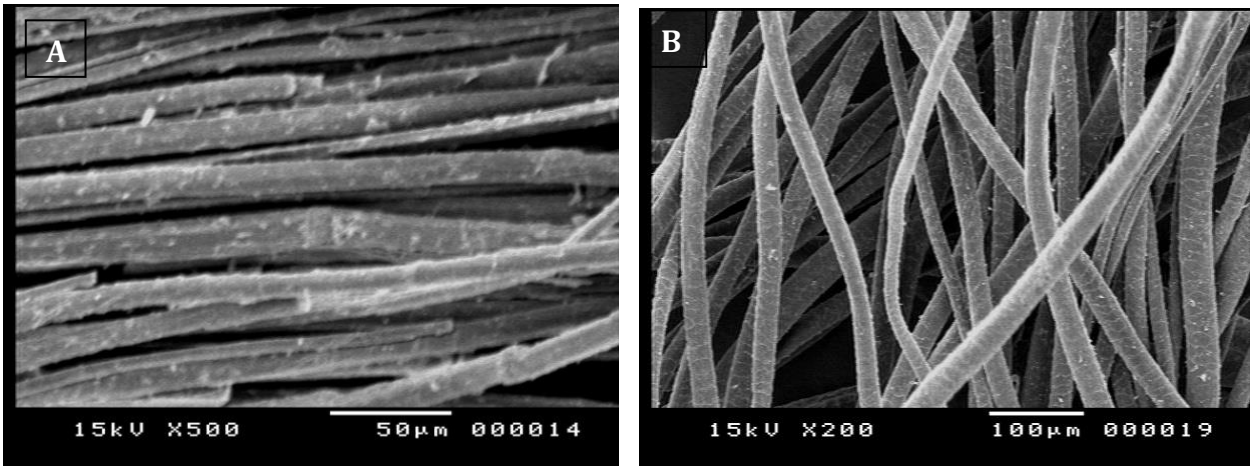


Figure 3,A. There is a previous restoration on the object by using old adhesives to adhere the supporting fabric from the edges, B. The supporting fabric became yellowing and very hardened, C. The object was supported on a type of Rigid Acrylic Sheets without porous it, D. One side of the Acrylic Sheet covered by non- woven cloth, E. The object was supported with Herringbone stitch, F. The Herringbone stitch does not maintain the bulk external edges thread of the piece, G. It is allowing for the separation of the threads

3. INVESTIGATIONS

3.1. *Scanning Electron Microscopy (SEM)*

The samples collected from the ground and the decoration threads were investigated by using Scanning Electron Microscope (SEM) (FEI-QUMTA 200SEM) .The (SEM) is enhanced with additional instruments like gold polishing of samples (Gold sputtering for 13min).Samples were mounted on aluminum stubs by double sided sticky tabs, then gold coated with a thin layer of gold with a thickness (Abdel-Kreem et al, 2010) of 10-30 nanometers after the drying processes of the samples to be tested in order to make it connected to the electrical current because the sampling is using electrons inside the scanner electron microscopy. To study the surface morphology as well as the damage aspects on these fibers. SEM Photos of examining threads are illustrated in (Fig. 4,a) , it showing that the undyed threads are linen and the brown threads are wool (Fig. 4,b), the fibers are extremely damaged and broken specially the linen fibers are breakdown and fractures with longitudinal splitting characterized (Fig. 4,c,d).



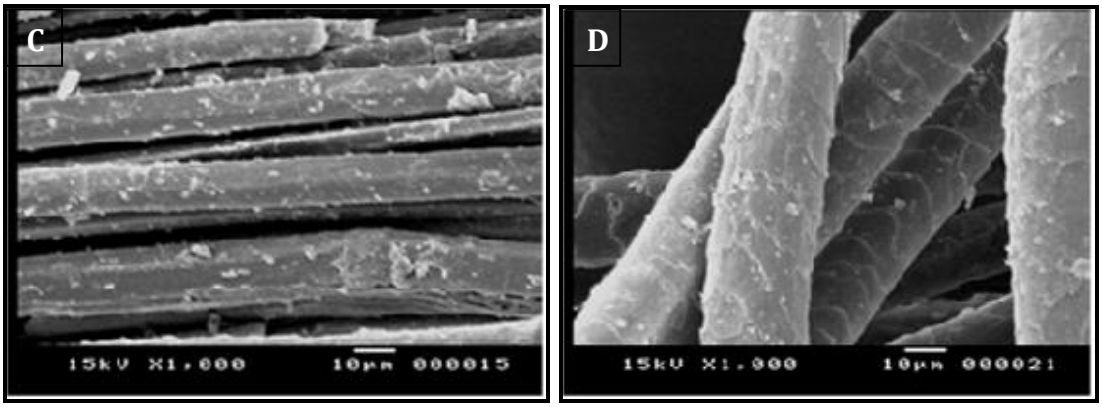


Figure 4,A. The figure shows SEM images of examined textile, One can see that the undyed fibers are linen, B. The brown fibers are wool, C, D. The fibers are extremely damaged, broken specially the linen fibers are breakdown and fractures with longitudinal splitting characterized

3.2. *Fourier Transform infrared spectral analysis (FTIR)*

FTIR analysis of solid phase samples performed using FTIR-KBr. FTIR analysis has been performed by transmission techniques, in which the infrared energy is passed directly through the compound being studied. The powder sample can be milled with potassium bromide (KBr) to form a very fine powder. This powder is then compressed into a thin pellet which can be analyzed. In this method the sample is diluted with KBr (IR grade) so that the concentration of the sample is 1%. Samples are placed directly onto the crystal surface itself. Single - bounce crystal modules tend to be the most versatile, since most are supplied with a pressure device and are appropriate for a variety of organic liquids and powders (Amin,2011). Infrared Analysis was performed on a sample of brown wool and compare the results with the results of infrared analysis of the natural dye known standard, which help knowing the dye used in fiber. The results of the two charts show that the source of this color is Indian cutch as shown in (Fig. 5). Furthermore, the analysis was shown the kind of mordant is (Alum) as shown in (Fig. 6).

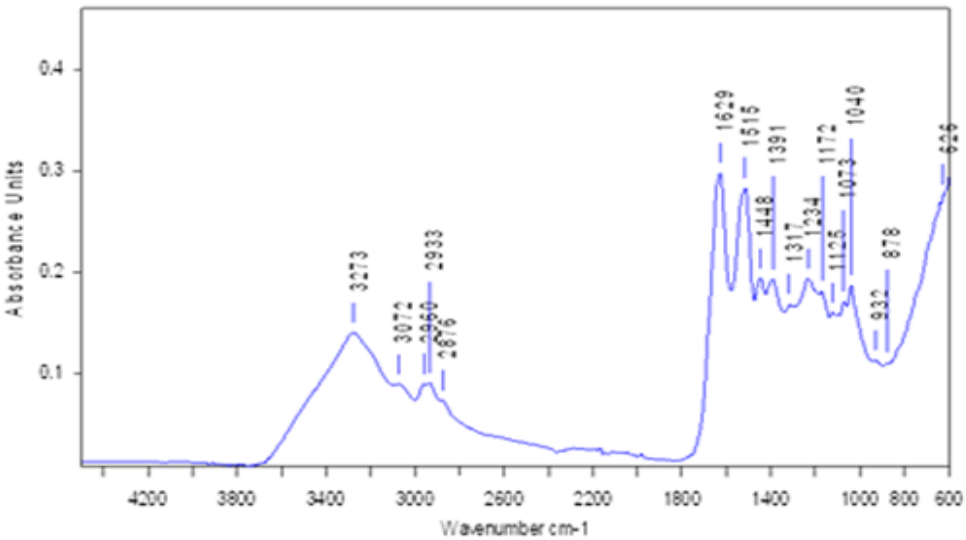


Figure 5. Spectra of textile dye with Indian cutch.

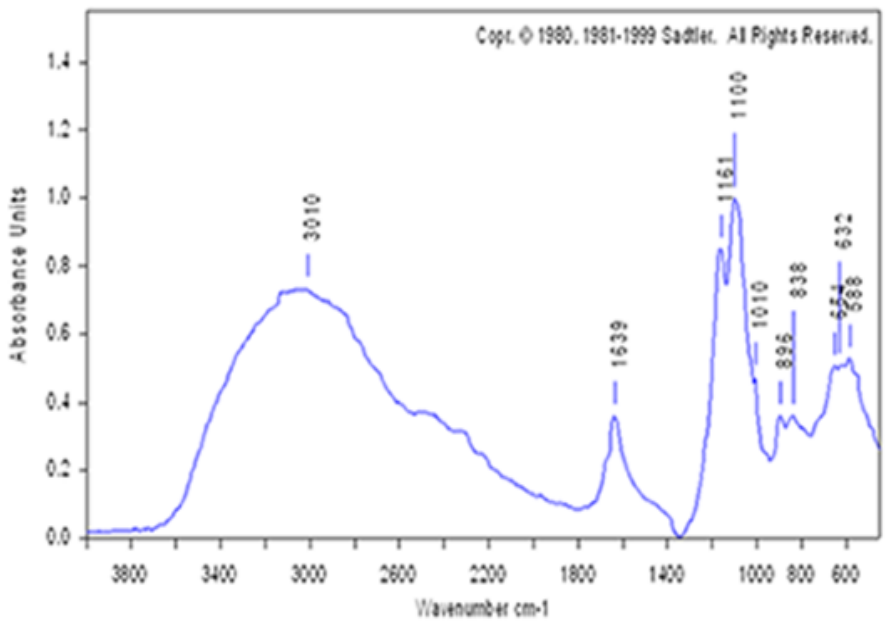


Figure 6. Spectra of textile mordent with (Alum).

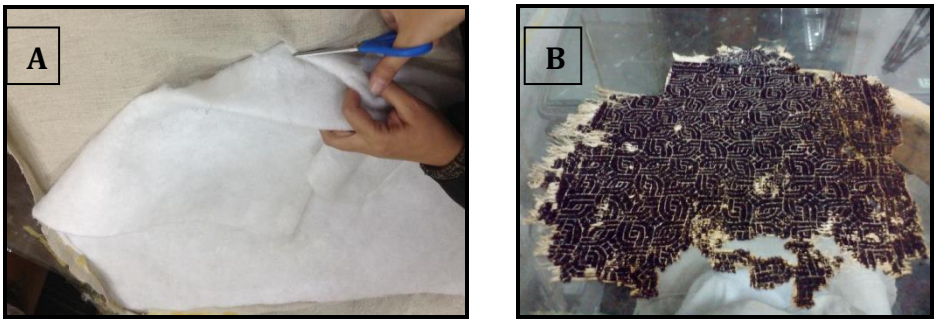


Figure 7,A. Removal of the old restoration by removing the supporting stitches, B. removing the old supporting fabric.

4. CONSERVATION PROCESSES

4.1. Removal of the old restoration

In the beginning, the supporting stitches were removed (Fig. 7,a). The object in the case showed severe dryness. Hence, the water sprayed over the object to moisten it. Then, the old supporting fabric was removed (Fig. 7,b).

4.2. *Cleaning of the object*

The mechanical cleaning was used by various types of fine brushes to remove free dust and dirt. The wet cleaning was used in the old treatment; it wasn't cleaned again to avoid the increasing damage. So the final support process was conducted.

4.3. Preparation of wooden frame and textile support

A new linen support fabric was prepared and washed to remove chemical residues and prevent shrinkage at a later time due to humidity changes. The new linen fabric was ironed to remove creases. The edges of the support fabric were perforated and the holes were reinforced by metallic rings. A wooden frame used for mounting. The rings were fixed for easy stretching on the wooden frame. Thick cotton thread was used for fixing the linen support on the wooden frame, (Fig. 8).

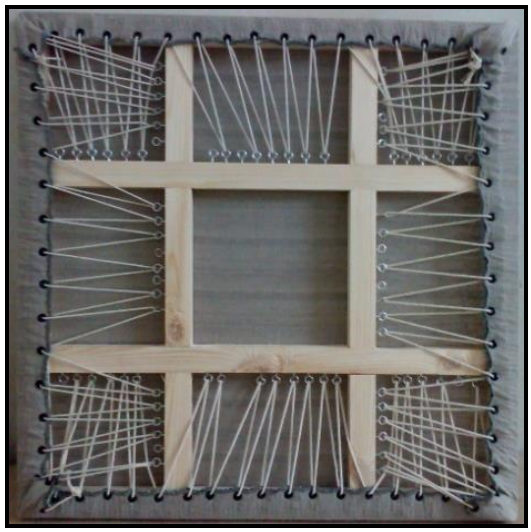


Figure 8. Preparation of wooden frame and linen support.

4.4. *Dying procedure of the silk threads*

The threads that were used to support the object were dyed by the researcher who used Indian cutch for the brown color. It was divided into the following stages:

a. Extracting the Dyes; aqueous dye solutions were prepared, by adding the Indian cutch powder to distilled water in a large beaker. The extractions were obtained directly by boiling (50g) of dye in (1000ml) of distilled water at 100˚C for 1 hour; the extractions were filtered through a filter paper to remove any powder residue and to obtain a clear filtrate.

b. Dying; Dying procedure was carried out by the natural dye. The pH of the dye bath was adjusted at (2-3) by adding few drops of acetic acid. The dying was carried out at 80-90 ˚C for 45 minutes with continuous stirring and the liquor ratio was 1:30.

c. Mordanting; Alum mordant was used by immersing the individual dyed samples in the mordant solution for one hour at a temperature of 80-90 ˚C uses liquor ratios 1:100. The mordant solution was prepared by dissolving (5 g/l of alum), After dyeing, the unfixed dyestuff was removed by rinsing three times with cold water (5 min, room temperature [25 ˚C, liquor ratio LR 1:20.) .

4.5. *Permanent supporting*

After completion of the object treatment, tacking stitches were used with a very fine needle and fine brown dyed silk thread to fix the object. At 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 the same stitches (Fig. 9,a,b). Similarly, couching stitches were used to attach the object to new linen fabric and fixed the separated threads in true place (Fig. 9,c). After completing the treatment process and fixing the object, it could be displayed in a suitable manner. One can see the object in final stage in (Fig. 10).

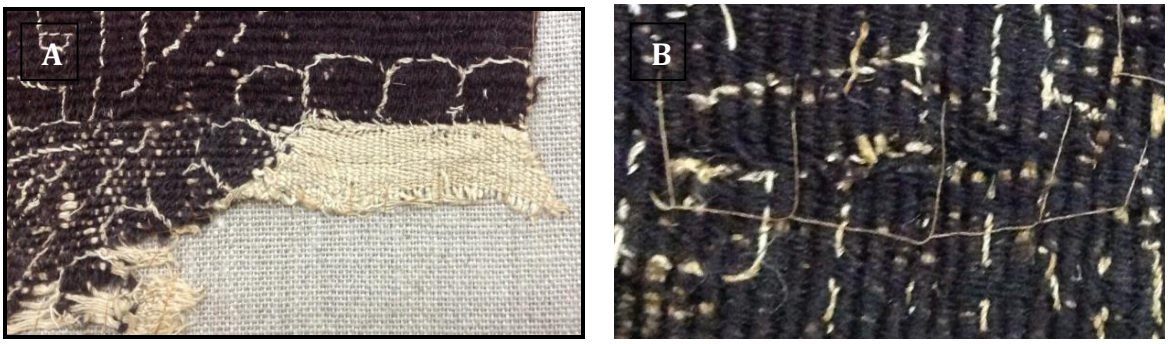


Figure 9,A,B. the permanent supporting of the object with blanket stitch.

Figure 9,C. couching stitches were used to fixed the separated threads in true place.

Figure 10. The object in the final stage.

5. DISCUSSION AND CONCLUSION

This practical study included treatment and conservation of an archaeological textile dates back to the Coptic period. The object was stored in Applied Art Museum, It is a piece of a shawl and weaved by 3/3 weft rib, it's had a decoration of geometric shapes decoration and overlapping together with undyed linen yarn which was embroidered with stem stitch above the brown weaved wool. The object suffers from fiber damage, many separated parts, missing area, missing weft threads, separated threads; discoloration of a part of the brown weaved wool, inflexibility of some warp and weft threads and yellowing of the lower part of the object. There is another previous restoration such as using old adhesives to adhere the supporting fabric from the edges which became yellowing and very hardened, the object was supported on a type of Rigid Acrylic Sheets without porous it and one side of the Acrylic Sheet was covered by non- woven cloth. And there is an old restoration with brown thread with Herringbone stitch. The piece was analyses by using (SEM) which shown that the brown threads are wool and the undyed threads are linen. The object surface is very weak and brittle. FTIR analysis has been performed showed that the source of the brown color is Indian cutch and the kind of mordant is Alum. Due to cleaning the piece on the old treatment, the piece wasn't cleaned to avoid the increasing damage. The old temporary restoration was removed then the final support process was conducted with needle work on a linen textile. Finally, the piece has been prepared for museum display on the wooden frame.

In conclusion, we can say that the analysis and good restoration proved that this method is an effective strategy for the restoration of historic textiles. It will stabilize historic textiles over a long period of time. For that the paper presents restoration method for a piece of a shawl weaved by 3/3 weft rib at the Applied Art Museum in Cairo, Egypt. The archaeological documentation had been explained, scientific examination and analysis had applied on specimen of selected piece to record the type of the threads and deterioration levels of the object, the supporting of objects has been performed by removing the old restoration and fixed on linen support with different stitches and final display.

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