

# Conservation and Restoration of Archaeological Textile at Coptic Museum, Cairo

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**Abstract**—this research present a very unique piece of archaeological textile called tapestry or" KABATY" according to the way of manufacturing at Coptic museum, Cairo. The object was found at one of the historical monasteries at sohag in Upper Egypt. It is performed by non woven technique, and considered the decorative parts of the Coptic tunic. The object was in a very bad state: fading in dyes, tears, missing parts and high drying of fibers. many archaeological samples were collected from many parts of object.. Treatment procedure was performed by several stages; firstly, Dating by comparing the decoration technique, the type of material and the decorative motifs existed in the object with another one known its date. Then samples taken from object were examined by optical microscope, scanning electron microscope to identify type of fibers and surface morphology, FTIR analysis to identify dyes in dyed samples. Then, stages of the treatment of tapestry were determined by testing sensitive of fiber to water, mechanical cleaning and chemical cleaning to remove stain, washing stage using distilled water, and finally consolidation the object by fixed on support of natural linen which was stretched on wooden frame treated by anti-fungal substance .archeological and technical studies was discussed besides photographs

**Keywords**—Textile, Conservation, Analysis, Tapestry

## I. INTRODUCTION

Coptic textile is one of the most interesting artifact through the Coptic period, as it documented the features of daily life of Egyptian from the end of grec-roman period to Islamic period. "kabaty" is one of the most important techniques for decoration textile [1], depending on used weft thread non extend through the loom [2]. Preparing process begins with good design before starting weaving, where specialists work sketches of designs for their religious symbols and portraits spread at Coptic art through this period, apply the design on the cartoons prepared in the beginning. After that settling on the design ,then beginning in in choosing the right colors, where it is possible to forget the colors factor at work [3-12], regarding to its loose structure , the pieces were I a bad need to be restored carefully and scientifically [6, 7].

The paper aim to deal with a complex object of tapestry by investigation and analysis fibers and dyes to define fibers and dyes used in and determine state of damage, which give us chance for applying suitable strategy for conservation, so the paper present the treatment stage such as cleaning, remove old restoration, complete loss part, consolidation by fixed in support of raw linen with frame of treated wood frame [13-21].

### A. Description of Archaeological pieces

The object was stored in wooden case no.127/1 and 127/2 in conservation lab at Coptic museum, Cairo. It dated to 6-7 century according to the comparison study of the selected object and known date pieces at textile museum , alazahar as shown in (fig. 1). the object consisted of two separated pieces was waved by tapestry technique, they had the same motifs in decoration . the first and second ones are represent parts of cover for tables or may be hangings , which consisted of two circle included animal and geometric motifs in addition to religious decoration in the central circle which represent angle .The first piece is made of wool thread in both of warp and weft and dyed with many colors such as red, orange, blue, green, white and light brown.



Fig.1 show the first piece of Coptic textile (6-7 century)



Fig.2 show the two pieces of Coptic textile

The first piece consists of 10 yarn of warp threads in one cm and 25 yarns of weft in one cm. its geometric measures are 16.5x 12cm , the diameter of internal and external circle are 15 , 5 cm and the second 10 yarn of warp threads in one cm and 25 yarns of weft in one cm. its geometric measures are 18cm in length 16.5 cm in width. this point show the two pieces were parts of one object. The decoration was waved of brown , orange, red, yellow and green dyed wool. There are many signs of damage on this object such as, many separate parts from the edges, loss parts, weakened fibers, and brittleness combined with other previous repairs, hardness, tears, old restoration error , stains in the ground of decoration and fading in the most of dying parts.

**B. Examination and Analysis**

Many samples were taken from different parts of archaeological object and were examined by optical microscope, SEM and analyzed by FTIR. The results were discussed.

**1. Examination by optical microscope:**

Optical microscope of kind " " was used in conservation lab, faculty of archaeology, Fayoum University to provide us with morphological appearance of the raw materials used in making the object. The initial examination show the state of damage which appear in the looses fibers, fading dyes the selvages and edges suffered from wear and abrasion. There are several Cuttings and tears in different parts as show in figure as shown in fig.3,4 ,5.



Fig .3 show microscopic photo of sample taken from the frame of the first piece



Fig.4 show microscopic photos for samples taken of dying fibers used in decoration parts of the first one



Fig.5 show microscopic photos for samples taken of frame and dying fibers used in decoration parts of the second one

**2. Scanning electron microscope:**

The morphology of the surface was investigated and kind of fibers was defined by using Scanning Electron Microscope (SEM), Philips XL30, at micro analytical center-Cairo university Egypt. The same Small samples which were taken obviously from two pieces from Different parts were examined , to show the damage aspects on these fibers. SEM Photos illustrated that the samples of fibers consist of raw wool threads dyeing with different dyes.in addition to The fibers are extremely damaged, transverse cracking and longitudinal scratches and holes in addition to lose in parts of pieces. Furthermore, one can see the dust, dirt that covered the fiber as shown in fig 6,7,8.

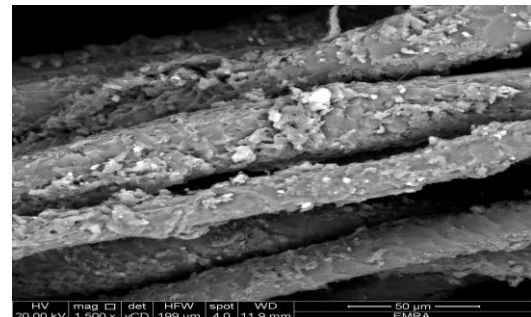


Fig.6 show the damage of wool fibers used in piece no.1

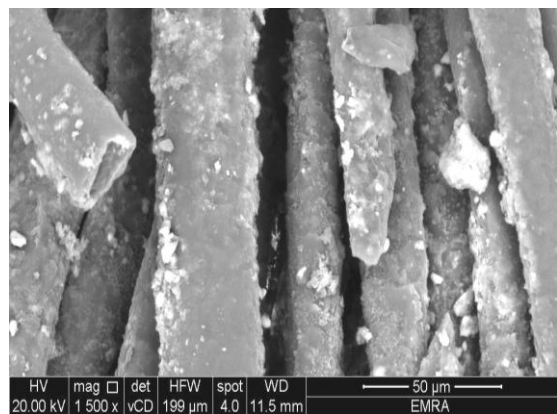


Fig.7 show the existence of dust between the fibers and broken, brittle yarns of the piece no.1



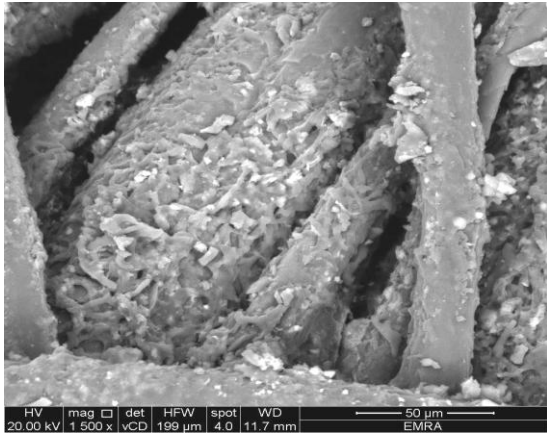


Fig.8 show the disappearing of morphological properties of raw wool yarns used in piece no.2 as a result of ageing

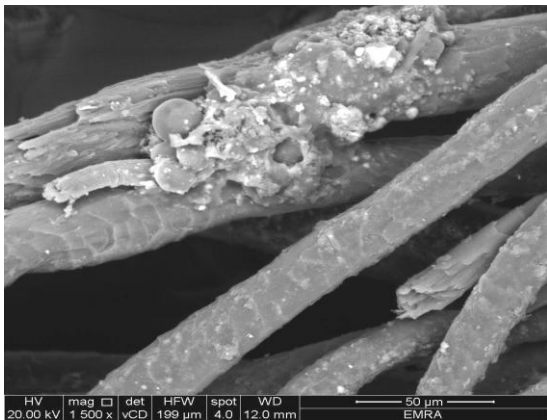


Fig.8 show the physical changes happened in dyeing wool samples of piece no.2

### 3. FTIA "Fourier transform infrared analysis":

The Fourier Transform Infrared (FTIR) Analysis were carried out for samples Using FTIR Model Cary 630 FTIR spectrometer produced by Agilent technologies Company, for both Qualitative and Quantitative(for liquid samples) analysis, in spectral range (wave numbers  $\text{cm}^{-1}$ ) from  $4000\text{cm}^{-1}$  to  $400\text{cm}^{-1}$  without any treatment.

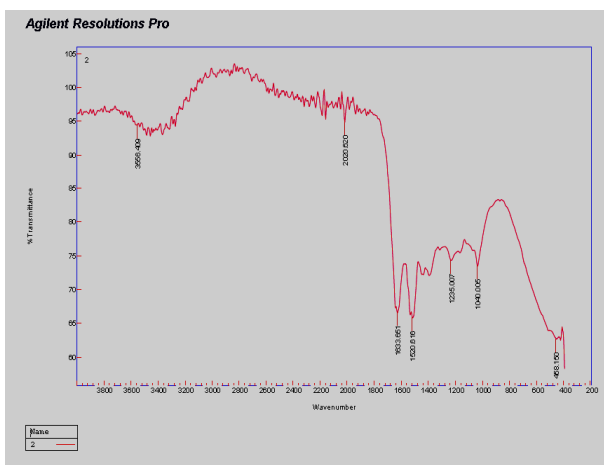


Fig.9 show the chart of FTIR of archaeological sample taken from dyeing parts of the object

Infrared Analysis was performed to a sample of red wool and compare the results with the results of infrared analysis of the natural dye known standard, which help know the dye used in fiber The results of the charts of the first piece show that the source of this color is Indian cutch and the

second piece show that the dye used is madder which confirm that the two pieces is a part of one object as shown in fig.13.

**Table.1** The correspondence between the peaks of infrared analysis of a madder and infrared analysis of archaeological sample of red dye :

Absorption peaks No. of Archeology sample ( $\text{cm}^{-1}$ )	Absorption peaks No. of standard madder ( $\text{cm}^{-1}$ )	Functional Group
3556.4	3343.26	-Ho- stretch
1633.6	1636.28	-C=C-
1520.16	1518.85	-C=O-
1040.05	1045.1	-CO-

### c. Treatment procedure

after finishing all the needed examination and analysis to define the type of warp and weft yarns used in the two pieces and determined the state of damage for applying appropriate strategy of treatment beginning with all kind of cleaning until fixing on linen support.

#### 1. treatment the high dryness of fibers:

The dry fabric (the object) was softened by spraying distilled Water four times and, to reverts its moisture content lost by ageing. To let the fibers absorb water gradually to avoid the deterioration of drying wool threads.

#### 2. Testing the stability of dyes:

The next step was to test the stability of the colored parts to wet cleaning by immersing a piece of cotton wrapped round a wooden stick into water and all kind of solvent will be used in cleaning and placing it in direct contact with the colorful parts of the object, each color was individually tested. It was found that all the dyes were stable and did not fade with the effect of wet cleaning solution.

### 3. Cleaning procedure

This stage divide into two steps: mechanical, chemical cleaning by using different methods, techniques and materials.

#### 3.1 Mechanical cleaning:

Various types of fine brushes are used to remove free dust and dirt (i.e., not attached to textile fibers).on the surface of the object or between fibers.

#### 3.2 Wet cleaning:

This cleaning procedure used water only and water with other detergent agents, to assist the cleaning process. The ratio was very little of detergent one part of saponin to 100 parts of distilled water. and using a piece of cotton fixed with wooden stick and tries to clean the stains existing on the surface of the two pieces as much as possible.

#### 3.3 Chemical cleaning:

Many kind of light solvent used to remove the darken stains spreading in many parts of the pieces, such as acetone, ethyl alcohol and tolowen .the results were acceptable as we could remove many parts of stains.

#### 3.4 Fixing on linen support:

Appropriate support of foam support covered by raw linen was prepared to fix the archaeological textile on it, as a kind of consolidation and ideal way for exhibition. Because this way

didn't form any pressure on the loose threads of the object. The linen was prepared before using by washing it in very hot water to remove any harmful things, and then was ironed.



Fig.10 show the steps of preparing the linen support for Consolidation stage



Fig.11 show the steps of fixing the objects on the support by with non-dyed raw silk yarn



Fig.12 parts of archaeological which were fixed by plain stitches using fine silk threads

#### **Fixing of the pieces**

The margins were weak and stiff. The stiffness was removed by Water and separated edge was fixed from four sides by a linen band of 5 cm width with Fine silky stitches, which have the same color of the part we wanted to support.

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#### **References**

- [1] G.Thomson; History of Tapestry from Earliest until the Present Day, New York, 1977.
- [2] L. Allane Kilims, Thames and Hudson, New York 1995,p. 7.
- [3] J.Harris, 5000 Years of Textile, British Museum Press, Albert and Victoria Museum, London, 2004, p.26.
- [4] S.Depas, Macramé Weaving and Tapestry, Art in fiber, Macmillan Publishes Go, INC, New York, p.112.
- [5] K.Finch, G. Putnam, The Care and Preservation of Textile, First Publish, London 1982, p. 74-82.
- [6] J. Marn, Exploring , Tapestry Weave, Textile Museum, Washington, 2003.
- [7] P.T.Nicholson, I. Shaw, Ancient Egyptian Materials and Technology, Cambridge University Press, Cambridge, 2000.
- [8] S, Landi, the textile conservator manual, London, Butter worth, 1992.
- [9] J. Marn, Exploring Tapestry weave, textile museum, Washington, December, 2003
- [10]J.H. Hofenk de Graaff, The Colourful Past, Abegg-Stiftung, Riggisberg, The colourful past : origins, chemistry and identification of natural dyestuffs. Archetype Publications, London, 2004.
- [11]A, Zarkogianni, et el, revival of traditional dyeing techniques , 2010 Society of Dyers and Colorists, Color. Technol., 127, 18–27.
- [12]I. Vanden Berghe, J.Wouters, in: R. Janaway, P. Wyeth (Eds.), Scientific Analysis of Ancient and Historical Textiles: Informing Preservation, Display and Interpretation, Archetype, London, 2005.
- [13]I, Deganoa, et el,Historical and archaeological textiles An insight on degradation products of wool and silk yarns, Journal of Chromatography A,1218(2011).
- [14]H.E, Ahmed andY.E, Ziddan; New approach for conservation treatment a silk textile in Islamic art museum, Cairo, journal of cultural heritage 12( 2011).
- [15]C.Bergfjord and B.Hols; A procedure for identifying textile bast fibers using microscopy: Flax, nettle/ramie, hemp and jute, Ultra microscopy,110 (2010).
- [16]Verella, E.A, conservation science for the cultural heritage, Springer, Greece, 2013.
- [17]Abdel-Kareem, O.M.A; The long-term effect of selected conservation materials used in the treatment of museum artifacts on some properties of textiles, Polymer Degradation and Stability 87 (2005).
- [18]J.Liu, ET EL, Identification of ancient textiles from Yingpan, Xinjiang, by multiple analytical techniques, Journal of Archaeological Science 38 (2011).
- [19]O.Kareem, Conservation And Restoration Of A Rare Large Persian Carpet, E-Conservation Magazine, **E-Conservationline.Com**
- [20]H.Eharby, Strategy For Conservation Of Ptolemic Warpped Mummy's Linen In Tuna El Gabal Excavation, Egypt.A Case Study,International Journal Of Conservation Science, Volume 2, Issue 3, July-September 2011.