The methods of treatment of Indian archaeological cashmere textile 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 Indian archaeological cashmere piece. The textile is multicolored, and was exhibited in Applied Art museum in case m.s 121/6. Also, treatment and conservation method have been done successfully such as cleaning the piece, supporting of the deteriorated areas on new linen fabric and the museum display have been done by using a wood frame. But many deteriorated, degradation aspects were investigated by using recent technologies such as scanning electron microscopy were used to identify the kind of fibers, their condition and surface morphology, FTIR was used to identify the kinds of dyes, and XR-D was used to identify mordant.

Keywords:

deterioration; degradation; Cashmere; conservation; investigated; mordant; supporting

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1. Introduction

Textiles in all forms are an essential part of human civilization[1]. Archaeological textiles, as all organic materials, are hardly preserved due to several factors, which caused different types of deterioration and degradation, depending on the nature of the fibers and the environment where the objects were kept[2],[3]. Archeological textiles in Egyptian Museums are exposed to many challenges[4]. The damage may be a consequence of display and storage practices in the Egyptian Museums, which are far from the accepted standards[5]. Appropriate climate control within museums is still a major unsolved problem in heritage conservation. Unfavorable environmental conditions inside museums have serious impact on structures and collections[6]. The main environmental parameters influencing the collections conservations were identified by: oscillate relative humidity (RH), light, insects, microorganisms, and air pollution which, alone or together, causes considerable loss of tensile strength and pliability. The oxygen in the atmosphere affects all organic substances to varying degrees[7],[8],[9],[10]. For this reason, the only conservation

[1] Bergfjord. C, et al, "Nettle as a distinct Bronze Age textile plant", pp1:4.
[2] Ina. V. B, "Towards an early warning system for oxidative degradation of protein fibres in historical tapestries by means of calibrated amino acid analysis", pp 1349-1359.
[3] Maria. C, et al, "Archaeological Textiles – A Need for New Methods of Analysis and Reconstruction, FIBRES & TEXTILES in Eastern Europe", pp 64 - 65.
[4] Harby. E. A, et al,"A new approach for conservation treatment of a silk textile in Islamic Art Museum, Cairo", pp 412–419.
[5] Omar. A-K, et al, "Conservation of A Rare Painted Ancient Egyptian Textile Object from the Egyptian Museum in Cairo", pp 9-16.
[6] Giacomo. G, et al, "Test of A Device for the Active Control of Environmental Humidity in Museum Display Cases", pp 43-50.
[7] Giacomo. G, et al, Op Cit., pp 43-50.
[8] Harby E. A, et al, Op Cit., pp 412–419.
[9] Omar A-K, et al, Op Cit., pp 9-16.

measures that should be taken were to rid the fragments from inappropriate materials[11] and to improve the properties of textile objects and enhancing their long term stability. Also conservation aims to slow down the rate of the further deterioration of textile artifacts as much as possible[12] and then store or display them in the best possible way. Such as cleaning, fixing separate parts, support weak and damaged areas with new fabrics using stitching techniques. There is no standard or neutral material that can be used for all textiles; a choice has to be made. A support fabric is selected primarily on the basis that it is of an appropriate structure, weight and fiber to provide support to the textile[13], and making a new display. But in order to choose the proper treatment methods as well as the conditions of display and storage, So we have to get sufficient information about the state of damage existed in objects, identifying the type of fibers, the state of deterioration/degradation and kind of dyeing by application of non-destructive analytical methods on dyed samples, taken from different parts of textile. These techniques enrich conservation scientist information about the conditions of preservation and physiochemical properties of materials[14].

So the paper aim to deal with a complex object by investigation and analysis fibers and dyes to know every detail about case of damage to be able to make a suitable strategy for the treatment

[10] Saher. F. I, et al, "Fast Production of Artificial Mimic Textile Samples Using UV/OZONE Treatment Application in Conservation and Consolidation", pp 15-22

[11] Johanna. N, et al, "Fragments of Queen Kristina's Burial Costume, Preservation and Documentation of Materials, Textile Techniques and Dyestuffs, p10.

[12] Omar A-K et al, "Conservation and Restoration of the Bedoun Dyed Textiles in the Museum of Jordanian Heritage", pp. 25-36.

[13] Lennard. F, et al, "Using digital and hand printing techniques to compensate for loss: re-establishing colour and texture in historic textiles", pp 55-65.

[14] Eman M. O, et al, "The Determination of Conservation State of Archaeological Moroccan Kilim by Physical Analytical Methods", pp 51-58.

stage such as cleaning, complete loss part, consolidation by fixed in support of raw linen with a frame of the treated wood frame.

2. Description of Archaeological object

The Indian cashmere textile dated to the modern period is hold by the applied art museum (Fig. 1). It is considered a kind of nonwoven textile called tapestry, as the weft thread didn't pass through loom from the one side to width other[(15)]. The dimensions of the piece are 70 x 21 cm. The threads are made from goat wool. It was exhibited in Applied Art museum in case m.s 121/6. The most present colors in the piece are dark red, light blue, white, black, yellow, olive-green, purple and green. The piece design was compared with an Indian cashmere piece from 1964. Both of the same characteristic design (Fig. 2,A,B). The lower of the piece is consisting of geometric shapes units. And each unit of different ground color. Each unit is sewn to the other to form the piece. This is given a thickness at the border between each decorative unit. The lower part of the piece is separate from the upper part and has been sewn together. The piece decoration consisting of large cone forms, flowers and leaves. The embroidery stitches: couching, blanket and stem stitch.

[(15)] Eman M. O, et al, "The Determination of Conservation State of Archaeological Moroccan Kilim by Physical Analytical Methods", pp 51-58.

Fig 1: The cashmere textile

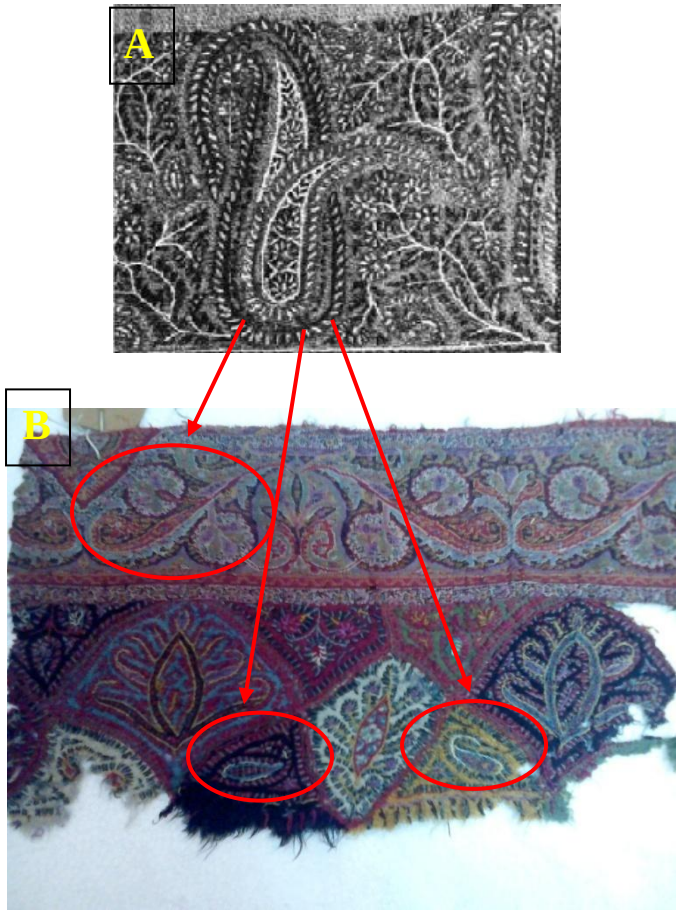

Fig 2,A,B: The piece design was compared with an Indian cashmere piece from 1964. Both of the same characteristic design

3. Condition report:

Initial examination indicated that the piece's condition (Fig. 3) was as follows: the whole surface was dirty due to dust accumulated during the long term storage of the piece on non compact wheel in the museum. There were many holes in the highest part of the piece (Fig. 3,A) and there were also enormous missing parts in the lower part of the piece (Fig. 3,B) and small missing parts (Fig. 3,C). The edges suffered from wear and there are no selvedges (Fig. 3,D) and there are separated parts (Fig. 3,E). Nevertheless, except for the aforementioned aspects, the piece still appeared in fair condition.

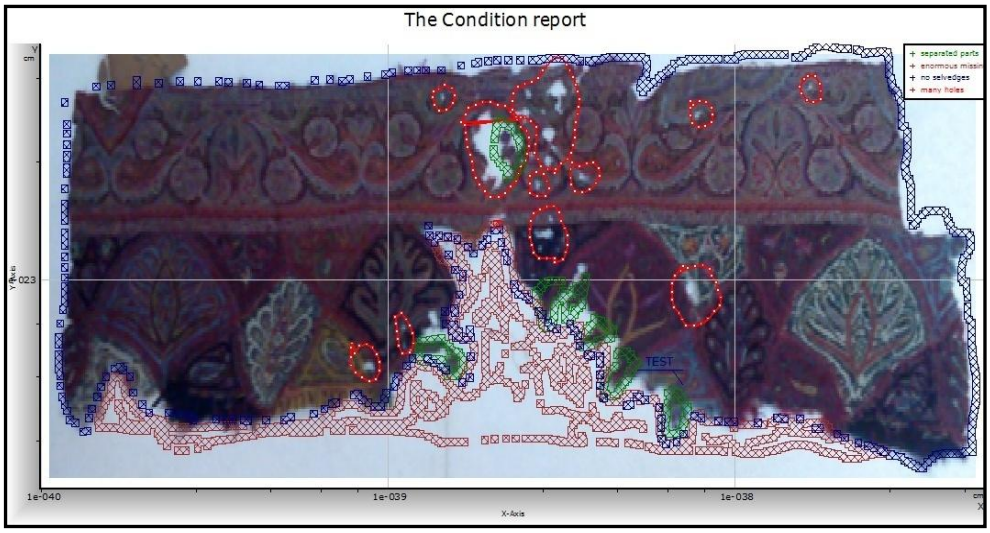

Fig 3: The piece condition

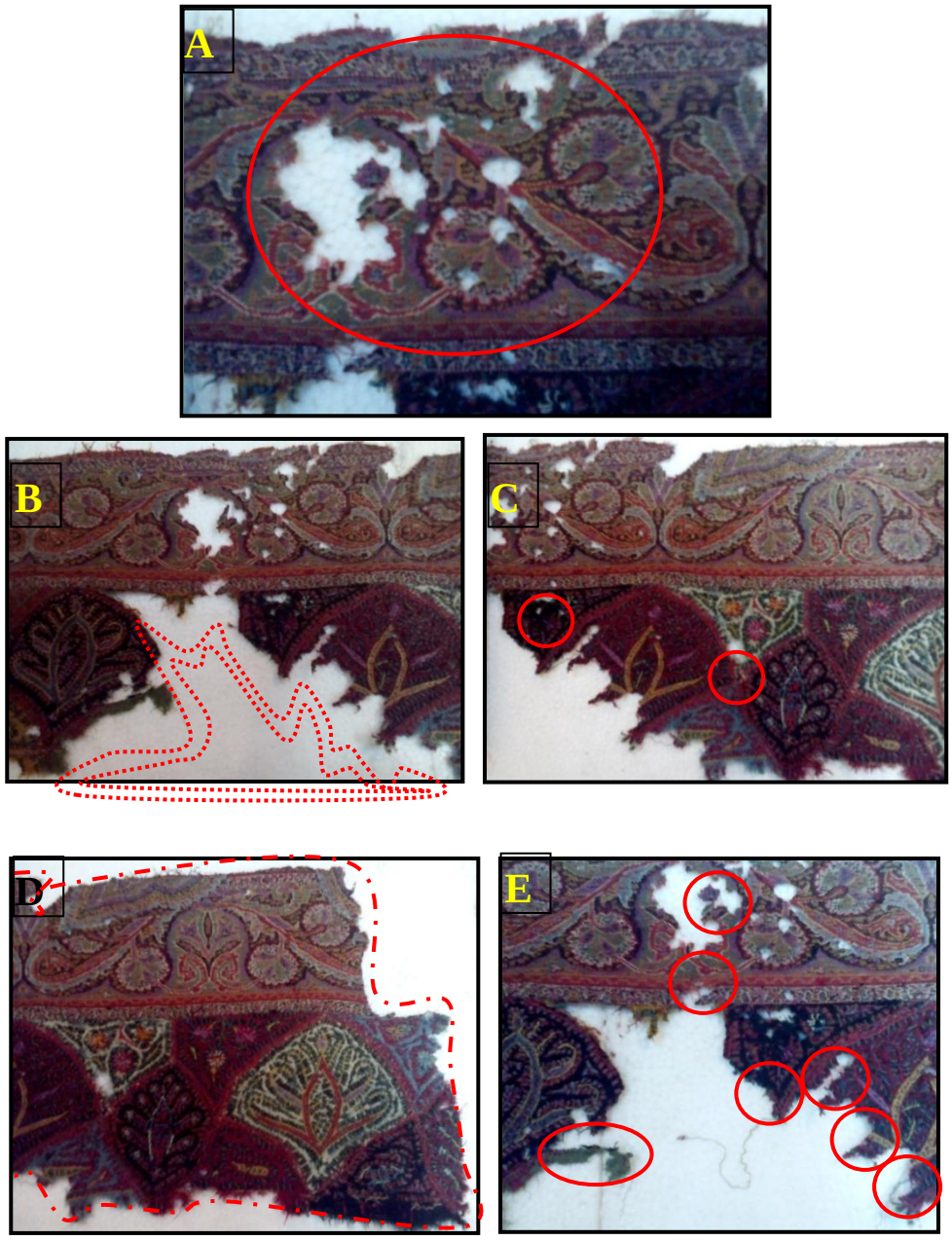

Fig 3,A: Many holes in the highest part from the piece. B: Missing parts in the lower part from the piece. C: small missing parts. D: No selvedges. E: separated parts

4. Testing and analysis

4.1. SEM

The samples collected from the ground and the decoration threads were investigated by using Scanning Electron Microscope (SEM) (FEI-QUMTA 200SEM) 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,B), it's showing that the all threads are goat wool, the yarns are extremely rough, damaged, broken (Fig. 4,C), the scales have disappeared in many parts (Fig. 4,D), with characteristic transverse cracking (Fig. 4,E) and longitudinal splitting (Fig. 4,F).

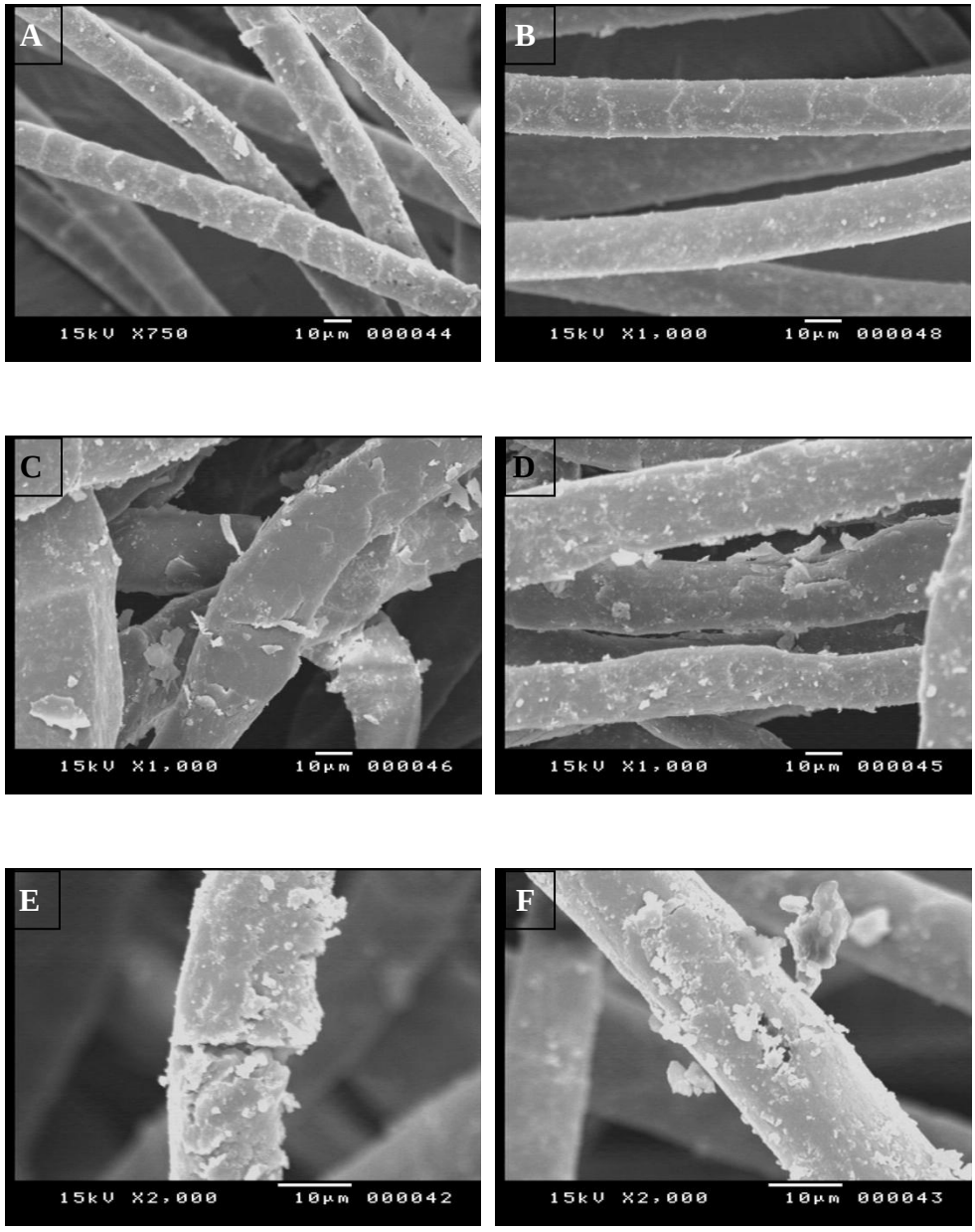

Fig 4,A,B: The all piece threads are goat woo. C: The yarns are extremely rough, damaged, broken. D: The scales have disappeared in many parts. E: There is characteristic transverse cracking. F: There is longitudinal splitting

4.2. 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[(16),(17),(18),(19)]. Infrared Analysis was performed on a sample of dyed threads 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 charts show that the sources of these colors are: the red is Madder, the black is Haematein which extract from Logwood, the purple is Madder mixed with Indigo, the blue is Indigo, the yellow is Turmeric, the green is Turmeric mixed with Indigo as shown in (Fig. 5, A,B,C,D,E,F).

(16) Enas. A. A., "The mechanism of degradation the wool and linen textiles by iron corrosion effect" p 856.
(17) Enas. A. A., "Study and Treatment of Selected Decorated Shawl in Applied Art Museum, Cairo, Egypt" pp. 1-11.
(18) Harby E. A, et al , Op Cit., pp 412–419.
(19) Neven. K. F, et al, "Practical Study on Treatment of Selected Decorated Tapestry in Applied Art Museum, Cairo" pp 423-432.

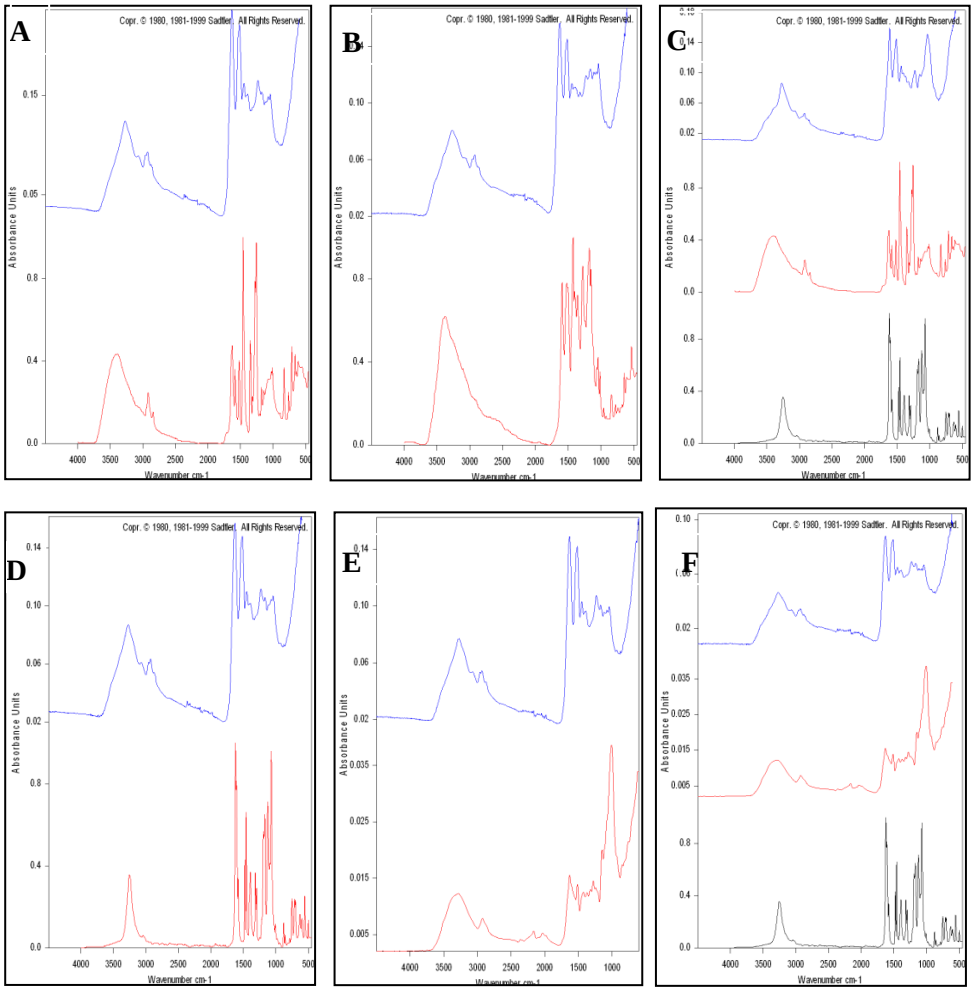

Fig 5,A: The red is Madder. B: The black is Haematein from Logwood. C: The purple is Madder mixed with Indigo. D: The blue is Indigo. E: The yellow is Turmeric. F: The green is Turmeric mixed with Indigo.

4.3. XRD analysis

X-ray diffraction of threads was carried out in (Measurements at XRD Unit in Nanotechnology and Advanced Material Central Lab (NAMCL), Agriculture of Research Center (ARC) in Egypt), using a (X, PERT - PRO - PANalytical - Netherland), type Continuous, given 45 Kv CU , radiation of 30mA. This was done in order to identify the type of mordant used in the dyeing process.

The spectra of the examined samples didn't show the mordant maybe due to the smallness of the sample (Fig. 6).

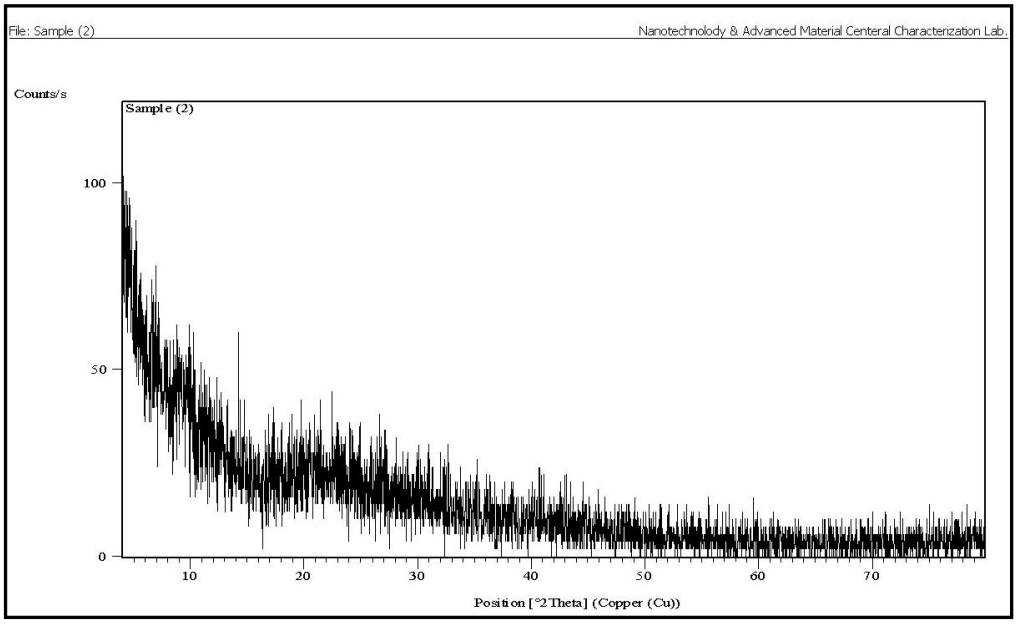

Fig 6: XRD for dyeing fibers didn't show the mordant

5. Treatment procedure

5.1. The mechanical Cleaning of the object

The mechanical cleaning was used by various types of fine brushes to remove free dust and dirt.

5.2. Testing the stability of dyes

The stability of the colored parts to wet cleaning was tested 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 piece, each color was individually tested (Fig 7,A,B,C,D). It was found that all the dyes were stable and didn't bleed with the wet cleaning solution.

Fig 7,A,B,C,D: Each color was individually tested

5.3. The wet cleaning

It was applied a primary support to the object by fixed it by fine cotton thread with running stitch (Fig 8,A) also fixed the separated parts (Fig 8,B) then placed it between two muslin support fabrics, and sewed it together by running stitch (Fig 8,C), to protect the textile from disintegrating during the different cleaning processes. The water was used with other detergent agents, to assist the cleaning process. The ratio was one part detergent Synperonic N to 100 parts of water. The water was agitated to allow it to penetrate through the fibers to release the dirt particles (Fig 8,D), for 15 min. at 30ºC. Then a second cleaning bath with water only was applied for 10 mins again with water agitation, and then a third bath with water only, for 10 mins as shown in figure 13. The wet cleaning reduced the dust.

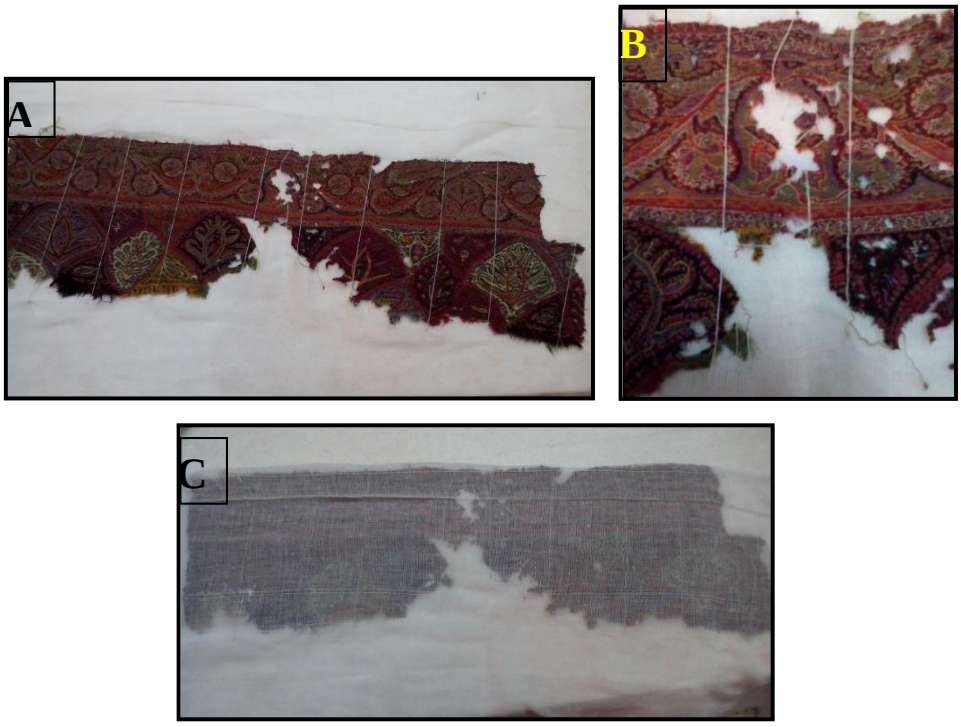

Fig 8,A: The object was fixed by fine cotton thread with running stitch on muslin fabric. B: The separated part was fixed. C: The object was placed between two muslin support fabrics and sewed it together

Fig 8,D: The water was agitated to allow it to penetrate through the fibers to release the dirt particles

5.4. The drying process

After cleaning the object was transferred onto clean and flat horizontal surface. The primary support was removed. The absorbent drying cotton fabric was used as a poultice and pressed lightly to the surface of the textile to absorb the remaining water of washing stage (Fig 9). By ensuring that the wet textile settled in a place. The object was left uncovered to complete drying at ambient conditions.

Fig 9: The absorbent drying cotton fabric was used to absorb the remaining water

6. The final support process

6.1. Preparation of wooden frame and textile support:

A new linen support fabric (The weave structure was plain 1/1) 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 fabric was stretched on a wooden frame which was chosen from a good wood after cut it with dimensions 80 × 31cm.

6.2. Dying procedure of the silk threads:

The silk threads that were used to support the object were dyed by the researcher who used cochineal for the red color (Fig 10). It was divided into the following stages:

The threads were dyed with cochineal to give red color. It was divided into the following stages:

- The cochineal dye was ground to a fine powder and sieved to remove any large residues. The dry powder obtained was used for the process of extraction.

- Aqueous dye solutions were prepared, by adding the dye powder to water in large beakers. The extractions were obtained directly by boiling (50g) of dye in (1000ml) of water at 100C° for 1 hour; the extractions were filtered through a filter paper to remove any big residue and to obtain a clear filtrate. The filtrate was used for dyeing of silk thread samples.

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

- Alum mordant was used by immersing the individual dyed silk threads in the mordant solution for one hour at a temperature of 80-90 C° using liquor ratio 1:100. The mordant solution was prepared by dissolving (alum, Tartaric acid, 5 g/l). After dyeing the unfixed dyestuff was removed by rinsing three times with cold water.

Fig 10: The silk threads were dyed by cochineal dye for the red color

6.3. *Permanent supporting*

Textile pieces are fixed on the new linen fabric holder by using knitting method; making small stitches by using a very fine needle with dyed silk yarn. The piece was set on the supporting fabric by taking into consideration putting it correctly. At the beginning, the piece edges are fixed in the wide stitch style with the blanket stitch (Fig 11,A). After that, the edges of the missing parts are fixed by using narrow stitches with the blanket stitch (Fig 11,B). The separated parts were fixed with couching stitch (Fig 11,C). After fixing, the piece became ready for displaying in the museum (Fig 12).

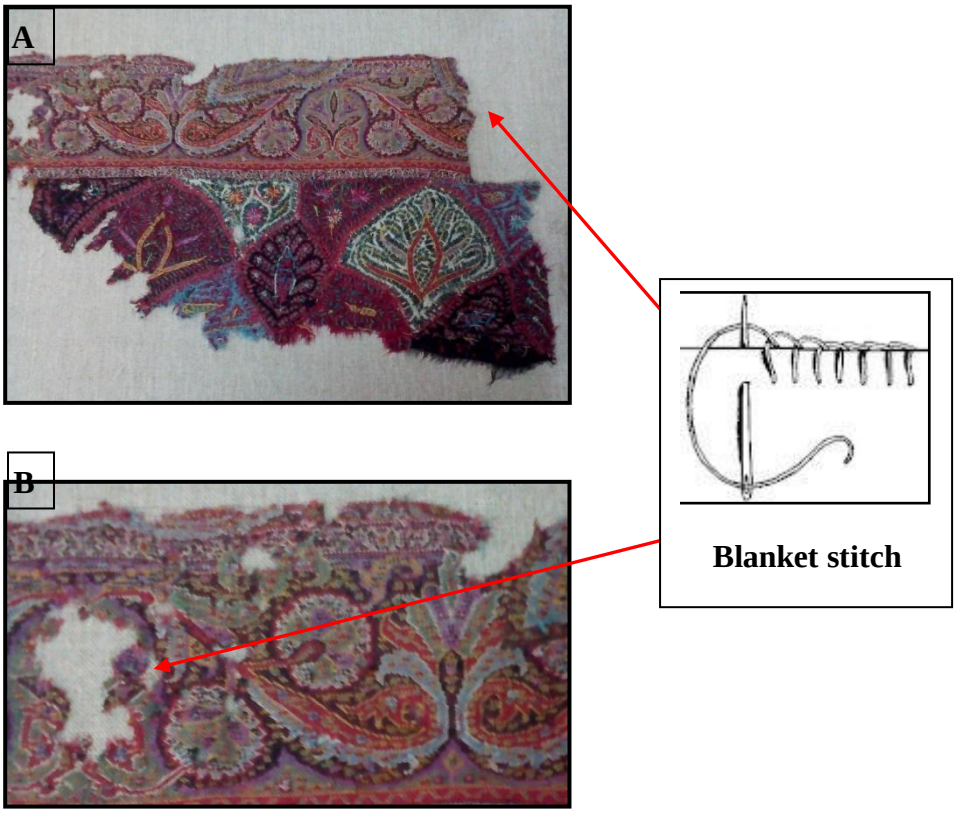

Fig 11,A: The piece edges are fixed with the blanket stitch. B: The edges of the missing parts are fixed with the blanket stitch. C: The separated parts were fixed with couching stitch

Fig 12: The piece after treatment process and became ready for displaying in the museum

7. The recommendations for displaying in the museum

- Rapidly fluctuating RH poses the greatest threat to organic materials. The goal guiding most collection management is to avoid a change in RH no greater than +/- 3% in one hour, +/-5% in 24 hours while sustaining a range of 40-65% RH.

- If RH is controlled, temperature control is generally less crucial, However Public areas are usually kept 17-19°C. For collections a range of 15- 25°C is acceptable.

- 50 lux is most often the given acceptable light level[(20)].

8. Discussion

This study included treatment and conservation of an archaeological cashmere textile dates back to the modern period. The object was stored in the Applied Art Museum. It is considered a kind of nonwoven textile. The object suffers from fiber damage, many separated parts, missing area, dirty. The piece was analyses by (SEM) which shown that the threads are wool. The object surface is very weak and brittle. FTIR analysis

(20) Daisy. S, "Conservation of Collections and Collection Management Plans", p 11.

has been performed showed that the sources of the colors are: Madder, Haematein which extract from Logwood, Madder mixed with Indigo, Indigo, Turmeric, Turmeric mixed with Indigo. The piece was cleaned 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.

9. Conclusions:

The cashmere textile dated to the modern period is hold by the applied art museum. It is considered a kind of nonwoven textile. The piece design was compared with an Indian cashmere piece from 1964. Both of the same characteristic design. The studying various damaging factors from the visual analysis and the others analysis of textile artifacts is a basic and essential step for conservation treatment. According to the results of dye analysis and technical analysis, yarns of the piece were dyed with Madder, Haematein which extract from Logwood, Madder mixed with Indigo, Indigo, Turmeric, Turmeric mixed with Indigo. This document used the various appropriate steps in the conservation process as: cleaning, repairing and supporting that is undertaken to remove pollutants from the artifacts and prevent their further damage.

10. References

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الملخص:

تناول هذا البحث مظاهر التدهور الموجودة بقطعة نسيج من الكشمير الهندى بسبب ما عانته من التعرض لعوامل التلف المتعددة أثناء التخزين السابق للقطعة النسجية بالمتحف، والقطعة تتميز بألوانها المتعددة وهى خزنت بمتحف كلية الفنون التطبيقية تحت رقم سجل ٦/١٢١، وقد تمت مراحل العلاج والترميم بنجاح حيث تمثلت مراحل العلاج فى: تنظيف القطعة، تدعيم المناطق المتدهورة للقطعة النسجية بتثبيتها على نسيج الكتان ثم تجهيزها للعرض المتحفى باستخدام إطار من الخشب، وقد تم فحص مظاهر التلف والتحلل العديدة الموجودة بالقطعة باستخدام الميكروسكوب الألكترونى الماسح وذلك للتعرف على نوع الألياف وحالتها والشكل المورفولوجى للألياف، وكذلك تم استخدام التحليل باستخدام الأشعة تحت الحمراء للتعرف على نوع الأصباغ، واستخدم التحليل باستخدام حيود الأشعة السينية للتعرف على نوع المرسخ.

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