

Original article

THE DOCUMENTATION AND TREATMENT OF A COPTIC CHILD'S TUNIC
IN EGYPT

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Abstract

Textiles are civilizational treasures and dresses are forms of cultural heritage, because clothing is a visual means of communicating ideas and values. It is very fragile, though, and can survive only in very good conservation conditions. Most become nearly completely destroyed due to ageing. This paper presents the documentation and conservation processes of a children Coptic tunic. The tunic is stored in the Egyptian textile museum. It dates to Coptic period, and it was made mostly of linen textile. Stereo microscopy was used in the identification of the textile structure and SEM microscopy associated with EDAX was used to identify the morphology of the fibers, recording the deterioration levels, and analysis the dirty threads. The analytical results proved that the textile structure involves plain weave openwork technique. The tunic was made of linen fibers. There are traces of calcium, chlorine, silicon, sulphide, magnesium and aluminum, elements. Within the same context, it could be said that the main challenges of conservation were the poor condition of the tunic and the previous supporting. The main conservation treatments were surface cleaning and supporting the dress on silk crepe line. The previous supporting stitches were removed. Finally, the tunic was prepared for museum display.

Keywords: *Conservation, Children's Coptic Tunic, documentation, SEM, Silk crepe line*

1. Introduction

Textiles removed from Egyptian burials allow us to figure out similarities in representation, and to speculate about the materials, construction, and design [1]. The era of Coptic arts started in ancient Egypt around the third century BC, after the conquest of Alexander the great in 332 BC. It combines the ancient Egyptian arts and other forms of arts which made its way to Egypt with the succession of states that continued since 30 BC until after the Islamic rule of Egypt in 641 AD [2]. Coptic textile arts can be divided into three periods from paganism to Christianity. There are three general and overlapping emerging categories: the Graeco-Roman period, followed by the transitional

period, and finally the Coptic period [3,4]. The main burial rite during this period was inhumation and corpses were usually dressed and fully clothed, sometimes even wearing many layers of clothes, with further dresses usually tunics and other textiles sometimes added in the grave, instead of mummification [5-8]. Tunics were the most popular burial dresses. A tunic is a simple garment that, as a rule, comprises two rectangles of cloth sewn together leaving an opening for the head [9]. This fashion changed with the turn of the 2nd and 3rd centuries AD. At this time, in addition to sleeveless tunics, the inhabitants of Egypt started to wear tunics with 'true' sleeves-long or short, wide or tight. Tunics were woven to shape

one piece [10]. When it came off the loom required only that it be folded in half at the shoulders, slit at the neck, and seamed up the sides and down the sleeves [1]. Probably starting from the 5th century AD, tunics were made up of three pieces stitched together. As for sleeveless tunics, they were also woven in one piece only. In Egypt of the 6th and 7th centuries AD, this tendency was expressed in tunics with long sleeves, sewn in several pieces [10]. It is a better use of fabric, because it's not cut out in a "one-piece" format. The fabric was an expensive and time-consuming commodity and it was not to be wasted. Also, making clothing using the panel and gore design allowed the sewer to better fit the garment, while still keeping all the seams straight lines. As you can see there is very little waste [11]. These Coptic textiles were constructed using the skilled weaving techniques of the Pharaonic era. Yet, wool was introduced, whereas flax had been favored for plain weave fabric [12], which is the simplest, plainest weave. While being extremely versatile in terms of appearance. Textiles of the same fabric structure may look quite different and have different material properties [13].

1.1. Description of Coptic tunic

The tunic was uncovered in El Fustat excavation area in Cairo, Egypt and was stored in the Egyptian Textile Museum under registration number no. T 573. It dates back to the Coptic era. The documentation of textile structure is shown in tab. (1), it represents a child's tunic with long sleeves. This white plain weaving linen garment was cut in a T-shape like most Egyptian tunics, forming an almost straight-sided body. The front is 4 cm longer than the back, with an opening slit at the front hem edge, fig. (1-a & b). Gores have been inserted in the side seams of the skirt, allowing the garment a better shape and fit. This reflects the development of tailoring in the Coptic centuries in Egypt [20]. The tunic was constructed from four gores with plain weave structure, 10 panels: eight with plain weave openwork and two with plain weave structure, There is one panel piece with plain weave stru-

Although the exceptionally dry conditions in Egypt have enabled the survival of that many textiles and complete tunics [14-16]. However, all organic materials are inherently unstable, very fragile, exposed to dangers of deterioration all the time, and it is quite impossible to stop such ageing and deterioration [17]. Besides, burial cloths usually bear evidence of stains and discoloration that cause change in the actual textile [9]. But these processes can be slowed down with interventive and preventive conservation processes [11]. Conservation is not merely a technical procedure performed on a cultural object. Rather, it is a cultural process made possible by technical means. The conservation processes includes several different steps: basic cleaning and drying steps, as well as consolidating [18]. For such reasons, this study aims at the documentation of the tunic including all information concerning conservation, analysis of cultural and historical context, data concerning the archaeological site, as well as the results of different analyses [19], and finally establishing a conservational strategy and selecting the right mount and a safe display.

cture as a lining was sewn from the inside of the dress from the top of the back at the shoulders. To provide a slight quilted effect, it was widened about 4 cm at the top, so it could be part of a collar or maybe a missing child hood. There are two small square pieces (gathered triangular gussets) with a plain weave openwork structure that give ease at the underarm. Finally, all pieces are seamed together. Here we could see that the panels and gores are widened towards the bottom edge, fig. (1-c). The tunic bear signs of wear, reuse, and mending, indicating that they had been in use long before being placed in the grave because there are wrapped edges of some missing parts to avoid further tear with the same type of the threads and stitching in which the Tunic parts were sewn, fig. (1-d). Generally, the tunic is small, very light and transparent.

Table (1) Documentation of the textile structure

Dimensions	62 cm long x 50 cm wide
Weave structure	plain weave 1/1 plain weave openwork
No. of the warp	20/cm
No. of the weft	20/cm
Direction of twist of yarn	's' direction
Design	Coptic design
Fibers	Natural linen

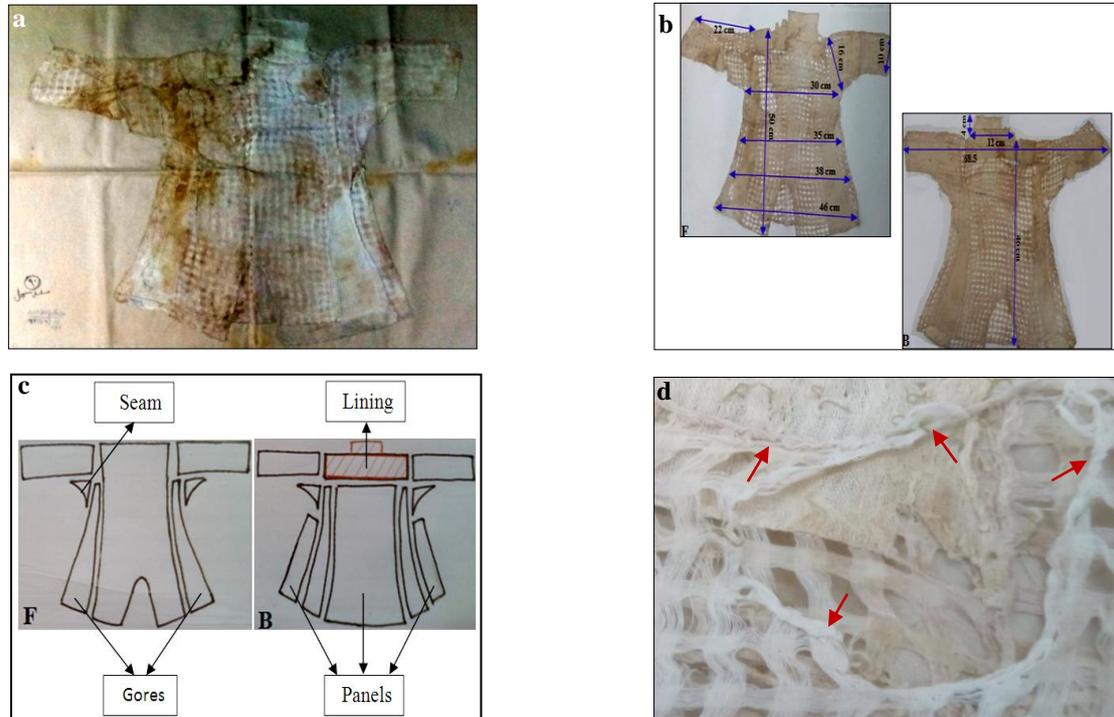


Figure (1) Shows **a.** the Coptic child's tunic in the Egyptian textile museum, **b.** dimensions of the garment from the front (F) and back(B), **c.** the tunic was constructed from gores and panels, **d.** wrapped edges of some missing parts as a bear signs of wear

1.2. Deterioration state of Coptic tunic

The Coptic tunic was already cleaned at the excavation site and then was fixed on a cotton fabric with smallest buttonhole stitches and green cotton threads as a flat textile and was folded in many layers which created stress on the folding spots, fig. (2-a). There are big sections of fabric missing from the front of the tunic and the right side exte-

nding to the arm, fig. (2-b,c). The Coptic tunic is very dirty, fig. (2-d), and shows various signs of deteriorations such as separated threads, fig. (2-e), loss of small parts, fig. (2-f), the registration number of the tunic is written with blue ink, fig. (2-g), and the parts around the missing fabric and the dirty parts are very weakened and hard, fig. (2-h).

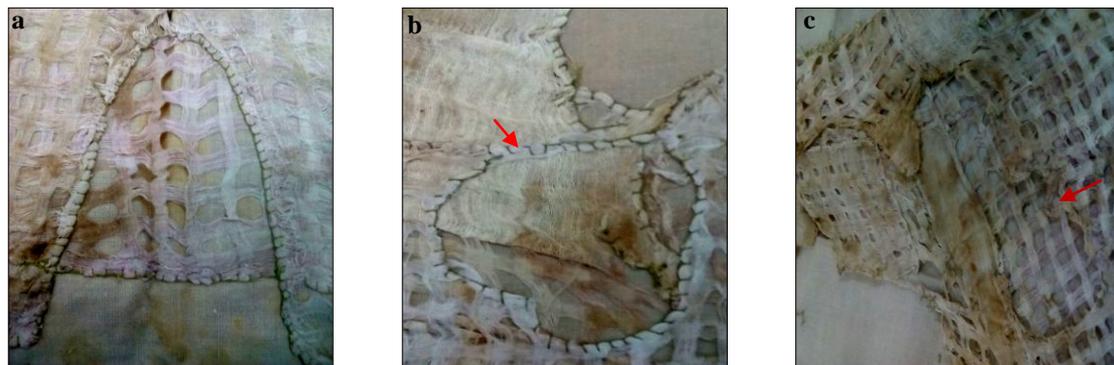




Figure (2) Shows many deterioration forms such as **a.** fixed with a flat textile, **b.** missing parts, **c.** missing part on the right side, **d.** dirties, **e.** separated threads, **f.** loss of small parts, **g.** writing with blue ink, **h.** weakened parts

2. Materials and Methods

2.1. Samples

Small samples were taken from the Coptic child's tunic and subjected to

2.2. Techniques used

Stereo microscope was used to investigate the weave structure of the tunic, the dirty threads and the direction of yarn twist. In addition, Quanta 250 FEG SEM attached with EDX Unit (Energy Dispersive X-ray Analyses, and K550X

further specific investigation through using some scientific techniques.

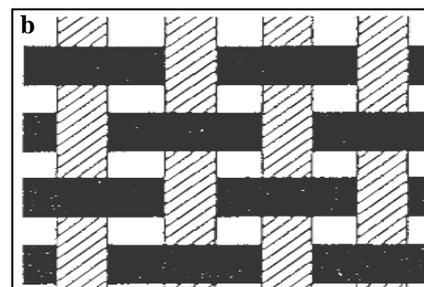
sputter coater England), was adapted to investigate the morphology of the surface of the fabric, and evaluate the different components qualities and quantities, as well as the damage its aspects of the fibers according to Amin [21].

3. Results

3.1. Stereo microscopy

Stereo microscope photos of threads examination illustrate that the weave structure of the tunic was 1/1 plain weave technique, fig. (3-a,b) and this plain is an

openwork weave technique, fig. (3-c,d,e). In addition, the dirty threads are appear, fig. (3-f), and the yarns spin is in 's' direction, fig. (3-g).



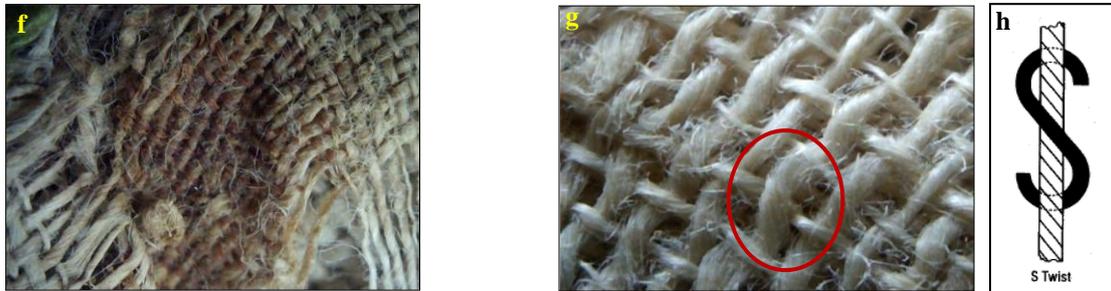
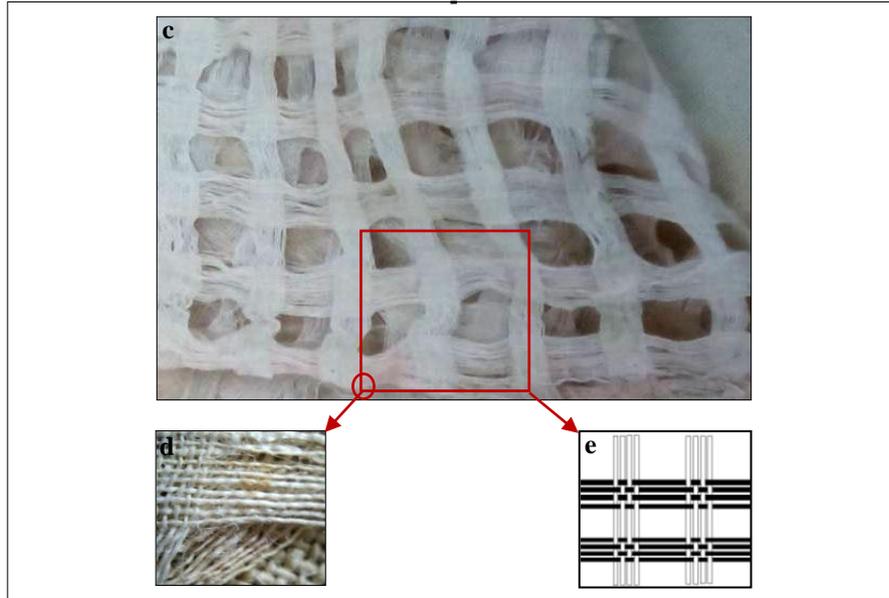
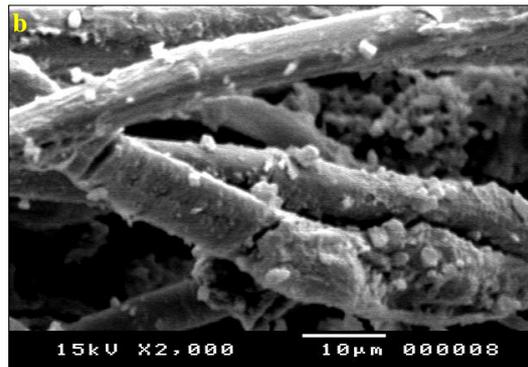
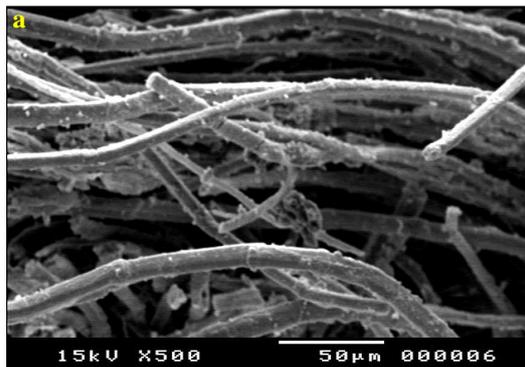


Figure (3) Shows **a.** & **b.** the plain weave structure of some parts in the tunic, **c., d.** & **e.** the plain openwork weave structure of the tunic, **f.** stereoscopic photo showed that the fabric coated with dirt, **g.** & **h.** the direction of twist of yarn in 's' direction.

3.2. SEM photomicrographs and EDX analysis

The examined threads by SEM illustrate that all of them are linen fibers as shown in fig. (4-a). These fibers are extremely damaged, broken and dirty, fig. (4-b). Moreover, the results of EDX analysis, fig. (4-c) show that there are dust accumulations on the surface of the fibers, exhibiting many elements which came from the burial soil. The dirt consists of calcium, chlorine, silicon, sulphide, magnesium and aluminum. These elements cause damage

to fibers if accumulated over a long period of time as attested by Antoniou [22] and Hassan [23] in their studies. In addition, the results show that the subsurface conditions at El Fustat consist of silt, clay and fine sand, where, this city suffers from a rise of groundwater levels that characterized by high saline index. This high index is essentially attributed to the presence of sulphate, nitrates and chlorides.



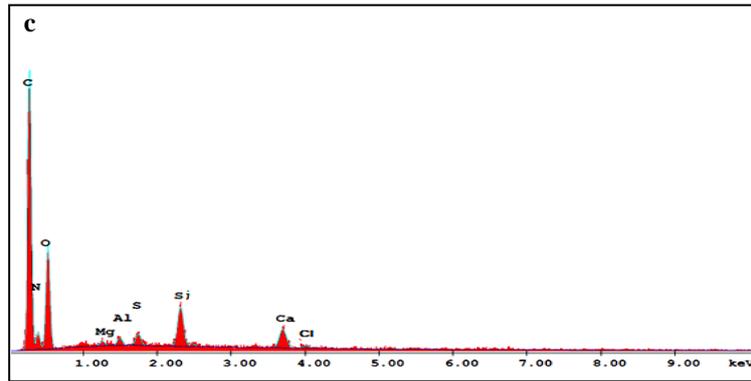


Figure (4) Shows **a.** linen fibers features **b.** the broken fibers containing dirties, **c.** EDX pattern of accumulations of dust on the fibers surface

4. Strategic Plan for the Tunic Conservation

4.1. Cleaning procedure

4.1.1. Mechanical cleaning

Regarding the mechanical cleaning process, there was no free dust can be removed.

4.1.2. Wet cleaning

Since the Tunic showed signs of dirt and dryness inducing structural weakness that impeded proper manipulation, it was necessary to submit them to a treatment aimed at providing strength and stability [24]. For this purpose, the wet cleaning was used. This procedure was conducted in several steps as follow:

- * Firstly, the fixed stitches were removed, fig. (5-a,b), and the tunic showed severe dryness, especially to the high right side of the Tunic.
- * Secondly, the tunic was primarily supported by placing it between two webbed support fabrics, and sewed together around the tunic with cotton threads using a running stitch, fig. (5-c). In order to protect the parts of the textile from disintegration during the different cleaning processes [25].
- * Finally, washing solution was prepared by mixing water with other detergent agents (Synperonic N), to increase the effectiveness of the cleaning process [26]. It adheres to the surface of soiling and reduces the surface tension and penetrates into soiling on the fiber surface and removes it [27,28].

4.1.3. Dry cleaning

In this process, Ethyl alcohol was used for removing of the spots and soiling ink residual by using a piece of

oved because the tunic was cleaned before, and it has never been used since then.

The ratio was one part of detergent (Synperonic N) to 100 parts of water. Another additive was also included, namely sodium carboxymethyl cellulose (SCMC) (concentration 0.1 g / L) [29]. The washing solution was agitated by brush to allow it to penetrate between the fibers to release the dirt particles for 15 mints. The bath temperature was 30 °C. Then a second cleaning bath with water only was applied for 10 mints again with water agitation, and then a third bath with water only, for 10 mints, and then a fourth bath with water only, for 10 mints to remove any detergent remains [30,31], fig. (5-d). So, we took advantage of the wet cleaning as it provided humidity to the dry threads, avoiding their loss. It, also, reduced the soiling, obtaining satisfactory results. After cleaning the Tunic 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 remove all excessive water. By ensuring that the wet threads settled in a place. The tunic was left on blotting paper to completely dry at room temperature [30,32], fig. (5-e).

cotton after 5 minutes according to Amin [21], fig. (5-f).



Figure (5) Shows **a.** fixed stitches were removed, **b.** stages of removal the green fixed threads, **c.** supporting the tunic during the cleaning, **d.** immersing the tunic in the washing solution, **e.** the tunic on a blotting paper, **f.** the tunic before and after removing of remains of blue ink using dry cleaning

4.2. Support process

4.2.1. Tunic reinforcement

A complete lining attached to the back of the tunic is required to stabilize the loose elements and to support the tunic for display [33]. The tunic was laid onto a dress of silk crepe. The backing mounting dress has to be attached with the tunic using fine needles and silk threads.

4.2.2. Preparation for museum display

A mount was created to display the tunic. Mounts has been provide the additional support needed to further stabilize the artifacts for the display duration. Good

Different stitches were used in this work. The damaged areas were stitched using couching stitches and running stitches. The edges of lost areas and all the out edges of the Tunic was mounted and stitched on a new crepe dress using blanket stitches.

mounts are able to support weak areas, not stress the artifacts, and allow them to fit accurately and unobtrusively. Their assembly should not be too complicated

so as not to cause over-handling. There is no fixed fabrication method or material to use, as each one is unique and customized to the special needs of an artifact. Mannequins are usually padded and wrapped to protect artifacts against rough edges. When a garment is worn over a mount that has been customized to its shape, it is presented in three-dimensional form. Mounts are held in place with horizontal bars or T-bars [11]. The mount was prepared to display the Tunic with T-bars, fig. (6-a), and was wrapped with blue linen

fabrics according to the museum requirements as follows:

- 1) The Garment was worn over the customized mount.
- 2) Horizontal bars were inserted through the sleeve and bottom openings.
- 3) Horizontal and vertical bars were screwed together through an opening in the vertical bar.
- 4) The T-bar and base plate were screwed together and anchored to the floor [11]. The tunic in the final stage is shown in fig. (6-b,c).

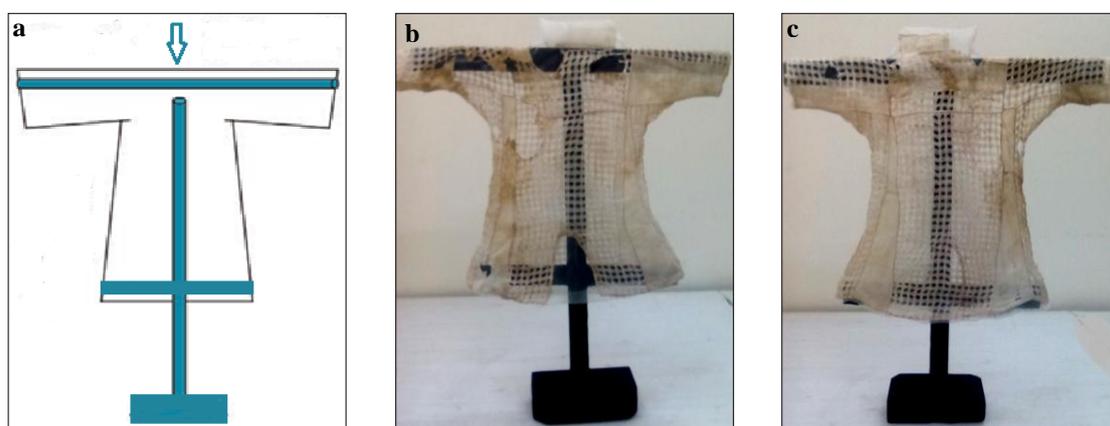


Figure (6) Shows **a.** the mount was prepared with T-bars, **b.** the tunic in the final stage from the front, **c.** the tunic in the final stage from the back

5. Discussion

The tunic from the Coptic age, was investigated to help in its documentation and to a properly conservation [34]. The visual investigation showed that this object suffer from fiber damage and missing parts especially from the front of the tunic and the right side extending to the arm, dirt and stains which caused a lot of deterioration aspects [35], separated threads, loss of small parts, the registration number of the tunic is written on it with blue ink. The tunic was cleaned at the excavation site and then was fixed on a cotton fabric with smallest buttonhole stitches and green cotton threads as a flat textile and was folded in many layers which created stress on the folding spots. The stereo microscopy, figure (3-a,b,c,d,e,f,g) showed that simple weaving patterns of interlacing have been found to be used most frequently in the fabric. Furthermore, a very straight forward system of inter-working elements

such as the warp and weft passes under or over each other include 1/1 plain weave technique as argued previously by Karydis [36] in his case study, and 1/1 plain openwork weave technique. SEM photomicrographs, (4-a,b) was able to show the morphology of fiber and fabric surfaces, because of the irregular nodes [37]. The images clarified the degree of deterioration and degradation of tunic, in addition to linen fibers as a main component. While the EDX analytical results, (4-c) showed that the Ca, Cl, Si, S, Mg and Al as traces elements are essentially attributed to the burial effects as attested by Antoniou, et al. [22] Hassan, et al., and [23]. The study is also confirm that it is necessary to conserve the tunic in the museum, this processes that improved the appearance of the tunic through improving its physical and mechanical properties which will make it more durable. The usual met-

hod of cleaning textile objects by immersion in an aqueous solution (wet cleaning) was the most suitable for our case study [25,29,32,38]. After finishing the cleaning processes of the tunic; it appeared softer and it was supported through stitching to silk crepe fabric to reinforce the deg-

radation areas, control the physical damage and to stabilize the whole artifacts shape [39]. Finally, a mount was created to display the tunic to minimize damage in handling, display and to exhibit it in an attractive way as noted previously by Abdel-Kareem [33] Rowe, et al. [40].

6. Conclusions

The present study shows the scientific restoration of a Coptic child's tunic preserved at the Egyptian Textile museum in Cairo, Egypt. The archaeological documentation has been explained, selected specimen of tunic have been examined and it shows the textile structure involves plain weave openwork technique, the linen and threads of the were extremely damaged. The restoration of the Tunic has been performed following scientific procedures starting with wet and dry cleaning, followed by consolidation by fixing on crepe silk support with different stitches and final display.

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