FIRST AID OF RARE PTOLEMAIC TEXTILE IN TUNA EL-GEBEL EXCAVATION, EGYPT

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Among the findings of the excavations of Tuna el-Gebel, Egypt several pieces of textiles were unearthed. These textiles were found in poor conservation state and risked further deterioration if left untreated. This article describes the analytical study and simple conservation interventions that were applied to these textiles, here exemplified with the treatment of a single object. Prior to the intervention, scanning electron microscopy was used to analyze the fibers to identify them and to characterize their deterioration. This case study provides a clear example of the type of damage that exist on the textiles recovered in Tuna el-Gebel.

Introduction

The excavation of Tuna el-Gebel was a scientific joint venture between the Institute of Egyptology of the University of Munich, Germany and the University of Cairo, Egypt. The ibis burial place at Tuna el-Gebel, located at west of the ancient city of Thermopolis Magna, has been the first, and for a long period, the only ibis and baboon animal cemetery during the reign of Pharaoh Pasmetkhos (664–619 BC).

The number of ibises deposited in the extensive subterranean galleries network clearly exceeds one million individuals in total, indicating that on average some 15000 birds had been placed each year in the galleries by the cult servants. Although most specimens originated from more than a dozen ibises feeding places around Tuna el-Gebel, there is evidence of mummified specimens from elsewhere such as from the Province of Faiyum. In addition to the bundles and mummies of Sacred and Glossy Ibises which constitute most part of the collection (> 80%), at least 115 other vertebrate taxa could be found in the galleries, comprising domestic (cattle, sheep, dogs and cats) and wild mammals (such as shrews, monkeys, ichneumons, wild cats, and gazelles), reptiles (crocodiles and snakes) and fishes, as well as a huge variety of birds (such as herons, storks, geese, ducks, birds of prey, and owls). The archaeological zone of Tuna el-Gebel (Figure 1) is situated in a flat desert landscape at west of the cultivated Nile valley, 5 km to the south of the modern village, opposite to a wide desert valley [1].

Textiles are sensitive materials since they are very prone to damage when exposed to light, heat, humidity, pollution and microorganisms. They are extremely vulnerable to decay when stored or displayed in inappropriate environmental conditions. The main purpose of this conservation intervention is to improve the properties of the textile objects, enhancing their long term stability by slowing down the rate of further deterioration. Conservation processes comprised cleaning disinfection, consolidation, mounting and storage [2, 3].

Description and Condition

Among other findings, a piece of dyed textile with vertical and horizontal threads colored with blue and dark beige was unearthed (Figure 2). The piece (registry number T.G 4184) belongs to the Ptolemaic era and was found in the Tuna el-Gebel excavations (Gallery D–D-2) in February 2001. The width of the vertical beige threads and of the vertical blue strips is 2.5 cm and 1 cm, respectively. The horizontal stripes are repeated every 12 cm. The textile is severely damaged and there are many parts missing in the middle.

The textile has dark stains of unknown source that were difficult to remove when traditional methods
were used. There are also other unclear parts, probably due to the soil and dust from the tomb ground, that were difficult to clean. The edges of the textile show some sort of solid that could be gypsum. Archeologists have identified this piece as being a cloth bag to place the ibis mummy. It should be noticed that there are two threads above the piece which could have been used for closing the bag opening. The textile has weak or missing parts in the irregular edges. Considering its poor conservation state, the textile object required conservation intervention, especially cleaning for the removal of foreign material to avoid further damage.

After its discover, the textiles were initially preserved under uncontrolled conditions in cellars at the Ibis cemetery (Figures 2 and 3). The existence of high humidity in the cellars is a constant throughout the year making these textiles more easily exposed to degradation under these conditions.

Examination and Analysis

Visual Study

The initial visual assessment revealed that the textile presented a poor conservation condition (Figures 4 and 5). The textiles were weak and very dirty since they were covered with dust, soil and stains. In general, the object suffered from intensive surface damage resulting in fiber deformation, missing parts and holes especially along the objects edges. The fringes were weak and suffered from abrasive damage and tearing.

Morphological Study

The morphology of the textile surface was examined using a scanning electron microscope (SEM) FEI Quanta 200 ESEM FEG. The textile fibers were examined according to the Tabulations of Recognition Characteristics for Fibers [4, 5]. The results showed that both warp and weft yarns were
Figure 2. View from the front and back of the textile with dyed trappings consisting of vertical and horizontal threads colored with blue and dark beige.

Figure 3. Views of the textile showing different details from its conservation condition prior to the conservation intervention.
Figure 4. Several views and details of the textile. There are unclear parts, probably from dust and soil from the tomb ground, and dark stains from unknown source.

Figure 5. Details from the mechanical damage: fiber deformation, missing parts and holes, especially along the edges.
composed of linen fibers. The SEM micrographs (Figure 6) show changes in the fiber morphology. In particular, it can be seen that the fibers are roughened, damaged, broken with transverse cracking and longitudinal splitting characterized by scratches, slits and holes in the fibers. These damages are the effects of degradation induced by light, relative humidity and soiling. Furthermore, dust, dirt and adhesive can also be seen covering the fibers.

**Conservation Intervention**

**Mechanical cleaning**

The object was covered with dirt, namely dust, lose sand particles and calcified and compact sand deposits, that was removed with the use of different types of smooth and rough brushes. To help the removal of the calcified sand, an air blower together was also used with the brushes.

**Temporary Support Reinforcement**

Before proceeding with any wet cleaning procedure, the object was temporarily inserted between two layers of fine nylon tulle (sandwich method) in order to offer the fabric the necessary support to withstand the cleaning process (Figure 8A). The stitching was made with a very thin needle and cotton thread using a running stitch. The needle was carefully inserted between the yarns and not through them to avoid any damage to the weakened fibers. In this process, it is very important to keep the stitches tension fairly loose, allowing
Figure 7. The stability test had the objective of determining if the dyes were soluble in the cleaning solutions. For the test, a cotton swab immersed in the cleaning solutions used for washing was placed in contact with the colored fibers.

Figure 8. Details from the wet cleaning procedure: (A) the textile was placed temporarily between two layers of fine nylon tulle (sandwich method); (B) wet cleaning procedure using water and natural detergent Syneronic N; (C) local dry cleaning with alcohol for the soiling parts with smooth brushes; (D) drying the object after the cleaning process.
an even weight distribution across several yarns for each stitch.

**Wet cleaning**

The main purpose of the wet cleaning was to remove the rests of harmful deposits of soils and dirt that were disfiguring or causing physical and chemical damage to the textile. The selection of the most appropriate cleaning method depends from several factors such as the nature of the dirt and of the materials, structure, and condition of the textile [8]. To avoid causing unnecessary movements during the cleaning of the textile, the washing is best performed in the same tray and changing the cleaning solutions when required.

The solution used for the first bath consisted of one part of detergent Synperonic N to 100 parts of distilled water at 30 °C. The solution was agitated for 15 minutes to increase its penetration in the fibers and the release of the dirt particles (Figure 8B). Then, a second and third baths with pure distilled water were given, each for 10 minutes and again agitating the water. This operation reduced the soiling, relaxed the fibers, removed the creasing and brightened the colors [2, 9, 10]. A pH indicator was used to control the solutions’ pH.

**Dry cleaning**

After the wet cleaning was completed, it was observed that some soiling was not removed.
Hence, further cleaning was attempted using smooth brushes with alcohol for 15 minutes (Figure 8C). However, this procedure had poor results and the dirt was not completely removed. Afterwards, the textile was inserted in a bath with distilled water and alcohol without soap for five minutes to remove any undesired traces and to equalize the effect of the alcohol on the fibers. This step was applied on all the pieces that were cleaned. This process also allowed the sterilization of the fabric from the effect of fungi and fungal spores that could have been present [11].

**Drying and Laying out**

The drying process of wet textiles can provide an opportunity to realign distorted fibers. The water acts as a lubricant reducing the stress of the fibers and allowing the straightening of the yarns with minimum risk. Blocking and drying are considered a crucial part of wet cleaning process [3]. To proceed with the next stage – drying – a table was prepared and covered with sheets of black plastic. Then, the textile pieces still wet from the wet cleaning were placed on top of the table and
covered with sheets of Japanese papers to absorb any water surplus (Figure 8D). It should not be forgotten that while wet the textile is soft and can easily be damaged during handling [3, 12].

**The Final Support**

In order to prepare the textile for storage and display, it is necessary to provide the fabric with a new support to increase its strength. For this, a wooden frame was prepared by a carpenter from a nearby village to the location of excavations. The wooden frame was later coated with Paraloid B72 (10% in acetone) to isolate the wood from the environmental conditions, minimizing thus the movements of the wooden frame [2]. Later, a new undyed linen support was prepared and washed to remove any chemical residues from the sizing and finishes, and to prevent shrinkage at a later time due to the humidity changes. After washing and drying, the linen was ironed to remove creases and it was then attached to the wooden frame with tacks [13].

**Mounting**

Once the new fabric support was prepared, the textile object was placed carefully over the fabric (Figures 9 and 10). In mounting, it is important to choose the right materials such as needles and threads to provide the maximum visual satisfaction and to ensure of the future stability without the risk of adverse effects [2]. Usually, conservators recommend silk threads as the best choice, followed by cotton, viscose rayon or polyester, depending on availability. In this project, a very fine undyed silk thread was used. In the beginning, the object was fixed in the support with wide stitches to preserve its place. Later on, two types of stitches were used: the first type, an overcast stitch, was used to support the edges of the object; and the second type, a running stitch, was used to support the internal areas adjacent to primary stitches and damaged areas. These stitches ensured that the mounted textile was not strained, although they were tight enough to prevent movements or abrasion on the mounting. This type of framing ensures good support for the object and will reduce future handling to a minimum rate (Figure 11). The mounting is the last stage of the interventions, after which the object becomes ready for either storing or display [2, 14, 15].

**Conclusion**

The present article described the analysis and conservation intervention of a textile found in the archeological excavations in Tuna el-Gebel, Egypt. The textile, dating from the Ptolemaic period, is thought to have been a bag for a Ibis mummy. Analyses by SEM have shown that the textile found in the excavations of Tuna el-Gebel are made of linen. The objects 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 its cleaning and mounting in a proper support, had the objective of increasing its stability. Although there was a noticeable improvement of 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 the cleaning and its mounting, the object is free from dirt, has become softer and it is aesthetically more pleasing.

Physically, the wrinkles and folds are also much less obvious. It is recommended that the textiles should be moved from the excavation to the to the Al-Ashmounin Museum storage as soon as possible after the conservation treatment for safe keeping of the pieces. It is also recommended that
further research should be carried out to study the materials used in the manufacture of the textile, namely the natural dyes and mordents.

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