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AN ANALYTICAL BASELINE FOR RED-COLOURED TEXTILES OF PHARAONIC EGYPT

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The image of an Egyptian mummy is normally one of a human body wrapped with pallid-coloured linen bandages. However, in spite of this image which endures in the public imagination, some mummies in the first millennium B.C. were covered by red shrouds or wrapped with red-coloured bandages. Some of these shrouds have fully retained their intense colour over time, and in some other cases red-coloured textiles become visible by removing external straps or other mummy bindings to expose the under-laying textiles. This is frequent during conservation treatments, which allow us to take a look at the colourful reality hidden under textiles that - apparently – have the colour of natural flax fibres.
Although some general information on likely candidates for colour are reported in the archaeological literature [1], a systematic scientific study, aimed at defining the general strategy for the detection of the colouring materials in ancient Pharaonic textiles, has so far been lacking. A set of analytical approaches have been explored in this work in order to define the most suitable tools to support archaeologists in shedding light on how the use of red shrouds and textiles was embedded in the funerary practices of Pharaonic Egypt.
The collaboration between analytical chemists and archaeologists yielded a set of 15 samples, which were obtained from mummy bandages and shrouds from the collections at the Museo Egizio in Torino and at the British Museum in London. The scientific team investigated the colourants *in situ* by non-invasive techniques (namely, fibre optic reflectance spectroscopy - FORS - and portable fluorimetry, p-FL), and in the laboratory according to a micro-invasive approach. Optical microscopy (OM) under visible or UV illumination, HPLC-ESI-Q-ToF, SEM-EDX and micro-XRF were employed on the samples detached from the selected textiles. The analytical approach was primarily aimed at highlighting the advantages and drawbacks of each technique regarding the identification of

O3 CH

colourants and dyeing methods. The investigation of inorganic mordants was considered throughout, particularly because these textiles are normally heavily contaminated and data from elemental analyses are open to misinterpretation. Overall, the main aim of the study was to establish an analytical baseline over which further case studies may be assessed and added to in the future.

Figure 1. The red shroud on mummy S. 5227 (Torino, Museo Egizio).

The discolouration of some of these textiles represents a further intriguing aspect, as in some cases the red colour is still vivid and well-preserved (Figure 1), whereas in others it appears faded or severely discoloured.
Results pointed towards the presence of at least three sources of the red colour: safflower (*Carthamus tinctorus*), madder (*Rubia* sp.) and a red ochre. As expected, the information obtained by HPLC-MS enabled more detailed information to be collected when organic dyes are present, with high sensitivity and detailed identification of mixtures of dyes. On the other hand, both FORS and UV-OM microscopy proved to be very effective and affordable tools for an informative screening of the colouring materials. FORS can provide conclusive identification of the main colouring agents, and UV-OM is able to distinguish between luminescing (madder and safflower) and absorbing (red ochre) materials.
The investigation of the inorganic components by comprehensive analysis on the whole fibre by micro-XRF and spot analysis on single particles by SEM-EDS enabled some information on mordanting to be recovered, although the unequivocal recognition of the raw materials possibly used for fixing the dyes proved to be a hard task.
The combination of micro-morphological observations and elemental analyses yielded some insights into the colouring processes and allowed us to highlight the most fugitive colour. Textiles dyed with red ochre or madder still preserve, at least partially, their red colour. For madder, the scientific insight lead to conclude that light fastness was improved by exploiting the combined effect of alum and tannins in a same dye-bath to produce a sort of “madder lake” deposited on the fibres. As expected, poor light-fastness of safflower resulted in the almost complete fading of the areas that have been exposed to light.

References

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