

The Challenges and Opportunities in Looking for Iron Mineral Dyes in Textiles using XRF Spectroscopy

Maeve Moriarty, Canadian Conservation Institute

Jennifer Poulin, Canadian Conservation Institute

Contact Author E-mail Address: Maeve.Moriarty@canada.ca

Iron has long been used in textile dyeing. Iron can be bound to textile fibres during dyeing, either to fix an organic dye to the textile (as a mordant), or developed as the mineral dye called iron buff. This golden-yellow to brownish-yellow colourant is associated with ancient cultures, and more recently as a colourant for 18th- and 19th-century printed fabrics, curtains and rugs due to its colour and permanence.¹ Although iron buff was detected on ancient Egyptian textiles by scientists over a hundred years ago,² since then it has rarely been identified. There are a number of possible sources for trace iron concentrations detected on archaeological textiles. These include iron that is present in fibres naturally and iron that is associated with burial environments. The difficulty in confirming the presence of iron buff is due to the multiple possible sources of iron on archaeological textiles.

This presentation will discuss a multi-analytical approach to differentiate between fibre-bound iron buff dye and iron soil contamination. Methods used include X-ray fluorescence spectroscopy (XRF) for mapping and elemental analysis, gas chromatography-mass spectrometry (GC-MS) for the detection of organic dyes, scanning electron microscopy (SEM) for imaging, and staining techniques to determine the nature of iron present on the fibres. The results from the analysis and imaging of a number of threads experimentally dyed with iron buff will be presented. Additionally, the results of XRF mapping of two 19th century textiles will be presented, one an iron buff calico print, and the other a textile dyed with madder and mordanted with iron. Finally, a number of archaeological textiles where iron buff colourant was suspected and analysed using the same techniques and the results will be presented.

References

1. Exmouth CEP. *Dyes and Dyeing*. New York, R. M. McBride & company; 1918.
2. Lucas A, Harris J. *Ancient Egyptian Materials and Industries*. Courier Corporation; 2012.