

## Accepted Manuscript

Ancient encaustic: An experimental exploration of technology, ageing behaviour and approaches to analytical investigation

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PII: S0026-265X(17)30869-X  
DOI: <https://doi.org/10.1016/j.microc.2018.01.040>  
Reference: MICROC 3032  
To appear in: *Microchemical Journal*  
Received date: 30 August 2017  
Revised date: 18 December 2017  
Accepted date: 24 January 2018

Please cite this article as: R.J. Stacey, J. Dyer, C. Mussell, A. Lluveras-Tenorio, M.P. Colombini, Celia Duce, Jacopo La Nasa, Emma Cantisani, S. Prati, G. Sciutto, R. Mazzeo, S. Sotiropoulou, F. Rosi, C. Miliiani, L. Cartechini, J. Mazurek, M. Schilling , Ancient encaustic: An experimental exploration of technology, ageing behaviour and approaches to analytical investigation. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. *Microc*(2017), <https://doi.org/10.1016/j.microc.2018.01.040>

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**Abstract**

The composition of the ancient wax-based painting technique known as encaustic has long been the subject of debate. Ancient sources provide few details of the technology, and modern understanding of the medium is restricted to theoretical interpretation and experimental observation. In this multi-analytical collaborative study, a number of analytical approaches were used to investigate the physical and molecular properties of a range of experimentally prepared encaustic paints before and after ageing. Analysis using gas chromatography mass spectrometry, Fourier transform infrared spectroscopy (invasive and non-invasive), X-ray diffraction and thermogravimetric analysis demonstrated how differences in the technology of production alter the properties and composition of the medium and showed how these are modified by the addition of pigment and the effects of ageing. Comparison of results from the different analytical techniques highlights the benefit of an integrated analytical approach to the analysis of ancient encaustic paints and the fundamental importance of insights from invasive study to evaluating the results of non-invasive analysis.

**Keywords:** Encaustic; Punic wax; GC-MS; FTIR; TGA; XRD**1. Introduction**

The wax-based painting technique, known as encaustic, was used in antiquity for the production of wall and panel paintings (such as the Roman period Egyptian mummy portraits), ceramics and polychrome sculpture [1]. The ancient documentary sources provide few details of the technology of the technique, which has been a subject of much debate for many years [1, 2]. In consequence, modern understanding of the medium is limited to theoretical interpretation of the results obtained from analysis of ancient encaustic paints and observations from experimental reproduction, either to replicate ancient recipes, model the interpretation of analytical studies or to explore working properties [1, 3, 4].

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