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Multi-analytical study of Roman frescoes from Villa dei Quintili (Rome, Italy)

Vincenza Crupi[a], Barbara Fazio[b], Giacomo Fiocco[c,d], Giuliana Galli[e], Mauro Francesco La Russa[f], Maurizio Licchelli[g], Domenico Majolino[a], Marco Malagodi[c,h,*], Michela Ricca[f], Silvestro Antonio Ruffolo[f], Valentina Venuti[a,**]

[a] Dipartimento di Scienze Matematiche e Informatiche, Scienze Fisiche e Scienze della Terra, Università degli Studi di Messina, Viale Ferdinando Stagno D'Alcontres 31, 98166 Messina, Italy
[b] CNR-IPCF Istituto per i Processi Chimico Fisici, viale F. Stagno d'Alcontres 37, Faro Superiore, I-98158 Messina, Italy
[c] Laboratorio Arvedi di Diagnostica non Invasiva, CISRiC, University of Pavia, Via Bell'Aspa 3, 26100 Cremona, Italy
[d] Dipartimento di Chimica, Università di Torino, Via Pietro Giuria 5, 10125 Torino, Italy
[e] Soprintendenza Speciale per i Beni Archeologici di Roma, Villa dei Quintili, via Appia Nuova 1092, 00197 Roma, Italy
[f] Dipartimento di Biologia, Ecologia e Scienze della Terra (DiBEST), Università degli Studi della Calabria, Via Pietro Bucci, 87036 Arcavacata di Rende, CS, Italy
[g] Dipartimento di Chimica, Università di Pavia, Via Taramelli 12, 27100 Pavia, Italy
[h] Dipartimento di Musicologia e Beni Culturali, Università di Pavia, corso Garibaldi 178, 26100 Cremona, Italy

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ABSTRACT

The present work reports a multi-analytical study, based on Polarized Optical Microscopy (POM), Scanning Electron Microscopy equipped with an Energy Dispersive X-ray detector (SEM-EDX), micro-Raman and Fourier Transform Infrared Spectroscopy (FT-IR) techniques, aimed at establishing the painting techniques and palettes used to decorate a variety of fragments of frescoes coming from Villa dei Quintili in Rome (Italy) and dated back 2nd century CE. This combined methodological approach, covering different spatial scales extending from the macroscopic to the elemental domain, revealed successful for the unambiguous identification and characterization, in non-invasive or at least micro-destructive way, of pigments, binders and stone materials. The used chromatic palette was identified as yellow ochre (goethite), carbon black (vegetal origin), probably green earth and Cu-green pigment, red ochre (haematite), lime white and Egyptian blue (cuprorivaite). Organic and inorganic binders were respectively identified as linseed oil and lime, this latter carbonated to calcium carbonate. Textural features of plasters were also evaluated in order to investigate raw materials used for their production.

The obtained data revealed crucial for improving knowledge of materials and preparation methods of pigmenting agents of these fragments, taken from the warehouse of the Villa and hence of unknown provenance area, in view of their right positioning in a specific area of the archaeological complex. In fact, the characterization of the different pigments could support conservators to better identify the distribution of the frescoes among the different rooms, and to reconstruct the original aesthetics of the Villa during the Quintili age.

1. Introduction

Since long time, the investigation of Roman wall paintings has attracted the interest of researchers for many reasons. In fact, frescoes extend in a wide geographic area, in different architectural contexts, exhibiting a variety of vivid colours. At present, even if many studies have been performed from the artistic and archaeological points of view, we are still far from a comprehensive evaluation of the employed materials and techniques (Bakiler et al., 2016; Mazzocchin et al., 2003).

In this context, the identification of pigments and of the composition of the plaster layers used on the mural paintings represents one of the most important issues. As well known, it constitutes the starting point for the understanding of the particular technique used from Roman artists in a specific area (Barilaro et al., 2008). From that, the reconstruction of the possible communication and trade routes can be, in principle, attempted.

An archaeometric investigation has been conducted on Roman plasters at different Italian and international archaeological sites

* Correspondence to: M. Malagodi, Laboratorio Arvedi di Diagnostica non Invasiva, CISRiC, University of Pavia, Via Bell'Aspa 3, 26100 Cremona, Italy.
** Corresponding author.
E-mail addresses: marco.malagodi@unipv.it (M. Malagodi), vvenuti@unime.it (V. Venuti).

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Fig. 1. (a) A generalized map of Rome, showing the location of Villa dei Quintili (Rome, Italy). (b) A view of the Villa dei Quintili. (c) Details of the archaeological site.

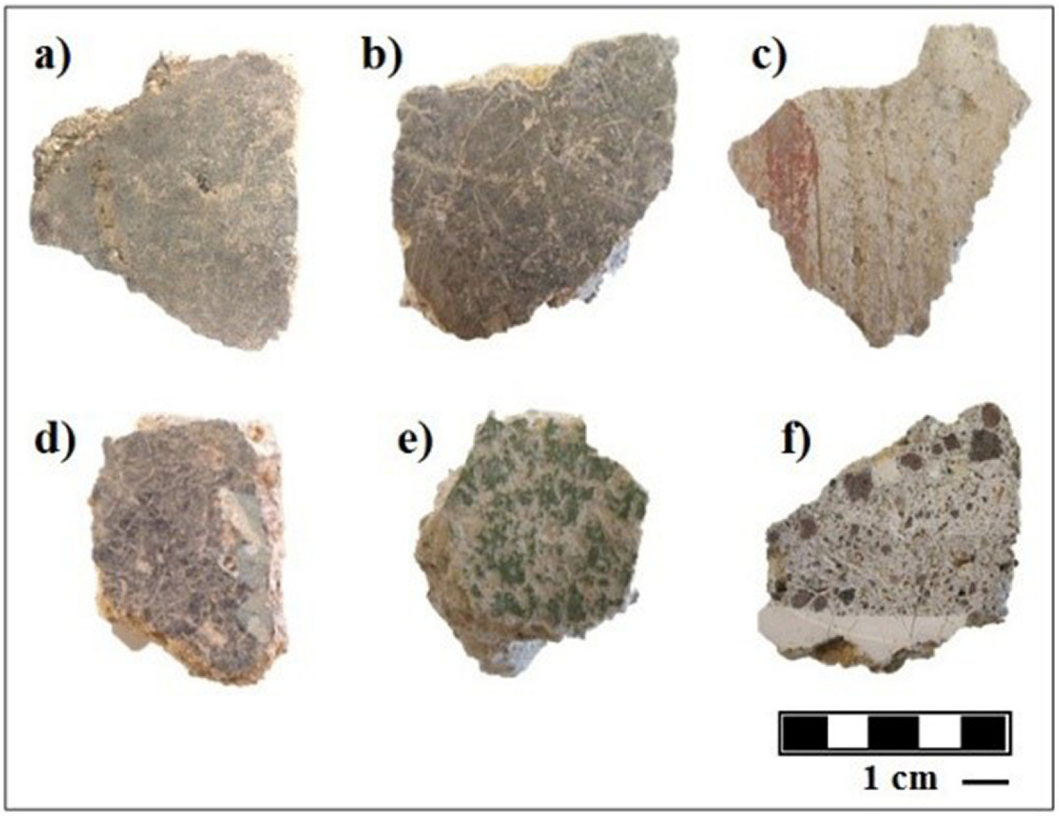

Fig. 2. Photographs of analyzed fragments. a) Fresco Cod. r19a, b) Fresco Cod. r19b, c) Fresco Cod. r19c, d) Fresco Cod. r19d, e) Fresco Cod. r19f, f) Fresco Cod. section.

Table 1
Macroscopic features of investigated frescoes together with the analytical techniques used.

Sample	Description	Employed techniques
Cod. r19a	Fragment of fresco with two pigmented areas: yellow and black	SEM-EDX, FT-IR, micro-Raman, POM
Cod. r19b	Fragment of fresco with a green pigmented area	XRF (previously), SEM-EDX, FT-IR, micro-Raman, POM
Cod. r19c	Fragment of fresco with two pigmented areas: red and white	XRF (previously), SEM-EDX, FT-IR, micro-Raman, POM
Cod. r19d	Fragment of fresco with two pigmented areas: blue and white	XRF (previously), OM, SEM-EDX, FT-IR, micro-Raman, POM
Cod. r19f	Fragment of fresco with a green pigmented area	XRF (previously), OM, SEM-EDX, FT-IR, micro-Raman, POM
Cod. section	Fragment of fresco with three pigmented areas: brown, dark brown and white	XRF (previously), SEM-EDX mapping, FT-IR, micro-Raman, POM

(Aliatis et al., 2010; Amadori et al., 2015; Baraldi et al., 2007; Duran et al., 2011; Edwards et al., 2003; Mahmoud et al., 2012; Mateos et al., 2015; Weber et al., 2009). In all these cases, a multi-technique approach, involving both non-invasive and micro-destructive methods such as micro-Raman spectroscopy, Fourier Transform Infrared Spectroscopy (FT-IR), Scanning Electron Microscopy equipped with an Energy Dispersive X-ray detector (SEM-EDX) and Polarized Optical Microscopy (POM), revealed successful in the determination of the plaster composition and of the nature of pigments.

Hence, an investigation has been carried out on some ancient Roman frescoes from Villa dei Quintili (Rome, Italy) (Alberti et al., 2017; Crupi et al., 2015, 2016) in the framework of a wide multi-technique archaeometric research performed on a variety of materials from this renowned archaeological site (Belfiore et al., 2015; Belfiore