



## 1. Research activity

Development of a new protocol to discriminate organic colourants and inorganic components in polychrome artifacts preserving their integrity. The research is thought to overcome an analytical issue: the difficulty of identifying organic components by means of non-invasive analyses in the presence of inorganic materials. In specific, an in-situ micro-extraction procedure will be designed for the identification of pigments derived from brazilwood, madder and indigo on inorganic supports. The procedure, thought to assist non-invasive analyses, takes advantage of gel substrates versatility to conduct multi-analytical identification: once extracted in-situ by gel substrates, colourants can be directly analysed by means of spectroscopic techniques, and successively re-extracted for chromatographic analyses. The project provides for preparation of twelve mockups of brazilwood, madder and indigo pigments on clay and inorganic paint layers, basing on ancient recipes. The development of suitable extraction procedures will take about twelve months. For the extraction practice, agar-agar gel and different versions of Nanorestore gel will be tested to compare their performances. The loaded gel will be let to extract the colourant from mockups. Immediately after extraction, Ag colloid will be dropped into the gel for SERS analyses. Re-extraction will be carried out from gel substrates for HPLC-DAD and HPLC-MS analyses. SEM-EDS and optical microscopy analyses will be performed on mockups after extraction, to confirm their integrity. Optical non-invasiveness of the procedure will be measured by means of colorimetry. Successively, non-invasive FORS, fluorescence spectroscopy, XRF and Raman spectroscopy analyses will be conducted, to test the whole analytical protocol. In a second phase, mockups will be artificially aged to reproduce ancient objects conditions. The aging experiments will be performed at extreme condition to speed up degradation processes. Afterwards, the entire procedure will be repeated. Once successful, the protocol will be applied on real cases of study and polychrome archaeological artifacts will be investigated.

## 2. Research products

- a) Publications (ISI journals)
- b) Publications (NON ISI journals)

Adele Bosi, Alessandro Ciccola, Ilaria Serafini, Marcella Guiso, Francesca Ripanti, Paolo Postorino, Roberta Curini, Armandodoriano Bianco, Street art graffiti: Discovering their composition and alteration by FTIR and micro-Raman spectroscopy, *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, Volume 225, January 2020, DOI: 10.1016/j.saa.2019.117474

- c) Manuscripts (submitted, in press)
- d) Abstracts

Adele Bosi, Elke Cwiertnia, Ina Reiche, Identification of synthetic organic pigments in *Gebrüder Schmidt* printing inks by Raman spectroscopy - A case study, Proceeding for the *RAA2019* Conference, Potsdam, 3-7 September 2019

Adele Bosi, Caroline Figueroa, Siobhan Piekarek, Elisabeth von Galen, Ulrich Rüdell, Research on *Agfa* and *ORWO* magnetic sound materials in the collection stock of the Potsdam Filmmuseum, Proceeding for the *British and Irish Sound Archive Conference*, Aberystwyth, 16-17 November 2018

Adele Bosi, Alessandro Ciccola, Ilaria Serafini, Marcella Guiso, Francesca Ripanti, Paolo Postorino, Roberta Curini, Armandodoriano Bianco, Modern Paints used in Street Art: Discovering their composition and alteration by FT-IR and  $\mu$ -Raman spectroscopy, Poster, *XVII Congresso Nazionale della Divisione di Chimica dell'Ambiente e dei Beni Culturali*, Genoa, 24-27 June 2018