EDITORIAL

The characterization of paintings: some key research issues

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Through the centuries paintings have been made on a variety of supports (canvas, wood, different types of plaster) and employing diverse painting materials (pigments, binding media, varnishes).

Characterization of such materials and study of their behaviour are fundamental for evaluating manufacturing techniques and guiding conservators in the selection of the most appropriate conservation and restoration procedures. Nowadays, detection of inorganic components in paintings is a relatively straightforward process but identification of the organic materials used as pigment binders, adhesives, and varnishes, which range from lipids (siccative oils, waxes) to proteins (animal glue, milk, casein, egg), polysaccharides (vegetable gums), and terpenes (natural resins), is still a challenging analytical task. Indeed, it is well known that, in comparison with inorganic pigments and grounds, organic binding media in paintings are usually present in small amounts and deteriorate faster than inorganic components. In addition, contamination from materials, such as organic polymers, applied as fixatives or protective coatings in later restoration interventions, may hamper detection of the original organic components.

Other than their identification, localization of organic materials within the painting layers is often crucial for

interpretation of analytical results (for example, to assess whether the painting material is original or is derived from later conservation treatment). The bulk-sample chromatographic and mass-spectrometric techniques usually applied for analysis of organic materials in paintings do not provide this information. On the other hand, in the last few years analytical techniques capable of identifying organic materials in painting cross-sections (thus retaining the spatial information about their localization) have come into use. Among these, worth mentioning are immunofluorescence microscopy (IFM), microspectrofluorimetry, surface-enhanced Raman spectroscopy (SERS), mapping and imaging FTIR, synchrotron FTIR, secondary-ion mass spectrometry (SIMS) imaging, laser desorption mass spectrometry (LD-MS), and matrix-assisted laser desorption-ionization time-of-flight mass spectrometry (MALDI ToF-MS).

Study of the complex and heterogeneous structure of paintings requires the combination of information from several analytical techniques. First, non-invasive investigation techniques, such as multi-spectral (UV, visible and infrared) imaging, X-ray radiography and tomography, X-ray fluorescence (XRF), proton induced X-ray and gamma-ray emission (PIXE, PIGE), can be used to provide structural and topographical information about the distribution of painting materials on the painting surface. Then, invasive investigations carried out on microsamples collected from the painting will provide specific and more detailed information on selected sampling areas.

Painting cross-sections show typical layered structures characterized by one or more paint layers of different colour and thickness. Study of the stratigraphic localization of organic materials in these layers should be a key component of any conservation-restoration project, because it provides information about the painting techniques and intent of the artist, contributes to understanding of deterioration process-

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es, and facilitates development of effective cleaning and consolidation interventions. Stratigraphic analysis of painting cross-sections is usually performed by embedding the sample in polymers, for example epoxy, polyester, and acrylic resins. Sample preparation is also a crucial step, because contamination from the embedding material may considerably limit the detectability of organic components. The search for alternative embedding systems and materials for the preparation of both thin and cross-sections is, therefore, still an issue deserving further research.

Most of the above mentioned research topics were discussed during the international workshop "Characterization of organic materials (binding media, varnishes, pigments) in paint cross sections", held in Bologna in September 2007 and jointly organised by the Microchemistry and Microscopy Art Diagnostic Laboratory of the University of Bologna and the Scientific Department of the National Gallery of London under the auspices of Eu-ARTECH (Access Research and Technology for the conservation of the European Cultural Heritage) project (www.eu-artech.org). In this issue of Analytical and Bioanalytical Chemistry we present a selection of papers, submitted by the participants in the workshop, that deal with key research issues concerning the characterization of organic materials in painting cross-sections.

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