SOCIÉTÉ CHIMIQUE DE GENÈVE

Scientific Examination of Pigments in Art and Archaeology: Art meets Science via Raman Microscopy

Prof. Robin J. H. CLARK

University College London, U.K.

Raman spectroscopy is a light scattering technique used historically in the characterisation of vibrational modes of molecules and thereby molecular structure. It provides a very effective means of identifying minute grains of any material such as a pigment. The technique has high specificity, sensitivity, reproducibility, spatial and spectral resolution, and is both non-destructive and applicable in situ. It is thus highly appropriate for the study of materials for which sampling may be either undesirable or forbidden. Raman research has taken advantage of these attributes, leading to the identification of pigments on manuscripts, paintings, postage stamps, papyri, icons, ceramics, stuccoes, and archaeological artefacts, and to the establishment of artists' palettes at different periods and in different localities. At the arts/science interface, information has thereby been obtained which bears upon restoration, conservation and dating of artefacts, and upon the detection of forgeries. Complementary techniques are also used a needed, viz. XRF, XRD, IR and LIBS.

Important recent case studies include: the Lindisfarne Gospels (thought for centuries to involve illumination with the blue pigment lazurite, now identified as indigo; eight Gutenberg Bibles for comparative palette studies; the 36th Vermeer painting, the study involving the identification of key date-indicator pigments; the first scientific study of the archaeological finds (9th C stuccoes) of 1911 AD at Samarra; the analysis of the pigments used on 16th-18th C Islamic manuscripts, shown to differ only slightly from those used on secular ones; anatase (TiO_2) as a date marker material in Chinese kaolinitic clays; French miniatures by Bourdichon c.1500 AD involving the use of metallic bismuth as a mid-gray pigment; miniatures considered to be medieval French-Belgian, shown to be forgeries by the identification thereon of the modern pigments chrome yellow, Scheele's green, emerald green and ultramarine blue. In conclusion, it is rare that an optical technique has made such an impact on seemingly unrelated areas.

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