Advances in Conservation Science

Sponsor: ACS Student Affiliates
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Session Overview: This session represents the start of the undergraduate program at SERMACS 2007 - Chemistry in the Arts. These presentations will both introduce you to the field of conservation science and describe some of the current advances in this field. A focus on the instrumental techniques utilized within this field will be explored through a number of case studies.

554. From Mummies to Manuscripts: The Role of Science in the Study of Works of Art

Karen Trentelman, Getty Conservation Institute, Los Angeles, CA
The study of works of art is a multi-disciplinary effort involving scientists, art historians, curators, and conservators. In general, research is conducted in order to determine: i) what materials and techniques were used to create a work of art (and thus help evaluate its authenticity); ii) what environmental conditions or repair materials may be most appropriate to help preserve the work; and/or iii) how a work relates to a larger historical or cultural context. Works of art can be composed of a wide variety of materials, ranging from natural minerals to synthetic polymers, and the analysis of such diverse and complex systems typically requires the use of multiple complementary analytical techniques. Because of the precious nature of works of art, the removal of samples for analysis is often limited, if permitted at all. Therefore, analytical techniques which are non-invasive and can be used in situ, such as X-ray fluorescence and Raman spectroscopies, have found extensive use in museum scientific laboratories. Furthermore, the development of portable analytical methodologies has been of great benefit to the study of museum objects by enabling the examination of works of art which were heretofore inaccessible because of size or shape limitations. Case studies from recent work conducted by the Getty Conservation Institute's Museum Research Laboratory will be presented, including the determination of the source of a red pigment on an ancient Egyptian mummy to the possible discovery of the earliest use of of an unusual bismuth pigment on a 15th C. French illuminated manuscript.

555. Chemistry and Rock Art: Characterization and Dating

Ruth Ann Armitage, Eastern Michigan University, Ypsilanti, MI
Rock art, which includes petroglyphs (engravings) and pictographs (paintings), are enigmatic artifacts from the past: neither their reason for being nor their meaning is typically understood today. Rock paintings are difficult to place into archaeological contexts because they are not a part of the stratigraphic record of a site. Direct radiocarbon dating of the organic fraction of the paint itself, usually an inorganic pigment mixed with an organic binder, would ideally provide their age. We are currently using THM-GC-MS to determine the nature of the organic material present in samples from rock paintings from sites around the world. We seek to answer several questions about the paintings: Is there organic material present in the painting samples? If so, does the composition of that material differ significantly from that of organic material found on the unpainted rock background from the same site? Can the binder material be identified as something that might be culturally important (i.e., blood, plant extracts, or animal tissue)? Answers to these questions will also help us to better understand the plasma-chemical oxidation process that was developed specifically to prepare rock paintings for radiocarbon analysis by accelerator mass spectrometry. Ultimately, we are developing analytical methods that will provide archaeologists and rock art researchers with meaningful direct ages for these unique artifacts.

556. Deconstructing a 17th C. Collaboration by David Teniers the Younger and Jan Brueghel the Younger Using Confocal X-Ray Fluorescence Microscopy

Jennifer L. Mass, Winterthur Museum, Winterthur, DE, Arthur Woll, Cornell University, Ithaca, NY, Noelle Ocon, North Carolina Museum of Art, Raleigh, NC and Christina Bisulca, Freer and Sackler Galleries, Smithsonian Institution, Washington, DC

The 17th c. Flemish painting on panel, The Armorer's Shop, has long been attributed to David Teniers the Younger (1610-1690). The Teniers attribution is derived from his signature at the bottom right as well as figural groups associated with him and executed in his style. During dendrochronological examination of the painting, a portion of the oak plank comprising the overall structure was found to have been carved out so that a smaller plank (containing the parade armor) could be inserted. This unusual construction, combined with the identification of several paintings by Jan Brueghel the Younger (1601-1678) depicting the same parade armor, raised questions about the attribution of the painting. Art historical research suggests that the smaller plank was painted by Brueghel and that the remainder of the panel was painted by his brother-in-law Teniers. While Brueghel writes of collaborating with Teniers in his journal, this appears to be the only identified collaboration of the two artists. Confocal x-ray fluorescence microscopy (CXRF) revealed the composition and location of buried paint layers at the panel interfaces by producing virtual cross-sections over 20 mm in length. This provided evidence for the armor panel having been painted prior to the rest of the composition. The confocal data, along with dendrochronological and infrared reflectography data, provided a chronology of construction for the painting corroborating the Brueghel attribution. An overview of the CXRF technique will be provided along with a discussion of how CXRF relates to conventional microanalysis techniques.