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Cultural Heritage and Archaeological Issues in Materials Science II

EDITORS

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Cultural Heritage and Archaeological Issues in Materials Science II

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PREFACE

This publication presents papers from Symposium 8A, Cultural Heritage and Archaeological Issues in Materials Science (CHARIMSc), of the XXII International Materials Research Congress (IMRC) held in Cancún, Quintana Roo, Mexico, in August 2013. This is the second volume of the second symposium that follows a series of several similar meetings in Mexico since 1998. The first volume was published as MRS Symposium Proceedings Volume 1374 in 2011. More than 50 papers were presented in the second CHARIMSc Symposium; in this volume 26 papers are included. They present interdisciplinary research that provides new insights into cultural heritage, mainly from Mexico, leading to its preservation.

The objective of the CHARIMSc Symposium is to discuss the most recent research for the study of cultural heritage, historical objects, and archaeological remains, using the most diverse techniques and scientific methodologies, including all kind of spectroscopies, non-destructive methods, nuclear and ion beam accelerator techniques, optical and electronic microscopy, imaging methodologies, experimental archaeology, chemical methods, dating, deterioration studies, and conservation procedures and their evaluation.

This interdisciplinary forum is open to physicists, chemists, engineers, conservators, archaeologists, art historians, architects, and other specialists involved in the scientific study of cultural heritage, archaeological materials, and historical collections.

Topics in this volume include:

i) Application of materials science to promote technical understanding and preservation of cultural heritage.
ii) Analyses of art objects and archaeological artifacts, of particular interest are the technological and cultural processes.
iii) Production of materials and nanotechnology and its impact on new applications of ancient materials.
iv) Non-destructive, *in-situ* characterization of works of art and cultural heritage.
v) Studies on deterioration of cultural heritage and development of new materials, as well as original strategies for its conservation.

In this volume, the papers are grouped in main sections: Non-Destructive Characterization of Cultural Heritage, Archaeological Science, Technical Art History, Biomaterials, Science in Conservation, and Methodologies and Instrumentation.

The studied materials cover a broad range: Mayan murals and pigments, Mexican colonial paintings, Mayan pottery and pre-Hispanic floors, stucco, stone, and shells from offerings from the main Temple of the Aztecs using X-ray fluorescence, Raman and Infrared (FTIR) spectroscopies, X-ray diffraction and optic microscopy methods, Scanning Electron Microscopy (SEM) and Electron Dispersive Spectroscopy (EDS),

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among other techniques. Other materials studied included amber from the most outstanding Mexican beds using FTIR with a synchrotron light source and several important ancient pigments, including Egyptian blue and Han blue. Manuscripts and metallic artifacts that are related to the colonial periods of Mexico were also studied.

The non-destructive analysis of green stone objects from perhaps the most ancient burial in a pyramid in Mesoamerica showed the earliest use of turquoise in this area (700-750 B.C.). This result may change the accepted ideas about the turquoise sourcing. Other minerals were also identified, but most of the ornaments were made from jadeite. The results provide new data about the exchange of raw materials and objects in the south of Mexico in the middle pre-Classic period. On the other hand, extensive analysis of iron gall inks of Mexican archives by X-ray fluorescence proposes to integrate the first historical database from -16th through 19th centuries using a non-invasive approach.

In the Archaeological Science topic, one invited talk presented the most recent results of the "Archaeometrical Studies of Classic Mayan Mural Painting at Peten: La Blanca and Chilonche," in Guatemala. The advantages of a multi-analytical approach for complex objects, such as mural paintings with Maya blue and organic materials, were pointed out. Particularly, the use of the voltammetry of microparticles (VMP) to understand the chemistry of indigo in the Maya Blue and the characterization of the organic components of the materials by gas chromatography mass spectrometry (GCeMS) was stressed.

The technological studies include several works of the group of researchers of the Templo Mayor site of Mexico. Their methodology bases on the characterization of the remaining surface traces of the archaeological artifacts, and the use of experimental archaeology to reproduce the surface traces observed in the archaeological pieces. From the comparison with experimental data, the technological styles and the materials used in the manufacturing of the objects are determined. The studied artifacts from the offerings and excavations of the main ceremonial precinct of the Aztec people were made using shells and various types of stone. One of the most outstanding oral presentations of the meeting corresponded to one of these studies: "The Manufacturing Techniques of the Teotihuacan Style Masks from the Great Temple of Tenochtitlan." These works show the imitation of the styles of previous civilizations by the Aztecs, but also the extensive long-distance trade of manufactured objects.

In the technical art section, most of the papers focused on pigments. Manuscripts on the use and alteration of smalt pigments in colonial Mexican paintings, as well as the characterization of a reference set of 16th and 17th-century pigments by Raman spectroscopy are representative of the research.

"Nanoscience of Metal Silicate-Based Pigments" focuses on the properties and new applications of nanosheets of Egyptian blue and Han blue pigments using powder X-ray diffraction, photoluminescence measurements, and Raman spectroscopy. This work was awarded as the best oral presentation of the symposium.

A significant proportion of papers from the symposium were concentrated in the section on Science in Conservation, second only to that on Archaeological Science. Most of the papers were dedicated to the study of stone walls from Colonial fortresses of Mexico and stucco from Mayan sites, as well as to metallic objects from the Colonial period of Campeche, in the Yucatan peninsula. These works focus on the effects of

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weather conditions, alterations due to atmospheric corrosion, evaluation of deterioration, and restoration processes. One of these papers was devoted to the application of nanotechnology for bio-deterioration control.

One of the best articles in this section, "Conservation of Volcanic Tuffs Bearing Rock Paintings at La Pintada, Sonora Archaeological Site", focused on the development of a methodology to test a new consolidant specially conceived for tuff under a natural environment, such as a rocky wall situated in a cliff, for the preservation of rock art painting.

Another interesting work was related to the examination of the deterioration of a collection of copper alloy objects from a 19^{th}-century shipwreck off the seacoast of the Yucatan Peninsula of Mexico and the evaluation of conservation treatment.

Some papers related to development of new instrumentation and methods for the characterization and conservation of cultural heritage materials were also included in this volume.

Finally, the collected papers of this fascinating symposium represent an example of interdisciplinary work and show the meanings of materiality in terms of cultural heritage, archaeology and history.

Jose Luis Ruvalcaba Sil
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