

How materials science is forging a new path in holistic documentation of cultural heritage

Dr. Ioanna KAKOULLI

Professor, UCLA Department of Materials Science and Engineering
Professor, UCLA Conservation Program and Archaeology Program (joint appointment)
Adjunct Professor, University of Cyprus

EDUCATION

DPhil (Ph.D.), University of Oxford, UK
Materials Science
PostGrad Dipl. & MA Courtauld Institute of Art, University of London
Conservation of Wall Paintings & Conservation Science

Material Culture



Swedish Cyprus Expedition, 1927-31

- Key to a series of interconnected processes to deconstruct societies;
- Natural or artificially produced (synthesis): certain appearance, morphology and structure that defines their performance, strength and durability
- Attributes responsible/influence function & use

Cultural Heritage Materials are Non-Renewable Resources

Climate change and the threat to our cultural heritage



Rescued from the Seine: Louvre artworks rescued from flooding in Paris. Photograph: Markus Schreiber/AP



Rapa Nui National Park, Easter Island, Chile

Globalization and Industrialization

Mesa Aynak - Mega Copper Deal in Afghanistan
Fuels Rush to Save Ancient Treasures



Warfare and Political Conflict

Destruction of Antiquities in Syria and Iraq



Trade of looted and illegally excavated artifacts from the 'source' countries to the 'market' countries

<http://www.cbsnews.com/news/greek-antiquities-tried-to-sell-stolen-statues-for-12m/>



<http://www.nytimes.com/imagepages/2008/01/19/arts/19bow11.ready.html>

<http://globalnews.ca/news/2018859/Un-returns-looted-million-dollar-artifacts-to-Italy/>



<https://news.artnet.com/art-world/un-bans-export-of-antiquities-to-target-islamic-state-revenue-255058>

Holistic Documentation is Pivotal and Necessary

Holistic approach encompassing the documentation of materials both as cultural biographies and physical evidence



The deliberate destruction of antiquities in the birthplace of human civilization is **cultural genocide**

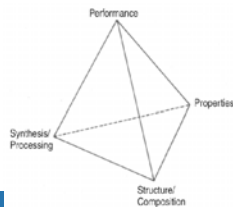
Security Council Condemns Destruction, Smuggling of Cultural Heritage by Terrorist Groups, Unanimously Adopting Resolution 2347 (2017)
...affirming that such attacks might constitute a war crime and must be brought to justice

A Roman marble winged girl from the eighth century B.C. Assyrian royal palace in Khorsabad (Iraq). ISIS raised the city's ruins last year.

Approach and pursuits in materials analysis

- Production technology and operation sequences (by which raw materials were selected, processed and transformed into cultural objects).
- Identification of fingerprint markers for authentication and classification.
- Condition assessment: identification of sources and causes of deterioration

Materials Science: Investigating the relationships between structure and properties



CHEMICAL IMAGING AND SPECTROSCOPY at the macroscopic and microscopic and sub-micron scale

Non-invasive, field deployable technology

Microscopy and Microanalysis



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Macro X-ray fluorescence (XRF) scanner

MULTIMODAL IMAGING SPECTROSCOPY

Copper (Cu)-based pigment

Cu = Major element in emerald green paint

Cu Kα
Cu Kβ

Cu Kα
Cu Kβ

Cu Kα
Cu Kβ

Cu Kα

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Delaney, J. K., Doolley, K. A., Radpour, R., & Kakoulli, I. (2017). Macroscale multimodal imaging reveals ancient painting production technology and the vogue in Greco-Roman Egypt. *Scientific reports*, 7(1), 15509

Hair style revealed by XRF

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