

Introduction to the Acta IMEKO special issue on the 'IMEKO TC4 international conference on Metrology for Archaeology and Cultural heritage'

Fabio Santaniello¹, Michele Fedel², Annalisa Pedrotti¹

¹ LaBAAF - Laboratorio Bagolini Archeologia, Archeometria, Fotografia; CeASUm – Centro di Alti Studi Umanistici, Dipartimento di Lettere e Filosofia, Università di Trento, via Tommaso Gar n°14, 38122, Trento (Italy).

² Dipartimento di Ingegneria Industriale, Università di Trento, via Sommarive n° 9, 38123 Trento (Italy).

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Corresponding author: Fabio Santaniello, e-mail: fabio.santaniello@unitn.it

Dear Readers,

This special issue of Acta IMEKO is the result of the 5th International Conference on Metrology for Archaeology and Cultural Heritage.

The conference was originally planned to be held in Trento (Italy) hosted by the Department of Humanities of Trento University, on October 22-24, 2020, but due to the sanitary emergency caused by Covid-19, the organisers decided to hold the conference online. Despite the unexpected situation, the conference has been a great success with 158 initial submissions, 126 accepted papers, 431 authors from 19 countries, 4 invited plenary speakers, 13 special sessions, 3 tutorial sessions and 11 patronages. Out of the numerous presented papers, a selection has been made by the scientific committee to realize this issue. Particular attention has been paid to the papers which inspire the exchange of knowledge and expertise between “human sciences” and “hard sciences”. After the review process, seventeen papers have been accepted for publication encompassing several research fields and methodological approaches.

More in detail, several papers are devoted to material characterization by means of different analytical techniques. Six of them are focused on the analysis of archaeological artefacts. Particularly, Zerai Gebremariam et al. analysed the pottery assemblage from the site of Adulis (Eritrea): colorimetric measurements show new technological and manufacturing insights used for ceramic production during the Roman age.

An Egyptian wooden statuette stored in the Museo Egizio di Torino has been analysed by Vigorelli et al., who compared the results of a multi-analytical strategy based on both non-invasive and micro-invasive procedures to investigate the original artistic techniques and the ancient restorations of the artefact.

The paper by Stagno and Capuano compares micro-MRI, diffusion-NMR and portable NMR data to highlight the diagnostic features of Roman archaeological woods.

Es Sebar et al. analysed different metal tools used during the construction of the Santa Maria del Fiore Cupola in Florence, PCA analyses performed on XRF data allow to determine different alloys depicting new details about the Renaissance technology.

Tavella et al. used a graphic elaboration software to calculate the capacity of several prehistoric vessels from northeastern Italy, suggesting possible functions and/or cultural traditions related to the potteries.

The article by Mazzocato et al. shows the significance of laser scanning microprofilometry for surface analysis and 3D printing in the study of archaeological pottery.

Passing from the archaeology to the artworks, Sottili et al. present an interesting contribution based on the combination of MA-XRF and DR to study painting layers and colours composition.

A second group of eight papers is more related to the study and also to the management and valorisation of architectural heritage. Baiocchi et al. proposed an approach to realize a geomatic survey by smartphones useful to create digital twins and virtual models. This approach has been tested on the Intihuatana stone in Machu Picchu (Peru) providing intriguing results and possibilities.

Brienza and Fornaciari combined GIS and photogrammetry to study the masonry of the *Bagni di Eliogabalo* (Rome). Their detailed data offer a wide reconstructive hypothesis allowing to point out roman construction techniques and expedients.

The history and the architectural transformations of the bridge of Canosa di Puglia (Italy) have been analysed through

archival documentation and field surveys by Germanò, who finally hypnotize the original configuration of the bridge.

Doria et al. present the result of a multi-steps program related to the study and the conservation of the Castiglioni Chapel in Pavia, focusing on the digital survey and the creation of an immersive 3D model with different levels of analysis and visualization.

The paper by Antolini focuses on the development of a wide approach for the reconstruction of the ephemeral apparatuses, the latter has been applied to the case study of the funeral apparatus realized in Rome for Cardinal Mazarin.

Several banded vaults systems in Turin Baroque atria have been analysed by Natta. The author proposes an integrated approach involving metric survey by laser scanning and digital drawing in order to investigate the original constructive methodologies and the changes due to time.

Moving to more recent structures, the paper by Gabellone shows an interesting 3D reconstruction of an underground oil-mil in the town of Gallipoli, which has been used to develop shared virtual visits during the COVID-19 emergency.

Pirinu et al. presents the results of an extended survey activity related to the military architectures built in Sardinia during the Second World War. The collected data allow to analyse the historical construction techniques as well as to recover a peculiar heritage which is part of the contemporary landscape.

Bertola discusses a methodology that by starting from archival documentation and using BIM allows to reproduce a 3D model of *Due case a Capri* by Aldo Morbelli.

Eventually, the article by Weththimuni et al. deals with the preservation of cultural heritage buildings by using ZrO₂-doped ZnO-PDMS nanocomposites as protective coatings for the stone materials, providing interesting future perspectives.

The contributions of this special issue provide an overview of the significant impact achieved by a more intense synergy between metrology and human sciences. Moreover, following the constraint given by the international situation that occurred since 2020, this issue stressed the importance to promote a diffuse accessibility of cultural heritage thanks to the virtualization and digitalization of archaeological artefacts, human landscapes, historical documents and so on.

To conclude we hope that this special issue catches the attention of the readers thanks to its interdisciplinarity. Actually, we strongly believe that the intermingling of competencies is the way to look beyond contemporary research and sketch both the opportunities and the path of the cultural heritage in the future.

Hope you will have an exciting reading!

Fabio Santaniello, Michele Fedel, Annalisa Pedrotti
Guest Editors