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BOOK OF ABSTRACT

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elemental and molecular data, providing pigment identification with a high degree of confidence. Moreover, XRF spectra can allow the mapping of the sub-layer distribution of elements complementing data regarding the presence of hidden painted layers provided by NIR-reflectography. In the proposed approach, visible multispectral imaging, combined with novel methods of cluster analysis of multivariate spectral data makes it possible to map areas of paintings with similar spectral features and color properties, which correlate with the presence of the same pigment or mixture of pigments. Examples of applications on model paintings and in situ case studies will be discussed. In particular in-situ analysis on two 15-16th C illuminated manuscripts highlight the approach in the characterization of the color palette thedetection of hidden paint layers and anachronistic pigments, which yielded valuable information for identifying the original owners and the history and trade of the artworks. Advantages of this image-based multi-analytical approach will be discussed, thus informing future analysis on other heterogeneous works of art.

#011 - LIBS analysis for a stratigraphic study on Cultural Heritage materials

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Among the possible analytical approaches for Cultural Heritage studies, the Laser-Induced Breakdown Spectroscopy (LIBS) allows deep profile analysis with high spatial resolution enough to discriminate different layers in the typical complex structures [1, 2].
LIBS, based on the principles of laser ablation, allows a detailed stratigraphic analysis on the basis of spectra recorded from successive laser pulses delivered onto the same sample point. This technique has significant advantages, even if the assessment of potentialities in the quantitative analyses are object of several works. It is well-known that performance of LIBS in qualitative and quantitative analysis is affected by many factors related to plasma formation and evolution, still now under investigation.
The aim of this work is to show the importance of finding the optimum parameters for different material typologies in order to acquire the maximum information with the least damage to the works of art.
The results concern mainly the comparison between the identification of the chemical elements by using the more traditional X-Ray fluorescence technique and the study of their distribution along the thicknesses of the layers from the Laser-Induced Breakdown Spectroscopy analyses.
The collected data have demonstrated the usefulness of the Laser-Induced Breakdown Spectroscopy investigation, through which it has been possible to reveal chemical elements undetectable by X-ray Fluorescence spectroscopy [3, 4], and to analyse the stratigraphic sequence of archaeological corroded bronzes, salt efflorescence on mural paintings and paint layers from the surface up to the bulk.
This methodological approach through the LIBS analysis, although micro - destructive, avoids the sampling, allowing a stratigraphic analysis with high spatial resolution and accuracy of the sample point localization.

References

[1] Giakoumaki A., Melessanaki K., Anglos, D. (2007). Laser-induced breakdown spectroscopy (LIBS) in archaeological science—applications and prospects. Analytical and bioanalytical chemistry, 387(3), 749-760.
[2] Alberghina M.F., Barraco R., Brai M., Schillaci T. and Tranchina L. (2011a) - Integrated analytical methodologies for the study of corrosion processes in archaeological bronzes. Spectrochimica Acta Part B: Atomic Spectroscopy, 66, 129-137.
[3] Alberghina M.F., Barraco R., Brai M., Schillaci T. and Tranchina L. (2011b) - Comparison of LIBS and m-XRF measurements on bronze alloy for monitoring plasma effects. Journal of Physics: Conference Series, 275, 1- 11.
[4] Alberghina M.F., Barraco R., Brai M., Schillaci T. and Tranchina L. Double laser LIBS and micro-XRF spectroscopy applied to characterize materials coming from the Greek-Roman theater of Taormina. Proceedings of SPIE - The International Society for Optical Engineering 7391- 7397.

#012 - XRF and LIBS integrated analysis to identify the chemical composition and the conservation state of photographic and paper materials

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In the early period, even though professional photographers worked with similar techniques and products, their artistic and commercial aims determined different choices and lead them to follow different, often personal, recipes. For this reason, identification of the techniques through date and name of the photographer or some visual features like colour, tonality and