

Accepted Manuscript

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PII: S0584-8547(17)30405-6
DOI: doi:[10.1016/j.sab.2018.02.018](https://doi.org/10.1016/j.sab.2018.02.018)
Reference: SAB 5387

To appear in: *Spectrochimica Acta Part B: Atomic Spectroscopy*

Received date: 12 October 2017
Revised date: 26 February 2018
Accepted date: 27 February 2018

Please cite this article as: Giorgio S. Senesi, Beatrice Campanella, Emanuela Grifoni, Stefano Legnaioli, Giulia Lorenzetti, Stefano Pagnotta, Francesco Poggialini, Vincenzo Palleschi, Olga De Pascale, Elemental and mineralogical imaging of a weathered limestone rock by double-pulse micro-Laser-Induced Breakdown Spectroscopy. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sab(2017), doi:[10.1016/j.sab.2018.02.018](https://doi.org/10.1016/j.sab.2018.02.018)

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Elemental and mineralogical imaging of a weathered limestone rock by double-pulse micro-Laser-Induced Breakdown Spectroscopy

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Abstract

The present work aims to evaluate the alteration conditions of historical limestone rocks exposed to urban environment using the Laser-Induced Breakdown Spectroscopy (LIBS) technique. The approach proposed is based on the microscale three dimensional (3D) compositional imaging of the sample through double-pulse micro-Laser-Induced Breakdown Spectroscopy (DP- μ LIBS) in conjunction with optical microscopy. DP- μ LIBS allows to perform a quick and detailed in-depth analysis of the composition of the weathered artifact by creating a ‘virtual thin section’ (VTS) of the sample which can estimate the extent of the alteration processes occurred at the limestone surface. The DP- μ LIBS analysis of these thin sections showed a reduction with depth of the elements (mainly Fe, Si and Na) originating from atmospheric dust, particulate deposition and the surrounding environment (due to the proximity of the sea), whereas, the LIBS signal of Ca increased in intensity from the black crust to the limestone underneath.

Keywords: Limestone, DP- μ LIBS, Microscope, Compositional imaging, 3D analysis

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