



## Multi-analytical methodology to indagate the Pietraforte sandstone risk assessment

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Pietraforte sandstone is one of the most important stone material used during Renaissance in Historic Center of Florence, a UNESCO World Heritage Site. One of its main uses as building material is rusticated block facades, a peculiar masonry technique typical of many historical Florentine palace (ie. Palazzo Pitti, Palazzo Medici Riccardi, Palazzo Strozzi, etc.). The characteristic color of Pietraforte, ranging from grey to yellow-ochreous, is a distinctive feature of the urban landscape of Florence.

Stone rusticated blocks constitute elements with different overhangs which make them subject to decay phenomena due to weathering that, together with their intrinsic characteristics, can lead to detachment and loss of blocks (even of considerable size).

The study of Pietraforte as a geoheritage with its morphological, mechanical, physical, mineralogical, and petrographic characterization is an important starting point to understand the possible evolution of decay processes.

A multi-analytical characterization of this stone in several study cases allow the comparison of Florentine rusticated blocks used in different architectural registers (rough-hewn, smooth-faced and pillow rusticated), highlighting different behaviors of Pietraforte in distint architectural contexts.

For example, convolute laminations and calcite veins (Pecchioni et al. 2007, Pecchioni et al. 2020), typical macroscopic characteristics of Pietraforte, show different behavior depending on the type of rusticated blocks.

A multi-analytical methodology has been developed including sampling for physical, petrographic and mineralogical characterization and Non Destructive Techniques (NTD), using ultrasonic pulse velocity and sclerometric tests for mechanical behaviors (Salvatici et al. 2020, Centauro et al. 2022, Calandra et al. 2023). The main morphological features of Pietraforte from a geological point of view are investigated pondering each rusticated blocks as a rock mass and applied some methods of rock slope stability analysis.

The study performed in this work aims to protect and preserve geoheritage stones finding a new and sustainable restoration and conservation approach for Pietraforte built Cultural Heritage weaknesses. Furthermore this multi analytical approach allow the diagnosis of the vulnerability of the stone material to detachments of scales, fragments and whole blocks that represent a damage to the monuments and a danger for people.