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Experimental study on the Neapolitan Yellow Tuff: Salt weathering and consolidation

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Salt crystallization is one of the major weathering agents in porous building materials due to the crystallization pressure exerted by salt crystals growing in confined pores. The consolidation of such degraded stone materials is a crucial issue in the field of Cultural Heritage restoration.
This contribution deals with laboratory experimentation carried out on the Neapolitan Tuff, a pyroclastic rock largely used in the Campanian architecture. Several specimens, collected from a historical quarry nearby the city of Naples, were treated with two different consolidating products: a suspension of nanosilica in water (Syton X30®) and ethyl silicate (Estel 1000®) dispersed in organic solvent (TEOS). Then, in order to assess the effectiveness of consolidation treatments, both treated and untreated samples underwent accelerated degradation through salt crystallization tests. A multi-analytical approach, including mercury intrusion porosimetry, peeling tests and point load test, was employed to evaluate the correlation between the salt crystallization and the micro-structural features of the examined tuff specimens. In addition, the calculation of the crystallization pressures was also performed in order to make a correlation between the porous structure of the tuff and its susceptivity to salt crystallization. Obtained results show that both the tested products increase the resistance of tuff to salt crystallization, although inducing an increase of crystallization pressure. Ethyl silicate, however, shows a better behaviour in terms of superficial cohesion, even after several degradation cycles.