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Petro-physical characterization of calcareous stones from Scicli (Sicily, Itlay): implications for P-waves propagation upon salt crystallization

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Petro-physical features of the calcarenite employed as building materials of baroque church and historical monuments of Scicli (south eastern Sicily) have been analyzed by means of non-invasive methods in order to testify the durability of the stones and their suitability for renovation works.
The ultrasound propagation technique has been used with the aim to test the petro-physical features of the stone material and to evaluate the variation of the P-waves velocity after weathering tests according to salt crystallization processes.
Cubic 70±5 mm/sided samples, preliminarily classified as calcarenite by means of petrographic analysis, were subjected to total and partial water immersion for the determination of water absorption coefficient, and the dry coefficient. Such parameters, mainly linked to the pore structure, are particularly important as they influence the rock decay and its durability. Afterwards the degradation tests were performed by total immersion of samples into a saline solution (the test was carried out according UNI EN 12370 recommendation).
After salt crystallization a general decrease of P-waves velocity was observed in response to the occurring of macro- and micro-fractures generated by the growth of salt crystals within the pore system. Some samples showed that a modest increase of the wave velocity followed the initial decrease where salt crystallization filled some voids simulating a more compact structure.
The observed trend for the p-waves propagation obtained by means of the non-invasive ultrasound method strongly confirm the decay of the stone materials upon salt crystallization and therefore the suitability of this technique in enhancing the knowledge about the durability and quality of stone materials belonging to the Cultural Heritage.