Application of the non-destructive UPV (Ultrasonic Pulse Velocity) technique for assessing the physical properties of salt-weathered natural stones used in cultural heritage buildings.

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Stone-built heritage is often affected by salt-induced weathering. The salt crystallizes within the pore system under thermodynamically specific conditions, producing internal stress that leads to surface flaking and material loss. Damage severity correlates with variables, such as salt phase, concentration, pore geometry, and the material's overall porosity and permeability. The aim of this research is to assess the damage of rocks during salt crystallization cycles by analyzing the variation in ultrasonic wave velocity using the non-destructive UPV (Ultrasonic Pulse Velocity) technique. UPV testing is a valuable method for assessing the physical and mechanical properties of stone, detecting internal defects, and evaluating consolidant effectiveness. To complement UPV data, peeling tests and total water absorption measurements were performed to evaluate surface cohesion and porosimetric characteristics. Laboratory tests were conducted on 5x5x5 cm cubic samples of three different lithotypes widely used as construction materials in cultural heritage: "Lecce stone" (biocalcarenite), "Mendicino stone" (calcarenite), and "Viterbo Tuff" (ignimbrite). Five consolidants were applied to these samples after they had been aged through salt crystallization (Nanorestore, Estel 1100, Ammonium Phosphate, TEOS, and Nanoestel). The objective is to detect early signs of internal material degradation before they become macroscopically visible or the samples reach failure and to assess, using the same measurement, whether the application of the five consolidants had any effect on improving the UPV values.