

Durability evaluation of pyroclastic rocks used in the historical built environment of Hungary

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Pyroclastic rocks of diverse composition have experienced a broad historical usage in the built environment of Hungary, especially from the Middle Ages. In the northern regions, for instance, acid ignimbrites have been widely used as building stones in monumental construction, e.g., churches and castles, Ottoman architectures like mosques and spas, as well as common dwellings. Their characterization reveals a small-scale inconstancy of their physico-mechanical performance and petrographic features, which affects weathering susceptibility. That involves most significantly porosity, pore-size distribution, and tensile strength, considering the technical properties; on the other hand, texture must be accounted for in terms of changing quantity and size of pumice clasts, phenocrysts, and crystals, and amount of the weak and porous groundmass. The behavior of the ignimbrites when subjected to artificial weathering, by freeze-thaw and salt attack tests, alters accordingly. The variability of open porosity represents the most important factor marking a possible dramatically diverse durability. It turns out to be proportional to water absorption, controlling the amount of infiltrating water or salt solutions, at the base of potential rock failure due to ice or salt crystallization. The sole high moisture may also lead to an extreme and hazardous deterioration of the mechanical properties. Finally, high porosity is correlated with low welding degree and, in turn, low strength. Such outcomes suggest criteria for evaluating the vulnerability of these volcanic rocks in cultural heritage, and directing reasonable material selections for stonework restorations.

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