

Small-scale variability of texture and physico-mechanical properties in volcanic tuffs affecting weathering resistance

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Volcanic tuffs are notoriously very heterogeneous materials exhibiting a recurrent lithological diversity, which, in turn, can be associated with changing petrophysical and mechanical properties. This variability was investigated on a small scale in different Miocene acid tuffs from Hungary, extracted in the same quarry region, within a few km radius from the town of Eger. They have been exploited since the Middle Ages and used for common construction and historical monuments – castles, churches, Ottoman architectures – or excavated and carved for creating wine cellars, cave houses, ritual sites, etc. These pyroclastic rocks are compositionally analogue but turn out to show unexpected major differences in texture and technical properties, which affect their resistance to decay. The rate and intensity of weathering, examined in laboratory conditions by freeze-thaw and salt attack tests, is governed mainly by the following properties: open porosity; relative abundance of pumice, crystals, and groundmass; pore-size distribution; and tensile strength. Nevertheless, open porosity – which here is proportional to water absorption and indirectly related to mechanical performance – is considerably different among the tuff varieties, and this seems to be the most significant factor marking the diverse durability. That is questionable in case of unpredicted textural diversities, e.g., enrichment in pumice and higher concentration of groundmass. Therefore, without rejecting the importance of complementary tests, a basic and fast study involving thin-section examination and open-porosity measurement would be sufficient for providing many indications on the quality of these materials and for the selection of dimension stones for restoration of historical heritage and construction.