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Comparison of water absorption methods: testing the water absorption of recently quarried and weathered porous limestone on site and under laboratory conditions

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The water absorption of weathering sensitive stones is a critical parameter that influences durability. The current paper compares different methods of water absorption tests by using on site and laboratory tests. The aims of the tests were to assess the water absorption of un-weathered quarry stones and various weathering forms occurring on porous limestone monuments. For the tests a Miocene porous limestone was used that occurs in Central and Western Hungary and especially near and in Budapest. Besides the Hungarian occurrences the same or very similar porous limestones are found in Austria, Slovakia and in the Czech Republic. Several quarries were operating in these countries. Due to the high workability the stone have been intensively used as construction material from the Roman period onward. The most prominent monuments made of this stone were built in Vienna and in Budapest during the 18th -19th century and in the early 20th century. The high porosity and the micro-fabric of the stone make it prone to frost- and salt weathering. Three different limestone types were tested representing coarse-, medium- and fine grained lithologies. The test methods included Rilem tube (Karsten tube) tests and capillary water absorption tests. The latter methodology has been described in detail in EN 1925:2000. The test results of on-site tests of weathered porous limestone clearly show that the water absorption of dissolved limestone surfaces and crumbling or micro-cracked limestone is similar. The water absorption curves have similar inclinations marking high amount of absorbed water. To the contrary, the white weathering crusts covered stone blocks and black crusts have significantly lower water absorptions and many of these crusts are considered as very tight almost impermeable surfaces. Capillary water absorption tests in the laboratory allowed the determination of maximum water absorption of quarried porous limestone. Specimens were placed in 3 mm of water column and the absorbed amount of water was detected. The obtained 29-30m% water absorption values compared to the 30-35m% of the total porosity of the stone, clearly suggest that the pores can be saturated with water under standard barometric pressure and therefore the tested porous Miocene limestones are very prone to salt attack.