

Moisture distribution in the stone portal of a church: how it influences the salt accumulation in porous limestone

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Mathias Church of Budapest (Hungary) is an emblematic stone monument that represents various phases of constructions from Medieval period to the early 20th century. The church is found at the elevated Castle Hill and forms a landmark at the UNESCO World Heritage Site of Budapest. Its main construction material is porous Miocene limestone. Besides porous limestone travertine was also extensively used. The current study focuses on the Medieval Gate of the church which encompasses richly decorated porous limestone ornaments. The gate is now sheltered and form an interior portal of the church. It shows various forms of stone decay. The most striking one is efflorescence of salts. This feature has become more intense in the past years leading to flaking and granular disintegration of the limestone, causing damage to the monument. This study focuses on the detection of moisture content within the stone structure and its role in the salt accumulation. To obtain this goal in situ moisture measurements were made along vertical profiles by a portable moisture detector (Gann-Hydromette). It allowed outlining the moisture distribution within the studied structure. The moisture measurement was combined with sampling of salt efflorescence and porous limestone of the gate, itself. The samples were tested by optical microscopy. Conductivity, salt content and main elements were also detected from solutions. Mineralogical composition was recorded by XRD and Thermogravimetric analyses. Magnesium-sulphates were found to be the main salts responsible for damages. Besides sulphates chlorides were also detected. Gypsum was also found in the weathering crusts of the previously exposed limestone surfaces. It accumulated in black crusts but was also detected in white efflorescence and below the stone surface. The salt distribution clearly correlates with the moisture content. The financial support of NKFI Fund (ref. no. K 116532) is appreciated.