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Comparative study of porous limestones used in heritage structures in Cyprus and in Hungary

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Porous limestone is widely used as construction material in the monuments of Cyprus and Hungary. The present study compares the physical properties of a bioclastic limestone from Cyprus and an oolitic limestone from Hungary.

Petra Gerolakkou is a Pliocene limestone from Cyprus that originates from the district of Nicosia, the island's capital. It has been extensively used throughout the years in construction and restoration projects, particularly in the Nicosia area. Distinctive examples of its use can be found in the majority of the most important historic monuments in Nicosia, such as the Venetian walls and fortifications, churches (e.g. the Agia Sofia Cathedral), the archbishop and presidential palaces and a high number of other traditional buildings.

The studied Miocene limestone from Hungary was exploited from Sóskút quarry (15-20 km W-SW to Budapest). The quarry provided stone for emblematic monuments of the capital of Hungary such as the Parliament building, Mathias Church, the Opera House and Citadella.

In this study, mechanical parameters for both aforementioned stones, such as uniaxial compressive and tensile strengths, were tested under laboratory conditions. Their density, porosity and water absorption were also compared.

The studied limestone from Cyprus exhibits porosity values within the range of 48-51%, apparent density between 1340 and 1400 kg/m3 and strength values under uniaxial compressive load between 1.2 and 2.8 MPa. This lithotype is also considered susceptible to salt decay, since an approximate mass loss of 12.5% is noted after 15 salt crystallization artificial weathering cycles.

The porosity of the Hungarian limestone is in the order of 16-35%, the bulk density is 1600-1950 kg/m3, while the compressive strength is 2.5-15 MPa. Durability tests indicate that even after 10 freeze-thaw cycles the loss in strength is dramatic.

Test results indicate that use of porous limestone in both countries is common and fabric strongly controls the properties of limestone. The climatic conditions and trigger mechanisms of limestone decay are different in the two countries; therefore durability tests have different focus areas: salt-related decay is most common in Cyprus, while freeze-thaw action causes the major damage in Hungary. The proper selection of lithologies for different structural elements has to consider both fabric differences and potential mechanisms of decay.