



## The influence of freeze-thaw and heat on the strength of ten different rock types

Alina Vattai, Zita Pápay, and Ákos Török

Budapest University of Technology and Economics, Construction Materials and Engineering Geology, Budapest, Hungary  
(torokakos@mail.bme.hu)

Ten different lithologies were studied under laboratory conditions to understand the effect of temperature changes and freeze-thaw on the mechanical properties of rocks. The tested lithologies included sedimentary and igneous rocks commonly used as dimension stones. One type of travertine (a Hungarian), an Italian and a Hungarian crystalline limestone, a porous limestone, two types of sandstones (fine grained and medium-grained ones) an Italian granite (Rosa Beta) a diorite and a gabbro both from China and a rhyolite tuff were analysed. Cubic tests specimens were exposed to 50 freeze-thaw cycles, to 126 thermal cycles of 20-80°C and 20-105°C, respectively. Changes in mass, in density and in ultrasonic pulse velocities were recorded after each three freeze-thaw cycles and after each 20 thermal cycles. Uniaxial compressive strength of the test specimens was measured after the termination of cycles. The results of mass changes, ultrasonic pulse velocities and strength differences were compared to air dry and water saturated reference samples. For most sedimentary rocks thermal cycles reduced the compressive strength with a few exception, while both tested granite and gabbro seemed to be less sensitive to low temperature (80 and 105°C) thermal load in terms of strength. 50 freeze-thaw cycles completely destroyed the porous limestone and reduced significantly the compressive strength of sandstones and the diorite. These tests indicate that bulk density does not necessarily reflect the durability of stones, meanwhile lithological variations and especially the fabric has a strong control on the ultimate strength.