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Volcanic tuffs in Hungary and Germany: a comparison of properties and use as dimension stones

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Volcanic tuffs are commonly used dimension stones in monuments of Germany and Hungary, especially castles and fortresses were built from various types of tuffs. Two quarries from Hungary (Eger-Tihamér and Eger-Demjén) and three localities from Germany (Weiberner, Kasseler and Rochlitzer) provided the stones for laboratory tests. The tuffs represent wide range of lithologies starting from rhyolite tuffs (Rochlitzer, Eger-Tihamér and Eger-Demjén) and phonolitic tuff (Weiberner) ending with basalt tuff (Kasseler). Mineralogical composition (XRD) and chemical composition (XRF) of selected samples were determined for comparison. Textural elements were described by using petrographic microscopy and SEM. The physical properties of tuff types such as bulk density, ultrasonic sound velocity, and indirect tensile strength were analyzed on air-dry and water saturated samples. Water absorption was measured by capillary –rise method while mercury porosimetry provided the pore-size distribution. The comparison of tests results has shown that tuffs are very heterogeneous with respect to physical properties and textural characteristics. Several types are very sensitive to water and show significant decrease in strength, when air-dry and water saturated samples is compared. The pore-size distribution significantly influences these changes and is considered as one of the key factors in influencing the durability of tuff besides mineralogy. The obtained data set provides valuable information when stone replacement and conservation of historic tuff sites are considered.