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Influence of rock properties on salt weathering of natural and reconstituted stones: An experimental approach

Toshiaki Fujimaki^{1*}, Yuko Osawa², Chiaki T. Oguchi³, Celine SCHNEIDER⁴

¹Saitama university, ²Saitama University, ³GRIS, saitama University, ⁴GEGENA Universite de Reims Champagne-Ard

To investigate the influence of properties of rocks used in buildings, salt weathering experiments were performed using five building stones used in Europe and Japan. They are; (1) the Bajocian limestone (BL) with abundant well-preserved calcite shells and (2) the Sinemurian limestone (SL), rich in quartz grains, (3) reconstituted stones (RS), agglutinated using cement with crushed above two types of limestones, (4) Savonniere limestone (SV), porous and biogenetic limestone widely used in north France, and (5) Oya tuff (OY), altered rhyolitic tuff and one of the most famous stone resources in Japan. The BL, SL and RS stones are used in the Orval Abbey in south Belgium, and SV is used as a restoration stone of the Reim Cathedral in France. Their rock properties as a starting material such as porosity, bulk density, pore size distribution and tensile strength are investigated. The porosity of these stones are; RS 29.0%, SL 12.9%, BL 34.8%, SV 40.0% and OY 38.9%. The tensile strength are; RS 3.05 MPa, SL 4.82 MPa, BL 1.38 MP, SV 1.41 MPa and OY 1.85 MPa. The specimens are cut into cylindrical with a size of 4.5 cm in diameter and 5 cm in height. A capillary rise experiment was performed under 20 degree C atmosphere using saturated Na₂SO₄ solution at 20 degree C (16% Na₂SO₄ solution), half concentration of it (8% Na₂SO₄ solution) and distilled water as a control.

The results showed that BL had the fastest rates of capillary rise under 16% Na₂SO₄ solution and SL, RS, SV and OY follow in this order. Under 8% Na₂SO₄ solution, the faster rates of capillary rates recorded BL, RS, SV, OR and SL in this order. After the capillary test, only RS was completely destroyed, although it has much higher tensile strength than BL and SV. Small amount of debris was produced from the top edge of OY specimen.

Keywords: Salt Wethering, Limestone, Oya Tuff, Rock Property