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Porosity characterization of fresh and altered stones by ultrasound velocity and mercury intrusion porosimetry

Simona Scrivano (1), Laura Gaggero (1), and Josep Gisbert Aguilar (2)

(1) Department of Earth, Environment and Life Sciences, University of Genoa, Italy (simona.scrivano@edu.unige.it), (2) Department of Earth Sciences, University of Zaragoza, Spain

Porosity is the main physical feature dealing with rocks durability and storage capacity. The analysis of this parameter is key factor in predicting rock performances (Molina et al., 2011).
There are several techniques that can be applied to acquire the widest information range possible about pores (e.g. size, shape, distribution), leading to a better understanding of decay processes and trapping capacity.
The coupling of a detailed minero-petrographic analysis with physical measures such as ultrasounds and mercury intrusion porosimetry (MIP) proved to be a valid tool for understanding the porous network and its evolution during weathering processes.
Both fresh and salt-weathered samples were analysed to investigate the modification triggered in the porous network by crystallization. The ageing process was induced using a Na2SO4 saturated saline solution with the partial continuous immersion method (Benavente et al., 2001).
The study was addressed to four sedimentary lithotypes: 1) Arenaria Macigno, a greywacke made up of thickened clasts of quartz, plagioclase and K-feldspar cemented by micritic calcite and phyllosilicates; 2) Breccia Aurora, a calcareous breccia with nodules of compact limestone and micritic cement joints; 3) Rosso Verona, a biomicrite where the compact bio-micrite matrix is cut by clay minerals veins; and 4) Vicenza Stone, an organogenic limestone rich in micro- and macro foraminifera, algae, bryozoans and remains of echinoderms, with iron oxides.
An appropriate description of the porous network variation and recognition of the origin of secondary porosity was attained. The study defined that the pore shape and distribution (anisotropy coefficient K) has a fluctuation up to the 50% after weathering treatments and pore-size distribution (defined in a range between 0,0025 – 75 μm), allowing modelling the mechanisms of water transport and evaluating decay susceptibility of these lithotypes.

Molina E, Cultrone G, Sebastián E, Alonso FJ, Carrizo L, Gisbert J, et al. The pore system of sedimentary rocks as a key factor in the durability of building materials. Eng Geol 118 (2011) 110–21.

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