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Dilatometric behaviour of building stones submitted to brine.

C. Thomachot, G. Fronteau, A. Lombard, V. Barbin

Groupe d'Etude des Géomatériaux et des Environnements Naturels et Anthropiques, EA 375, Université de Reims Champagne-Ardenne, CREA, 2 esplanade Roland Garros, 51100 Reims, France.

Salt crystallizations in porous network of stones are one of the main causes of building stone weathering. Concentration and crystallizations of salts due to water transfer lead to dilatometric variations in stones that override the medium rupture resistance. If salts concentrate at the surface, they form efflorescence that does not lead to major weathering. On the other hand, if they crystallise at depth, slab detachments with shivering can occur.

European standards focus on effects of salt crystallisations by analysing loss of weight, resistance and strength, and morphology changes. Measurements are carried out after cycles of brine absorption and drying up of samples without measuring dilation.

In this study, a protocol was set up to measure rock samples dilation with strain gauges during absorption-drying cycles. Different brine concentrations were tested (NaCl and/or $NaSO_4$) and different drying rates (0, 33 and 55 % of relative humidity). The aim was to measure dilatometric changes depending on salt concentrations to determine whether a threshold under which salt concentration in the rock was insignificant existed. Salt accumulation kinetics could be proportional to salt concentrations, or salt accumulation depth could depend on brine concentration or drying rates. Alternatively, transfer properties of the material could by themselves control crystallization depth.

Lutetian limestone, widely used as building stone since the Gallo-Roman period ($e.g.$ Rheims and Paris cathedrals or St-Denis basilica), were tested first. Quarries are located in the Parisian Basin (Eocene, -45Ma). Limestone behaviour to salt crystallizations was easily analysed due to *in situ* observations and measurements. It allowed ver-

ifying whether experimental results could be used to model salt crystallization mechanisms in relation with salt concentrations and drying rates. The long-term aim would be to extend this model in order to predict material susceptibility to salt weathering and thus to assess durability.