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High Temperature Behaviour of Various Limestone Used in Heritage Buildings at Material and Block Scales

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Abstract : As a fact, many cultural heritage masonry buildings have undergone violent fires during their history. In order to investigate the high temperature behaviour of stone masonry, six French limestones were heated to 600 °C at a rate of 9 °C/min. The main focus is the comparison between the high temperature behaviour of stones at the material and at the structural scale. In order to evaluate the risk of spalling, the tests have been carried out on the stone blocks (12x30x30 cm) instrumented with thermocouples and subjected to an unidirectional heating on one face. Thereafter, visual assessments and non-destructive measurements (dynamic elastic modulus) performed on blocks demonstrate a different behaviour from what was observed at the material scale. Finally, a series of thermo-mechanical computations, using finite element method, allowed us to highlight the difference between the behaviour of stones at material and block scales.

Keywords : limestones, hight temperature behaviour, damage, thermo-mechanical modeling, material and blocks scales, color change
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