HYPERION: understanding and quantifying the effects of climate change on cultural heritage

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Abstract

Climate change is one of the most critical global challenges of our time. During the last century, the anthropic activity had a great impact not only on the environment, affecting even the conservation of cultural heritage. This is becoming a mandatory issue to be tackled by international and local administrations and heritage stakeholders.

Stone is one of the natural materials most utilized in historical monuments. Although stone decay phenomena have been broadly investigated in the past, only few studies are moving towards the understanding and quantification of the short- and long-term effects of climate change. This research direction, however, is essential for supporting sustainable mitigation plans and the city management.

The HYPERION project aims to fill this gap, improving the knowledge of measurable material- and climate-based parameters that influence stone decay rate. The project includes simulations of future scenarios and potential effects of changing climate patterns and air quality, extreme climate events, and multi-hazard circumstances in the historical urban context.

In this contribution, we present the preliminary results of the study of selected building stones used in four European demonstration sites, in Italy (Venice), Greece (Rhodes), Spain (Granada), and Norway (Tønsberg). The basic petrographic and physical-mechanical investigation of the materials is combined with accelerated ageing tests under different environmental stresses (cycles of salt crystallization and freeze-thaw and interaction with rainwaters with different compositions) and field-exposure tests. The expected results will help refining adequate material-specific models of stone surface recession and support structural and hygrothermal simulations about the future decay of cultural heritage.