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Investigation of moisture levels at carved rock sites with novel sensors and supplementary techniques

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Rock moisture is essential for a variety of weathering processes. Since its quantitative assessment, especially on field sites, is still challenging, the purpose of the development of and investigation with novel moisture sensors is to assess small-scale moisture levels and fluctuations in natural rock and artificial stonework. Additional techniques are applied to investigate interacting parameters like temperature, salts and rock parameters that promote rock decay. The aims of the presented investigations are as follows:

1. Developing and testing a novel type of small, capacitance-based moisture sensors for solid rock.
2. Applying the laboratory- and field-tested moisture and temperature sensors to monitor small-scale moisture and temperature fluctuations at different depths and on surfaces in three different hydro-climates (United Kingdom, Germany, Georgia) over a period of 1.5 years. With this long moisture monitoring dataset seasonal moisture variations which influence stone decay are detected.
3. Implementation of two multi-method field campaigns at each of the two main sites in Uplistsikhe, Georgia and Sächsische Schweiz, Germany. We apply geoelectrical resistivity surveys and infrared thermography, generate surface models and map decay patterns. Rock samples, drill dust and extracted salts from field sites are analyzed in the laboratory.
4. Numerical simulations of temperature and moisture in material are based on current meteorological data, which is measured in the study areas during the monitoring campaign. By modifying meteorological input data different climate change scenarios can be simulated.

Based on this multi-method investigation with long term monitoring of moisture and temperature in stone, spatial and temporal variability input parameters could give new insights into environmental triggers of stone decay, providing knowledge for heritage protection and building conservation. Preliminary data from first field campaigns and moisture / temperature monitoring in Georgia is presented.