



Analysis of the Constituent Materials of Historical Building in Jeddah, Saudi Arabia

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Abstract

Increasing levels of atmospheric pollution is observed to accentuate and accelerate the degradation of historical sites. This paper investigates the chemical and mineralogical characteristic of the building materials used to construct the declared UNESCO world heritage site located in Jeddah, Saudi Arabia., and provide an initial assessment of the primary mechanisms for their environmental degradation.

Stone and plaster samples were collected from six historic houses as well as the quarry from which the stone was originally produced. The main objective of this work was to identify the composition and alteration of the stone, plaster and quarry materials and to provide information about the decay mechanisms, thereby better enabling conservators to identify the correct methods and materials for onwards conservation and restoration works.

X-ray Diffraction (XRD), Laser Raman spectroscopy (LRS) and Scanning Electron Microscopy combined with energy-dispersion X-ray spectroscopy (FEGSEM-EDS) were utilized as analytical techniques to conjointly to determine the chemical composition of the corresponding materials.

The results revealed that the stone used throughout the historic buildings comprises a mixture of calcareous limestone and corallite stones. The associated binding plaster is lime based, made with non-hydraulic lime and local sand, whilst the decorative plaster is made of gypsum (CaSO_4). On degraded surfaces it was possible to detect the deposition of sea salt, sulphur and phosphorus as the main atmospheric pollutants and significant contributors to the observed environmental degradation.