Environmental aspects of the depreciation of the culturally significant Wall of Cartagena de Indias – Colombia

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Abstract

Among the diverse archeological relics of the past, the Cartagena de Indias Wall is one of the greatest representations of European cultural architecture in South America. To assess the implication of contamination on the depreciation of the culturally significant Wall of Cartagena de Indias - Colombia, a detailed, multi-analytical approach was conducted on components of the wall. Accumulated ultra-fine particles (UFPs) and superficial nano-particles (NPs) containing hazardous elements (HEs) on the wall were identified in an attempt to understand whether atmospheric pollution is hastening the depreciation of the structure itself. Mortar which at one point held the stones together is now weak and has fallen away in places. Irreparable damage is being done by salt spray, acid rain and the site's tropical humid climate. Several HEs and organic compounds found within the local environment are also contributing to the gradual deterioration of the construction. In this study, advanced microscopy analyses have been applied to understand the properties of UFPs and NPs deposited onto the wall's weathered external walls through exposure to atmospheric pollution. Several materials identified by X-Ray Diffraction (XRD) can be detected using high-resolution transmission electron microscopy (HR-TEM) and field emission scanning electron microscope (FE-SEM). The presence of anglesite, gypsum, hematite containing HEs, and several organic compounds modified due to moisture and contamination was found. Black crusts located on the structure could potentially serve as a source of HEs pollution and a probable hazard to not only to the ecosystem but also to human health.

Keywords

UNESCO monument, Caribbean fortification, Impacted walls, Scheme of degradation, Stone constituents