

Treatment and conservation of an antique stone block

In the exhibition hall of Al-Qantara east

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Abstract

An archaeological stone block dating back to the era of new kingdom and displayed in the exhibition hall in Al Qantara East, registered with No. 930 and as a result of its display in an inappropriate display as a result of the use of natural lighting in the display, Represented in sunlight through windows opened day and night. The danger of these daily changes between the temperature degrees of night and day both daily and seasonally, which lead to the expansion and contraction of the rocks and then weakening their cohesion causing fragmentation. This is indeed the current situation of this block displayed in the hall, in addition to the fading of colors, as well as the use of a high-viscosity restoration material in the reinforcement that led to the attraction of dust and dirt and its adhesion to the surface. The color faded as a result of the lack of lighting control inside the exhibition hall, the remnants of the existing colors were blurred as a result of applying a reinforcement material with a high viscosity, which led to the attraction of dust and dirt, and then blurring the colors on the inscription. Examinations and analyzes were carried out on the block, and the results of the examination with a polarized microscope showed that it is of primitive limestone, which contains fossils and microorganisms, which helps to damage. The analysis using the Raman device also showed that the high viscosity material used in restoration in the past is Paraloid B72. The stone block was reinforced by using two materials; Nano calcium hydroxide with Nano silica in the form of (Core shell) at a concentration of 10% and it was applied using the brush.

Keywords

Al Qantara East; stone block, Treatment; Nano Materials; Nano Silica.

An Introduction

Creating optimal conditions for preserving and displaying stone artifacts in exhibition halls is one of the things that those in charge of conservation and restoration must take into account (Rushdi, 2018). And the important architectural monuments related to military history and military architecture on the eastern borders of Egypt were revealed, we find that the discovered fortress at Tel Habuh is the largest for the fortified cities discovered in Egypt in terms of area

for this important fortification in that important strategic location at the entrance to the eastern delta at the head of the road known as The road of Horus (Gardinar a, 1920. The discovery of the site of Tell Habuh came to correct and support, as well as to achieve the correct location on the closest possibilities of the site of Tharu Castle at the beginning of Horus Road as a starting point for the Egyptian armies to secure the eastern borders of Egypt in the era of the modern state (Kamal, 2001), and this The stone block was suffering from some aspects of damage and its rates increased as a result of its inappropriate display, for example displaying some stone blocks on dilapidated wooden bases that are a source of water damage Crobiology that affects the displayed blocks, as well as the use of natural lighting represented by sunlight and temperature variation, and one of the characteristics of these stones is that they are poor conduction of heat, the effect of thermal change is limited to its upper levels without lower, and this results in pressure Stress through the components of the rocks that lead to the creation of Fracture parallel to their surfaces and the rocks then disintegrate in the form of bars parallel to their surfaces and the process of disintegration in this description is usually called exfoliation and whenever a layer is removed another flake and so on. In addition to the initial strengthening that took place at the site from which the stone block was extracted, it led to the attraction of dust and dirt and its adhesion to the surface. Therefore, this research aims to treat and maintain one of the stone blocks displayed in the exhibition hall in Al Qantara Sharq, using modern methods and materials used recently in the field of monument restoration, such as nanomaterials, nano material. Calcium hydroxide and nano silica, after testing them on stone models and atmospheric conditions similar to the impact state.

Results

Through the tests and analyzes that were conducted on some samples of the stone mass as well as the nanometric materials used in the reinforcement, many results were drawn that can be discussed as follows:

- After examining one of the stone samples with a polarized microscope, it was found that this stone is classified as Oolitic limestone, as it consists mainly of calcite, as well as fossils and some microorganisms that help damage the stone.
- After analyzing one of the stone samples using the (XRD) device, it turned out that it consists mainly of calcite and gypsum adhered to the stone sample as a result of the mortar layer.
- A sample of a red colored substance was also analyzed using the (XRD) device, and it was found that it mainly consisted of the mineral hematite, while the other sample, which was of a yellow colored substance, was found to be from the mineral goethite.
- After analyzing a sample of the polymer used in strengthening (previous restoration) using the Raman device, it was found that it is Paraloid B72.
- Examination results with a scanning electron microscope for the reinforcement used

The results obtained after scanning electron microscopy showed the surface roughness and heterogeneity of the sample treated with Nano SiO₂ (Core shell) + Nano Ca(OH)₂ at a concentration of 5%. On the other hand, surface smoothness was observed using SEM micrograph of the 10% treated limestone sample. In addition, the surface of the treated sample is covered by the reinforcement by 10% in addition to the encapsulation of stone crystals. Through the aforementioned results, Nano SiO₂ (Core shell) + Nano Ca(OH)₂ at a concentration of 10% has proven its effectiveness in strengthening limestone.

Recommendations

After completing many examinations, analyzes and applied study, the research reached a set of recommendations, which are:

- (1) Studying the various factors of damage that affect the effects inside the exhibition halls and understanding the mechanism of damage that occurs in them, which leads to the development of ways to maintain them.
- (2) Interest in studying different nanometric materials, and how to benefit from them in the field of restoration and maintenance of archaeological materials of all kinds, due to the very distinct physical and mechanical properties of this type of material.
- (3) The use of nano-gear with nano-silica in strengthening the limestone, which gave an effective result in strengthening the stones, and the bonding of the grains and not closing the pores of the impact.
- (4) The necessity of providing an adequate display for displaying the stone blocks by controlling the temperature, humidity and air pollution, using modern air-conditioning devices.

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