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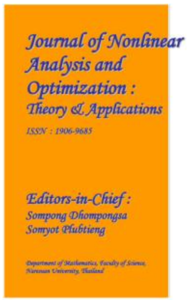

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PRESERVING THE ANCIENT SANDSTONE INSCRIPTION ON THE OLD WATER WELL AT MUHAMMADADEN ANGLO-ORIENTAL COLLEGE IN ALIGARH

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ABSTRACT: Water is crucial for the survival of life on Earth. Every living creature requires water to survive. Given the many ways in which water is essential to human survival, one could argue that human civilization is built on its exploitation. Prior to the modern age, people' principal tasks were to build wells and gather water from them. Some isolated areas still use wells. Aligarh Muslim University, previously known as Muhammadan Anglo-Oriental (MAO) College, relied on these wells for a range of essential supplies, including water. These are part of the historical infrastructure at MAO College. The university, mosque, Victoria Gate, and other ancient structures that comprise the Sir Syed Hall complex have all been scrupulously maintained. Unfortunately, the water well's decimal status—another hallmark of modern AMU buildings—has gone unnoticed. This essay discusses the current status of MAO College's water wells. The aims of this investigation are to determine the mineral makeup of the water well, clean it mechanically and chemically, and restore the eroded sandstone inscription. It also includes important aspects that affect the severity of sandstone degradation. The conservation efficiency was examined using scanning electron microscopy and an X-ray diffractometer.

Key words: Built heritage, Conservation, Inscription, Restoration, Sandstone, Scanning electron microscopy, Water well, X-raydiffractometer.

1. INTRODUCTION

Our country rarely addresses constructed heritage preservation, which could result in the loss of our history. People who seek to understand the cultural, social, historical, and architectural aspects of the built environment are driving the grassroots conservation movement forward. People began to save structures that are now part of our national identity and contribute to our city's aesthetics and educational value. Preserving our country's rich cultural heritage helps to restore its history. Heritage is cherished by society, yet maintaining and conserving it is tough. Historic structures and monuments across the country must be carefully conserved and restored to give future generations a sense of continuity and identity in an ever-changing environment.

Sandstone is the most common building stone.

Sandstone was discovered to be the primary material used to engrave Ashoka's proclamation onto Mauryan pillars. Sandstone is formed by combining quartz, round or angular silica (SiO_2) grains, clay, carbonate ($CaCO_3$), iron oxide (Fe_2O_3), and SiO_2. Sandstone varies in colour, hardness, and durability. Quartz is discovered to be the predominant component of sandstone.

Historic stone buildings and monuments decay in similar ways. Most stones erode slowly and intermittently over millennia of weathering, but others remain intact. World culture is primarily stone and disappearing. A preliminary visual inspection is required to detect stone deterioration before more advanced technologies are employed to pinpoint the causes. This approach necessitated many inspections because a single inspection can only describe the stone's condition at a given moment and cannot measure deterioration. Before taking any effort to safeguard our cultural heritage, the stones must be identified. Stone deterioration can take several forms, therefore measuring it requires several methods. Fluorescence light detection and ranging, as well as 3D laser scanning, only quantify surface deterioration in stone. When the stone's cohesiveness is damaged and layers, blisters, or interior voids develop, thermography, MRI, and ultrasonic measurements can be useful. While many stones have similar compositions and share some characteristics, this must be considered while categorizing them. Deterioration must be described and measured in terms of degree, intensity, and rate. The next step is to understand the mechanics and causes of degradation.

Understanding the causes of stone deterioration is necessary before we can prevent or treat it. Sometimes the cause is evident, but other factors must be considered. Stones deteriorate primarily due to physical, chemical, and biological weathering, biodeterioration, salts, and air pollution. At the 2007 Stone Weathering and Atmospheric Pollution Network (SWAPNET) meeting in Malta, air pollution was identified as the most significant barrier to understanding rapid stone degradation. Central Europe, China, India, Russia, and other developed countries continue to suffer from air pollution-related stone damage. To reduce SO_2, the Taj Mahal in India has scrubbers. However, the site's poor air quality, limited water supply, and power outages hampered scrubber efficiency. Rising air pollution from climate change endangers our monuments.

In addition to air pollution, soluble salts damage stone. Salts harm stone in a variety of ways. The most serious issue is salt crystals developing in a stone's pores, which can exceed its tensile strength and reduce it to powder. The salt problem has been connected to the deterioration of famous sites such the Great Sphinx of Giza, Petra, Venice, and Angkor Wat. While living organisms do contribute to stone degradation, their impact is often less substantial than other variables. Numerous studies on significant cave painting sites in Altamira, Spain, have shown that cyanobacteria, algae, and networks of heterotrophic bacteria accelerate stone deterioration through mechanical change, biomediated disintegration, and metabolic products. As expected, managing food, moisture, and light appears to be the most effective ways to prevent biodeterioration. Air pollution, salt accumulation, and biodeterioration are major causes of stone disintegration, but there are additional quick-acting ones. They include earthquakes, fires, floods, terrorism, vandalism, negligence, tourism, and intrinsic elements.

The sandstone inscription atop the water well at Muhammadan Anglo-Oriental (MAO) College is degrading for a variety of causes. Mineral components promote weathering and cause the sandstone inscription to crack, fragment, and disintegrate. In this investigation, I employed two approaches to assess the object's deterioration and mineral content. Thus, SEM and XRD were utilized to determine conservation efficiency. The object was conserved and restored in accordance with the scientific analysis. After photographing the object's numerous damage factors, the repair and conservation process was completed.

2. MATERIALS AND METHODS

This study used and explained the following materials and methods.

Stone Decay and Material Identification

First, we must characterize the stones to identify materials. It will quantify degradation rate, severity, and extent. It explains the deterioration's mechanisms and causes. Then and only then can we grasp a stone's qualities in a given area.

Visual examination

Visual assessment is the first stage in examining a water well's sandstone inscription for signs of deterioration. Figure 1 shows that the item is in terrible condition, with carbon deposits, air pollution, and soluble salt flowing from its surface. Because of this, several characterizations are used to examine the object's compositions before treating it.

Examination by SEM

SEM analysis reveals the object's surface form, mineral composition, texture, degradation, grain size, and distribution. The study used the "LEO 435VP SEM," which revealed the 30 kV item. The Aligarh Muslim University Sophisticated Instrumentation Facility in India conducted this investigation.

Examination by XRD

XRD examination shows MAO College's water wells' sandstone inscriptions' minerals. It helps diagnose sandstone degradation processes, material properties, and environmental mineral changes to measure and quantify weathering and deterioration. In India, the Chemistry Department at Aligarh Muslim University used "Miniflex-II XRD" with CuK radiation for the analysis.

Figure 1: The product emits soluble salts, air pollutants, and carbon. Sandstone Water Well Inscription: Preservation and Handling

Treatment and Conservation of the Object (Sandstone Inscription on the Water Well)

Recording and documentation

The artwork, a well inscription, measures "131 cm × 87 cm." This light brown sandstone well is named after the donor who helped build it. Figures 1-3 show the inscription is covered in carbon deposits and air pollution, and soluble salt is leaking from the surface. It's simple yet vital because gaps, fissures, and ink loss can make recording these inscriptions difficult. Before restoration and conservation, all damage should be photographed.

Cleaning of the object

The cleaning method tries to highlight the stone inscriptions by restoring the stone's surface. This process ends with a thorough inspection. The inscription is in terrible condition due to dirt and carbon deposits, air pollutants, fungi and algae growth in surface pores, and soluble salts on the object's surface. This procedure uses two cleaning methods:

- Mechanical cleaning
- Chemical cleaning.

Procedure of mechanical cleaning

Remove dust and dried salts or desalinate first. Usually the initial step to stop stone degradation. After that, a nylon brush removed loose salt deposits from the object's surface (Figure 4). In the wet paper pulp process, capillary suction extracts soluble ions (Figure 5). Reduced pressure or suction can force saline fluid from the sandstone's inside to the surface. Figure 6 shows the object drying naturally after application. Wet paper pulp helps compression. Salts are pushed from capillaries and absorbed by paper pulp during drying. The dry paper pulp was removed, cleaned, and reapplied. This was repeated until the salts were gone.

Procedure of chemical cleaning

We made the chemical solution to clean the thing. Two parts liquor ammonia, two parts liquid detergent, and six parts distilled water were mixed. After then, the solution was swirled until dissolved. Figure 7 depicts how a brush applied chemical solution to a defined region. Was abandoned for a while.

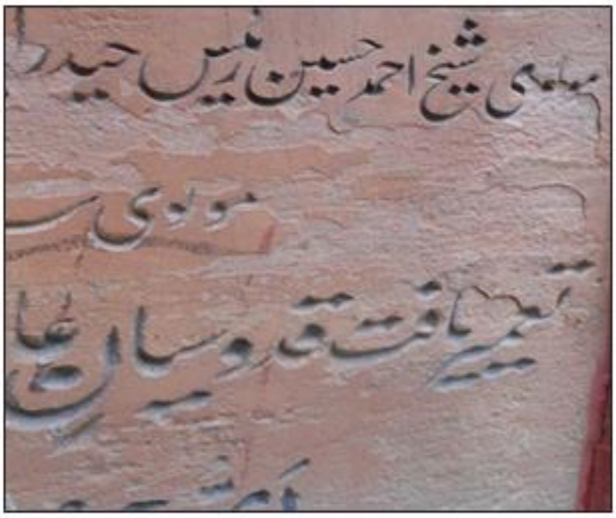

Figure 2: Ink and soluble salt removal causes surface degradation.

Figure 3: Ink and soluble salt removal causes surface degradation.

Figure 4: First, dust and dried salts are cleaned with a nylon brush, then wet paper pulp is applied for capillary suction.

Figure 5: First, dust and dried salts are cleaned with a nylon brush, then wet paper pulp is applied for capillary suction

Figure 8 shows how the chemical removed the deposit by lightly brushing the object, then repeating the process. Figure 9 shows how the entire apparatus was washed and disinfected using running water. Figure 10 shows how a blotting sheet removed excess water from the object. Figure 11 shows the object subjected to sunshine for a day to totally dehydrate it.

Figure 6: Paper pulp air-dries in sunlight.

Figure 7: The piece was sprayed with chemical

solvent and brushed again.

Figure 8: The piece was sprayed with chemical solvent and brushed again.

Figure 9: Rinse the chemical with water and dry it with a blotting sheet.

Figure 10: Rinse the chemical with water and dry it with a blotting sheet.

Figure 11: Re-inserting black ink into a missing piece of an etched sandstone inscription was exhibited on water after a day of full sun exposure.

Figure 12: Re-inserting black ink into a missing piece of an etched sandstone inscription was exhibited on water after a day of full sun exposure. Finally, the sandstone water well inscription's ink is found. In Figure 12, black oil paint replaces it.

3. RESULTS AND DISCUSSION

Visual investigation revealed that salts had crystallized inside the cracks and fractures or on the object's surface due to sand deposits. It indicated that cementing components had broken down, causing granules to lose cohesion, and that sandstone had a poor physical structure that made it readily broken apart by hand. Visual inspection revealed gaps, oblique and vertical deep cracks, exfoliation, erosion, loss of some sandstone owing to strong weathering or earthquakes, and salt crystallization, which is mostly affected by water saturation and pore size distribution. SEM pictures revealed the object's coarse structure of unstructured coarse quartz grains, some spherical and some not.

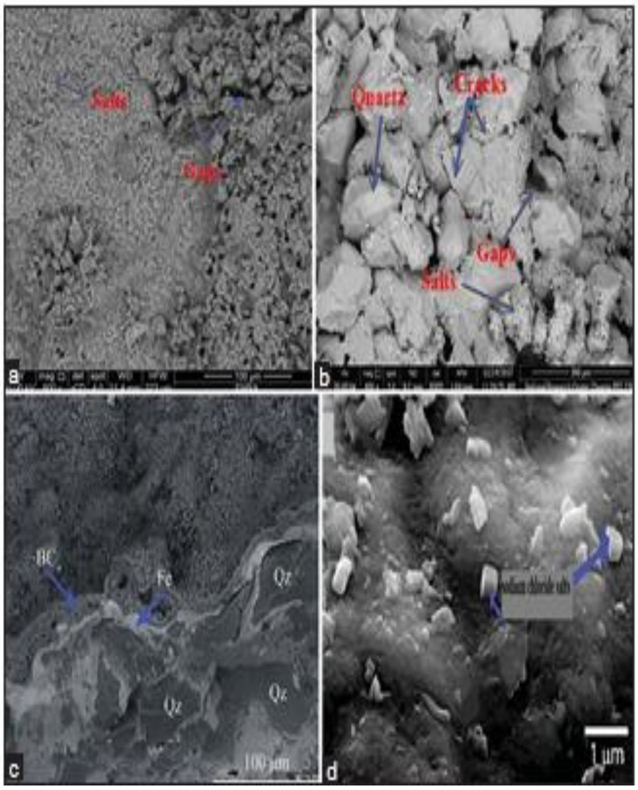

Figure 13: At 400 and 800 magnifications, scanning electron microscopy photographs of a Muhammadan Anglo-Oriental (MAO) College water well sandstone inscription show quartz grains, gaps, and fissures. (c and d) SEM images showing salt loaded on the sandstone, Nacl cubes, black crust, Fe (Fe2O3) incrustation between quartz grains, and weathering crust on the inscription.

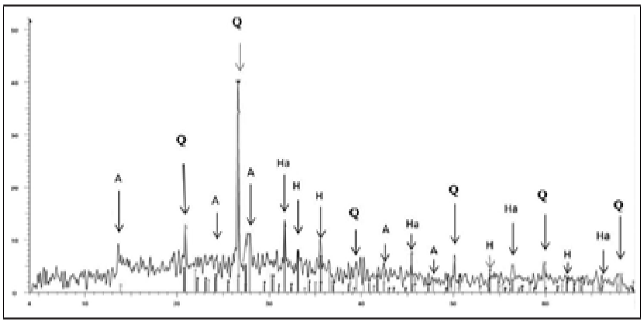

Figure 14: An X-ray diffractometer pattern of a sandstone inscription sample. Quartz, albite, halite, and hematite are at the peak. Conservation and restoration are complete when the object is appropriately treated; Figures 15a and b demonstrate the results.

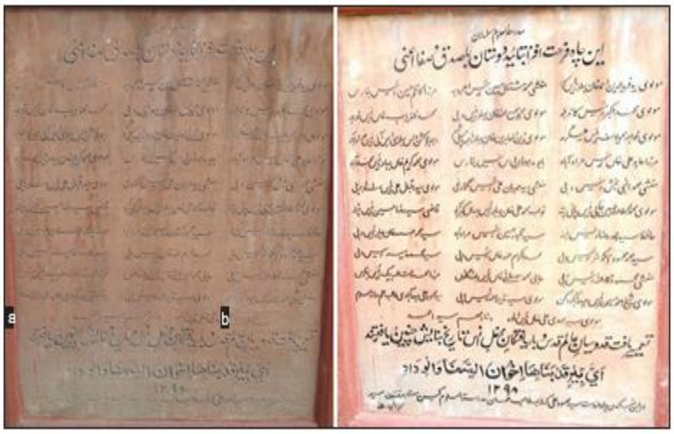

Figure 15: Sandstone well inscriptions before and after treatment.

Its angular, tarnished look comes from sodium chloride salt crystallization gaps, fissures, and cubes. The sandstone inscription includes black crust (BC), Fe (Fe2O3) incrustation between quartz grains, and Qz (quartz) (Figures 13a–d). After XRD investigation of a sandstone sample, hematite (Fe2O3), quartz (SiO2), albite (NaAlSi3O8), halite (NaCl), and albite were found, indicating that Fe2O3 is the cementing ingredient (Figure 14). Peak of graph shows quartz (SiO2), the most abundant component. Thus, the sandstone inscription lists quartz as the main mineral. XRD analysis at 2ば (Theta) values revealed both sharp and strong peaks, also with lesser intensity. The peak similarity at 2 • /degree indicates the object's strong crystalline structure.

4. CONCLUSION

Well-digging and water collection dominated human culture until the modern age. It continues in isolated places with operational wells. MAO College relies on these wells for water and other supplies. While MAO College is working to preserve Victoria Gate, University, Mosque, and Central Vista, S.S. Hall is part of its constructed legacy. But no one considered the well's decimal state, another MAO structural component. Since developing a conservation strategy for a particular site needs extensive research, it is never too early to give clear and complete principles for historic complex preservation. However, some general criteria may help maintain any built heritage site. Most heritage sites struggle due to insufficient maintenance and oversight. All national historic structures follow this standard.

Important findings from the current investigation included sandstone type, texture, and degradation diagnosis. Scientific studies, reviews, and analyses corroborate the findings. The study shows that peeling, cracking, erosion, disintegration, and salt crystallization on the surface or inside sandstone cracks and gaps impacted MAO College's water well's sandstone inscriptions. Documentation, repair, and conservation need careful selection of materials and treatment methods based on the damaged piece. The artwork was also mechanically and chemically cleaned. The study also underlined the importance of boosting people's and professionals' archeology knowledge to recognize how vital it is to maintain historic inscriptions and MAO water wells in their original state, which can be readily repaired with little help.

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