



Stone alterations in Hatuniye Madrasah

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Keywords

Mardin
Hatuniye Madrasah
Stone Alteration
Types of Alteration
Traditional Stone Buildings

Abstract

The durability of the stone in traditional buildings is effective in the survival of the buildings to the present day. External environmental effects cause alterations on these stones. Determining these alterations and their causes and presenting solution suggestions will ensure that the structures will survive longer. In this study, it is aimed to examine the alterations occurring in Hatuniye Madrasah. In this framework, the alterations in the courtyard and exterior walls of the building were examined and classified as physical, chemical, biological and anthropogenic. The distribution of the alterations in the courtyard and exterior façades of the building was analyzed and it was aimed to form a basis for the determination of the existing problems and the causes of the alterations for the repair projects to be carried out.

Introduction

Mardin has hosted different civilizations throughout history due to its geographical location [1]. Civilizations living in Mardin have built many buildings in the city. While some of these buildings have survived to the present day with the same function, some of them have survived to the present day using different functions [2]. Among these buildings, madrasahs served as educational and cultural buildings [3].

Limestone was used in historical buildings in Mardin. Limestone is subject to alteration over time due to adverse climatic conditions, traffic intensity, user error, internal and external factors [4-6]. In some cases, the alterations occurring in the structures prepare the environment for the formation of another alteration. In order to prevent alterations in buildings, it is important to identify the alterations, investigate the causes of alterations and transfer them to future years [7, 8]. The study is aimed to provide an important basis for the identification of existing problems and their causes in terms of repair interventions [9].

Material and Method

In this study, the alterations on the stone surfaces of the courtyard and facades of the Hatuniye Madrasah in Mardin, which were exposed to external environmental conditions, were analyzed. Alterations on the walls of the building were identified and classified [10]. The alterations in the building were classified and analyzed as physical, chemical, biological and anthropogenic alterations [11].

Results and Discussion

Alterations occur over time in stone exposed to external factors such as climatic factors such as pressure, temperature and wind, natural factors and human effects [12]. The strength of the stone decreases over time due to alterations. In order to prevent the alterations occurring in the stone and to transfer them to future generations, they should be identified and measures should be taken [13, 14].

Surface losses that occur as a result of mechanical effects on the stone surface are expressed as physical alteration. Examples include fractures, cracks, fragment breaks, deformation, abrasion, cuts, honeycombing and hairline cracks [15, 16].

The type of alteration that occurs on the surface of the stone as a result of atmospheric events is called chemical alteration. Examples such as color change, salting, crystallization (blooming), crusting, blistering, sugaring and foliation are examples of chemical alteration [11].

The types of alteration caused by organic substances on the surface of the stone are called biological alteration. Moss formation, plant formation, biological accumulation is among the types of biological alteration [17, 18].

Alterations that occur as a result of destruction such as misapplication, misuse and periodic wear and tear given to the structures by humans are called anthropogenic alteration [19].

The limestone, which is the main material of the building, has been subjected to physical alterations such as fragment breakage, joint discharge (Figure 1a), capillary crack (Figure 1b) and abrasions due to the effect of dust carried by wind (Figure 1c and 1d).



Figure 1. Physical alterations at Hatuniye Madrasah (November, 2019)

Chemical alteration types such as salination, discoloration and bacterial growth were observed in Hatuniye Madrasah. Discoloration was observed on the inner courtyard façade (Figure 2a) and the main façade (Figure 2b). Salination (Figure 2c) and bacterial growth (Figure 2d) were also observed.

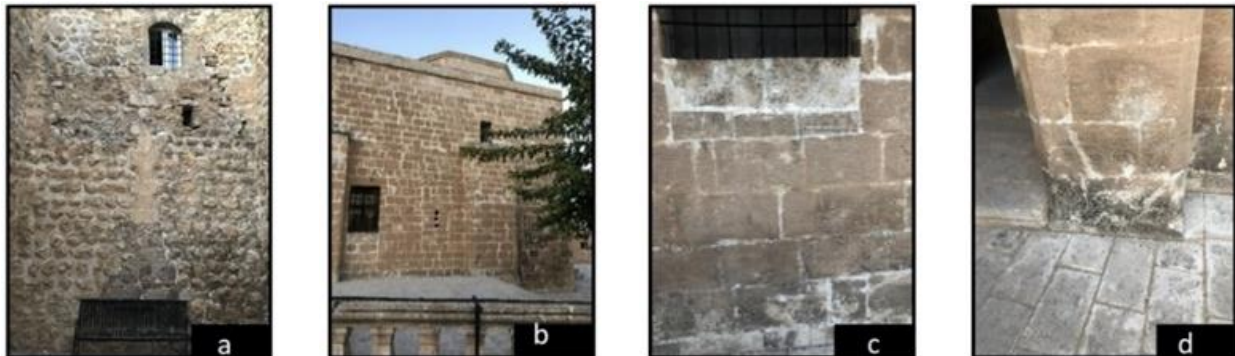


Figure 2. Chemical alterations at Hatuniye Madrasah (November, 2019)

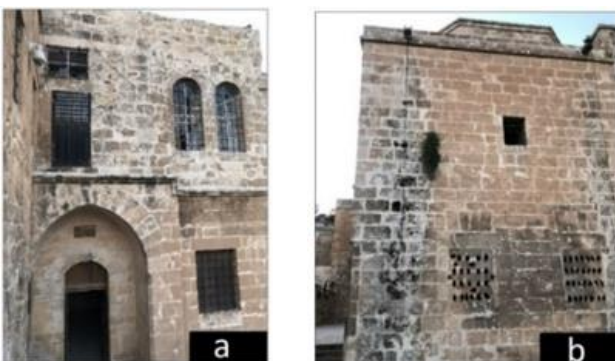


Figure 3. Biological alterations at Hatuniye Madrasah (November, 2019)



Figure 4. Anthropogenic alterations at Hatuniye Madrasah (November, 2019)

Plant formation is encountered as biological alteration in Hatuniye Madrasah. The plant formations on the south and east facades of the building are shown in Figure 3.

Alterations were observed in Hatuniye Madrasah due to the use of sharp tools as a result of anthropogenic effects (Figure 4).

Conclusion

In this study, the alterations that occurred in Hatuniye Madrasah were analyzed. These alterations were determined as a result of visual analysis and then grouped into certain categories. According to the grouping, it was determined that the most common type of alterations occurring in the structure is chemical alteration and the least common type of alteration is anthropogenic alterations.

As a result of the analyses, the facade distributions of the alterations occurring in the structure are shown in Table 1. Accordingly, physical and chemical alterations were observed on all facades. Biological and anthropogenic alterations were also observed on different facades (Table 1).

Table 1. Alterations on the facades of Hatuniye Madrasah

Hatuniye Madrasah	Physical Alterations				Chemical Alterations			Biological Alterations		Anthropogenic Alterations	
	Abrasion	Capillary Crack	Joint Discharge	Part Breakage	Colour Change	Salinisation	Bacteria	Plant Formation	Moss Formation	Sharp Tool Use	Paint Usage
South Facade	+	+	+	+	+	+	+	+	-	-	-
East Facade	+	+	+	+	+	+	+	+	-	+	-
South Facing Courtyard Facade	+	+	+	+	+	+	+	-	-	-	-
West Facing Courtyard Facade	+	+	+	+	+	+	+	-	-	-	-

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