




Stone alterations in Şehidiye Madrasah

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Keywords

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Stone Alteration
Types of Alteration
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Abstract

The durability of stone, which is the main construction material of traditional stone buildings, plays an important role in the transfer of the buildings to future generations. Alterations occur in these stones as a result of external environment and climate effects. The causes, processes and solution proposals of these alterations are important for the survival of the buildings. For this purpose, the alterations in Şehidiye Madrasah were analyzed. Alterations occurring on the facades of the building were identified and classified. The classification was made as physical, chemical, biological and anthropogenic. It is aimed that the study will form the basis for the presentation of solution proposals according to the alterations occurring in the structure in the repair projects planned to be carried out in the coming years.

Introduction

In Mardin, which has hosted different cultures and civilisations, buildings with different functions such as mosques, madrasahs, mansions, churches, monasteries and tombs were built [1]. Madrasahs, one of the important buildings, were used for educational and cultural purposes [2].

Looking at the traditional stone buildings in Mardin, it is observed that the main material of the building is limestone. Limestone undergoes changes when exposed to internal and external factors due to its structure [3-7]. In order to transfer the buildings to future generations, it is of great importance to determine the changes that occur, to investigate the causes and to offer solutions [1]. The study aims to provide a basis for repair projects and to form the basis for investigating the causes of the changes and taking measures [8].

Material and Method

In this study, the alterations on the facades of Şehidiye Madrasah in Mardin were analyzed. The alterations occurring on the stone surface were analyzed and their causes were determined. The study covers the alterations on the south, east and west facades of the building [8]. The changes in the structure were classified and analyzed as physical, chemical, biological and anthropogenic changes [9].

Results and Discussion

Changes occur in stone over time as a result of exposure to natural and anthropogenic influences as well as environmental factors such as pressure, temperature, wind [10]. Over time, as a result of the changes, the strength of the stone is observed to decrease. It is important to detect alterations in the stone and take measures to transfer them to future generations [11, 12].

Surface losses on the surface of the stone as a result of internal and external factors are called physical alteration. Examples of these are fractures, cracks, fragment breaks, deformation, abrasion, cuts, honeycombing and capillary cracks [13, 14].

The physical alteration of the structure is shown in Figure 2. Physical alteration types such as capillary cracks, joint failure, fragment rupture and surface abrasion were observed. Due to the climatic conditions of Mardin province, the structure was exposed to thermal shock and capillary cracks occurred in the limestone which constitutes the main material of the structure (Figure 2a). Joint failure (Figure 2b, Figure 2c) and fragmentation

(Figure 2d, Figure 2e) were observed. Dust grains carried by the wind caused surface abrasions (Figure 2f) on the façade of the building over time.

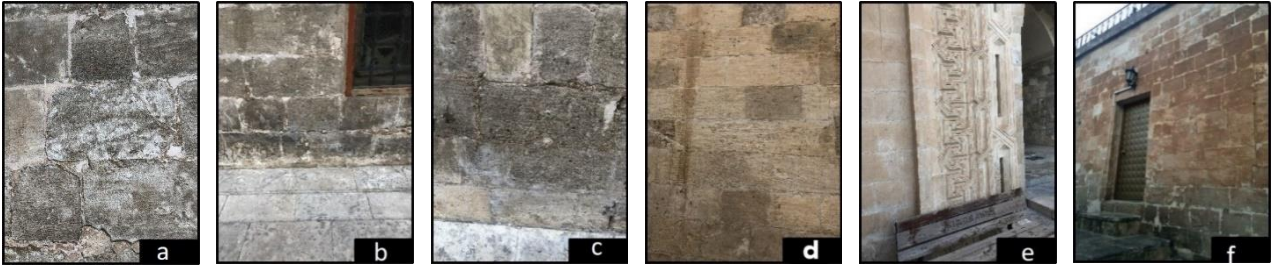


Figure 1. Physical alterations at Şehidiye Madrasah (November 2019)

The limestone, which constitutes the main material of the Şehidiye Madrasah, has undergone chemical alteration over time due to internal or external factors. These alterations are given in Figure 2. Discolouration is observed on the main portal providing access to the building (Figure 2a). It is also possible to observe discolouration on the façade facing the inner courtyard of the building, where the women's masjid is also located (Figure 2b). In the Şehidiye Madrasah, it was observed that salting of limestone occurred as a result of interaction with air (Figure 2d and Figure 2e). It is also possible to see bacterial formations on the limestone (Figure 2c and Figure 2f).

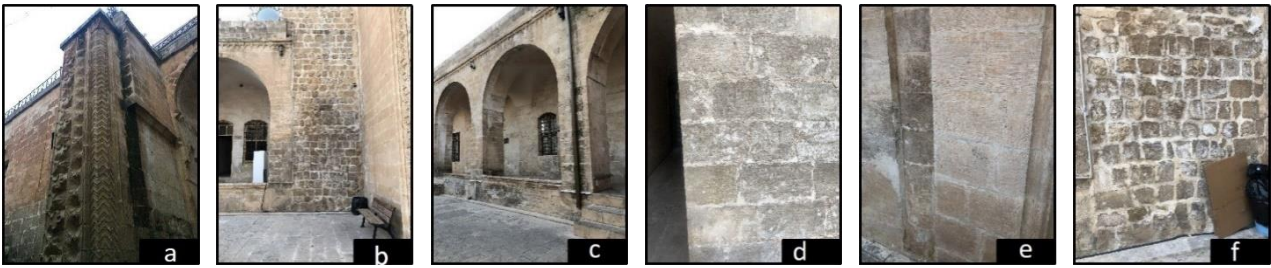


Figure 2. Chemical alterations at Şehidiye Madrasah (November 2019)

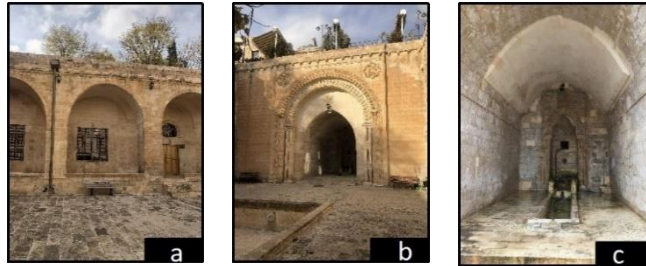


Figure 3. Biological alterations at Şehidiye Madrasah (November 2019)

Organic substances on stone surfaces cause alterations. These are called biological alterations. Algae formation, plant formation, biological accumulation is among the types of biological alteration [15, 16]. The biological alteration of the Şehidiye Madrasah is shown in Figure 3. Plant growth was observed on the façade of the women's masjid (Figure 3a) and the façade of the selsebil (Figure 3b), and moss growth was observed in areas that interact with water (Figure 3c).

In Şehidiye Madrasah, anthropogenic alterations were observed on the north-facing courtyard façade of the building as a result of sharp tools (Figure 4).



Figure 4. Anthropogenic alterations at Şehidiye Madrasah (November 2019)

Conclusion

In this study, the alterations that occurred in Şehidiye Madrasah were analyzed. These alterations were determined as a result of visual analysis and then grouped into certain categories.

When it was analyzed that occurred in Şehidiye Madrasah, it was determined that there were mostly chemical alterations in the structure and the least alterations that occurred as a result of human impact. When these alterations were analyzed in their sub-categories, it was determined that the most common type of physical alteration was surface abrasion and the least was fragment rupture. When chemical alterations were considered, discolouration and salting were the most common and bacterial formation was the least common. When biological alterations were considered, moss formation was the most common and plant formation was the least common. The use of sharp tools was encountered only in one stone as a type of alteration caused by human impact (Table 1).

Table 1. Alterations on the facades of Şehidiye Madrasah

Şehidiye 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
East Facade	+	+	+	+	+	+	+	+	-	-	-
South Facing Courtyard Facade	+	+	+	+	+	+	+	+	+	-	-
North Facing Courtyard Facade	+	+	+	+	+	+	+	-	-	-	-
East Facing Courtyard Facade	+	+	+	+	+	+	+	+	-	+	-

In the conservation and restoration projects that will be carried out in the upcoming years, the data obtained should be taken into account, and solutions should be suggested based on these data. The building should undergo some modifications, but they should be stopped and minimized.

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