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Stone alterations in Kasımiye Madrasah

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Abstract

The durability of the stone in traditional stone structures plays an important role in the survival of the structures to the present day. Alteration occurs on the stone surface of the structures exposed to climatic and environmental effects. The correct determination of these alterations and the reasons for their occurrence and the preparation of appropriate solutions will ensure that the structures will survive longer. In this context, this study aims to examine the alterations occurring in Kasımiye Madrasah. In this framework, the alterations occurring on the exterior and courtyard facades of the building were examined and grouped as physical, chemical, biological and anthropogenic. The distribution and ratios of the alterations on the facades were analysed and it was aimed to form the basis for determining the causes of alterations for the repair project.

Introduction

Throughout history, representatives of different cultures, civilisations, peoples, languages and religions have lived peacefully together in Mardin [1].

Civilisations living in Mardin built mosques, madrasahs, pavilions, churches, monasteries and tombs that were used for different functions in the city. Among these buildings, madrasahs were used as educational and cultural institutions [2]. The limestone, which is the main construction material of traditional stone buildings in Mardin, is subjected to alterations due to internal and external factors [3-5]. This alteration causes serious problems in buildings unless precautions are taken. It is important to detect the alterations occurring in the building and to take the correct measures in terms of the long-term survival of the buildings [1]. Regular inspection of the structures, cleaning the structure and taking measures to increase its strength play an important role in transferring the structure to future generations [6].

Material and Method

In this study, the alterations occurring in the Kasımiye Madrasah in Mardin were analysed. The deterioration of the stone surfaces of the building was analysed, and the types and causes of the deterioration were determined. The study covers the analysis of the surfaces of the building facades and the facades facing the inner courtyard that have been degraded as a result of environmental conditions. In the study, alterations were identified and these alterations were classified [7]. In line with the data obtained, the alterations occurring in the structure were grouped as physical, chemical, biological and anthropogenic alterations. This study aims to provide an important basis for the interventions to be made to Kasımiye Madrasah.

Results and Discussion

In traditional stone structures, alterations occur on the surface of the stone as a result of the stone facing environmental and climatic factors [8]. These alterations significantly deteriorate the structure of the stone. In some cases, alterations prepare the ground for the formation process of other alterations or accelerate the process

[9]. The alterations in Kasımiye Madrasah are classified as physical, chemical, biological and anthropogenic alterations [10].

Physical alterations on the surface of the stone as a result of climatic and environmental factors are shown in Figure 1. Capillary cracks on the walls (Figure 1a), fragment breaks in the window openings (Figure 1b), fragment breaks in the inner courtyard (Figures 1c and 1d), abrasion caused by dust carried by wind on the south façade (Figures 1e and 1f), fragment breaks, capillary cracks and joint discharges on the main portal and west façade of the building (Figures 1h and 1g) and abrasion on the entrance staircase due to visitor flow (Figure 1i). These observed degradations negatively affect minerals that increase strength and facilitate physical decomposition [11, 12].

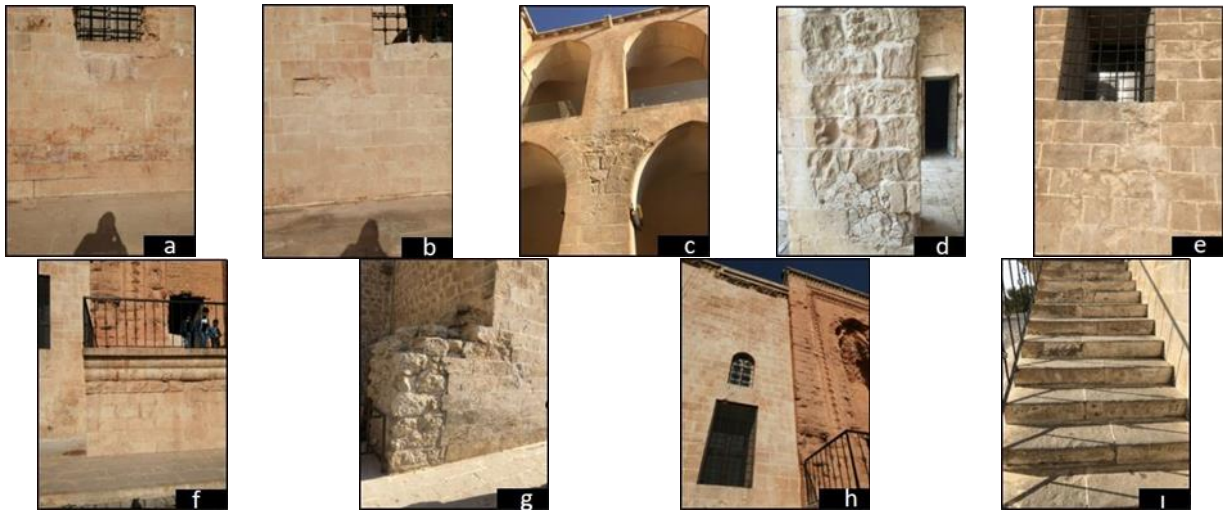

Figure 1. Physical alterations at Kasımiye Madrasah (November 2019)

Chemical alterations are the type of degradation on the surface of the stone as a result of atmospheric events. Salination and colour changes in the structure due to climatic factors are shown in Figure 2. Salination caused by the dissolution and evaporation of the salts in the limestone under the influence of humidity and temperature (Figure 2a, 2b and 2c) and colour changes caused by the interaction of the minerals in the stones (Figure 2d, 2e and 2f) were observed.

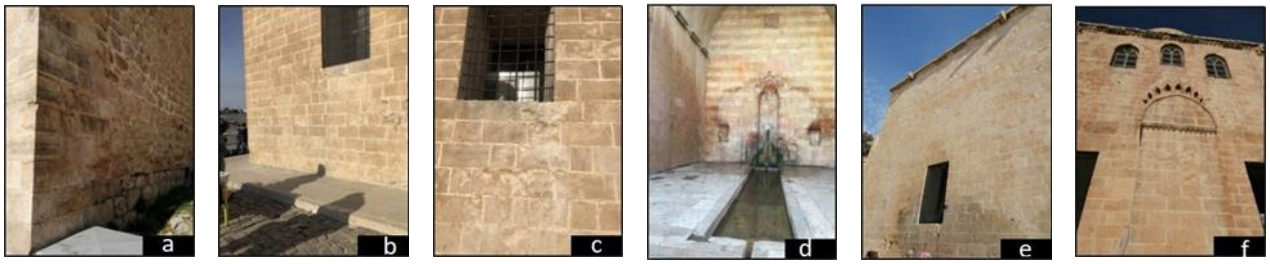

Figure 2. Chemical alterations at Kasımiye Madrasah (November 2019)

Biological alterations in the structure are shown in Figure 3. Plant formations are observed as a result of the interaction of the seeds that settle inside the capillary cracks with water [13]. Plant formations on the south façade (Figure 3a) and east façade (Figure 3e), biochemical alterations caused by bacteria settled on the stone surfaces (Figure 3b and 3c), alterations caused by bird droppings (Figure 3d) and moss formations in the iwan (Figure 3e) were observed.

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

The anthropogenic alterations seen on different facades as a result of the damage caused to the structure by unconscious users with sharp tools are shown in Figure 4.

Figure 4. Anthropogenic alterations at Kasımiye Madrasa (November 2019)

Conclusion

As a result of the investigations carried out in Kasımiye Madrasah, it was observed that the rate of chemical alteration was the highest while anthropogenic alteration was the lowest. Capillary cracks, abrasion, joint discharges and fragment breaks were observed as physical alteration types; discolouration and salting were observed as chemical alteration types; bacterial growth, plant growth and moss species were observed as biological alteration types, while sharp tools and paint usage were observed as anthropogenic alteration types.

When analysed on façade basis, physical degradation and chemical degradation types were found on all façades. Biological degradation types were observed on the south, east and south facing courtyard facade of the building. anthropogenic degradation types were observed on the south, west facing courtyard facade and south facing courtyard facade of the building (Table 1).

Table 1. Alterations on the facades of Kasımiye Madrasah

Kasımiye 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	+	+	+	+	+	+	+	+	-	-	-
West Façade	+	+	+	+	+	+	+	-	-	-	-
South Facing Courtyard Facade	+	+	+	+	+	+	+	-	+	+	-
West Facing Courtyard Facade	+	+	+	+	+	+	+	-	-	+	+

The data obtained from this study should be utilised in order to provide effective solutions for building conservation projects planned in the coming years. In order for a building to survive for a longer period of time, it is important to take necessary measures to slow down or stop structural alterations in buildings. In order for the buildings to be transferred to future generations, it is of critical importance to correctly identify and evaluate deterioration and to establish improvement techniques.

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