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The Architectural Investigation of Akseki Butonned Houses and Suggestions for Their Restoration

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Abstract: The history of Akseki, which is established in 1286 at the north east of province Antalya, Toros mountains, goes back to the age of The Roman Empire[1]. Akseki provides on interconnection between the important trade and port centers such as Antalya, Side and the Anatolia. "The Butonned Houses" reflects the features of Akseki's unique architecture and culture, and they are important culturel properties, however, recent structuring operations cause damages their architectural texture. In this study, we investigated the general, chacteristic and strucrural features of AksekiButonned Houses and we proposed suggestions for the restoration of AksekiButonned Houses.

Keywords: Restoration, Antalya, Akseki, Architectural, House.

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I. INTRODUCTION

The concept of housing encompasses all residences ranging from the most primitive form to the most developed examples where people live [2]. The most original forms of Buttoned Houses are seen in the districts of Akseki and İbradı in Antalya. The interaction between these two districts in the historical process, which is located on the Melas valley, has brought the character in the housing areas around Akseki-İbradi [3].

In this study, our aim is to provide the organic interface which is the architectural representation of the human-environmental integrity in the housing scale and to pass down the local culture of Akseki region. In addition, we examine the Buttoned Houses which are critical for preserving the unique architecture of the region and we suggest restoration proposals for the buildings which are historical monuments for their preserving [14].

A correct restoration provides the sustainable continuity of texture of the region. The buildings should reflect the spirit, the emotional power and the legacy of the place; it should adapt to its location, climate, landscape and common memory while staying away from imitation [15].

II. THE HISTORY OF AKSEKI

Akseki District was founded in a mountainous region at the source of the Ancient Melas River. Relics of important settlements, which belongs to ancient Greek and Roman ages, are found in the region [4].

Antalya was dominated by the Seljuks in 626. Akseki joined the Karamanoğlu in 675 and joined the Ottoman lands in 1472 [15].

III. GEOGRAPHY AND CLIMATE CHARACTERISTICS OF AKSEKI

It has a rugged and mountainous view, suitable for the general structure of the Toros, with a large valley formed by the Manavgat River. The vast majority of the land is covered with cedar, pine and fir trees. The altitude of the district is 1050 meters. Its surface area is 2.083 km² [1].

The climate of the district shows a transition between the Mediterranean climate and the continental climate regions in the south [6]. Figure 2 represents the meteorological analysis table which shows the climate parameters of the region and Figure 3 represents the earthquake map.

Figure 1: Akseki Map [1]

ANTALYA	January	Februray	March	April	May	June	July	August	September	October	November	December	Yearly
	Measurement Period (1929-2017)												
Average Temperature (°C)	10,0	10,7	12,8	16,3	20,5	25,3	28,4	28,3	25,1	20,4	15,4	11,6	18,7
Average Highest Temperature (°C)	14,9	15,5	17,9	21,3	25,5	30,7	34,0	34,0	31,0	26,5	21,2	16,6	24,1
Average Lowest Temperature (°C)	5,9	6,3	8,0	11,1	15,1	19,5	22,6	22,6	19,3	15,1	10,7	7,5	13,6
Average Sunshine Time (Hour)	5,0	5,7	6,7	7,9	9,6	11,3	11,7	11,2	9,7	7,7	6,3	4,8	97,6
Average Number Of Rainy Days	12,4	10,6	8,7	6,7	5,3	2,5	0,5	0,5	1,6	5,6	7,5	12,0	73,9
Average Of Monthly Total Precipitation (Mm)	235,2	154,5	97,0	52,4	32,2	9,3	2,4	2,7	14,4	71,9	131,1	259,3	1062,4
	Measurement Period (1929-2017)												
Lowest Temperature (°C)	23,9	26,7	30,7	36,4	38,7	44,8	45,4	44,6	42,5	38,7	33,0	26,1	45,4
Highest Temperature (°C)	-4,3	-4,6	-1,6	1,3	6,7	11,1	14,8	13,6	10,3	0,9	0,0	-1,9	-4,6
Daily Total Highest Precipitation Amount				Daily Fastest Wind						Highest Profit			
17.01.1969 **331,5 mm**				12.02.1969 **139,3 km/h**						07.01.1993 **5,0 cm**			

Figure.2-Meteorological analysis in Antalya(1929-2017) General Directorate of Meteorologydata [11].

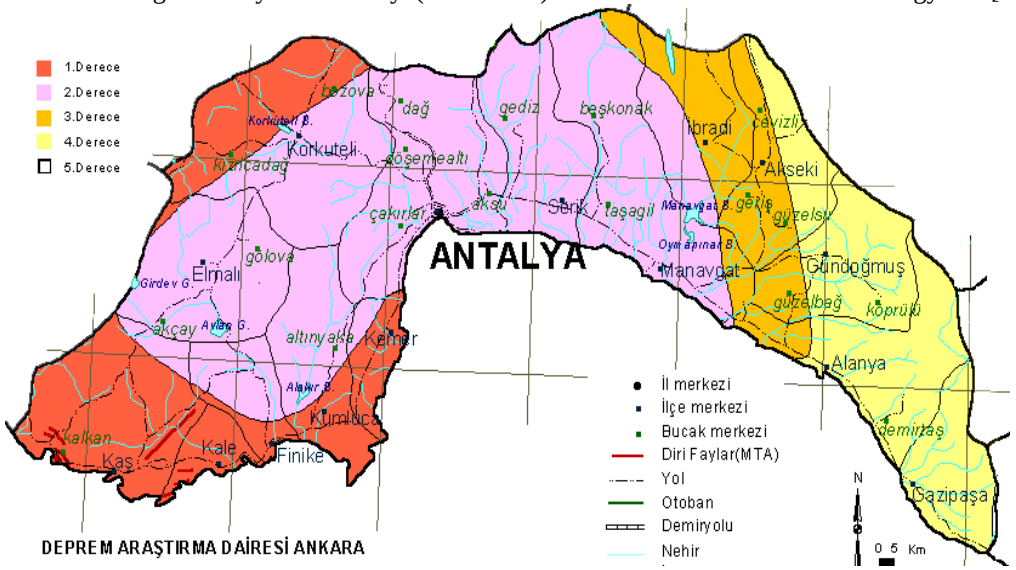


Figure.3 – Antalya Province District Map, Disaster and Emergency Management Administration [12].

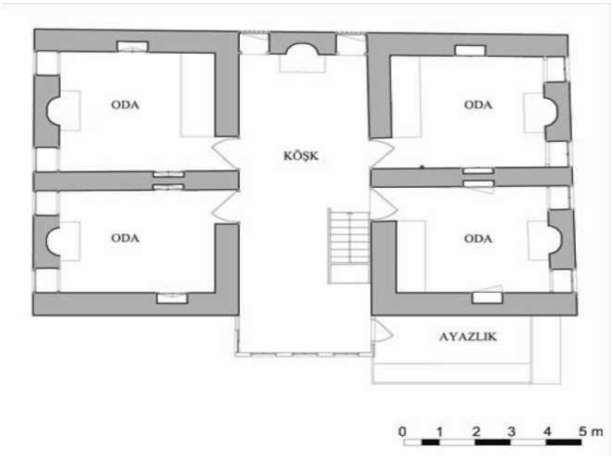
IV. THE BUTTONED HOUSES

Architecture

In the ground floor of the buildings which are mostly two-storey, there are places where the livestock breedings which constitutes the source of the people's income. The rooms where daily life passes, and the sofa are located on the top floor. There are two characteristic types of the house plans [7].

Central Sofa Type Plan: According to the principles of the central sofa type plan scheme, there is a sofa in the middle and there are rooms on the both sides [9].

Outer Sofa Type Plan: The outer sofa type houses are constructed as two-storey. It consists of rooms which are lined up in one direction of the sofa (see Figure 6). The rooms are directed to the street and the sofa is directed to the courtyard as openly [8]. The sofa area called as pavilion in the region provides circulation between the rooms [10].



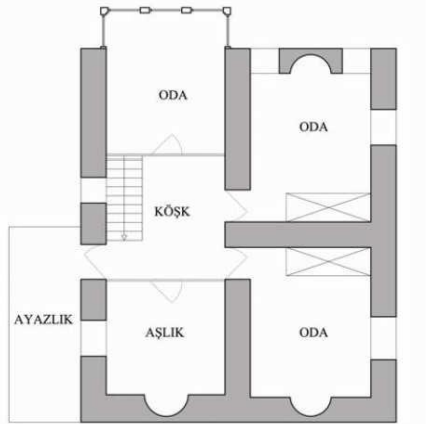


Figure 5: Central Sofa Type Plan [9]**Figure 6:** Outer Sofa Type Plan [9]

The number of rooms in folk type houses ranges from two to four. The rooms have a furniture that is integrated with the structure of rooms, the important ones are cedars, hoods and a cupboard [10].

Building and Construction Technology

Main walls undertake the role of carrier in the buttoned house architecture. The "dry wall" technique is applied without mortar and generally it is 50-60 cm thick. After the stone wall is walled then the wooden laths, which is 7x7 / 8x8 size and called as "bonding timber", are laid along the both sides of wall. These bonding timbers are connected with short laths and the masonry is continued by filling with stones.The end of the buttons is left out 10-15 cm from the outer surface [9].

Walls: The Buttoned houses have stone foundations that are not too deep. If the ground will sit on the rock, then the structure is unfounded, and the wall starts to be built on the rock. Exterior surfaces of these buildings are generally non-plastered in this technique [7].

The second method is called "Bağdadi" walling technique. In Bağdadi technique, approximately 1x3 cm size wooden laths which is called "Bağdadi lath", are piled on the both sides of timber framing. Then these surfaces are daubed with a daub which is called as "Bağdadi daub" and by this way, the walls are created [10].

Roofs: The roofs are mostly gable roof which slopes in two directions. The most common method for roofs is wood standing roof technique in this area. Cedar (tar) or juniper trees are generally used for the durability of the carrier elements on roofs made with this method [7].

Figure 7: Butonned house sample [13]

Figure 8: Butonned House floor sample [13]

Floors: In the wooden frame stone wall technique, the wooden beams which carries the top floors, are slabbed over the woodenbonding timber on the stone wall at certain distance in the direction of short edge and wall to wall. Trees that are called "rafter", are placed in the other direction on the beams more frequently and the roof board is penetrated on the top of them perpendicularly [7].

Cumba: It is one of the most important elements that creates the street silhouettes in Turkish settlements. The bay windows provide the opening of the places to the landscape and street, so that life in the upper floor allows the relationship with the street. Usually, the main element that builds the frontal is the covings. These covings are formed according to the sofa [7].

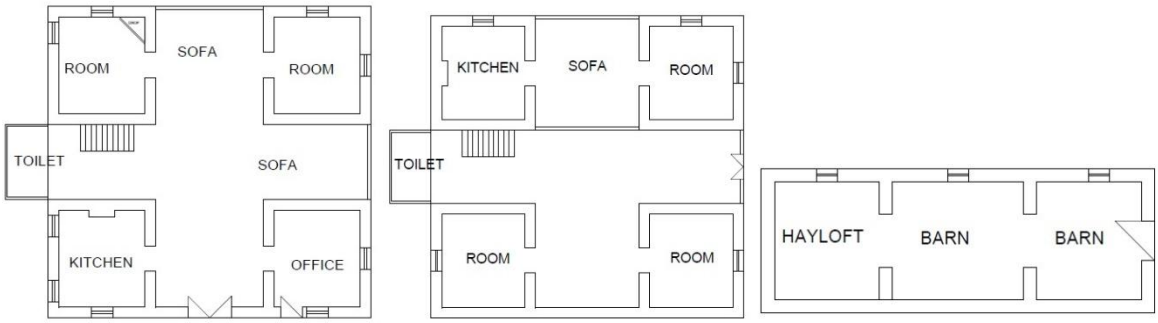
Figure 9: Butonned House roof sample [13]

Figure 10: Butonned House cumba sample [13]

V. AN ILLUSTRATIVE RESTORATION SUGGESTION

In this study, we investigated a 3-storey house which is in Akseki, Bademli district, block of 191 and parcel of 6 (see Figure 11). This house which is built according to the buttoned house technique, consists of six rooms, two kitchens, two kiosks, two stables and one straw. The house is single-storey from the road front and has three-storey from the rear front due to the difference in the elevation. The floor plans of the house are shown in Figure 12.

Figure 11: The Mentioned House [13]



GROUND FLOOR PLAN FIRST BASEMENT PLAN SECOND BASEMENT PLAN

Figure 12 : Floor Plans

Restoration Suggestions

Exterior Front: Stones and plasters on the exterior front must be repaired with appropriate material. Labourer must be careful about original construction. (see Figure 11)

Roof: The roof cover must be removed, firstly. Although the wooden carcarss which carries the roof, in good condition, reinforcements should be done where necessary and damaged parts should be replaced with the same wood material. Then the roof tiles should be re-laid and only the damaged ones should be replaced with the same tile. (see Figure 9)

Doors: Because the external doors are damaged, they must be re-made from the same material to the original. Since the interior doors are generally in good condition, they must be cleaned and protected without damage.

Cumba and Pavilion: The cumba and pavilions on the two sides of the building should be removed because they are seriously damaged. It must be re-manufactured according to the same wood material and assembly should be performed. (see Figure 14)

Windows: The windows are generally damaged. It must be disassembled and re-manufactured according to the original of the same material and assembly should be performed. (see Figure 14)

Floor: The building floors are in the form of wooden rafters and underlay cladding boards. They are in good condition and cleaning is sufficient without any damage. (see Figure 13)

Internal walls: The internal walls are generally in good condition, but some rooms have plaster spills. Room interior plasters should be removed and plastered in accordance with the original. This feature of unplastered walls in pavilions and corridors must be protected. (see Figure 13)

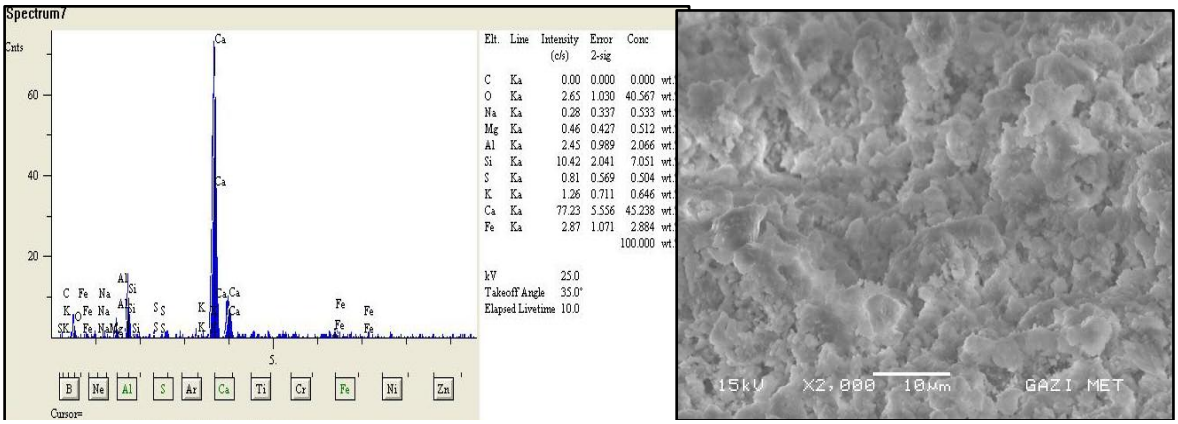
Cupboards: Since the cupboards which are made of wood, are in good condition, they must be protected by cleaning without damaging them. (see Figure 14)



Figure 13: Walls and Floor [13] **Figure 14 :** Cumba,Windows and Cupboard [13]

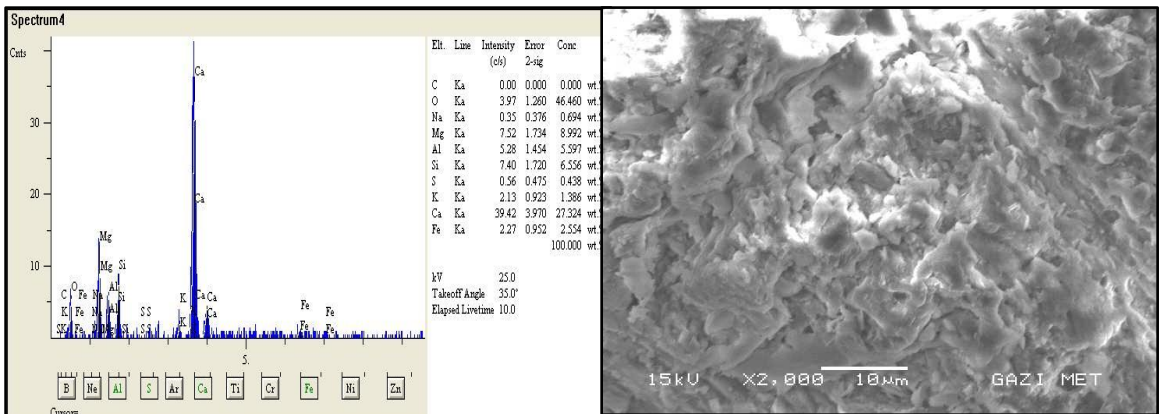
Sample SEM and EDS Analysis Results

In this study, the Scanning Electron Microscope (SEM) and Energy Dispersive X-Ray Microanalysis Spectrometer (EDS) analysis are made by taking the cast mortar and stone samples from the outer walls of the house.



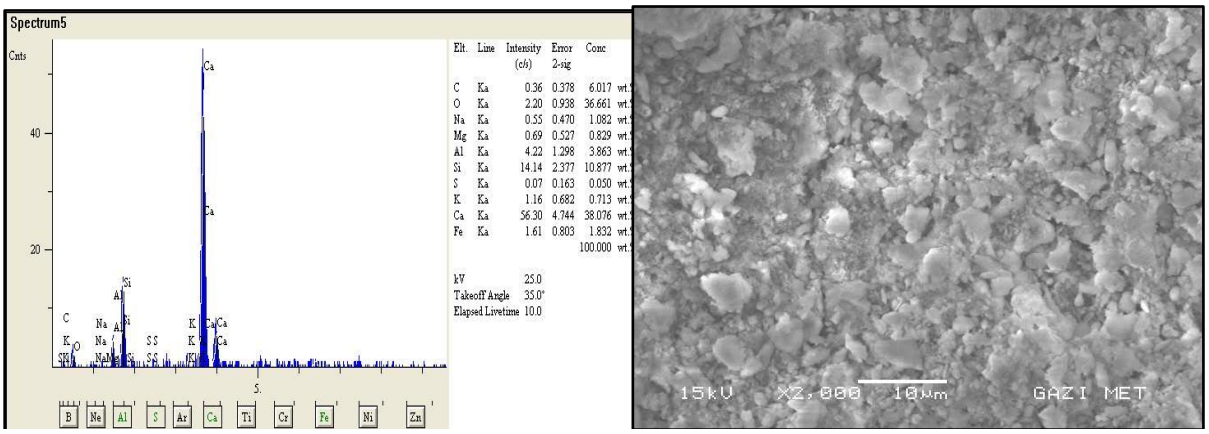
Analysis Result I: The EDS and SEM Analysis Results of West External Cast Mortar

In the SEM analysis of west external cast mortar,in x2000 magnification, the particles exhibit a homogeneous structure in oval shapes in dark gray and gray colors. Calcium (Ca), Silicium (Si), Aluminum (Al), Oxygen (O), Iron (Fe) and Potassium (K) elements are mainly found in the EDS analysis.

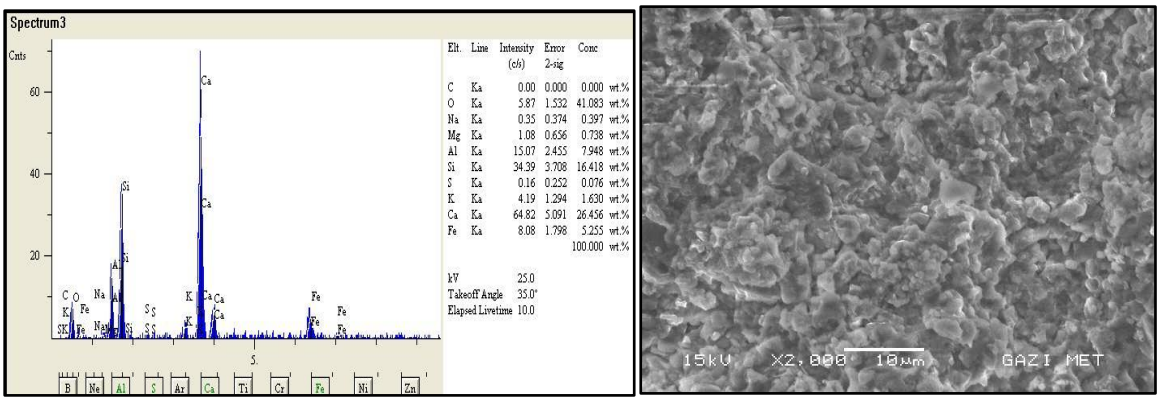


Analysis Result II: The EDS and SEM Analysis Results of West External Stone

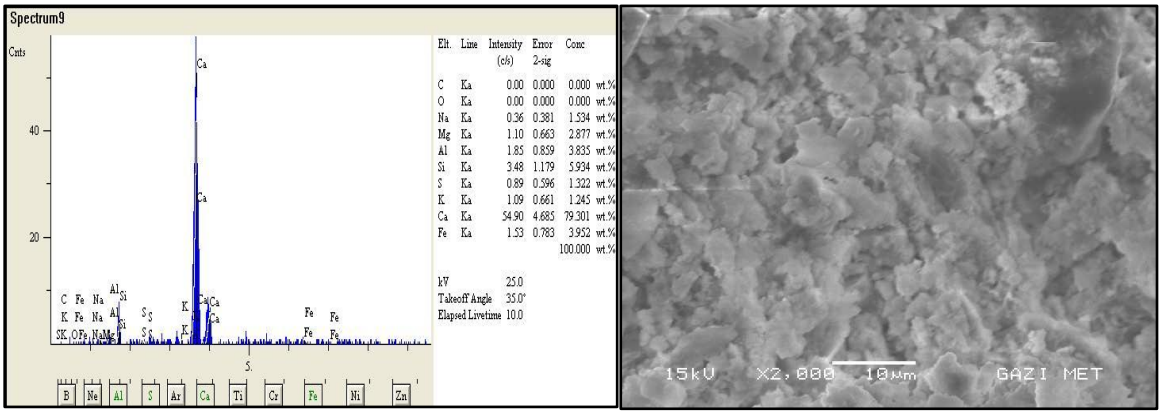
In the SEM analysis of west external stone,in x2000 magnification, the particles shows oval, more grift and an intertwined structure. Calcium (Ca), Magnesium (Mg), Silicium (Si), Aluminum (Al), Oxygen (O), Iron (Fe) and Potassium (K) elements are mainly found in the EDS analysis.



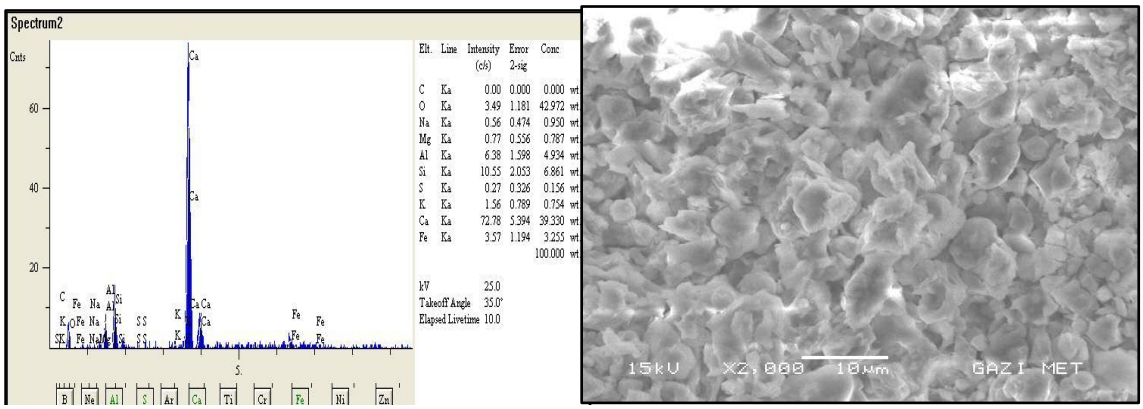
Analysis Result III: The EDS and SEM Analysis Results of East External Cast Mortar
In the SEM analysis of east external cast mortar,in x2000 magnification, the particles which are dense in partial areas and rarely seen in some areas, have polygonal shape. Calcium (Ca), Silicium (Si), Aluminum (Al), Oxygen (O), Iron (Fe) and Potassium (K) elements are mainly found in the EDS analysis.



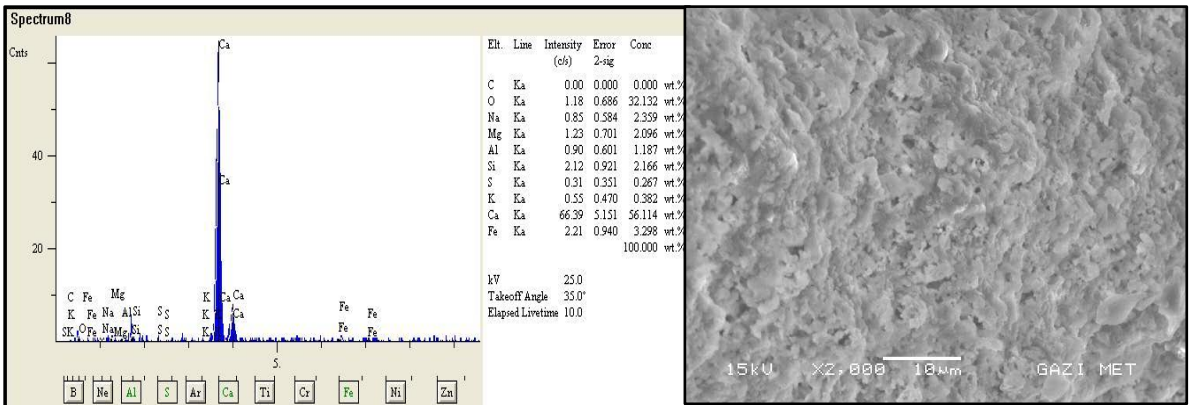
Analysis Result IV: The EDS and SEM Analysis Results of East External Stone
In the SEM analysis of east external stone,in x2000 magnification,the particles exhibit a homogenous structure with grift and densely oval motifs. Calcium (Ca), Silicium (Si), Aluminum (Al), Iron (Fe), Oxygen (O), Potassium (K) and Magnesium (Mg) elements are mainly found in the EDS analysis.



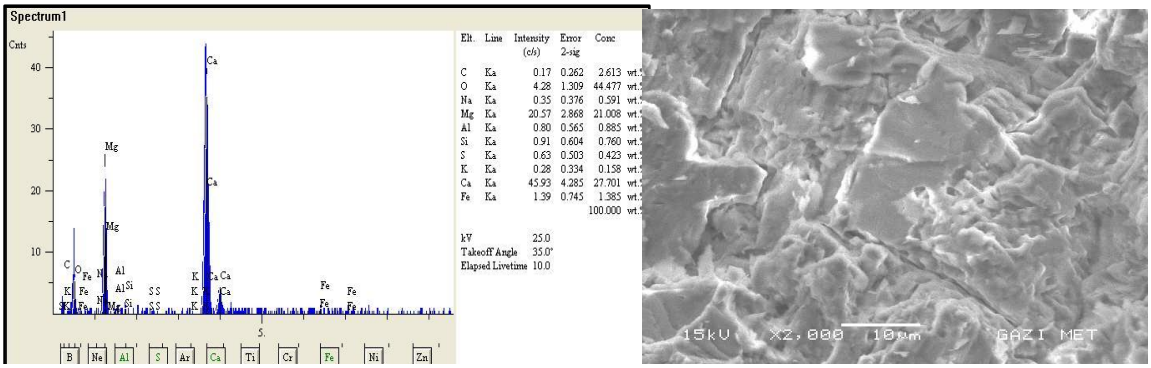
Analysis Result V: The EDS and SEM Analysis Results of South External Cast Mortar
In the SEM analysis of south external cast mortar, in x2000 magnification, the particles form a partially homogenous structure with oval geometric shapes. Calcium (Ca), Silicium (Si), Aluminum (Al), Iron (Fe), Magnesium (Mg) and Potassium (K) are mainly found in the EDS analysis.



Analysis Result VI: The EDS and SEM Analysis Results of South External Stone
In the SEM analysis of south external stone,in x2000 magnification, the particles formed an amorphous structure by taking oval shapes in their diameters and holding them together. Calcium (Ca), Silicium (Si), Aluminum (Al), Iron (Fe), Oxygen (O), and Potassium (K) elements are mainly found in the EDS analysis.



Analysis Result VII: The EDS and SEM Analysis Results of North External Cast Mortar
In the SEM analysis of north external cast mortar, in x2000 magnification, the particles are maintained their homogeneous position by bonded to each other in non-geometric forms. Calcium (Ca), Iron (Fe), Silicium (Si), Magnesium (Mg) and Oxygen (O) elements are mainly found in the EDS analysis.



Analysis Result VIII: The EDS and SEM Analysis Results of North External Stone
In the SEM analysis of north external stone,in x2000 magnification, it was observed that the particles were interlocked with uneven sharp geometric shapes. Calcium (Ca), Magnesium (Mg), Oxygen (O) and Iron (Fe) elements are mainly found in the EDS analysis.

VI. RESULTS

Historical Akseki Houses are unique in the world by its technique of construction. The restoration of these houses is important because of tourism and its history. It is important to careful about its restoration, because the "dry wall" technique is applied without mortar to the walls. The wooden parts where the 7x7 / 8x8 sized bonding timber are used. should be restored by paying attention to the material type. When selecting the material to be used, attention should be paid to climate parameters (temperature, precipitation, humidity, wind,freezing and thawing). The choice of stone and filler mortar should be made according to the results of the analysis.

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