METU JFA 2010/1
(27:1) *45-66*

DOI: 10.4305/METU.JFA.2010.1.3

SUSTAINABLE CONSERVATION ISSUES OF FOUR 14TH AND 15TH CENTURY MOSQUES IN ANKARA: AHİ ELVAN MOSQUE, ÖRTMELİ, SABUNÎ AND POYRAJI MESJIDS

Evin ERDER

Received: 18.12.2008, **Final Text:** 21.12.2009

Keywords: historic building materials; archival research; timber; clay-based plasters; the buffer effect; microclimatic measurements; sustainable conservation.

1. This paper provides a summary of the results of a dissertation (Erder, 2008) completed in the Program of Building Science at the Department of Architecture, Faculty of Architecture, METU.

2. The term *mesjid* refers to a small scale neighborhood facility in which only daily prayers can be performed and therefore usually does not have a *mimber*, or high pulpit, from which *khutba*, or sermons are delivered following the noon prayer on Holy Fridays in regular mosques.

3. Herein after, the term *cami*, is used in referring to specific mosques, or large Friday mosques in Ankara and elsewhere in Turkey.

4. A recent map of Ulus, digitized in AutoCAD and produced within the context of a studio course given by Baykan Günay and Erhan Acar at the Department of City and Regional Planning (METU) in 2008 provides the locations of all historic mosques and *mesjids* at the Ankara Citadel and Ulus.

INTRODUCTION

This paper provides a summary of a dissertation recently completed by the author and its salient findings (**1**). Mosques and *mesjids*, or small neighborhood mosques (**2**) built in Ankara between the 12th and 15th centuries are virtually the only buildings remaining from the Seljuq, Ahi and early Ottoman periods. Aside from *hans*, or commercial buildings, *hamams* and *türbes*, or mausolea, these structures, distributed throughout the urban topography, represent examples of buildings from the periods in which they were built. As may be noted in historiographic accounts of early Ottoman period such as Atsız (1992) and Neşri (1995), written documents concerning Ankara are surprisingly few, mentioning the city merely as a garrison seized or lost in well known battles. According to Aktüre (1987), a certain amount of documentary evidence from these early periods exist in *vaqf,* or foundation records which refer to this area under individual settlement names. Otherwise, the inscription panels of historic religious structures (i.e., mosques, or *Camisi* (**3**), *mesjids* and *türbes*) provide the only written information available on their dates of construction, patrons and builders.

According to both Aktüre (1987) and Bakırer (1992), a total of twenty-five historic mosques and *mesjids* still exist, both within and in neighborhoods around Ankara's Citadel. Few maps of Ankara provide the names and locations of such historic mosques and *mesjids*, *türbes*, as well as *hans* and *hamams* in Ulus, now the historic district of Ankara. A map sketched by Akçura (n.d.) and a more recent, digitized map (**4**) provide the locations of all historic mosques and *mesjids* in Ulus with their dates which show their distribution within the Ankara Citadel and throughout Ulus (**Figure 1**). As Bakırer (1992) rightly indicates, historic religious buildings present at the Ankara Citadel and its surroundings, although not as well known as contemporaneous examples in other cities, shed light on the historical and physical development of the city and form a collection of building

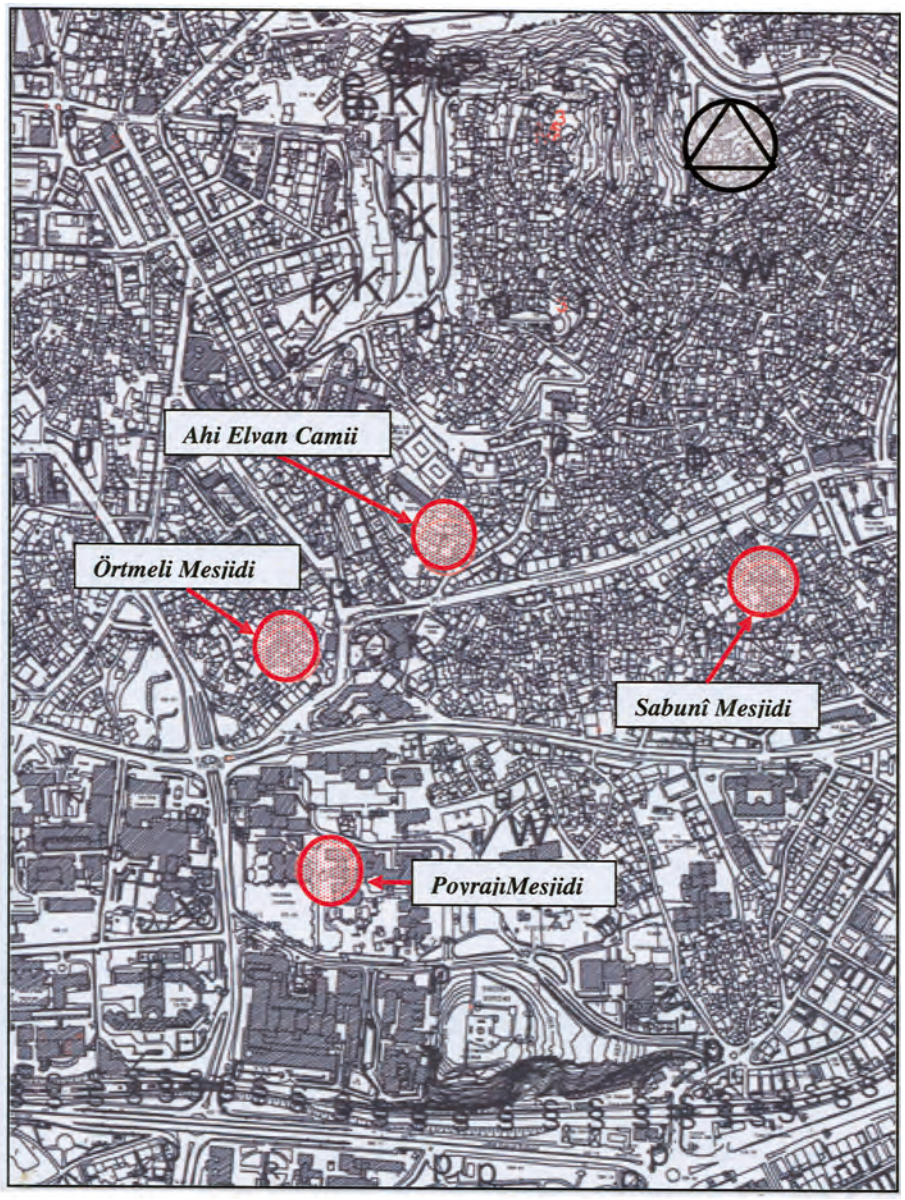


Figure 1. Map of Ankara indicating the locations of Ahi Elvan Camii, Örtmeli Mesjidi, Sabunî Mesjidi and Poyrajı Mesjidi (Map courtesy of the Department of City and Regional Planning, derived from 1:5000 scale map of Ulus based on aerial photographs and digital maps of the area, Greater Municipality of Ankara, 1997).

types which share distinct architectural qualities (**5**). Earlier examples of such mosques and *mesjids* not only reflect the transition of Ankara from a primarily Byzantine garrison to a Turkish commercial and military establishment, but also bear material evidence of their times. While some of these historic buildings may be dated based on their inscriptions panels, others may be grouped by period based on their architectural, structural and decorative characteristics. Öney (1971) studied these historic buildings as a whole, defining and evaluating their architectural characteristics based on the following classification (**6**):

- Mosques and *mesjids* from the Seljuq period,
- 14th and 15th century mud brick mosques and *mesjids* with flat timber roofs,
- 15th century stone and brick mosques and *mesjids*,
- 16th century stone and brick mosques and *mesjids*,

5. See Bakırer (1992, 72).

6. For more detailed information on these mosques and *mesjids* in Ankara and their plans, Öney (1971). These plans were revised on site for this study, and when plans were missing, as in the case of Poyrajı Mesjidi, drawn prior to the micro-environmental study. The plan for Poyrajı Mesjidi was drawn by Mustafa Önge.

- 17th and 18th century mud brick, stone and brick mosques and *mesjids*,
- 19th and early 20th century mud brick and stone mosques and *mesjids*.

These six groups, examined with respect to their dates of construction, architectural and structural characteristics and distribution in Ulus, suggest that after the Turks took over the administation of Ankara, neighborhoods spread in concentric circles from the Citadel to the surrounding plain (7).

Öney (1971) cites that only nine of these, one Friday mosque, or *cami* and eight *mesjids*, still remain in their original form. These buildings, though for the most part of modest scale, not only represent a traditional form of religious architecture introduced to Anatolia during the Medieval period, but also shed light on inteventions performed on such structures since the 1920s, whether it be to ensure their continued use or otherwise. All nine of these historic structures, registered as historic monuments, formed the core of historic neighborhoods in the Ulus district, once the center of Ankara. However, it is not just on such historical significance that their intrinsic values rest. Built mostly with timber framing, stone and mud brick, perhaps to an even greater extent it is the architectural and artistic practices of their era they embody that render them worthwhile subjects of study, especially if the absence of any recent reports or studies on their present condition is taken into account.

Given that one of the most important factors affecting the physical state of historic structures is their macro- and micro-climatic environments, it merely follows that such structures will deteriorate when exposed to adverse conditions of this environment for any length of time, while due upkeep of roofs and water drainage systems, coupled with the occasional application of new rendering can, to a certain extent, alleviate those of the macro-climate on the exterior, adverse effects of the micro-climate on the interior are more difficult to detect. What may ordinarily be considered as regular maintenance activities, such as the application of new rendering and/or coatings, for the most part carried out merely to improve interior appearance or the installation of heating and/or ventilation systems for the comfort of their users, may also compromise the physical integrity of the structure itself. These aside, even existing and, over time, changing micro-climatic conditions may themselves lead to a variety of problematic situations within the structure such as condensation, chemical degradation through exposure to pollutive substances, decay in/of timber elements, etc. Delay in the due assessment of such conditions may indeed lead to the total loss of their physical integrity. Ergo, this investigation, through an up-to-date assessment in these respects, aims to shed light on how these structures can be better and more effectively conserved for their continuous use, if not for mere display as part of our cultural heritage.

From the nine structures, one mosque and eight *mesjids*, identified by Öney (1971) as still standing with their original form preserved, all dating to the 14th and 15th centuries, four structures were selected for this study to represent a roughly 45% sample. The selection itself was necessarily purposive rather than random in order to cover as broad a range as possible regarding not only size and location, but also the degree to which their original architectural elements and decorative features have been preserved. Historic religious structures of this time period were chosen as the focus of this study due primariy to the existence of the highest number of structures remaining in Ankara from this period. These religious

7. For a detailed analysis of the location of historic mosques and *mesjids* with respect to their dates of construction and historic neighborhoods in Ankara, Bakırer (1992, 72-94).

Figure 2. Candaroğlu Mahmut Bey Camii (Photo: Vakıflar Genel Müdürlüğü Archives (n.d.)).

structures, preserved remarkably intact, though less well known than the more monumental ones, such as Arslanhane Camisi, may be considered equally worthwhile subjects of study.

HISTORICAL CONTEXT

Mud brick and timber-posted mosques and *mesjids* only became prevalent in Ankara during the latter period of what may be regarded as the 'timber-posted' mosque tradition in Central Anatolia. Prior to the mid-13th century, many Friday mosques had timber ceilings, such as Alaaddin Camisi in Konya, however those with freestanding timber posts date to the last quarter of the 13th century: Afyon (1273), Sivrihisar (c. 1279), Ankara (1289), Beyşehir (1299) and Samsun (1300), destroyed by fire in c.1879. After that date, during the 14th century, this mosque type decreased in size as exemplified by Candaroğlu Mahmut Bey Camisi in Kastamonu, Ulu Camisi in Ayaş and those in and near Ankara (**8**).

Mosques and *mesjids* of the 14th and 15th centuries with timber ceilings in Ankara have been the subject of numerous publications as well as unpublished documents, both recent and dated (Konyalı, 1943; Yücel, 1969; Öney, 1987; Öney, 1994; Ötüken, Durukan, Acun and Pekak, 1983; Hancıoğlu, 1990; Bakırer, 1992; Aslanapa, 1993; Eskici, 2001). Techniques of timber carving used in buildings of Anatolia during the Seljuq and Beylik periods have also been studied in some detail (Öney, 1970; Öney, 1978; Demiriz, 1979; Bilici, 1988; Sönmez, 1989; Uysal, 1991). Ötüken, et al. (1983)

Figure 3. Ahi Elvan Camii, Samanpazarı, October 2005 (Photo: E.Erder).

Figure 4. Örtmeli Mesjidi, Old Jewish Neighborhood, April, 2006 (Photo: E. Erder).

Figure 5. Sabunî Mesjidi, Akalar Neighborhood, July, 2006 (Photo E Erder).

Figure 6. Poyrajı Mesjidi, Hacettepe University main campus, April, 2006 (Photo: E.Erder).

have provided an up-to-date description of each structure, as well as some information on their history and past interventions. Nonetheless, due to the nature of this publication, intended as a guidebook, the information is brief and limited. Other published sources relevant to this study were those of Akok (1946) and Bilici (1988) who both studied the landmark mosque Candaroğlu Mahmut Bey Camisi at Kasabaköy, Kastamonu (**Figure 2**) and that of Acun (2001) who documented in detail İlyakut Camisi, similar to those in Ulus, located at the Village of Sincan, approximately 30 km. south of Ankara.

OBJECTIVES

The primary objective of this investigation was to assess the current physical and environmental conditions of selected buildings with particular emphasis on their state of conservation and original timber elements. In specific terms, this entailed the determination of several factors such as (1) prevailing external conditions ensuing from their physical setting, including the macro-climate, (2) the physical characteristics of their architectural elements and the effect of these on their micro-climate, (3) the parameters required for the conservation of their interior timber elements and associated decorative features, (4) the parameters required for maintaining acceptable levels of indoor comfort without compromising the physical condition of their original architectural elements, and (5) recommendations for their long-term sustainable conservation, including maintenance, preventive measures and restoration. Its secondary and incidental objective concerned their statutory and administative standing and reassessment of past and recent interventions for their restoration in an historical context. This essentially involved assessment of past and current measures put in place, or condoned, for their maintenance, repair and conservation by the various authorities under whose jurisdiction they fall.

MATERIALS AND METHOD

Of the four selected buildings, one was a Friday mosque and three were *mesjids*. These four structures, Ahi Elvan Camisi, Örtmeli Mesjidi, Sabunî Mesjidi and Poyracı Mesjidi (**Figure 3-6**), are each located in different neighborhoods or areas within Ulus. A research program was thus developed for a micro-climatic study at the four structures to enable an assessment of how their building envelopes may react to prevailing environmental conditions and thus evaluate requirements for comfort versus conservation, as well as define pertinent criteria for future restoration work. The present physical condition of the structures and any traces of previous interventions were first observed visually and recorded *in situ*, followed by research through the available literature and archival documents and a range of analytical techniques. For this, a research program was defined for on site environmental monitoring based on long-term meteorological data for Ankara during a one year period, each season (**9**). Macro- and micro-climatic data were thus gathered during January and July as the coldest and hottest months, and April and October as transitional months.

Macro and micro environmental data, used for diagnostic purposes, provided up-to-date information on the present physical condition and characteristics of the four structures and their effect on internal micro-climatic conditions. Limitations in this study were imposed primarily by the time-frame established for the study (i.e., one year) and times of

8. I owe these observations to Kenneth Hayes who has visited many of these structures. Hayes suggests that Sahip Ata Camisi (1258) is likely to be the first timber posted mosque in Anatolia which was destroyed by a fire in 1871 and no longer exists. Two small timber mosques with timber columns have recently been located which predate the monumental Central Anatolian mosque type: Sey Habil Camisi (1204) and Gökçeli Camisi (1206) in the town of Çarşamba near Samsun (Hayes, 2008).

9. Monthly data on mean temperatures for a ten year period between 1994 and 2005 obtained from Devlet Meteoroloji İşleri Genel Müdürlüğü (National Directorate of Meteorology) in Ankara, served to establish the exact months for the collection of environmental data at all four structures. Data were gathered successively at each structure, rather than simultaneously, for approximately one week.

accessibility, as well as financial and practical constraints in the diagnostic methods applied and availability of instrumentation employed. All four structures, still in use, could be accessed in the morning or afternoon, before or after noon-time prayer. It was therefore necessary to coordinate field work with their open hours. Data gathered manually thus generally reflected micro-climatic conditions during their restricted open hours. The changeable climate also influenced data analysis: with less rain and higher temperatures than usual, attributed to the effects of global warming, data gathered reflected conditions during a single year.

Tiny tag® Plus data loggers, installed at each structure during one week per season, measured both exterior and interior ambient temperatures and relative humidity, as well as the surface temperature of their timber ceilings every 15 minutes. Changes in temparature and relative humidity are especially important to understand its effects on their timber elements. These data were therefore analyzed with respect to their timber elements in all four structure per season by statistical methods. The potential 'buffer effect' (**10**) of materials contained within each structure, on the other hand, was estimated by determining the volume of interior air space and approximate area per building material (i.e., timber ceiling and re-plastered and/or re-painted walls) and wool carpetting with a Hilti® PD-20 laser range meter. Samples of original and repair materials at each structure were not taken for ethical reasons, in order not to cause any potential damage. This study therefore reflects an analysis of the potential/expected effects of differing macro and micro climatic conditions on their original materials, with particular emphasis on their interior timber elements, as well as their bearing walls and exterior renders.

Temperature and relative humidity measurements per m^2 taken with a hand-held Kestrel® 3000 hygro-thermometer both in the main prayer hall and *kadınlar mahfeli*, or women's section, at approximately 1 m. above floor level, on the other hand, reflected conditions during open hours. Surface temperature measurements at their timber ceilings, timber posts and interior walls, taken with a hand-held Raytek® PM Plus infrared thermometer at all four structures in October, January and April also detected the presence of possible dampness problems. This diagnostic method is necessarily only indicative of potential dampness problems through differences observed in surface temperatures. Infrared thermography would be required for a more detailed analysis.

Data gathered by Tiny tag® Plus data loggers, first graphed in full using Gemini™ GLM Version 2.8 software, allowed for a comparison of macro- and micro-environmental conditions at each structure per season. Microsoft Excell™ was used as software to compare isolated factors such as exterior and interior dew point temperatures at each structure per season to determine the effects of exteriot macro climatic conditions on their interior micro-climate based on the physical composition of their bearing walls.(**11**). The risk of condensation at the exterior walls and timber ceiling of each structure was determined by analyzing the difference between ambient and/or surface temperatures and dew point temperatures. Data analysis also included statistical analyses with respect to several other factors such as (a) frequency distribution of relative humidity with respect to the optimal environmental baseline for structural stability (**12**) and (b) frequency range of the dew point temperature in each structure during the summer and winter with respect to comfort conditions (**13**). These analysis were necessarily indicative of various macro- and micro-environmental

10. Padfield has demonstrated recently through laboratory research that various building materials are not only affected by their micro-environment, but also changes in micro-climatic conditions by their buffer capacity. Padfield's research has shown that "the factors that define the performance of humidity buffers in rooms with a significant air exchange rate are [their] water capacity and water vapor permeability" and that the "best common buffer materials are wood, cut across the grain, and unfired brick" whereas the worst materials are the "coarsely porous materials: lime mortar, gypsum plaster and brick" (Padfield, 1999a, 1). Indoor relative humidity is therefore a consequence of water production, or removal, moderated by absorption and desorption by the materials" (author's italics) in an indoor environment; and that "[t]he house as it has developed in modern times is less and less absorbent" (Padfield, 1999b, 1).

11. The effects of the macro-climate was determined based on a comparison of exterior and interior micro-climatic data (temperature, relative humidity and dew point temperatures) and the physical characteristics of their bearing walls and exterior renders.

12. Mecklenburg, Tumosa and Erhardt (1998) have indicated, based on their laboratory research, that the "optimal environmental baseline for structural stability in most objects is in the mid-relative humidity region (45%-55%)" Mecklenburg, et al. (1998, 482). The frequency distribution of relative humidity within each structure per season was thus analyzed with respect to this baseline.

13. Tenwolde and Rose (1994, 63-5). The authors indicate that the ASHRAE Standard 55 on thermal environmental conditions for human occpancy recommends one temperature comfort zone for winter and another for summer. This standard defines a comfort range in terms of dew point temperature for both summer and winter with ranges between 1.7°C and 16.7°C.

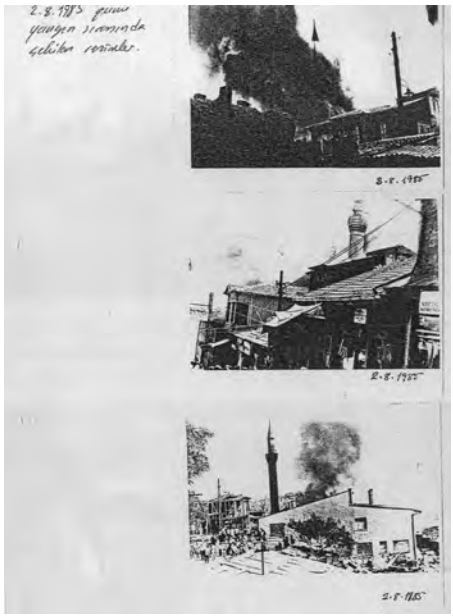


Figure 7. Ahi Elvan Camii maintenance and repainting campaign in 1970s (VGM Archives).

Figure 8. Ahi Elvan Camii, during fire at adjacent shops in 1985 (VGM Archives).

trends, and their potential effects on their original materials, rather than conclusive concerning their adverse effects on their original materials, exterior renders and/or bearing walls.

Review of all archival documents available at Vakıflar Genel Müdürlüğü (the General-Directorate of Endowments) in Ankara, now digitized, was indispensible in evaluating the history of each structure. Archival records, composed primarily of inventory forms, or 'identity cards', as it were, utilized in the registration and restoration of historic monuments in Turkey, as well as photographs and drawings provide invaluable visual and/or written information not only on the buildings themselves, but also significant past events such as earlier restoration and/or maintenance work. After its restoration in the late 1960s or early 1970s, photographs taken at Ahi Elvan Camisi document a re-painting and maintenance campaign during the 1970s and a major fire adjacent to the mosque in 1985 (**Figure 7, 8**). Similarly, many archival records also exist concerning Poyrajı Mesjidi, documented and registered during the construction of Hacettepe University main campus in 1971, and thus saved from its total destruction (**Figure 9, 10**). Written and visual records of its restoration also document the general approach taken towards its restoration.

Figure 9. Poyrajı Mesjidi before its registration and restoration in 1970s (VGM Archives).

Figure 10. Poyrajı Mesjidi during its restoration in the 1970s (VGM Archives).

Ahi Elvan Camisi and eight *mesjids* in Ankara, dating to the 14th and 15th centuries are generally associated with the Ahi period, or period of craftsman's guilds. The primary distinguishing feature of this period is their construction materials: mud brick bearing walls with timber tie-beams and stone foundations. This aside, each structure differs from the others in plan-type. Ahi Elvan Camisi, plan of which is the most typical of this period, is rectangular with almost equally spaced freestanding timber posts (**Figure 11**). The three *mesjids*, on the other hand, vary in their plan types, with Örtmeli Mesjidi and Sabunî Mesjidi which are almost square, although their walls were not built at exact right angles, and Poyrajı Mesjidi which is rectangular in plan. A *son cemaat*, or open portico, present both at Sabunî Mesjidi and Poyrajı Mesjidi, is completely absent at Örtmeli Mesjidi. All four structures have timber balconies, used by women (*kadınlar mahfeli*) added later. Their bearing walls, approximately 1 m. thick, act as

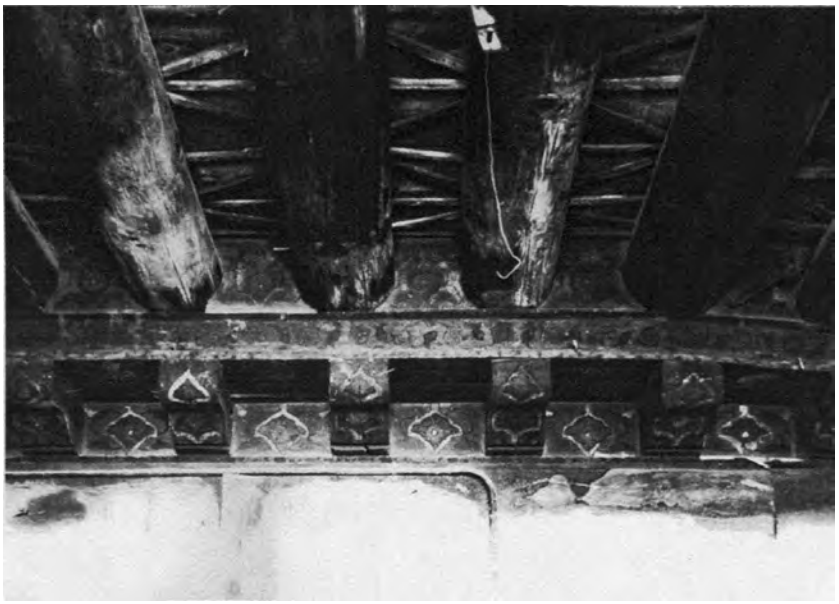


Figure 11. Plan of Ahi Elvan Mosque (n.d.) (VGM Archives).

Figure 12. View of timber ceiling of Poyrajı Mesjidi before its restoration.

barriers against the summer heat and cold winters. Their timber ceilings, on the other hand, were originally flat-roofed, a roof type sometimes referred to as '*kara dam*', black roof (**14**). This roof type, at times still present in mud-brick buildings in Central Anatolia, usually consists of timber planks, plastered with mud, and is covered with clayey soil, called *çorak*, approximately 30-40 cm. thick, sometimes salted and compressed with a cylindrical roller called *loğ taşı* (**15**). The roofs of all such structures were later replaced with pitched timber roofing and ceramic tiles while the *çorak*, when still present, as at Örtmeli Mesjidi, provides additional insulation.

PAST AND CURRENT INTERVENTIONS

Each of the four structures underwent various changes during their restoration, conservation and maintenance during the 20th century. Based on archival records, it is known that Ahi Elvan Camisi was restored substantially during the late 1960s or early 1970s when its mud brick bearing walls were repaired and re-faced with brick and cement-based cladding (**16**). Its *mihrab*, also re-painted with oil-based paints by the 1970s (**17**) remains so today. Its original timber *mimber*, or pulpit, on the other hand, has remained in a deteriorated condition since the 1970s (**18**). In 1985, a fire took place in an adjacent cotton shop burning surrounding shops to the ground, an event documented by many photographs now at the VGM Archives. Fortunately, this fire only scathed the west side of the building.

Örtmeli Mesjidi, on the other hand, last restored in 1951 prior to this study, was restored during the winter of 2006 and 2007, providing an example of current trends in the conservation of historic mosques and *mesjids* in Ankara and elsewhere in Turkey. During its restoration in 1951, its bearing walls were repaired, re-faced with cement-based cladding and repainted. As with all such structures, re-painting its *mihrab* and timber posts with oil paints later became regular practice. Its ceiling is quite low in comparison to other *mesjids*; the original floor level may therefore have been somewhat lower, raised at an earlier date (**19**). In 1994, a report presented to the VGM recommended its restoration followed by a survey of the entire structure and its decorative features and recommendations for its restoration (**20**).

14. Önge (1972, 181).

15. Thermal insulation the timber ceilings at these structures may provide was analyzed through a study at Sabunî Mesjidi in July which compared the surface temperature of the roof, and temperature and relative humidty of the attic space and air adjacent to the ceiling. It was apparent that changes in surface temperatures at its roof, reaching up to 56.0°C, were followed by temperature changes within the attic space (max. 32.0°C) but not within the *mesjid*, where temperatures varied between 24.0°C and 25.0°C.

16. Öney (1971, 26).

17. Öney (1971, 26). A decision for the conservation of the timber *mimber* at Ahi Elvan Camisi taken recently indicates common agreement that this *mihrab* requires attention.

18. Öney (1971, 27).

19. This interpretation of the low ceiling at Örtmeli Mesjidi, recently suggested, has not been proven, and given that its restoration is now complete, will not be proven, Aktan and Aktan (2004, 54).

20. Aktan and Aktan (2004) submitted a report to Vakıflar Genel Müdürlüğü (VGM) for the restoration of Örtmeli Mesjidi which was referred to for restoration work at the *mesjid* in the winter of 2006-2007.

Sabunî Mesjidi, last restored in the 1920s, represents the least intervened example. At the time, its roof and bearing walls were raised and a pitched timber roof with baked clay-tile cladding installed (**21**), later replaced by factory-produced clay-based tiles. As with Ahi Elvan Camisi and Örtmeli Mesjidi, its *mihrab* and timber posts were re-painted with oil-based paints. Aside from this, this *mesjid* underwent no major interventions since the 1920s and still has *hımış*, or clay based renders with organic fiber additives. In 1987, a report presented to Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulu (Regional Committee for the Conservation of Cultural and Natural Heritage) of Ankara requested its restoration. Subsequently, a designated architectural firm prepared a survey and restoration project proposal for the *mesjid*.

Poyrajı Mesjidi, now located within the main campus of Hacettepe University, was once situated in the neighborhood of Kurtuluş, an old residential neighborhood, once called Buyracı at the cross-roads of Sakızlı and Akbaş Streets. This *mesjid* may have once been used as a *tekke*, or dervishes' lodge, with the dervishes' houses adjacent (**22**). In 1948, following the destruction of adjacent buildings, neighborhood residents repaired the *mesjid* and later used the building both as a residence and a *mesjid* (**23**). According to archival records, the structure was still in use in the 1960's by local residents for Koran lessons and its second storey above its portico (*son cemaat yeri*), as a residence. A photograph shows an exterior staircase to its east, leading up to the women's section (*kadınlar mahfeli*), then used as a residence (**24**). At the time, a thick layer of dust and dirt covered its original *kalem işi* decorative work, or pigmented embossments, with original motifs clearly visible (**Figure 12**), while its stucco *mihrab*, blocked with mud brick infill, no longer served its original purpose.

Poyrajı Mesjidi was restored completely by VGM between 1971 and 1975 (**25**). In an old photograph, taken prior to its restoration in the 1970s, its walls were timber-frame with mud brick infill. This *mesjid* also had stucco window frames with stained glass windows, later replaced in the 1970s by cast concrete windows similar in form and appearance to their originals (**26**). In 1971, during the construction of the Hacettepe University campus, a report by two art historians, Bilcen and Bayburtluoğlu, dated September 8, 1971, requested the registration of this structure as an historic monument (**27**). The report declared that the most valuable part of the *mesjid* was the timber projection of its women's section, or *kadınlar mahfeli*, and its *kalem işi*, or pigmented embossments. At the time, its *aşı boyası* or natural pigments had "different tones of green, orange, yellow, white, turquoise and *vişneçürüğü* (cherry red)" (**28**). Its timber ceiling also featured *kalem işi* which "perfectly reflecting the taste of their time" (**29**). This report thus ensured the registration of Poyrajı Mesjidi as an historic monument worthy of protection and conservation. As a result, on September 15, 1973, Gayrimenkul Eski Eserler ve Anıtlar Yüksek Kurulu (Committee for Immovable Historic Works and Monuments) decided that Poyrajı Mesjidi would be restored (**30**). Its restoration involved partial removal and replacement of its deteriorated mud bricks and tie-beams and re-plastering of the building entirely with cement-based cladding as well as replacement of its timber ceiling with a new one resembling its original.

Ahi Elvan Camisi in Samanpazarı, Örtmeli Mesjidi in *Eski Yahudi Mahallesi* (the Old Jewish neighborhood), Sabunî Mesjidi in Akalar neighborhood and Poyrajı Mesjidi, now within the Hacettepe University campus are all in continuous use. From a physical standpoint, all four buildings showed

21. *Türkiye'de Vakıf Abideler ve Eski Eserler*, v: 4 (1983, 345).

22. Öney (1971, 37).

23. *Türkiye'de Vakıf Abideler ve Eski Eserler*, v: 4 (1983, 430-1).

24. *Türkiye'de Vakıf Abideler ve Eski Eserler*, v: 4 (1983, 431).

25. Konyalı (1978, 30).

26. Öney (1971, 37).

27. File no. 06.01.01/054, repair doc. 007A, VGM Archives, Ankara.

28. File no. 06.01.01/054, repair doc. 007A, VGM Archives, Ankara.

29. File no. 06/01.01/054, repair doc. 006B, VGM Archives, Ankara.

30. File no. 06.01.01/062, doc. 001, VGM Archives, Ankara.

surprisingly few signs of decay, however, each one, in varying degrees of neglect, had similar problems such as signs of rising damp and evidence of past maintenance and conservation activities concerned primarily with improving their appearance. The timber ceiling of Ahi Elvan Camii with no painted decorations only showed slight signs of dampness. However, its timber *mimber* was quite deteriorated and stucco *mihrab* and timber posts were repainted with oil paints. Sabunî Mesjid, on the other hand, had *kalem işi*, or pigmented embossments at its ceiling, however, much of these decorations had been lost over time. Its *mihrab* and timber posts were repainted with oil paints. The decorative *kalem işi* at Poyrajı Mesjidi, on the other hand, hand, had been repainted with oil paints, along with its timber posts and stucco *mihrab*.

Örtmeli Mesjidi appeared the most neglected. Unlike the other three structures, its timber ceiling had cracks and most of its kalem işi decorations had disappeared over time. Recognized as such, this *mesjid* underwent major restoration and conservation work which fundamentally changed and transformed its physical condition and appearance. A complete survey and graphic documentation of the building and its decorative motifs at both at its timber ceiling and cast stucco *mihrab* by Aktan and Aktan (2004), accompanied by their recommendations for restoration work, was approved by Kültür ve Tabiat Varlıklarını Koruma Bölge Kurulu of Ankara. In the fall of 2006, restoration work began at the *mesjid* which involved both preventive measures such as the installation of a new water drainage system, as well as re-painting of its kalem işi (pigmented embossments). In addition, removal of all previous paint layers from its stucco *mihrab* revealed its original motifs facilitating its total restoration by the completion of missing areas with cast stucco.

Removal of all its cement-based cladding and interior plasters followed by the installation of a new water drainage system at its foundations and application of new clay-based plasters, both at its interior and exterior wall surfaces, has fundamentally changed the physical characteristics of its bearing walls and reduced the likelihood of rising damp. The application of clay-based renders, composed of a mixture of soil and whitish clay obtained from Balâ, an admistrative district within the province of Ankara, also reflects current awareness of the importance of physical compatibility of materials used in restoration with original materials and their sustainability. However, as is customary, the project, initiated when funds became available, began in the late fall and winter. Consequently, its interior, exposed to the cold climate, required a heating system used during working hours. Other repairs involved the replacement of its roof drainage system, as well as its timber minaret and conical cap, re-clad with copper sheeting, and replacement of window casings with new casings and installation of double-paned glass. Within the *mesjid*, a new sub-floor heating system replaced the portable, gas and/or electrical heaters commonly used in such structures. The timber balcony of its women's section (*kadınlar mahfeli*), entirely removed during restoration work, was later replaced by a new one.

Re-painting of its *kalem işi* decorative work required skilled and careful execution by a trained conservator. After removing any soil deriving from its original *çorak* roof by vacuuming and subsequent photo-documentation of the entire ceiling, the ceiling was cleaned carefully with alcohol diluted in water and re-photographed. The colors of the original *aşı boyası* (natural pigments), were also examined in daylight and the ceiling re-painted in

Figure 13. Örtmeli Mesjidi, after restoration work, April, 2007 (Photo: E. Erder).

Figure 14. Örtmeli Mesjidi timber ceiling, after re-painting (Photo: E. Erder).

Figure 15. Örtmeli Mesjidi cast stucco mihrab after restoration (Photo: E. Erder).

selected areas with matching colors. During this process, the cast-stucco *mihrab* was also repaired and restored with cast stucco matching its original geometric and floral motifs. Repair and re-painting of the timber ceiling involved the following steps (**31**).

Broken or cracked timber elements were removed, stapled at the back and reinforced with cloth and *ağaç tutkalı*, an organic adhesive. Missing *hançer*, or dagger-shaped timber elements and timber laths were replaced by newly carved pine elements. Subsequently, areas of the ceiling with their original pigments still present were coated with an *astar*, or undercoat of linseed oil, followed by all other areas due to be re-painted. The *kalem işi* (pigmented embossments) were then re-painted or reproduced in selected areas by first re-drawing the pattern of each decorative feature, filling each with a suitable color made of a mixture of *toprak boya*, or commercially available natural pigments, followed by contour-lines around each feature. It also became apparent that two different brush-strokes were apparent during re-painting: one very smooth and skillful, possibly that of the master-craftsman, and the other, apparently less skillful, possibly belonging to his assistant. One decorative element, placed in reverse, may have been placed as such intentionally. After all re-painting was complete, all timber elements within the *mesjid* were coated with at least three layers of shellac, called *gomalak* diluted in alcohol.

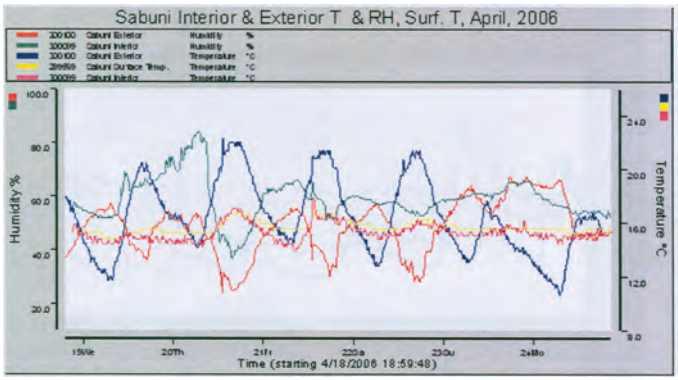
Restoration work at Örtmeli Mesjidi, completed by April, 2007, thus changed and transformed the structure entirely (**Figure 13**). Its ceiling, re-painted in selected areas, its stucco *mihrab* restored, its interior and exterior wall surfaces re-painted with a white limewash, its minaret replaced and conical cap re-clad with copper and the new chandelier within the *mesjid* created a sense of "newness" at the *mesjid* (**Figure 14-15**).

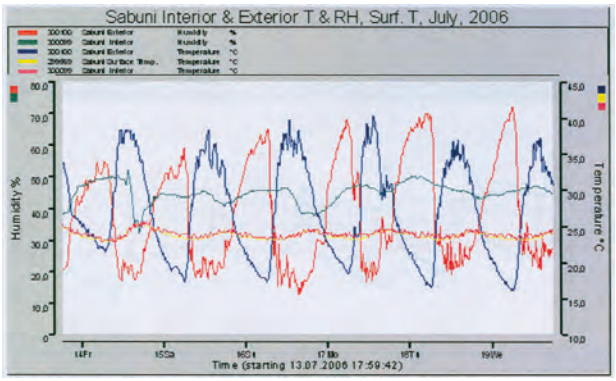
RESULTS

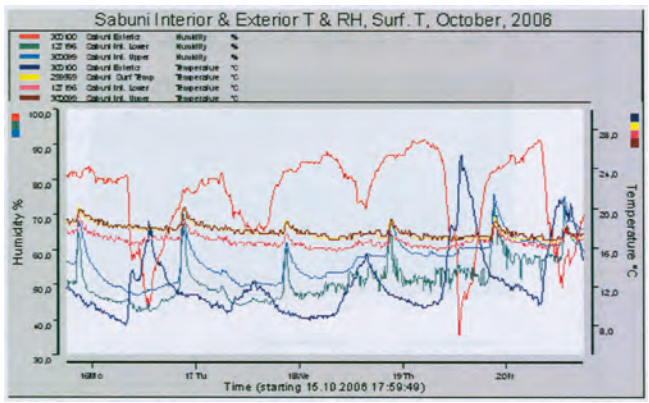
Microclimatic data were recorded for all four structures during each season. Provided here are the results for one of the mesjids, Sabunî Mesjidi (**Figure 16-19**). These data were analyzed at each structure per season in order to ascertain whether existing micro- and macro-climatic conditions may have a detrimental effect on the structures themselves, with particular emphasis on their timber elements. Data collected during a one year period consisted of ambient temperatures and relative humidity inside each structure, near their timber ceilings, the surface temperature of their ceilings and temperature and relative humidity variations outside each structure for a one week period per season.

Several factors had an effect on the micro-climatic conditions within these four structures: exterior macro-climatic conditions, usage patterns, ventilation rates, as well as the physical characteristics of their building envelopes and the "buffer effect" of materials within. As would be expected, exterior macro-climatic conditions had an effect, especially when doors remained open for their users and visitors. Similarly, although not measured, ventilation rates appeared to be dependent primarily upon the extent to which their doors or windows remained open. While the physical properties of their building materials and especially those of their ceilings and load-bearing walls influenced interior micro-climatic conditions. Materials used for cladding their walls clearly had an impact on their internal micro-climatic conditions. Materials contained within the four

31. Kazım Sözak, the conservator at Örtmeli Mesjidi, kindly conveyed this detailed description of the stages of repair and repainting at its timber ceiling.







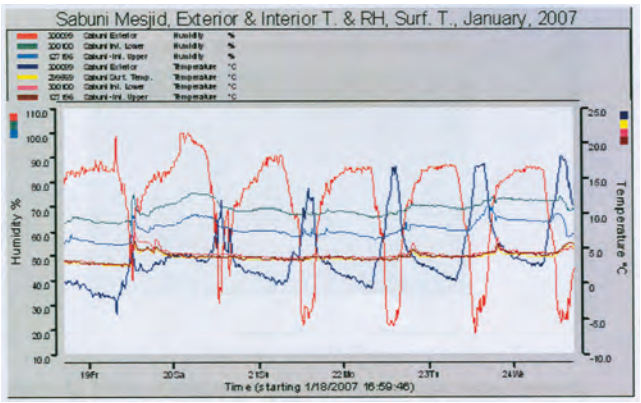


Figure 16. Exterior and interior temperature and relative humidity and surface temperature of ceiling at Sabunî Mesjidi during April.

Figure 17. Exterior and interior temperature and relative humidity and surface temperature of ceiling at Sabunî Mesjidi during July.

Figure 18. Exterior and interior temperature and relative humidity and surface temperature of ceiling at Sabunî Mesjidi during October.

Figure 19. Exterior and interior temperature and relative humidity and surface temperature of ceiling at Sabunî Mesjidi during January.

structures (i.e., timber ceilings, wool carpeting, etc.) also buffered changes in relative humidity.

During their repair and restoration in the 1920s, 1940s, 1950s, 1960s and 1970s, the bearing walls of each structure underwent a variety of changes which have influenced their physical and micro-climatic conditions in different ways. To summarize, in the case of Ahi Elvan Camisi, its original mud brick walls, reinforced with brick facing and cement cladding in the 1960s or 1970s, changed substantially. Poyrajı Mesjidi, on the other hand, restored substantially in the 1970s, was practically re-built with a new timber ceiling, new mud-bricks and timber tie-beams, followed by cement-based cladding. Örtmeli Mesjidi, restored in 1951 with cement-based cladding, and more recently during the winter of 2006-2007, now has clay-based renders at its exterior and interior walls. Lastly, Sabunî Mesjidi, last restored in the 1920s, underwent fewer changes: its exterior walls, rendered with *hımış*, or clay-based plasters, remained as such. One may also assume that regular maintenance activities at each structure involved re-plastering and/or the application of a lime wash, acrylic and/or oil-based paints, primarily to improve the appearance of their walls and *mihrabs*.

Comparison of exterior and interior macro- and micro-climatic conditions at each structure per season by way of their mean temperatures, relative humidity and especially dew point temperatures revealed that the physical characteristics of their bearing walls had a direct impact on their internal micro-climatic conditions, mudbrick, brick and cement-based cladding at Ahi Elvan Camisi, mudbrick and cement-based cladding and/or renders at Örtmeli Mesjidi and Poyrajı Mesjidi, and mudbrick and clay-based renders at Sabunî Mesjidi. For example, a comparison of exterior and interior dew point temperatures at Ahi Elvan Camisi, Poyrajı Mesjidi and Sabunî

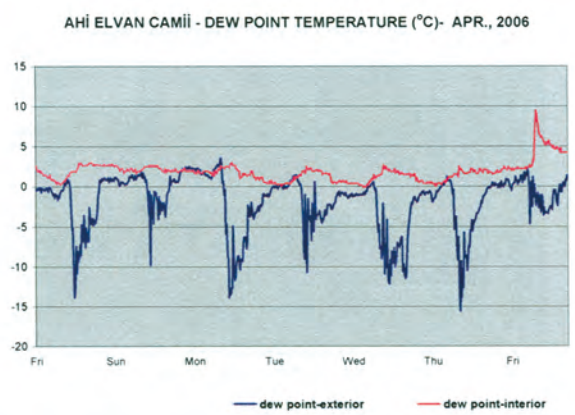


Figure 20. Ahi Elvan Camii, exterior and interior dew point temperatures in April.

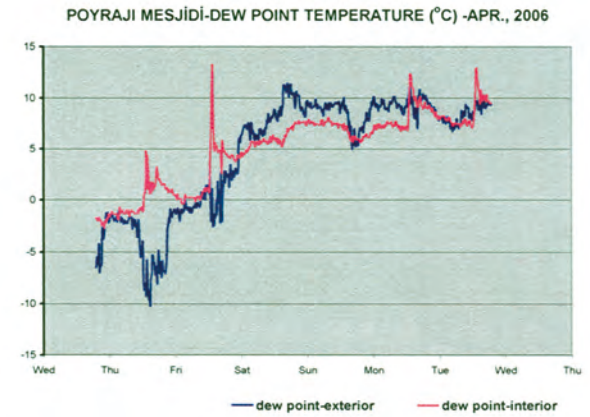


Figure 21. Poyrajı Mesjidi, exterior and interior dew point temperatures in April.

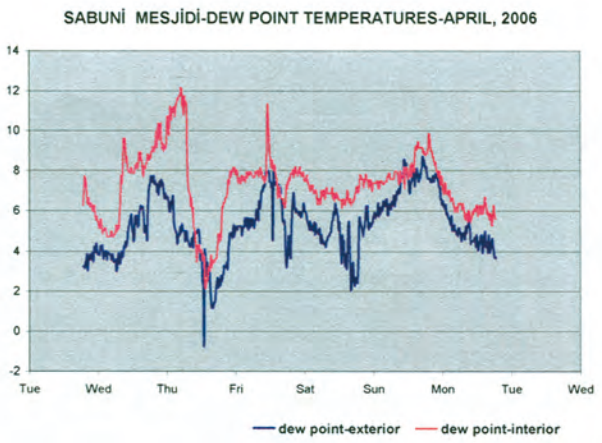


Figure 22. Sabunî Mesjidi, exterior and interior dew point temperatures in April.

Mesjidi during April showed that their interior dew point temperatures varied depending upon the physical characteristics of their bearing walls. When the data from all three structures were compared, at Ahi Elvan Camisi the dew point temperature varied the least and at Sabunî Mesjidi the most (**Figure 20-22**).

However, a comparison of the differences between mean exterior and interior dew point temperatures also suggested that overall, Sabunî Mesjidi's bearing walls with clay-based renders provide a more effective

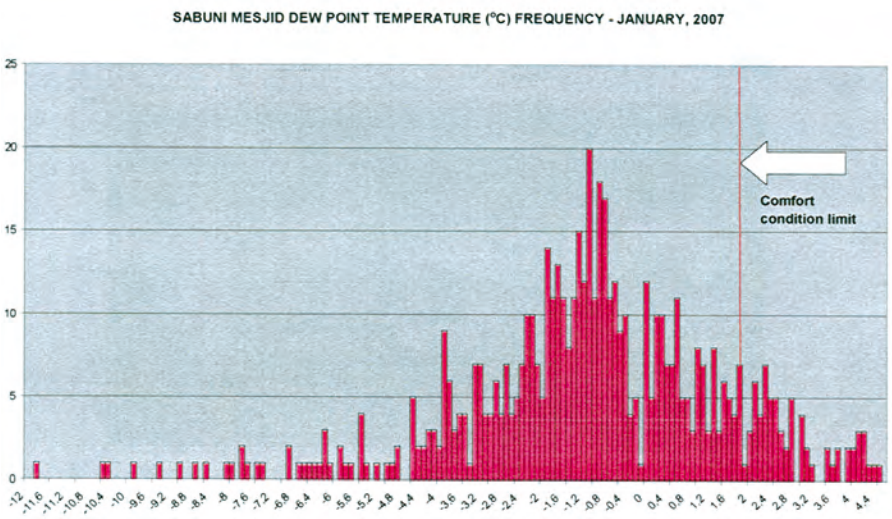


Figure 23. Dew point temperature frequency distribution at Sabunî Mesjidi in January, 2007 with respect to comfort condition limit.

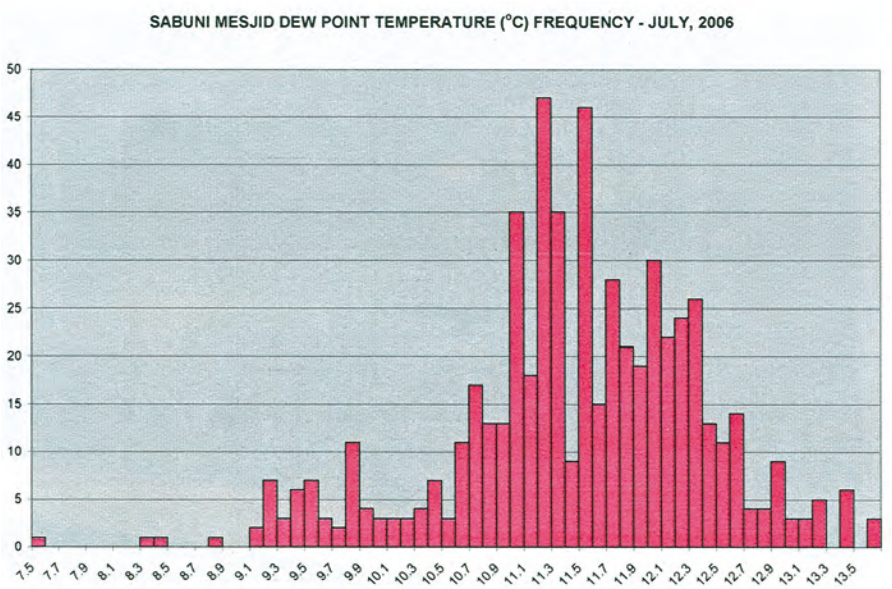


Figure 24. Dew point temperature frequency distribution at Sabunî Mesjidi in July, 2006.

barrier against exterior climatic conditions in comparison to the cement-based renders at the other two *mesjids*. Thus, exterior environmental conditions affected Ahi Elvan Camisi the least, having a 4.7°C higher mean dew point temperature inside the structure, followed by Sabunî Mesjidi, Örtmeli Mesjidi and Poyrajı Mesjidi, 2.6°C, 2.0°C and 1.0°C respectively. These results thus showed that in general, at Sabunî Mesjidi, the combination of the 'buffer effect' of its materials (i.e., timber ceiling and carpets) and physical characteristics of its bearing walls (i.e., mud brick and traditional *hımış* plasters) resulted in a greater difference between interior and exterior dew point temperatures as compared to the other two *mesjids*.

Differences between mean temperatures within and outside each structure, on the other hand, were the greatest at Poyrajı Mesjidi (5.1°C) due primarily to the operation of its heating system in the winter, followed by Ahi Elvan Camisi (3.8°C), Örtmeli Mesjidi (1.5°C) and Sabunî Mesjidi (0.8°C). In July, mean temperatures, slightly higher inside the structure at Ahi Elvan Camisi and Poyrajı Mesjidi (+2.2°C and +0.8°C respectively) and lower within as compared to without at Sabunî Mesjidi and Örtmeli Mesjidi

(-3.2°C and -1.0°C respectively) also confirmed that Sabunî Mesjidi was the 'coolest' during the summer.

The 'buffer effect' present within these structures may be summarized as follows: due to their porous, adsorptive properties, as the relative humidity increases inside, their timber ceilings and wool carpeting absorb and release moisture as relative humidity changes. The buffering capacity of the materials thus stabilizes humidity changes as water vapor is absorbed from and released into the surrounding environment. The resulting relative humidity is therefore a consequence of changes in indoor relative humidity and the behavior of these materials. As a result of this, each structure may experience differing degrees of buffering within based on their relative size, as well as the ratios of area covered by the materials contained therein. Although the "buffer effect" of the materials within the four structures were not measured, an estimate of their potential effect on interior microclimatic conditions were determined based on the area covered by each material in relation to the volume of air space.

Ahi Elvan Camisi, the largest of the four, had the lowest ratio of ceiling area (m^2) per volume of air space (m^3) (0.143), floor area with wool carpeting per volume (0.195) and wall area per volume (0.226). This suggests that the lowest buffer effect exists within this structure. The three *mesjids*, on the other hand, much smaller in size, had a greater ratio of ceiling area, wall area and carpeting (m^2) per volume (m^3) air space. In Örtmeli Mesjidi, the ceiling area per volume of air was considerably higher (0.189), as well as floor area with carpeting per volume of air (0.237) and wall area per volume of air (0.539). In Sabunî Mesjidi, the same values were quite similar, 0.185, 0.227 and 0.500 respectively. These values indicated that the buffer capacity of materials within the two *mesjids* may be significantly higher. At Poyrajı Mesjidi, these ratios were the highest, 0.194, 0.267 and 0.641 respectively, indicating this *mesjid* may have the highest buffer capacity.

Although temperature may be the most important factor for comfort, relative dew point temperatures also provide a means for determining comfort levels within modern and historic buildings. The comfort conditions within all four structures, when considered with respect to the recommended frequency range for dew point temperatures within modern buildings, between 1.7°C and 16.7°C (**32**), the dew point temperature fell below the required mean in the winter at Ahi Elvan Camisi, Sabunî Mesjidi and Poyrajı Mesjidi (not considered at Örtmeli Mesjidi due to on-going restoration work) and remained within the desired limits in the summer at all four structures. The difference between comfort conditions during the winter and summer was the most noticeable at Sabunî Mesjidi (**Figure 23, 24**). Nevertheless, if the conservation of original materials is considered of primary importance, the lack of ideal comfort conditions during the winter may not be an issue. Only at Poyrajı Mesjidi does the level of heating increase and relative humidity decrease to a point which could cause damage within its timber elements (**33**). Otherwise, aside from high humidity levels at Sabunî Mesjidi in the winter, environmental conditions, in general, appeared favorable for the conservation of their original materials, and especially their decorative timber elements. Changes in relative humidity per hour in each structure throughout the year, on the other hand, showed that such changes never exceeded +/- 25%. At Örtmeli Mesjidi, the greatest variation, observed in January during restoration work, did not exceed 25% (**34**).

32. Tenwolde and Rose (1994, 63).

33. According to May (2006), relative humidity levels below 40% can start to effect timber and other fabrics by reducing the equillibrium moisture content excessively causing cracking and introducing brittleness, (May, 2006, 30).

34. Bratasz, Jakeila and Kozlowski (2005) have compared the effects of diurnal or weekly micro-climatic fluctuations within a church with a hot-air heating system which operated sporadically and found that natural fluctuations produced much less stress in wooden objects. The authors also predicted that the lime wood of the altar within the church could endure significant fluctuations in relative humidity amplitute of up to 25% per hour which defined the 'stress region'. These results, reached through laser triangulation measurements on the altar, refer to a specific wood species and micro-environment. The data on changes in relative humidity per hour at the four structures per season therefore only provide a benchmark for comparison.

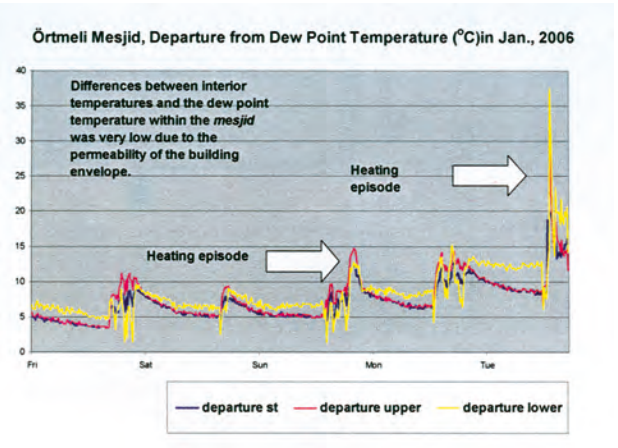


Figure 25. Örtmeli Mesjidi, difference between interior temperature and surface temperature at ceiling and dew point temperature in January, 2006.

Figure 26. Tiny tag® data loggers at ceiling of Örtmeli Mesjidi in January, 2006 during restoration work (Photo: E.Erder).

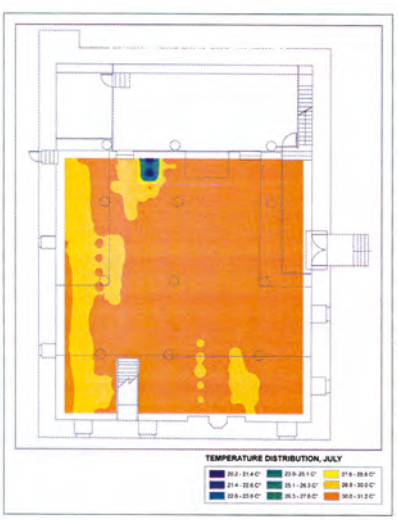
Micro-environmental data at Örtmeli Mesjidi in January, during its restoration work, confirmed that the restoration of this historic building in the winter became problematic. Data gathered by Tiny tag® data loggers placed adjacent to the timber ceiling and within the main prayer hall of Örtmeli Mesjidi revealed the risk of condensation along with temperature fluctuations due to the temporary heating system (**Figure 25, 26**). It was therefore likely that dust from the construction and re-plastering work adhered to the original *kalem işi* decorations, complicating their re-painting. These observations therefore clearly implied the necessity for greater care in the timing of conservation interventions and restoration work at these and other similar structures.

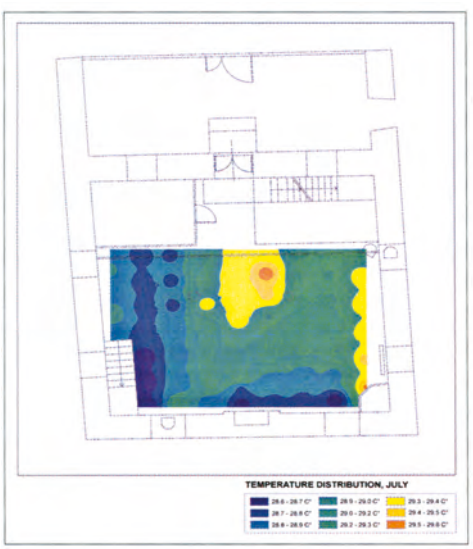
Mapping of the distribution of temperature and relative humidity at all four structuers showed that in general at Ahi Elvan Camisi and Örtmeli Mesjidi temperatures increased and relative humidity decreased at the east side of their main prayer halls, while at Sabunî Mesjidi and Poyrajı Mesjidi, temperatures increased and relative humidity decreased toward the west, indicating that in all four structures, exterior environmental conditions as well as their specific physical contexts and orientation, had an impact on their interior micro-climatic conditions. At the *kadınlar mahfeli* (women's section), the temperature generally increased and relative humidity

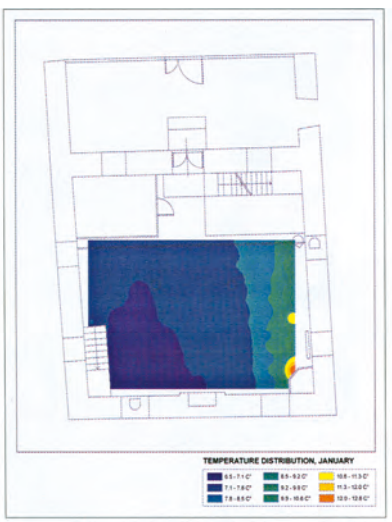
Figure 27. Temperature distribution at Ahi Elvan Camii in July, 2006.

Figure 28. Temperature distribution at Sabunî Mesjidi in July, 2006.

Figure 29. Temperature distribution at Sabunî Mesjidi in January, 2007.







decreased. The mapping also revealed thay in July, at Ahi Elvan Camisi, temperatures remained constant throughout the structure when its interior was most affected by exterior climatic conditions (**Figure 27**), and Sabunî Mesjidi was the least affected (**Figure 28**). Whereas in January, at Sabunî Mesjidi, constant low temperatures prevailed within when the structure was most affected by the cold winter climate (**Figure 29**).

CONCLUSIONS

Each of the four structures investigated during this study represents a unique example of a building tradition introduced to Anatolia during the Seljuq period and became common place in Ankara during the 14th and 15th centuries. This study thus re-evaluated their present physical condition, the effects of past restoration and repair work on the structures themselves and their users. In use for five centuries, such historic buildings require careful planning of appropriate conservation interventions and the determination of conditions necessary for their continued use and presentation. The combined use of non-destructive techniques and archival material thus provides a viable means for such an assessment and the determination of the most suitable and sustainable conservation and restoration methods.

Ahi Elvan Camisi, Örtmeli Mesjidi, Sabunî Mesjidi and Poyrajı Mesjidi, each restored at different periods since the 1920s after their registration as historic monuments, represent examples of differing approaches to the restoration and conservation of such structures based on available materials and trends which prevailed when restoration work took place. This study thus re-assessed the potentially detrimental effects of such interventions with the aim of suggesting possible sustainable measures for the conservation of these and other structures of similar value. The restoration work at Örtmeli Mesjidi is a case in point: restored during the time-frame established for this study, the work carried out at this *mesjid* reflects current approaches to the restoration and conservation of historic buildings in Turkey.

Due to current awareness of the benefits of natural and/or organic materials compatible with existing materials, in many cases, clay-based renders and *toprak boya* (natural pigments), may be preferred. These materials are not only physically and physico-mechanically compatible with the original building materials, but also sustainable. Another noticeable trend is a preferance for the creation of a sense of 'newness'. Rather than conserving the original materials and structures as they are, re-painting and renewal through the use of new cladding materials (e.g. clay-based renders and copper) and installation of new heating, electrical and water-drainage systems reflect current approaches toward restoration work.

The micro-climatic investigation has also confirmed the commonly held belief that mud brick structures tend to be "cooler" during the summer. Thus, as in the case of Sabunî Mesjidi, last restored in the 1920's, restoration work prior to the widespread use of cement-based materials may be more sustainable and user-friendly than those restored in the 1970s primarily with cement-based materials. The timber ceilings and wool carpeting within these structures, on the other hand, provide additional benefits in buffering changes in interior micro-climatic conditions and preventing the risk of condensation. Contrary to initial suppositions, the timber elements

Figure 30. İlyakut Camii re-painted cast stucco mihrab (Photo: E.Erder).

within these structures are in general well protected due to favorable micro-environmental conditions. In addition to this, the use of low levels of heating only during times of prayer is clearly more favorable for conservation of their timber elements.

This study also demonstrated that the combined use of archival documents, both visual and written, available literature and non-destructive diagnostic techniques presents a practical approach to shedding light not only on the history of an historic building and past restoration and maintenance activities, but also its cultural significance and values and current physical condition. Such an approach to the re-evaluation of the present physical condition of historic buildings of historic and cultural value may assist not only in understanding their history and the values they possess, but also determining suitable methods for their conservation in the long-term. Many non-destructive techniques exist for diagnosing the physical condition of historic structures. This study has therefore demostrated how a range of simple, inexpensive techniques may be applied to collect relevant micro-environmental data which may then be analyzed in conjuction with other available documents.

Aside from the studies carried out on site, research on the existing literature about these and other similar structures dating to the 14th and 15th centuries ascertained their intrinsic values. For example, the decorative motifs at the timber ceilings and *mihrabs* of such structures have been studied in varying levels of detail and historically significant features suggested such as the early appearance of the *çintemani* (three ringed motif at the ceilings) of both Örtmeli Mesjidi and İlyakut Camisi in the village of İlyakut near Sincan (**35**). Past and/or current restoration, conservation and maintenance activities, on the other hand, reflect associated cultural values. At the time of this study, the cast stucco *mihrab* at İlyakut Camisi had been repainted with oil-based paints in various colors (**Figure 30**). The application of such multi-colored oil-based paints thus also reflects traditional practices and values in the conservation and maintenance of such structures still present in Anatolia.

Restoration and conservation work at such structures requires critical decisions to be taken on the extent, nature and timing of such interventions. At Örtmeli Mesjidi, for example, the decision to re-paint its *kalem işi* decorative work in selected areas may not be condoned by certain art historians or individuals within the conservation community. Its timber ceiling and original pigmented motifs, if considered irreplaceable, may have been preserved as such out of respect for their authenticity. However, differing cultural values and traditions are also at play. Restoration projects may therefore favor 'newness' or 'renewal' as part on-going cultural processes. It is therefore hoped that this study will provide a basis for further discussions on notions of 'authenticity' versus 'newness' or 'renewal' and decisions taken in the conservation of historic structures in Turkey. Today, concepts such as 'cleanliness', 'renewal' and 'newness' tend to be highly valued. Therefore, the re-painting work at Örtmeli Mesjidi may reflect traditional as well as contemporary values and approaches to the conservation of historic buildings in Turkey.

Re-evaluation of the current condition of all four structures also suggests the need for improved, sustainable solutions for their restoration, conservation and maintenance. To begin, this study has demonstrated that the administration of conservation activities, such as the seasons during which restoration work is carried out, is important; restoration work in the

35. Acun (2001) has claimed that the çintemani, or three ringed motif, later seen in Ottoman art, made its first appearance at Örtmeli Mesjidi and İlyakut Camisi (2001, 4). Although unconfirmed, this view underlines the importance of careful documentation, analysis and conservation at such less well known historic buildings.

winter may cause damage due to condensation. Such potential problems must therefore be taken into consideration in the planning and execution of restoration or conservation work. In addition, rising damp problems at all four structures and the risk of interstitial condensation within their bearing walls, may be addressed through the installation of new water drainage systems, and if necessary, the careful removal of existing renders, replacement of decayed elements (e.g., mud bricks, timber tie-beams) and re-cladding with compatible materials.

As for their comfort conditions, the dew point temperature range within all four structures during the winter and summer indicated that in July, all four structures were 'comfortable' for their users, and that in January comfort conditions fell below the recommended range. However, these structures, in use primarily during times of prayer, do not require comfort conditions equal to those in modern houses. Portable gas and/or electrical heaters, the most commonly used heating method, may therefore still present the best and least costly heating method. Such heaters, used intermittently, prevent excessive heating and any potential damage to their original materials. However, safety concerns, especially in the use of electrical heaters and out-dated electrical systems must also be considered.

Sustainable approaches to the restoration and conservation of such structures must recognize the inevitability of change. These 14th and 15th century buildings, although mostly modest in scale, form an integral part of Ankara's cultural landscape and therefore must be conserved, through sustainable methods, for both their continued use and presentation to the public. Their physical form and fabric aside, efforts towards their sustainable conservation must respect their associated traditions and intangible values. This study therefore not only suggests the intrinsic value of archival research on such historic structures, but also the importance of visual analyses and micro-climatic investigations in re-evaluating their current conditions. Such research methods provide a vital means for thorough analysis of the history of such buildings, their physical characteristics and potentially damaging effects of their macro- and micro-environments. The determination of appropriate maintenance and/or conservation activities, on the other hand, must seek to strike a careful balance between respect for the physical integrity and authenticity of such structures and their continued use and display.

ACKNOWLEDGEMENTS

The author would like to express her gratitude to her advisor Assoc. Prof. Arda Düzgüneş for his scrupulous comments and criticisms and Prof. Dr. Ömür Bakırer for her continuous support and encouragement, and thanks Assoc. Prof. Dr. Kenan Bilici, Prof. Dr. Emine Caner-Saltık, Dr. Tim Padfield and Asst. Prof. Ayşe Tavukçuoğlu for their critical input and suggestions. The author is also indebted to Res. Asst. Pınar Aykaç, Kemal Gülcen, Gökçe Günel, Alp Güney, Serkan Kemeç, Ayşem Kılınç, Mustafa Önge, Kazım Sözak, Nermin Uz and Mahmut Meriç Yöndem for their technical assistance and input and all those who helped in gathering data. This work is dedicated to all my family and friends who stood by me patiently till the very end.

REFERENCES

ACUN, H. (2001) İlyakut (İlyağkut) Köyü Camii, *EJOS, IV*, *Proceedings of the 11th International Congress of Turkish Art, Utrecht - Netherlands, August 23-28, 1999*, eds.M. Kiel, L. Landman and H. Theunissen, Utrecht, Untrecht University, v: 2; 1-22.

AKÇURA, N. (n.d.) Map indicating the locations of all known historic buildings in Ulus, Unpublished document, Faculty of Architecture, METU, courtesy of Ö. Bakırer.

AKOK, M. (1946) Kastamonu'nun Kasabaköyü'nde Candaroğlu Mahmut Bey Camii, *Belleten*, n:x; 293-301.

AKTAN, K. K., AKTAN, M. F. (2004) *Örtmeli Mescidi / Hoca Hundi, 14. Yüzyıl*, unpublished report, Vakıflar Genel Müdürlüğü, Ankara.

AKTÜRE, S. (1987) 16. yüzyıl öncesi Ankara'sı üzerine bilinenler, *Tarih İçinde Ankara*, eds. A. Yavuz and İ. N. Uğurel, METU Faculty of Architecture, Ankara; 3-48.

ASLANAPA, O. (1993) *Türk Sanatı*, TC Kültür Bakanlığı, İstanbul.

ATSIZ (1992) *Aşıkpaşaoğlu Tarihi*, Milli Eğitim Bakanlığı**,** Ankara

BAKIRER, Ö. (1992) Ankara'da Cami ve Mescidler, *Ankara Konuşmaları*. ed. N. Şahin Güçhan, TMMOB Mimarlar Odası Ankara Şubesi, Ankara; 72-84.

BİLİCİ, Z. K. (1988) Kastamonu ve Kasaba Köy'deki İki Eseriyle Nakkaş Abdullah Bin Mahmut ve Sanat Tarihimizdeki Yeri, *Vakıflar Dergisi*, 20; 85-91.

BRATASZ, L. et al. (2005) Allowable thresholds in dynamic changes of micro-climate for wooden cultural objects: monitoring in situ and modelling, *Preprints of the ICOM Committee for Conservation 14th Triennial Meeting, the Hague, September 12-16, 2005*, v: 2 ed. I. Verger, James and James, London; 582-9.

DEMİRİZ, Y. (1979) *Osmanlı Mimarisinde Süsleme I; Erken Devir (1300-1453)*, TC Kültür Bakanlığı, İstanbul.

ERDER, E. (2008) Ahi Elvan Mosque, Örtmeli Mesjid, Sabunî Mesjid and Poyrajı Mesjid, Four 14th and 15th century Mosques in Ankara, A Re-evaluation for their Sustainable Conservation, unpublished Ph.D. Dissertation, Middle East Technical University, Ankara.

ESKİCİ, B. (2001) *Ankara Mihrabları*, TC Kültür Bakanlığı Yayınları, Ankara.

GÜNAY, B. (2008) Map of Ulus Indicating Locations of Historic Buildings, unpublished document, METU Faculty of Architecture, Ankara.

HANCIOĞLU, N. L. (1990) Bazı Ankara Camilerinde Bulunan Kalem İşi Süslemeli Ahşap Mimberler, unpublished Master's thesis, Gazi University, Ankara.

HAYES, K., Personal Communication, September 9, 2008.

KONYALI, I. H. (1943) *Ankara Camileri*, unpublished manuscript, Vakıflar Genel Müdürlüğü Archives, Ankara.

KONYALI, I. H., (1978) *Ankara Camileri*, Kültür Matbaacılık, Ankara.

MAY, N. (2006) Breathability: the key to building performance, reproduced in (http://www.natural insulation.co.uk/cms_items/20060607164406.pdf ; retrieved: March 2007).

M. F. MECKLENBURG, et al. (1994) Structural response of painted wood surfaces to changes in ambient relative humidity, *Painted Wood: History and Conservation*, Getty Conservation Institute, Los Angeles; 464-83.

NEŞRİ, M. (1995) *Kitab-ı Cühan-nüma, Neşri Tarihi* ed. F. R. Unat and M.A. Köymen, v: 1-2, Türk Tarih Kurumu, Ankara.

ÖNEY G. (1970) Anadolu'da Selçuklu ve Beylikler Devri Ahşap Teknikleri, *Sanat Tarihi Yıllığı, Istanbul Üniversitesi Edebiyat Fakültesi Sanat Tarihi Enstitüsü*, v: 3; 135-49.

ÖNEY, G. (1971) *Ankara'da Türk Devri Dini ve Sosyal Yapıları*, Ankara Üniversitesi Dil Tarih ve Coğrafya Fakültesi, Ankara.

ÖNEY, G. (1978) *Anadolu Selçuklu Mimarisinde Süsleme ve El Sanatları*, Ajans-Türk Matbaacılık Sanayii, Ankara.

ÖNEY, G. (1987) Ankara'nın İç ve Dış Kale İçinde Kalan Türk Devri Tarihi Yapıları, *Ankara Kalesi Koruma ve Geliştirme İmar Planı Projesi*, TC Kültür Bakanlığı ve Altındağ Belediye Başkanlığı, Ankara; 238-59.

ÖNEY, G. (1994) Ankara'da Selçuklu ve Beylikler Devri Ahşap Malzemeli Cami ve Mescitler, *Ankara Ankara*, Yapı Kredi Yayınları, İstanbul; 73-86.

ÖNGE, Y. (1972) Selçuklularda ve Beyliklerde ahşap tavanlar, *Atatürk Konferansları, V*, Türk Tarih Kurumu Yayınları, Ankara; 179-95.

ÖTÜKEN, Y., et al., eds. (1983) *Türkiye'de Vakıf Abideler ve Eski Eserler*, v: 4, Vakıflar Genel Müdürlüğü, Ankara.

PADFIELD, T. (1999a) Humidity buffering by absorbent materials in walls, reproduced in (http://www.natmus.dk/cons/tp/wallbuff/wallbuff.htm; retrieved January, 2006).

PADFIELD, T. (1999b) Humidity buffering of the indoor climate by absorbent walls, *Proceedings of the 5th Symposium on Building Physics in the Nordic Countries. Chalmes University of Technology, Gotteborg*. v: 2; 637-44. reproduced in (http://www.padfield. org.tim/ cfys/ appx/ pubs.php; retrieved April, 2006).

SÖNMEZ, Z. (1989) *Başlangıcından 16. yüzyıla kadar Anadolu Türk-İslam Mimarisinde Sanatçılar*, Türk Tarih Kurumu, Ankara.

SÖZAK, K. Personal communication, April, 2007.

TENWOLDE A., ROSE W. (1994) Criteria for humidity in the building and the building envelope, *Bugs, Mold, Rot, II: Proceedings of Workshop on Control of Humidity for Health, Artifacts and Buildings, November 16-17, 1993, Oak Ridge, TN*, W. B. Rose and A. TenWolde eds., National Institute of Building Sciences, Washington, DC; 63-5.

UYSAL, S. (1991) *Kastamonu Camilerindeki Bezemeli Ahşap Eserler*, upublished Master's thesis, Gazi University, Ankara.

YÜCEL, E. (1969) Selçuklu ve Osmanlı Ankarası, *Türkiye Turing Otomobil Kurumu Belleteni*, v: 34, n: 303; 9-14.

Alındı: 18.12.2008, **Son Metin:** 21.12.2009

Anahtar Sözcükler: tarihi yapı malzemeleri; arşiv araştırması; ahşap; kil-bazlı sıvalar; tampon etkisi; mikro-klimatik ölçümler; sürdürülebilir koruma.

ANKARA'DA 14. VE 15. YÜZYIL CAMİLERİNİN SÜRDÜRÜLEBİLİR KORUNMA SORUNLARI: AHİ ELVAN CAMİSİ, ÖRTMELİ, SABUNÎ VE POYRACI MESCİTLERİ

Bu çalışmada, Ankara'da bulunan Ahi Elvan Camisi, Örtmeli Mescidi, Sabunî Mescidi ve Poyracı Mescidi'lerinin bugünkü fiziksel durumları ile geçmişte ve günümüzde korunmaları için alınmış bulunan önlemler değerlendirilmiş, ve gelecekte yaşamlarının sürdürülebilir şekilde korunabilmesi için öneriler sunulumuştur. Ondördüncü ve onbeşinci yüzyıllarda inşa edilen bu dört tescilli yapı günümüze kadar özgün formları ile mimarî elemanlarını büyük ölçüde korumuşlardır. Bu ahşap direkli, ahşap tavanlı, taş temelli, ve kerpiç ile ahşap duvarlı yapılar, aynı zamanda inşa edildikleri dönemde Anadolu'ya gelen yeni bir yapı geleneğini temsil etmektedirler. 1920'lerden itibaren korunmaya başlanan bu tarihi yapılar farklı şekillerde müdaheleler geçirmiş ve geçmişte çeşitli malzemelerle sıvanmıştır (ör., çimento bazlı ya da toprak bazlı sıvalar). Geçmişte gerçekleştirilen bu koruma müdaheleleri ile varolan fiziksel sorunlar bazen gözle görülebilir olsa da, yapıların özgün malzemeleri üzerindeki pozitif ve/veya negatif etkilerini saptamak çok daha güçtür.

Bu çalışma sürecinde, bu amaca yönelik olarak, söz konusu yapılarda tahribatsız bir yöntem ile bir yıl boyunca mikro-klimatik ölçümler alınmış ve veri toplanmıştır. Ankara'nın uzun vadeli meteorolojik verilerine göre, Ocak, Nisan, Temmuz ve Ekim aylarında birer haftalık süreler boyunca Tiny tag® Plus *data logger*'leriyle, her yapıda iç ve dış sıcaklık ve bağıl nem oranları ile ahşap tavanlarının yüzey sıcaklıkları ölçülmüştür. Ayrıca, her mevsim, her yapıda, sıcaklık ve bağıl nem oranlarının dağılımları m^2 bazında ölçülmüş ve en kurak ay olan Temmuz ayı dışında, yapıların iç duvarları ve tavanlarının yüzey sıcaklıkları ölçülmüştür. Yapıların özgün malzemeleri ile geçmişte ya da günümüzde geçirdikleri koruma müdaheleri görsel olarak ya da var olan yazılı bilgiler ile Vakıflar Genel Müdürlüğü'nde bulunan arşiv belgelerinin incelenmesiyle saptanmıştır.

Çalışma sonucunda, bu dört yapının taşıyıcı duvarlarının fiziksel özellikleri ile iç mekanlarındaki malzemelerin tampon etkisi ve bu iki faktörün iç mekanlarındaki mikroklimatik koşullar üzerindeki etkileri incelenmiştir. Ayrıca, iç mekânlarda bulunan özgün ahşap elemanların ve/veya bezemelerin daha etkili bir şekilde korunabilmeleri için mikro-klimatik veriler çeşitli parametrelere göre incelenmiştir. Böylece, iç ortamlarında arzulanan gönencin özgün mimarî elemanlarına zarar vermeksizin sağlanması için gerekli koşullar ile yapıların sürdürülebilir biçimde korunabilmeleri (bakım, önleyici önlemler, restorasyon) için alınan önlemler değerlendirilmiştir. Sonuçta bu dört yapının fiziksel bütünlükleri ile özgünlük değerlerine zarar vermeden gelecekte yaşamlarının sürdürülebilir biçimde korunabilmeleri için alınabilecek önlemler geliştirilmiştir.

EVİN ERDER, B.A., M.Sc., Ph.D.
Received a BA in the History and Theory of Architecture from Princeton University, an M.Sc. in Historic Preservation from the University of Pennsylvania and a Ph.D. in Building Science from Middle East Technical University. She is currently a faculty member in the Department of Architecture at the METU.