2011

Documentation and Evaluation of the Conditions of the 9th Century B.C.E. Mosaic, from Gordion, Turkey and Recommendations for its Conservation and Treatment

Elizabeth T. Thompson
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Documentation and Evaluation of the Conditions of the 9th Century B.C.E. Mosaic, from Gordion, Turkey and Recommendations for its Conservation and Treatment

Abstract
The purpose of this report was to begin to consider options for how to improve the state of preservation and conservation of the Megaron 2 Mosaic. Archival documentation was gathered and a preliminary conditions assessment was performed. Research was conducted to find comparable projects that could establish a framework to help create a conservation plan for the mosaic. Finally, a phased program was created to guide the planning process. This information has been compiled in this thesis in order to establish a solid base on which future work can be built.

Disciplines
Historic Preservation and Conservation

Comments
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DOCUMENTATION AND EVALUATION OF THE CONDITIONS OF THE 9TH CENTURY B.C.E. MOSAIC, FROM GORDION, TURKEY AND RECOMMENDATIONS FOR ITS CONSERVATION AND TREATMENT

Elizabeth Tiffin Thompson

A THESIS

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Historic Preservation

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2011

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Professor of Architecture

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Dedication

To tacking and jibing and sailing upstream...
There are a number of people I would like to thank for their counsel and support:

Michael C. Henry
Frank Matero
Randy Mason
John Hinchman
Meredith Keller

I would also like to extend particular thanks to Gareth “Derbysmire” Darbyshire from the Gordion Archives. Your extensive knowledge of Gordion was invaluable to my research—both in Philadelphia and Turkey. Thank you for returning to the books and finding those images of the lifting process that I had overlooked in my initial efforts. Those images were incredibly important to this report. Your time, energy, and dedication is very much appreciated. Çok teşekkür ederim.

Next, to Roberto Nardi. Thank you for taking the time to talk to me about this project. I feel like I learned more from you in two hours than I did in the year I spent reading and taking notes. I particularly appreciate and respect your enthusiasm for educating and involving the public in the work that you have done. I will look to your work as examples of what to strive for in the projects I am involved with in the future.

To Bradley Schnell. Thanks for your help, but more for your patience, in teaching me all I know about all of the different computer programs and graphic design. Without you, this thesis would not be half of what it is. You are wonderful. I feel incredibly lucky to have you as a constant and supportive sounding board for all of my crazy, optimistic, and sometimes over-zealous ideas. I can’t wait for the next adventure.

Lastly, to my family. I love you. Thank you for always being there.
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(Gordion Archive, University of Pennsylvania Museum)
1.0 Introduction

Gordion’s Megaron 2 Mosaic is located in the town of Yasshöyük, in central Anatolia. It sits in an odd, subterranean display in the Gordion Museum complex just across the street from the monumental Midas Mound tumulus. On first glance, the mosaic is difficult to decipher: numerous panels are placed randomly around the display area. There is no explanation for their placement and some panels are badly fragmented and missing pebbles. A small, poorly placed sign provides the only information about the object on display.

The mosaic’s poor state of preservation has been the process of nearly 50 years of virtual neglect. The randomly patterned mosaic was found in 1956 in a large public building known as Megaron 2. Seven years later, a conservator came to the site and lifted what was referred to as a “sampling” of the mosaic—what appears to have been some of the most interesting and unique designs. While the intention was probably meant to save the unique mosaic, the result mixed, (had it been left in situ and not reburied it surely would have perished). After it was lifted, poor planning resulted in the panels of pebbles leaning against the walls surrounding the site’s dig house for several decades. The exact date of their move and installation into the museum is unknown. However, it is there that they currently reside, partially exposed to the elements.

The purpose of this report was to begin to consider options for how to improve the state of preservation and conservation of the Megaron 2 Mosaic. Archival documentation was gathered and a preliminary conditions assessment was performed. Research was con-
ducted to find comparable projects that could establish a framework to help create a conservation plan for the mosaic. Finally, a phased program was created to guide the planning process. This information has been compiled in this thesis in order to establish a solid base on which future work can be built.

1.1 Methodology

There are a number of different components that make up this research and each component has required its own strategy. First was the preliminary research into the history of the Megaron 2 Mosaic. Next came the documentation and survey of the conditions in the field, which was conducted during the summer of 2010. The information gathered in the summer months was digitized during the following fall semester. Technical research into the properties of the pebbles provided insight into conservation strategies for the mosaic, large portions of which are currently covered by a cementitious grout that obstructs the view of the designs. Finally, the summer research brought to light new questions about how best to display and interpret the mosaic.

Preliminary Research and Conditions Survey

The University of Pennsylvania's Museum of Archaeology and Anthropology has been in charge of the excavations at Gordion since the project began in 1950. The Gordion archives, which are located at the museum, provided a significant number of primary documents about the discovery of the mosaic. These include numerous slides and photographs, excavation notebooks, and excavation reports. Additionally, the archivist, Gareth Darbyshire,
Methodology

offered many hours of his time discussing and clarifying the history and chronology of Gord-
dion. All of the initial research formed the framework for the subsequent work.

Previous projects conducted by the University of Pennsylvania’s Architectural Con-
servation Laboratory (ACL) have created comprehensive methodologies for conditions sur-
veys. The conservation plan designed by the ACL for the New York State Pavilion’s Texaco
Road Map was used as a model for the Gordion mosaic project.1 Below is a brief overview
of the work, followed by a detailed description:

- Cleaning of the mosaic using bamboo sticks, small brushes, and a vacuum.
- Taking ortho-rectified images of the entire mosaic floor.
- Creating a photographic montage of the entire floor.
- Using the images from the montage to do a careful assessment of each of the
  33 panels to determine their conditions.
- Sampling for analysis during the winter at the University of Pennsylvania.
- Identifying the major problems regarding maintenance of the site during the
  rest of the year when the American team is not present.

Once the chronology had been established, work began on the mosaic itself. Within a very
short amount of time it was determined that the mosaic had not been properly cleaned in
the entire time it had been in the museum, (approximately 20 years). Subsequently, a thor-
ough cleaning was performed. This was done by manually picking dirt out from between
interstices of the pebbles with thin bamboo sticks, stirring up dirt with small brushes, and

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1 Thorkelson, Ann. 2007. An approach to conservation and presentation of the terrazzo map pavement of
the New York State Pavilion in Queens, New York. Thesis (M.S. in Historic Preservation) – University of
Methodology

using a vacuum cleaner to collect the dust. The cleaning took about two and a half weeks. All loose pebbles whose original locations were unknown were collected in bags according to panel location. Loose pebbles whose locations were known were temporarily adhered back into their original locations with putty, (these pebbles were all marked with small stickers).

Once cleaning was finished, photographs were taken that would be used to create the photographic montage. This was performed by affixing a digital SLR camera squarely to the top of a mobile frame, referred to as a ‘quadro-pod,’ that could be wheeled around the floor. The photography progressed by moving the quadro-pod, in a zigzag pattern, from one side of the basin to the other and then back until the entire floor had been documented. Two photographs were taken for every position: the first was of just the floor; the second included two target points that were placed on the ground and would be used later to rectify the photographs. Once the entire floor was photographed, all of the target points were surveyed and recorded to create a base map that would be used during the rectification process.

The surveyed points were imported into AutoCad and made into a 2-dimensional grid. This grid and the images were imported into the Adobe Photoshop for rectification. The photographs were rectified to the 2-D grid so that all of the target points in the images matched the corresponding survey points on the base map. Once rectified, these images were trimmed and color corrected to create a single seamless image. Over one hundred ortho-rectified images were stitched together in this way, (See Appendix A: Photographic Montage).

Using the montage, a copy of each panel was printed for use in the conditions survey. Using descriptions created by the Getty Conservation Institute (GCI) as guidelines, a
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list of conditions tailored to the Gordion mosaic were compiled. These included four major groups: structural deterioration, surface deterioration, biological problems, and interventions. Subgroups for structural deterioration include: dimensional loss, cavity, and cracks. Subgroups for surface deterioration include: lacunae, detached pebbles, and deteriorated pebbles. Subgroups for organic conditions include: micro-flora, moisture staining, and guano. Finally, subgroups for interventions include: exposed rebar, over-grout, and concrete fill. After the conditions had been established, a reference sheet was created that matched each condition to a specific color and hatch pattern. These were then used to indicate the condition in the survey. Examples of the different conditions were photographed for a visual conditions glossary, (See Appendix B: Conditions Glossary & Survey).

The actual survey, which recorded all of the panels, took two and one half weeks to perform. The printouts of each panel were inserted into acetate sleeves, and the conditions were drawn directly on these sleeves with colored permanent markers. Upon completion, each was scanned into the computer to create a digital record. Upon returning to Philadelphia, these were used to complete the digitized survey.

A number of samples were collected throughout the summer. All of these were brought back to Philadelphia for analysis during the 2010-2011 academic year. The samples included the following: loose pebbles that were no longer in situ within the panel, (pebbles existed for nearly every panel); a fragment of bedding mortar, (from Panel 9); and a soil sample from Megaron 2

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Methodology

that includes a pebble, (thought to be in situ). A small number of the loose pebbles, collected during the cleaning process, was selected and brought back to Philadelphia for research purposes. The fragment of concrete did not contain any pebbles and was loose from spalling rebar. It was lifted out of its original location and nothing around it was disturbed.

A soil sample was taken on the site, from a location within Megaron 2. A workman was tasked to carefully excavate a small area on the north wall of the megaron, approximately halfway down the wall. Because the first location yielded nothing, the workman moved south a few feet and some pebbles were found in the second attempt. The area that was uncovered appeared to be very poorly preserved and the pebbles were slumped towards the center of the megaron. A small location with few pebbles was selected for sampling. The sample was removed by hammering a small plastic container into the ground and then cutting and lifting it out with a trowel.

The final step of the summer research was a discussion of the maintenance of the mosaic during the fall, winter, and spring. The summer months have the mildest weather and are the months during which the mosaic requires the least amount of cleaning. During the rest of the year weather systems are stronger and the open nature of the shelter allows the mosaic display to collect dirt, dust, leaves, and other wind-borne debris, which necessitates cleaning it on a daily basis. The previous maintenance plan—set in place by the Anatolian Civilization Museum, in Ankara—requires that the subterranean display be swept out on a daily basis.

Before leaving for the year, a very soft brush was purchased for cleaning the mosaic. Because he understood the delicate condition of the mosaic, the director agreed to perform
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the cleaning himself. The decision to continue sweeping, as opposed to covering the mosaic, was made so as to prevent people from walking across the surface of the pebbles.

Digitization

The digitization of the conditions survey took the majority of the fall semester to complete. First, the manual surveys—done over the summer—were scanned to create digital copies. Those files were then individually imported into AutoCAD and traced. Once this was finished, the new .DWG files were imported, placed, and scaled to the correct size using the same geo-located base map that guided the creation of the photographic montage. Lastly, each separate condition was hatched to show overlapping conditions across the entire display area.

The full survey is depicted in two ways. First, it is visible in its entirety: the full montage was placed behind the survey and all of the conditions are visible on top. This was scaled up to fit a board with dimensions of 24x32 inches. Second, each individual panel, with all of its conditions, was isolated and placed on an 8½x11 size sheet. Each sheet has a locator map for the panels and a key for the hatches used to delineate each of the conditions.

Interpretation and Display

Research was conducted during the course of the academic year. However, analysis of the conditions survey helped direct the focus since it revealed that the mosaic should be re-housed under an enclosed shelter. This included attempting to find comparable projects that could provide insight into how to approach the challenges that are being faced with
Methodology

the Megaron 2 Mosaic. Information was gathered through reading the literature, visiting some of the comparable sites, and talking with experts in the field of mosaic conservation. In the end, the Zeugma Mosaics Conservation Project and the Conservation of the Great Place Mosaics provided the most useful studies for how to proceed with the conservation of the Megaron 2 Mosaic from Gordion. In both instances, the mosaics described had been previously lifted and backed. Conservation focused on re-backing the mosaics, cleaning the surfaces, and re-housing them with adequate information.

Scientific Research

Three pebbles, one of each color, were sent to a geologist to be thin sectioned in order to determine the morphology. The results indicated that the red are chert, the white are quartzite, and the blue are of volcanic origin. At the same time, it was also learned that the chert and quartzite are particularly susceptible to Alkali-Silica Reaction (ASR), which is a deleterious chemical reaction.

Conclusion

Based on the research conducted, a phased schedule for the conservation of the mosaic for the next few years has been proposed at the end of this thesis. The ultimate goal is to conserve the Megaron 2 Mosaic and re-house and interpret it under a permanent, enclosed shelter.
2.0 History and Context

Well-known mythology has made the name *Gordion* familiar to many, but outside of those references little is known about the actual place and its inhabitants. The site of Gordion is considered to be one of the most important archaeological sites in Turkey and the Near East. Its history stretches almost seamlessly from the Early Bronze Age (2500 B.C.E.) until today.\(^1\) Over that time it has seen periods of tremendous prosperity—as evidenced by the numerous tumuli that dot the modern landscape, most notably the large Midas Mound. But its good fortune was always countered by periods of ruin and defeat, which have been documented by archaeologists in the destruction layers found in the stratigraphy of the settlement mound.

Despite its extensive history, Gordion is primarily associated with the Phrygians who established their capital there. Their occupation spans three distinct periods. The Early Phrygian period (900-800 B.C.E.) was marked by a growth in the settlement size and the addition of a substantial fortification wall around the perimeter of the site.\(^2\) Such construction hints of major political and organizational changes. Numerous megarons were also constructed during this time.

Around 800 B.C.E, a massive fire destroyed much of the citadel mound. Its cause remains unknown but the Phrygians showed much resilience and rebuilt quickly following

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\(^2\) Ibid.
the devastation. This ushered in the second Phrygian period or the Middle Phrygian (800-550 B.C.E.). By the end of the 8th century, Gordion and Phrygia reached the height of their power—both politically and militarily—under the aegis of King Midas. However, the new prosperity only lasted until the first half of the 6th century, when the Lydians from Sardis began moving eastward and eventually engulfed Phrygia into their territory.

A defeat by the Persian Army under Cyrus II, or Cyrus the Great, marked the beginning of the Late Phrygian or Achaemenid Gordion, (540-330 B.C.E.). By this time, the city was ruled under Lydian control, but with the fall of Lydia to the Persians went Gordion. Despite an extant siege ramp on an adjacent höyük and significant evidence of conquest, Gordion seemed largely to have been left alone during Persian rule, and maintained its status as an economic center. As well, imported objects discovered during excavations, indicate that trade with neighboring regions remained strong. Particularly noteworthy architectural detailing was produced during this time, including: the Mosaic Building, which boasts a beautiful black-and-white pebble mosaic with a Greek-key pattern, and a house designated “the painted house,” because of fragments of figural wall paintings.

2.1 Site and Location

During the summer of 1956 a team of workmen were excavating on the citadel mound in a structure referred to today as Megaron 2. This building is centrally located in the area of the mound that has been excavated: to the southwest side of the Palace complex, but northeast of the main road along which most of the other megarons are located, (Figure 2.1). Megarons were a common form of Phrygian architecture and there are over a dozen
represented at Gordion. However, Megaron 2 had several distinguishing features that made it stand out from the others and these piqued the interest of Director Rodney Young. Young described the building in the Preliminary Report from 1956.

The somewhat larger and more elaborate building at the west was built of stone instead of crude [mud] brick, but employed the same system of timber framing to strengthen its walls… It consists of a deep porch or vestibule at the north, fronting on the open paved area, and a large inner room with central hearth, measuring 10.85 by 9.74 m.4

The overall configuration was much like a typical megaron, but the walls were covered with a durable lime plaster, and the nearly 2 m wide hearth was positioned slightly off center, small closets or niches were located next to the doorway, and graffiti doodled on the exterior stones suggested the roof was pitched—unusual for the time. But the most interesting aspect of the building was that all of the rooms were paved with pebble mosaics, however, none quite compared to the large size and geometric patterns of the mosaic in the main room.

The floor itself was of pebble mosaic in three colors, white, dark red, and dark blue. There was no over-all design fitted to the room or the hearth, rather the decoration was a sort of scatter-pattern of various geometric motives put down at random to fill the whole space. These include lozenges, meanders, swastikas, interlocking triangles, and large rosettes.5

The term megaron has been used for nearly as long as the field of archaeology has existed. As Kjell Werner wrote in his dissertation on Bronze Age megarons, “We have seen that the term

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“megaron” very early and almost by itself emerged to cover a need, a need to define or at least to describe a certain type of building. Indeed, the Great Poet Homer, Heinrich Schliemann—who claimed to have looked upon the face of Agamemnon at Troy, and the archaeologist Arthur Evans who excavated at the palace of Knossos, all had slightly different interpretations of what a megaron entailed. While this paper will not attempt to contribute to that discussion, it is important to consider the building’s use to try and best understand the mosaic.

In initial reports, Megaron 2 was actually referred to as the West Phrygian House. However, it seems that Rodney Young convinced himself that such an elaborate building could not possibly be an residence while writing the 1956 report.

Our house, then, clearly of Megaron type, of generous dimensions, richly paved throughout with pebble mosaic, and decorated outside with sculpted lion head of poros, must have been more than a common dwelling. The bench around the outside suggests a waiting place for clients. It must then have been a public building—perhaps the audience-chamber of a palace complex.

Megaron 1, which is directly adjacent to Megaron 2, has similar characteristics, including a mosaicked entrance hall that was very poorly preserved. Both of these buildings appear to have more complex treatments than any other megaron on site. Interestingly, there is a crude brick wall that runs between these two buildings—blocking Megaron 1 out of the palace complex. Built on top of stone slabs, the wall appears to have been an afterthought. Young suggested that it may have been erected to add privacy to the palace complex, which

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7 It is unclear when exactly it switched to being called Megaron 2.

is quite close to the city’s gate, but also possibly indicating the superior status of Megaron 2.9

In examining the mosaic floor more closely, Young postulated that some areas that had slightly darker pebbles might have actually been patched during antiquity, “In some places designs of slightly different color or with interrupted edges suggest that the floor had at some time been repaired by patching.”10 The possibility of patching could imply several things. First, the room was of enough importance that repairs would have been undertaken to fix damaged areas. The second point depends largely on the strength of the original bedding mortar, which Young and others have referred to simply as clay, and which today appears to lack any binding strength. Considering the excellent condition in which the mosaic was found, if the mosaic had been laid using clay that had low bond strength, it would suggest very few people were allowed to walk on it. On the other hand, it might be possible that the original matrix had deteriorated over the years during which it was buried but before it was found, leaving the mortar substantially weaker than it had previously been. If this was the case, fear of harm to the mosaic would not have been a factor in letting people enter the space.11

A last point arguing for the importance of Megaron 2, relates to the history of mosaic making. The principles of which were understood as early as 2500 B.C.E. by the Sumerians, in Ur, (modern day Iraq).12 There they manufactured colorful clay cones and inserted them into clay on walls and columns to add decoration. It has also been argued that the Su-

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9 Ibid.
10 Ibid.
11 Investigation into the original bedding mortar might help to shed light on this topic, but will not be addressed in this paper.
merians were the first to employ a technique similar to the Roman *opus sectile*, where pieces of stone were shaped into features and fit together to create a scene; the most well-known example is the “Standards of Ur,” which depicts Sumerians during both war and peace.

The Gordion mosaic from Megaron 2 is the earliest known pavement in the world—dating to the 9th century B.C.E.—and several centuries would pass before mosaics appeared in Greece or other Mediterranean locales. It is safe to say that very few visitors to Gordion would have been accustomed to such ornamentation, and we—who are very familiar with decorative floors—may not be able to appreciate the effect it might have had. For ancient Phrygians it would surely have been a sight to behold, thus strengthening the argument that Megaron 2 was of particular importance to Gordion.

### 2.2 Past Documentation

There is not a lot of information available about the Megaron 2 Mosaic. Even immediately following its discovery, very little was ever written about it. Both a summary report and final report were published at the end of the 1956 season, but in both reports only about a paragraph is given to the mosaic. Rod Young’s excavation notebooks are equally sparse in description. He did include a small drawing and some comments on the mosaic, but mostly his attention was focused on the structure, which he described in much more detail.

Fortunately, there is a large stock of photographs that were taken of the mosaic by

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Young’s team available in the Gordion archive at the University of Pennsylvania Museum. These photographs provide a substantial amount of information since they were taken from various angles and times during and after the excavation process: close-up photographs show finer details, while photographs framed from farther away capture the entire floor. These photographs reiterate what excellent condition the mosaic was in when it was discovered. Additional photographs provided by Crawford Greenwalt, a former student of Young’s, documented the lifting process.

Shortly after the mosaic was completely cleaned, the site’s field artist, Jonathan Last, painted a large watercolor picture of the entire mosaic. Images from the archive document Last painstakingly bent over the pavement with a tape measure and his drawing board in his lap, (Figure 2.1). The final painting is around nine square feet and the detail is incredible. A comparison of the photographs and the illustration indicate that it is not entirely accurate. Nevertheless, it is an incredible documentation effort.

In the years following its discovery, several additional publications mention the Gordion Mosaic in more depth. The first is by Rodney Young and was a nine-page report on the mosaics from Gordion, entitled Early Mosaics at Gordion. The report is the most thorough review of the all of the mosaics from the site. Interestingly enough, Young classifies the Megaron 2 Mosaic as being from the 8th century B.C.E., and discusses the possible course mosaic technology could have taken to reach Gordion, assuming that it traveled east from Greece as was the belief at that time.

History & Context

The second publication that mentions the Gordion Mosaic is a comprehensive study of the pebble mosaics from the Mediterranean Region, written by Dieter Salzmann: *Untersuchungen zu den antiken Kieselmosaiken*, (Studies of the Ancient Pebble Mosaics).\(^{16}\) Many different pebble mosaics are mentioned in this inventory, but he lists Gordion’s mosaic as being incredibly noteworthy for its age. He also suggests that the mosaic is evidence that previous assumptions about technology moving east from Greece are wrong and that it spread west from Mesopotamia instead.

A number of general interest books written on the history of mosaics briefly discuss the Megaron 2 Mosaic. These references seem to repeat each other and none consider it any further than mentioning that it is the oldest known mosaic. Occasionally it is referred to as a patterned pavement done in the, “mosaic technique,” and is not actually called a true mosaic.\(^{17}\)

Unfortunately, no new consideration of the Megaron 2 Mosaic has taken place since Salzmann’s book on pebble mosaics. This seems to be because mosaic specialists concentrate on mosaics from the Greek and Roman period since they are plentiful and well documented. However, with the general consensus now being that mosaic technology emerged first in the east and traveled west, it would be prudent for mosaic scholars to return to the Gordion Mosaic.\(^{18}\)


History & Context

2.3 Chronology

Based on the research that has been done a chronology for the mosaic has been established.

- **9th century B.C.E.** – The mosaic was created, burned, and buried.

- **1956** – The entire mosaic floor and central hearth were exposed and drawn. (The drawing still exists and is in the Gordion Archive at the Penn Archaeology Museum.)


- **1963** – Muzaffer Ertoren, from the Turkish Department of Antiquities, lifted selected parts of the mosaic and backed them with concrete.

- **1965** – The mosaic panels were taken outside so they could be transported by the Turkish authorities and moved to a new location. However, they were not and they remained outside for an unknown period of time.

- **1967** – Rodney Young wrote a letter to the Director General of the Museum in Ankara saying that some of the lifted panels had already weathered two winters outside.

- **1968** – Metadata from images, from the Mellink Archive, taken in this year showed some of the panels leaning against exterior walls inside and outside of the compound.

- **1983** – The Gordion Museum was built. The mosaic was installed sometime after this date.

- **2010** – Restoration and Conservation of the mosaic began. E. Tiffin Thompson, graduate student in the University of Pennsylvania's Historic Preservation Department, performed the work, which included thoroughly cleaning and performing a detailed conditions survey.
3.0 Lifting Process

The Turkish conservator, Muzaffer Ertoren, lifted the 9th century B.C.E. mosaic in 1963. No written documentation has been found to clarify how this process was approached and undertaken; however recently discovered photographs as well as in situ evidence visible on the panels themselves provide sufficient information to describe the process.¹

The first step for lifting the mosaic was to decide what parts to lift. There is no information available about how this was devised and, upon first glance, there does not appear to be a clear rationale for selection. However, it was helpful to examine the mosaic panels next to in situ photographs and drawings of the entire floor. This suggests that the archaeologists/conservators chose the most interesting and isolated geometric shapes and patterns for their “sampling.” The northwest corner of the mosaic was not lifted, but photographs reveal that area to be damaged and without distinguishable patterns.

Numerous sources have attested to the general weakness of the mortar used to hold the pebbles in place. Once the surfaces had been cleared of the over-dirt covering it, the actual removal of the pebbles must not have been difficult. Several photographs show workmen with shovels, trowels, and brushes removing the soil, (Figures 3.1 & 3.2). Once this was complete, it appears that sponges were used to clean the surface of the pebbles. An adhesive, probably an animal glue, was brushed onto the surface of the pebbles and a thin sheet of muslin fabric

¹ The photographs have kindly been provided by the Gordion Archive at the Penn Museum and by Crawford Greenwalt, who was a student of Rodney Young’s and was present at the site while the mosaic was being lifted.
Lifting Process

was pressed on top, (Figure 3.3). According to Charles Williams, another student of Rodney Young's who was present during this process, the workmen used squeeze brushes to beat the surface of the pebbles to get them to adhere to the muslin. It looks as if the conservators then covered the muslin with a thin layer of soil; this was probably done during the period when the glue was drying. An image shows the initial process of the lifting: a long piece of wood, (like a ‘2x4’), was nailed to the edge of the muslin, there was a man on each end, and two men kneeling next to the edge where they were working. The two kneeling men each have long thin pieces of metal that Charles Williams said resembled crowbars. As the two men holding the wood pulled up to peel the pebbles off the ground, the men with the crowbars loosened any pebbles that remained behind, (Figures 3.4 & 3.5).

The long crowbars do not look like they are terribly precise instruments. In some of the action photographs, small gaps in between the pebbles reveal the white muslin—indicating places that may have once had pebbles. Further proof can be found by looking at the ground directly below; it is possible to see loose pebbles in the stirred-up soil, (Figure 3.6).

Once the mosaic had been lifted, the next step would have been to back them. In several photographs, large wooden pallets are visible in the background. While, it is not certain if these were used during the backing process, it seems likely for two reasons. First, the general size of the pallets is similar to those of the mosaic panels. Second, the imprint of horizontally placed wooden boards is visible in the patches of cementitious mortar on some of the panels, (Figure 3.7).

\[2\text{It is unclear what kind of glue they used, but it was probably animal glue, or something similar, that was soluble in water.}\]
Lifting Process

A few additional steps would have been required before backing mortar or cement could be added. The muslin would have been laid on the boards with the pebbles face down, (since the tops of the pebbles were attached to the muslin, the bottoms would be facing up). Next, a small lip was probably tacked around the edges of the pallets to keep the mortar in place once it was added. Lastly, it is possible the muslin was fixed or nailed to the boards in some way to prevent it from shifting once the work began.

Large areas of ancient damage and loss, seen in the in situ photographs, would have been addressed first. These areas appear to have been filled with a coarse cement mortar to create a level surface with the pebbles, (Figure 3.8). Almost immediately following the filling of the lacunae, a thin layer of concrete was spread across the entire area. Once an even surface had been achieved, small diameter iron rebar was installed. Several panels in the museum have spalled enough to indicate that the rebar was laid in a grid and the perpendicular lengths were tied together with smaller pieces of wire, (Figure 3.9). Once the rebar was in place, the final layer of concrete was added.

The conservators would have waited until the concrete had set before turning the panels over and removing the muslin. There is no evidence in the documentation to indicate what steps were taken at this stage. Impressions of the muslin, (both its texture and apparent folds), are visible in the cavity in fills on numerous panels. Additionally, there are small fragments of cloth that remained embedded to the concrete that remain from after the removal of the muslin. Archival images dating to 1963 show the panels in the dig house courtyard with clean surfaces.
Lifting Process

Lifting was commonly employed during this period. The current state of the mosaic is the result of two additional events. First, the mosaic panels remained outside in the courtyard of the dig house for a long period of time before they were installed in the current subterranean display at the museum. During this time, the panels deteriorated and cracked. As a result, the installation of the panels into their new display was imprecise and complicated. The second event was the application of a thin, cementitious grout to affix the panels into their new locations. It was poorly applied, leaving the surfaces of many of the panels covered and designs illegible. An image of Panel 29 post-lifting/pre-installation reveals the mosaic’s beautiful designs, while an image taken in 2010 for the conditions survey shows the surface covered with over-grout, (Figures 3.10 & 3.11).
4.0 Explanation of the Conditions of the Megaron 2 Mosaic

Twelve different conditions have been identified and recorded in the condition survey performed for the Megaron 2 Mosaic, (See Appendix B: Conditions Glossary & Survey). To best analyze these conditions and to determine what further damage may be occurring, these conditions have been subdivided into three categories according to the time frame during which each formed or appeared. These categories correspond to the three major events in the history of the mosaic and include: ancient, recent, and present. Ancient encompasses all of the conditions that existed at the time of the mosaic's discovery. Recent conditions include those whose onset occurred after the mosaic was lifted from the site, but before its installation in the museum. Lastly, the present conditions are those that emerged after the panels were installed in the museum. There is also the possibility of unknown conditions that will be discussed at the end of this chapter.

4.1 Ancient Conditions

- Concrete Fill
- Cavity
- Deteriorated Pebbles

Because the mosaic was found in an excellent state of preservation, there are very few conditions that fall under the ‘ancient’ category. Three exist and include: ancient loss, (represented by concrete fill), cavity, and deteriorated pebbles. Several factors lend credence to the ancient loss of pavement pebbles at time of the fire and reburial. Primary is the pres-
enence of a mortar infill of existing voids done at the time of the lifting process. The fill is flush with the tops of the pebbles and is distinguishable by its coarse aggregate. Images of the mosaic taken immediately following its discovery indicate both large and small areas of missing pebbles. The artist Jonathan Last also documented these cavities in his drawing, which was done at approximately the same time as the photographs were taken. It seems probable that concrete fill was added to the voids during the lifting process in order to help stabilize the pebbles that bordered these areas, (See Lifting Process). Therefore, it is assumed that large areas of concrete fill indicate areas of ancient loss, which may have been the result of the fire that destroyed Megaron 2.

The second condition is cavity, which can be defined by areas below the current surface that appears never to have had pebbles in it. Like the concrete fill, cavity may also indicate areas of ancient loss and may simply have been a different way to treat areas of a lesser depth that did not have pebbles present. However, it is also possible that cavity can fall under the ‘present’ category as patches that were made after the backing of the mosaic had taken place.

The last condition is deteriorated pebbles. There appear to be two distinct types of deterioration occurring with the pebbles. The first is the most common and is characterized by general cracking of the pebbles. Following the ICOMOS-ISCS: Illustrated Glossary on

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1 The discussion in this section surrounding concrete fill pertains only to the instances when it appears as a unique condition and not when it appears in conjunction with other conditions.
2 This seems more plausible since the mosaic would have been facedown during the backing process and any additional infill added would have been at the same level as the pebbles.
3 It is impossible to tell when exactly the pebbles were damaged and so this condition is included in two categories: ancient and recent.
Explanation of the Conditions of the Megaron 2 Mosaic

Stone Deterioration Patterns, the deterioration can be classified as craquele, which is defined as: A network of minor cracks.\(^4\) This pattern seems to be most prevalent on the blue pebbles and has not been noted on pebbles of other colors. An example of this kind of deterioration can be seen clearly in Panel 1. Some pebbles that exhibit this deterioration pattern have reached a point where the exposed surfaces of the pebbles are simply disintegrating. The portion of the pebbles that is attached to the concrete remains in place and appears relatively stable. One idea is that this type of deterioration may have been initiated by the fire and collapse of the roof. However, because the craquele pattern seems to occur only on the blue pebbles it is also possible that this condition could actually have occurred after it was lifted from the site. A second thought is that the craquele may be due to thermal expansion in the dark pebbles that were exposed to sunlight while the panels were in the courtyard. The hard concrete would not have allowed the pebbles to expand as they heated up, and so they would have developed stress cracks. The necessary factors responsible for the onset of the craquele do not appear to still be active. However, secondary factors—such as freeze-thaw cycling or micro-flora—could be contributing to the continued deterioration of those pebbles that already exhibit these micro-cracking patterns.

The second type of pebble deterioration can be classified as fracture, which is defined by ICCOMOS as: A crack that completely crosses the pebble.\(^5\) An example of a panel that exhibits this is Panel 29. This type of deterioration is not limited to the blue pebbles, but is

\(^4\) Anson Cartwright, Tamara, and Véronique Vergès-Belmin. 2008. Illustrated glossary on stone deterioration patterns = Glossaire illustré sur les formes d’altération de la pierre. [Paris]: ICOMOS.

\(^5\) Ibid.
visible across the range of colors. The fractures often occur at or just above the level of the bedding mortar. It also occurs in conjunction with lacunae, which would indicate that the damage happened after they were lifted from the site and backed.\(^6\) Such clean breaks, and relatively sharp edges, indicate a swift, singular event—such as being struck by a hard object that knocked pebbles that were not securely bedded out of the bedding mortar and broken those pebbles that were securely bedded due to the high bond strength of the cement backing.

### 4.2 Recent Conditions

- Over-grout
- Lacunae
- Dimensional Loss
- Exposed Rebar
- Deteriorated Pebbles
- Detached Pebbles
- Cracks

The majority of the conditions occurred in the time between when the mosaic was lifted and its installation in the museum—the time the panels were in the courtyard of the dig house. Over-grout is the most obvious and prevalent condition recorded for the Megaron 2 Mosaic. It is characterized by a very thin slurry of cementitious material, covering large areas of pebbles. This condition is the result of poor workmanship during the installation of the mosaic into its display at the museum. Because it took place during a single event, it is no longer active. It greatly

\(^6\) This condition has also been listed in ‘recent’ as well.
Explanation of the Conditions of the Megaron 2 Mosaic

impairs the visibility and legibility of the pebbles and the geometric patterns.  

Lacunae is another condition that is very prevalent. It can be described as areas of concrete bedding that have indentations of pebbles that are no longer there. This condition could only have occurred after the mosaic was backed since the pebbles must have been present in order to have left their impression. This condition probably had its onset as soon as the mosaic was backed, and it is clear that this condition is still active. Conversations with the museum staff confirmed that they continue to find pebbles that have been dislocated when they clean the mosaic. Explanations for why they become dislocated are varied, but include: poor bonds with the bedding mortar, deterioration of the surrounding bedding mortar caused by corroding rebar or micro-flora, and daily mechanical cleaning of the mosaic display.

Dimensional loss is defined as areas of total loss of pebbles and bedding mortar. Examples of this condition are best seen in Panel 10. Images of the panels in the years immediately following their backing, from both the Gordion Archive and the Machteld J. Mellink Collection of Archaeological Site Photography, show their condition. While each panel is a different size, they are all rectangular in shape and none have large areas of loss or voids. A comparison of Panel 12 from shortly after it was lifted and backed to its appearance

7 Probing with a scalpel revealed that the over-grout is often easy to remove mechanically, without disturbing the pebbles below, by simply putting the blade under the affected area and flicking it off. The pebbles beneath are in stable condition. This does not work all the time, however, because in some areas the over-grout adhered more thoroughly to the concrete below.
8 The staff at the museum has been asked to pay particular attention to the loose pebbles when they clean the mosaic to try and prevent further loss of pebbles.
Explanation of the Conditions of the Megaron 2 Mosaic

today clearly demonstrates the level of deterioration that took place in the time before it was installed in the museum, (Figure 4.1 & 4.2). This sort of loss appears to be the result of the corrosion of the rebar used as supports for concrete. The indicator that this condition is no longer active is that the panels are all now encased in the concrete used to secure the panels in the current display.

There are several panels that have exposed rebar. This condition's onset occurred before the panels were installed in the museum and is the result of the corrosion of the rebar and subsequent loss of concrete due to spalling. Because the current shelter keeps most of the precipitation off of the mosaic, this condition does not appear to be active.

Detached pebbles is an active condition and there are many factors that contribute to pebbles loosening from the bedding mortar. The fact that the museum is required to clean the mosaic on a daily basis seems to be the most likely cause of this condition.10 The constant contact loosens pebbles that are not well adhered to the bedding mortar. Once one pebble is knocked free, others in the immediate vicinity have a greater risk of becoming loose because of the loss of cohesion of the bedding mortar and the lateral support the lost pebble provided. Eliminating the need to clean the mosaic on a daily basis will help to reduce the number of pebbles that become loose or detached.

Cracks appear in only a few panels and can be defined as: Linear breaks visible at the surface of the mosaic.11 Panel 10 exhibits considerable cracking. All cracks appear to be

10 Since the conditions survey was performed, the staff of the Gordion Museum has promised to try and be more conscious of loose pebbles as they clean the mosaic's display.
11 Cracks appear in Panels: 6, 8, 10, 17, 26, and 27.
the result of the deterioration of the panels from when they were located in the dig house courtyard. As the panels weathered, cracks formed; further deterioration in the same area probably lead to dimensional loss. Since the panels are mostly protected under a shelter, this condition does not appear to be active.

**4.3 Present Conditions**

- Micro-flora
- Moisture Staining
- Guano

Micro-flora, moisture staining, and guano are all conditions that began with the mosaic’s installation in the museum. These all are a result of the current shelter and location. All three are still active.

The current shelter has a pitched roof, with supporting metal trusses, and is held up by metal posts in each corner. The roof is made of corrugated asbestos and is thought to be the original roof for the mosaic display—having been erected in the early 1980s. However, holes throughout the roof imply that it is in its second use. These holes and additional cracks scattered around the roof allow water to leak through onto the mosaic. These leaks result in two conditions: micro-flora and moisture staining. Patches of micro-flora sprout up directly under these leaking areas. The moisture stains show the extent of the water that pools on the mosaic during episodes of rain.

The third condition is guano, which is the result of birds perching on the trusses. Close examination of the full conditions survey reveals that this condition is present in
Explanation of the Conditions of the Megaron 2 Mosaic

straight, parallel lines that correspond to the trusses overhead. Guano does not appear to be negatively affecting the physical properties of the mosaic. However, its presence is unsightly and impairs the view of some of the mosaic.

4.4 Unknown Conditions

A last point of consideration is the unknown variables that may be affecting the condition of the Megaron 2 Mosaic. There are several circumstances that could be contributing factors. One such condition is that the pebbles are deteriorating in the presence of the concrete, or possibly the guano. Another is that the rebar could be deteriorating more than is visibly perceptible on the panels on which pieces are exposed. Additional factors may exist and the conditions listed above should be amended as they are discovered.
5.0 Current Shelter and Recommendations for a Future Enclosed Shelter

5.1 Description of the Current Shelter

The current shelter is a light steel frame structure with a pitched roof. There are three steel posts along each of the sides. Steel Warren trusses, (composed of repeated equilateral triangles), span the length of the space and are welded to each post, (Figure 5.1). The roof itself is made of corrugated asbestos panels. Closer inspection of these panels suggests that they are in their second use. Small round holes, possibly nail holes, are visible in many of the panels. Additionally, there are areas where the panels do not line up correctly. This causes gaps to form in the roof, (Figure 5.2 & 5.3). The structure is surrounded on three sides by other buildings, though it is not directly attached to any of them. On the forth side, the east side, there is a line of trees that separates the subterranean display from a small garden area. On the west side, there is an area of about six feet between the edge of the asbestos roof and the roof of the museum. This area has been covered by a slightly pitched roof made of reinforced glass, the slope of which is perpendicular to that of the mosaic shelter, (Figure 5.4). No documentation has been found about the shelter. It is impossible to know the reasons behind the current configuration, choice of materials, or the timing of any of the construction.\(^1\)

\(^1\) In discussions with people who had been present at the site during the museum’s construction, no one remembers the details about the construction of the mosaic shelter.
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5.2 Active Conditions Associated With the Shelter

The conditions survey classified five conditions associated with the mosaic as active. All of these conditions are either directly or indirectly related to the current shelter and the immediate environment. These include: micro-flora, moisture staining, guano, detached pebbles, and lacunae. The first three conditions are the result of the open shelter.

The small holes allow precipitation to infiltrate the structure and fall onto the surface of the mosaic panels and sunlight shining through the same holes encourages micro-flora to grow. Most holes are fairly small and so these areas of micro-flora remain localized. However, the porous nature of the concrete allows water to disperse across a larger area during heavier episodes of precipitation. These areas, referred to as moisture staining, do not necessarily show the characteristic green bloom that is associated with the areas directly underneath the holes in the roof, but they have been stained a darker color and are visible in a larger swath around the biological colonization.\(^2\)

The open nature of the shelter allows for birds to enter the display area, and they often use the trusses as perches. The results of the conditions survey show that the location of the guano on the mosaic lines up directly underneath the trusses. While the guano itself does not appear to be damaging the pebbles, it is aesthetically disfiguring and interferes with the view of the mosaics.

Of all of the conditions, the most serious and deleterious relate to lacunae and detached pebbles. Unlike the previous conditions mentioned, there is an indirect relationship

\(^2\) The darker stain may also be micro-flora, however, without testing its not clear what this staining actually is.
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between each of these conditions and the current shelter. Both conditions result from the current maintenance practices. At the time of the conditions survey, the maintenance plan—as directed by the Anatolian Civilization Museum in Ankara—require that the basin be swept out on a daily basis, to clear the debris that blows into the display from the surrounding environment. For the most part this includes leaves from a variety of different plants, dirt, insects, sometimes twigs and larger branches, and trash from visitors. The summer months appear to have the mildest weather and during these months the mosaic requires the least amount of cleaning. The wind picks up during the other times of year and most debris accumulates in the display during these times. This necessitates frequent cleaning, during which time the staff sweeps and sometimes walks across the tops of the panels. The sturdy concrete bedding mortar may give a false sense of security, which may result in slightly less attention and care than an object of the mosaic’s age and uniqueness deserves.

Because the structure is open, the panels are subject to freeze-thaw and wet-dry cycles, which may contribute to the pebbles’ detachment. Sweeping or walking across the tops jars the most vulnerable pebbles out of place more quickly, exacerbating the conditions. Conversations with the museum staff confirmed the loss of pebbles due to cleaning. It was also discovered that until recently, pebbles that were swept up were discarded. It is unclear how many pebbles have been lost due to cleaning because archival records show the panels with areas of lacunae before they were installed in the museum.

Of additional concern is the possibility of Alkali-Silica Reaction (ASR). This is a deleterious chemical reaction that can occur between the pebbles and the bedding concrete
in the presence of water. Further research is required to clarify a number of questions on this topic, (See Possible Effects of the Current Concrete Backing: Alkali-Silica Reaction). This is very important to keep in mind as future plans are considered.

5.3 Review of the Literature

The primary function of a shelter is to provide environmental protection and prevent deterioration of interesting and important finds. This is true for shelters over both in situ objects or those displayed elsewhere, such as in a museum setting. A wide range of designs and styles has been used with varying success. Unfortunately, some shelters have failed in their tasks and have led to the onset or continuation of deterioration. The realization of widespread failure, in particular of mosaic shelters, prompted several studies that aimed to assess the condition of the mosaics and the shelters under which they are housed. A section of the Getty publication, Lessons Learned: Reflecting on the Theory and Practice of Mosaic Conservation, was dedicated to this topic.

Review of available documentation on the mosaic’s history is considered the necessary first step to understanding the present condition of a mosaic. In the report on shelters over mosaics in England, John Stewart noted that, “the significant gaps in knowledge of their post-excavation history,” proved to be a considerable limitation for his project. These gaps in documentation are well known across the field of conservation, where insufficient information about

Current Shelter and Recommendations for a Future Enclosed Shelter

histories of past damage and rates of deterioration can complicate the implementation of treatment and maintenance plans. As is the case with many disciplines, the more information available, the better equipped the conservator is to create a plan for how to proceed with stabilization and maintenance.

A considerable problem with shelters over historic material is the overwhelming focus on the aesthetics and the lack of emphasis placed on their need to function as protection. In the report, Protective Shelters over Archaeological Sites: A Review of Assessment Initiatives, Sibylla Tringham and John Stewart bring attention to this specific problem.

Literature on shelters has traditionally been descriptive, emphasizing aesthetic character and interpretive function, and critical reviews and evaluations of shelter performance are rare.4

They go on to describe what they found in reality, observing that most often shelters are not designed with the protection of the mosaic as the top priority.

From the information collected…it appears that when shelters fail in their protective function it is because aesthetic design, visitor comfort, presentation, or other aspects were prioritized over the protective function, resulting in an unbalanced solution.5

While shelters can prevent certain conditions from emerging or continuing, those that exhibit design flaws can accelerate the deterioration process and be among the main causes of deterioration. This is the case with the shelter over the Megaron 2 Mosaic at the Gordion Museum.

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5 Ibid.
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In the discussion about Protective Shelters, which was published following the reports in Lessons Learned, several panelists stressed the need to educate both architects and decision makers about conservation, citing that it is usually, “a great problem.” Federico Guidobaldi referred to the shelters over the mosaics at Kourion in Cyprus as an example of creative designs with poor protective results for some of the mosaics.6

In almost every case described, the assessments of shelters started with conditions surveys of both the mosaics and the shelters. These varied in degree of intensity, but most included basic information about the structure, such as: the type of shelter over the mosaic, (e.g, open, closed, tensile, metal or timber framed, or concrete); dates and a brief history of the shelter’s construction; number of mosaics and total surface area covered; and treatment of the mosaic, (in situ or re-laid).7 Upon completion of the conditions survey, the data was assessed to determine if and how active conditions correlated with the shelters.

Interesting results were discovered at the site of Caesarea, Israel. This site is located in a humid subtropical, marine environment and has in situ mosaics that are both covered and uncovered. After reviewing the data collected, it became clear that the greatest amounts of dust and salt accumulated on the mosaics that were under shelters.

High relative humidity and moisture content together with the presence of aero-

6 Michaelides’s report, “Lessons Not Learned: The Shelters at Kourion,” focuses on in situ mosaics. His comments touched on the vast channels of bureaucracy that must be traversed in order to make any decisions. With regards to design plans getting out of control he says, “At the end, you can’t blame anybody. It’s the lack of working together and programming everything well ahead.”

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sols and dust deposits in the marine environment can explain this phenomenon… The open shelters provided horizontal protection from rain, but does not prevent aerosols and dust from accumulating on the mosaic. On exposed mosaics these deposits were washed in the rain, but under the shelter their removal is controlled and depends on maintenance.8

This realization highlights the importance of conditions surveys for several reasons. The unexpected findings emphasize the need to consider all sites as unique situations. It serves to remind that not everything follows what may seem to be the most logical explanation. In this case the unprotected mosaic was cleaner and had less accumulation of dust and aerosols than the one that was under a shelter. Lastly, placing a shelter over a mosaic does not eliminate the need for maintenance and conservation of that mosaic.

An understanding of the possible conditions for mosaics under shelter is critical to the conservation and preservation of ancient mosaics. The article, Rapid Assessment of Shelters Over Mosaics: Initial Results from Israel, written by Jacques Neguer and Yael Alef, discusses the results of study of over a hundred mosaics and their shelters. The research team reported a list of ten principal risk factors for mosaics under shelters.9

1. Active decay/ongoing deterioration, whose mechanisms or causes have not been halted
2. Insufficient security and protection from vandalism/animals (mainly birds)
3. Inadequate roofing, which does not protect the mosaic from rain and sun
4. Inadequate site drainage (mainly water runoff)
5. Inadequate roof drainage

8 Ibid.
9 Ibid.
6. Vegetation and microbiological growth

7. Lack of preservation or inappropriate interventions (for example, treatment with cement)

8. Lack of mosaic maintenance

9. Lack of regular monitoring

10. Lack of shelter maintenance

Once the team had established these factors, it determined which these factors were the most prevalent, with the understanding that a higher percentage of risk meant a poorer condition of the mosaic. The top three were reported to be: lack of regular monitoring and maintenance, inadequate site drainage, and lack of preservation or inappropriate interventions.

These factors all relate to inadequate education and attention to the objects over the long term. The addition of a shelter may improve or eliminate certain situations or conditions immediately, for example: keeping rain off of the surface may stop biological colonization. But it seems that too often the installation of a shelter gives only the semblance of stability because there is a common disregard for conditions that develop slowly over time. Often even minimal efforts will keep these conditions at bay.

A last consideration is the actual difference between mosaics housed under open versus enclosed shelters. Of the sample that Neguer and Alef chose to study further, all of the mosaics in enclosed shelters were considered to be stable.

The survey results suggest that generally, as far as environmental factors are concerned, mosaics in enclosed shelters seem to be in better condition than mosaics in open-sided shelters.¹⁰

¹⁰ Ibid. This did not consider the year the mosaic was lifted. Most mosaics discussed here were re-laid on a
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In particular, a comparison of two mosaics that were both re-laid on cement slabs—one in an enclosed shelter and one under an open shelter—helps explain the difference. These two mosaics are located only three kilometers away from each other and are comparable across other factors, such as climate. The first is the mosaic from Beit Alpha Synagogue. It is displayed in an enclosed shelter and is considered to be in stable condition. The second is from Nir David and is displayed in a courtyard under a simple shed construction with a corrugated metal roof and, “the mosaic rests in a concrete podium in the shape of a pool.”11 Like Turkey, this region of the world gets very little rain on an annual basis. However, wind-driven rain and roof runoff accumulate on the surface of the mosaic and had caused the concrete slab to disaggregate. As a result, the Nir David mosaic is considered to be at greater risk of damage.

The environment is always important to consider with objects like mosaics. However, microclimates inside and around mosaic shelters, (both those that are open and enclosed), were addressed in several articles and are beginning to be considered threats to mosaics.12 Tringham and Stewart wrote that:

When monitoring data (such as climatic data) is examined alongside condition monitoring data, significant correlations may be revealed, shedding light on deterioration mechanisms and the performance of the shelter.13

Enclosed shelters often have a number of different microclimates. These are particularly

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11 Ibid.
12 This is particularly true for humid/moist climates, however it is also applicable for area that experiences multiple freeze-thaw cycles.
important to be aware of during construction of a new shelter since there are likely to be different than the previous microclimates, which could jump-start old or initiate new mechanisms of deterioration.

Unfortunately, the design of the Gordion mosaic shelter exhibits many of the negative characteristics mentioned in the reports discussed above. The Megaron 2 Mosaic is no exception when it comes to a lack of documentation about past conservation efforts and treatments. Its not surprising that there is so little information about it prior to its installation in the museum, given the long hiatus. However, it is unfortunate that so little information is available about its history since it was installed. That information would have been very helpful in assessing the rate of loss of pebbles.

While aesthetics do not appear to have been a top priority for the current shelter, it seems plausible that it was erected for visitor comfort during the summer months when the site is extremely hot and tourist numbers are at their peak. The shelter does provide some reprieve from the heat of the day. The small holes and leaks on rainy days do not affect tourists. It may also be the reason behind the choice of reused roof panels instead of new ones that would not have had holes. Had the mosaic been considered fragile at the time of its installation, a different roof probably would have been chosen.

The active conditions for the Gordion Mosaic were determined after the analysis of the thorough conditions survey. However, a survey of the shelter was not performed. While the mechanisms of deterioration for the conditions are clear from the survey of the mosaic, the current shelter should be assessed more carefully.
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The three principal risk factors listed as the most common included: lack of regular monitoring and maintenance, inadequate site drainage, and lack of preservation or inappropriate interventions. The first and last of these are pertinent to the Gordion mosaic. The mosaic has suffered because of insufficient monitoring and maintenance. As well, the amount of over-grout on the surface of the mosaic, the spalled rebar, and the active conditions attests to the inappropriate interventions and lack of preservation.

A new fully enclosed structure will eliminate current risks and active conditions present at the Gordion mosaic and would greatly improve its display. However, as was suggested above, shelters sometime can be misleading when it comes to care for the mosaic. A new shelter will not eliminate the need for maintenance and monitoring, but should encourage it. Dust and dirt will still find its way into the shelter, (though aerosols are not a problem at Gordion). Preventative conservation, such as regular maintenance, will ensure the mosaic remains in stable condition for a long time to come.

5.4 Shelters at other Archaeological Sites and Museums

Turkey has a significant number of extraordinary mosaics and the conservation and maintenance of these has begun to become a top priority. As of today, they vary in terms of intervention and project scope. The following is a look at some shelters over mosaics and other archaeological remains from both Turkey and Cyprus.

The Terrace Houses at Ephesus – Selçuk, Turkey

14 The second one refers to ground water movement, which is not a problem for the Gordion mosaic.
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The Terrace Houses at Ephesus date to the 1st century B.C.E. These houses, which were found in a very good state of preservation, were built by wealthy Romans into the side of a hill and overlook a major city street. Beautiful mosaics, both geometric and figural, and elaborate wall paintings cover the rooms of these houses and offer a glimpse of the elaborate interior decoration during that time.

The Austrian architect, Otto Häuselmayr, designed the new protective roof for the Terrace Houses at Ephesus in 1979. It is described as, “a lightweight supporting structure of high-grade steel with a roofing of textile membrane and a transparent polycarbonate façade in the form of overlapping scales,” and was designed to accomplish several things. First and foremost it needed to protect the sensitive materials that had been found in the buildings. These included wall paintings, mosaic floors, stone veneers, and plaster. The new structure allows for the temperature to be regulated. It keeps the rain, wind, and sun off of the artifacts and architecture on display. The ‘overlapping scales,’ which are positioned on an angle, allow air to circulate, but minimizes the amount of dust and dirt that enters the structure, (Figure 5.5). The shelter is significantly cooler than the exterior space. The textile roof and translucent scales disperses the light evenly and there very few shadows. However, because there are tall walls throughout the area, certain areas receive little light and are fairly dark.

Because everything remained in situ, the shelter over the Terrance Houses was very expensive to construct and was sponsored largely by several Austrian organizations,

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(Figure 5.6). Although a separate admissions charge is required to enter, it is still popular with the vast number of tourists who visit. Elevated glass walkways allow visitors to walk through the buildings and experience the tremendous spaces for themselves. Several viewing platforms provide information about what is visible and call out particularly interesting areas and objects. The walkway starts at the bottom of the hill, and wends its way across the display area, and exits at the top. A small path leads visitors back to the main thoroughfare.

The Great Palace Mosaics – Istanbul, Turkey

The Great Palace Mosaics (İstanbul Büyük Saray Mozayiği) are located in the Sultanahmet district of Istanbul, very close to most of the major monuments in the city. These mosaics, which depict mythological scenes and animals and date to the Byzantine period, were discovered during excavations from 1935 to 1954. The initial shelter was poorly built and never maintained. Its demise contributed significantly to the deterioration of the mosaics.

In 1982, cooperation between the Turkish and Austrian Governments enabled a team to design a phased conservation project aimed to conserve and rehouse the mosaics, (See Published Methods for Re-backing). Today, the new shelter for the mosaic is described as a, “Steel-girdered interior designed as a spacious hall. The platforms and galleries attached to the bearing structure allowing a good view of the mosaic.” It is a two level structure: visitors enter at ground level and are able to view the mosaics from above. They can

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then climb down a staircase to view the mosaics more closely. (Figure 5.7). Thin railing prevents visitors from entering the display area. However, some of the conserved mosaics are hung on the walls. A transparent barrel roof allows for daylight to come through and light the interior space, however halogen spotlights help to brighten dark corners.

There is quite a lot of information available to visitors. Signs around the top floor describe the creation and burial of the mosaics, the discovery and subsequent deterioration, and finally the entire conservation project. While the signs are small, images help to illustrate the processes described. The building is kept clean and is cool during the summer. The different viewing levels allow visitors to see the bigger picture, but to also get close enough to examine the craftsmanship.

**Orpheus Mosaic – Paphos, Cyprus**

The Orpheus Mosaic is one of Cyprus’s most famous mosaics. The mosaic was found during excavations of a Roman house in 1942. It is considered to be the largest single figural representation on the island. In 1985, the decision was made to lift the mosaic using the rolling technique. Once it was lifted, it was backed on a single panel with a lime-cement mortar and reinstalled in its original position on the site. In 1986 a semi-permanent shelter was erected over top of the mosaic. It was special designed for the mosaic and given the name: the Hexashelter, so named for its six sides, (Figure 5.8).

The shelter was evaluated in the Getty’s 1991 publication of the conservation of the Orpheus Mosaic and was considered a good option for the following reasons. It was light-
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weight, inexpensive, temporary, easy to erect, modular, expandable, and easy to dismantle. Its major flaw was the roof, which was originally covered with an “Aerotextile”—an open knit fabric. This proved inadequate for protection from rain. Additional attempts to waterproof the fabric using a silicone gel failed because it was difficult to get an even coat of the gel onto the fabric and uneven application allowed for water to continue to penetrate the shelter. Additionally, the flaps on the sides did not extend far enough down and wind driven rain still could enter through the sides. Improvements were later made, which included replacing the “Aerotextile” with a water impermeable fabric and extending the flaps to provide more weather protection. There was also discussions about adding better drainage off of the shelter should it be in use for much longer after the publication.

The report contained no discussion about conditions resulting from the shelter. Comments about the need to consider water removal from the site suggest that water may leak onto the top of the mosaic during periods of rain. Nor was there discussion of visitor comfort inside the shelter. The report has a picture of the shelter with one side open, and the caption reads that it is for visitor access. The climate is hot and arid in Cyprus, and so a cloth roof probably provides adequate cover from the sun, disperses the light across the area, and allows the breeze from the ocean to circulate the air.

**Sardis – Sart, Turkey**

The elaborate mosaic floor in the synagogue at Sardis dates to the 2nd century B.C.E.

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18 Ibid.
and is currently open to the elements. Because the archaeologists were interested in older levels, the mosaic was lifted and backed on concrete panels, and eventually these panels were reinstalled in their original location, (sometime during the 1960s). The mosaics have deteriorated over the years since they were put outside, however recent discussions with the architect suggest that the mosaic will soon be covered with the same system that is currently in place over in situ features nearby. The performance of that feature will be discussed here.

The architect and archaeologist, Philip Stinson, designed the simple shelter at Sardis, which covers part of the Monumental Mud Brick Structure (MMS) and a small apse that contains Roman wall paintings, (Figure 5.9). This structure is built on a light steel frame and uses tension rods to help hold down the roof, which is rounded and slopes north-south. The roof material is semi-transparent polycarbonate with UV protection, (10 year warranty).19 It is open on all sides, (though the western side abuts an ancient wall), and so poses similar problems to the current roof over the Gordion mosaic. Birds perch on the trusses and defecate onto the ancient mud brick walls. They also nest in holes in the masonry of the apse and have contributed to the deterioration of the wall paintings. In the morning, the light shines into the space from the east and casts shadows. However, small walls built around the perimeter of the display prevent heavier objects from falling or blowing into the display.

There are no trees close to the display to cast shadows into it and after the sun rises the light is even across the display, (Figure 5.10). In the hot Turkish summers, the shade

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19 Stinson, Philip. Email message to Author, March 17, 2011.
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keeps the area under the roof cooler than areas in direct sunlight, but it is also slightly more humid. Where the roof abuts the ancient wall on the west, water sometimes leaks onto the mud bricks, and has caused some deterioration. In the south, the lack of gutters results in water running off the roof and falling directly behind an ancient wall. Since the ground slopes towards the display, the moisture drains into the wall and has caused blooms of efflorescence.

The architectural elements on display under this shelter are in situ and located several meters below the present ground level. It is open on two sides and visitors are prevented from entering the display by small brick walls. There is virtually no signage and the display is very difficult to interpret and understand. Because it is located next to a small road it can often be noisy.

5.5 Considerations for the Megaron 2 Mosaic

After reviewing the literature and considering other mosaics and their shelters, it is clear that the best way to protect the Megaron 2 Mosaic is to relocate it within a new structure. The two most important functions of a new shelter are the mitigation of active environmental conditions and improved display and interpretation.

In considering a design for a new structure, it is essential that a conservation specialist be part of the planning process. As was apparent in the literature, many structures built to protect mosaics and other archaeological materials although built with good intentions produced harmful consequences. While it is very important to consider factors such as visitor circulation patterns, viewing areas, and information displays, these things should be considered only after the stability of the mosaic is ensured.

The environment is one of the most important factors in establishing a protective
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space for the mosaic. Simple monitors should be installed around the current mosaic display and left in place during the planning process for the new structure. Gathering such information as relative humidity, temperature, and dew point from the current configuration will help inform the design process and may highlight specific things that should be addressed as conservation of the mosaic begins. Monitors should be placed in discrete locations within the subterranean display, at ground level, and near the roof and left in place for at least a year. This will provide information about microclimates in and around the mosaic display. Such things as determining the number of freeze-thaw cycles the mosaic may experience over the course of the year could help drive new design proposals.

The lighting and ventilation of a new building will affect the environment of the space and should be considered carefully. The lighting of the current display is very poor and only on overcast days is the light evenly dispersed across the area. The eastern side of the display is lined with trees, while the western side has a roof extension made of wire-reinforced glass. This leads to very different effects on the east and west sides of the display. On the east side, the sunlight impairs visibility of the mosaic. The edges of the display cast shadows across the panels closest to the edge. Sunlight filters through the trees located just outside of the display area and cast additional shadows. At the same time bright light from in between the branches and leaves also shines onto the panels, (Figures 5.11 & 5.12). The combination of shadow and bright light makes those panels very hard to view on sunny days as the designs tend to become lost to the contrasts of the light. On the west side, the glass between the main museum building and the mosaic’s roof causes the western edge of
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the display to cast a shadow on those panels closest to that edge. However, the contrasts are not as dramatic on this side as they are on the east side. Lastly, rays of sunlight move across the floor as the light shines through the holes in the roof.20

Translucent plastics or waterproof textiles are possible ways of evening out the light throughout the mosaic display. All of the sites discussed above have incorporated such materials to improve the quality of the light inside the displays with good success. The most applicable and affordable solution may be one similar to the Great Palace Mosaics, where a large skylight is put in the center of a hipped roof, (Figure 5.13). Lights can be added if necessary to lighten dark corners. Whatever material is chosen for a skylight must be strong enough to handle snow loads during the winter months and the roof should be well equipped to remove rain water far away from any foundations.

Air circulation and ventilation are also important to maintaining an appropriate environment inside a new shelter. During the summer the temperature under the existing shelter is cool and pleasant. Additionally, the open sides allow for a constant light breeze. An enclosed structure risks trapping hot air inside, creating unpleasant—possibly humid—conditions for both the mosaic and visitors. Any ventilation plan must also strive to prevent precipitation, dirt and debris, and animals from enter the enclosed space. The Terrace House structure at Ephesus tried to encourage airflow by using ‘overlapping scales.’ This is a successful way of addressing the concern. In a conversation with University of Pennsylvania Professor and Architect Lindsay Falck, he suggested small flaps that could be raised

20 Because the sun is constantly moving across the sky and the holes are relatively small the light is never on a particular area for long enough to be concerned with thermal expansion and contraction.
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along the bottom of the structure coupled with an opening at the top. This would encourage
cooler air to come in from the bottom and allow hot air to exit out the top.\textsuperscript{21}

The cost of a new structure must be kept as low as possible. As a result, the materials
and labor should be available locally. Any design proposal must consider the availability of
materials as it is being drawn up so as to avoid last minute problems with incompatible, un-
available, or highly expensive items. A wide variety of materials can be purchased in Polathlı
and often local craftsmen can make parts at low costs. Materials not available in Polathlı can
often be found in Ankara, which is quite close.

While the cost of materials should be kept low, those that are ultimately chosen for
use should be durable and have long service lives and be readily available when repair or
replacement is needed. The compatibility of the materials should also be considered so as to
prevent damage to the building due to incompatible materials—especially those that may
expand and contract with temperatures since Gordion is very cold in the winter and very
hot in the summer. The Gordion Museum has very limited funds to maintain its property.
Any new construction should be very conscious of this and design and construction plans
should be carefully thought out and organized.

Lastly, long-term temporary fixes should be avoided. Projects at Turkish archaeol-
ogy sites have in some instances never completed. While actions should be taken immedi-
ately to stop the active conditions, energy should be put into creating a sustainable design
that can be built soon so as to protect the mosaic, but also avoid incompletion.

\textsuperscript{21} This was done at Çatalhöyük. However, this may not be an adequate solution to eliminate dirt and dust, or
keep animals out.
6.0 The Megaron 2 Mosaic Display

6.1 Description of the Current Display

The current configuration of the display is inadequate and inappropriate for the interpretation of the Megaron 2 Mosaic. Many visitors stand at the corner of the subterranean display for a few minutes before proceeding to the restrooms, access to which is next to the display. There is no signage at this location to indicate what is being displayed.¹

Some visitors proceed onto the walkway that surrounds the mosaic display. If these visitors turn right and walk along the west side of the display, (the side closest to the museum), they are unlikely to see the information that is available. Only those visitors who walk far enough down along the north side of the display, (past the central roof support), will see the signage that is currently available to visitors. Of all of the visitors to the site during the summer months very few actually walk all the way around the perimeter of the display.

The mosaic itself is nearly impossible to understand. Thirty-three panels have been bonded into the floor with a thin slurry of cementitious-grout, (which now coats the tops of some of the panels). No two panels share the same dimensions and, to the uninformed viewer, their positioning in the display seems to be arbitrary. Each panel is set so that it stands proud of the concrete floor by about an inch and a half to two inches, possibly indicating a prior plan to try and restore unity across the floor by filling in the lower areas.

¹There is no signage at all to indicate that there is another mosaic and a reconstructed Gallic Tomb farther past the Megaron 2 Mosaic. Most visitors to the site do not visit these artifacts.
The Megaron 2 Mosaic Display

Unfortunately, if that was the reason for the raised installation—it was never brought to fruition. However, had efforts been made to fill the void spaces between the panels, it would have been complicated by the fact that the panels are not located in their exact, correct location, a fact that was only recently realized. Currently, very few of the designs connect across panels, most panels are not contiguous, and almost every panel is separated by a few inches on each side from any adjacent panels.

The small yellow sign, that has information about the mosaic in both Turkish and English, is inadequate for such an interesting object as the Megaron 2 Mosaic, (Figure 6.1). Not only is the information on the sign sparse, but it is hidden behind one of the support columns for the roof. It speaks generally about the history of Gordion as a site and says very little about what is on display. Some of the information that describes the mosaic is inaccurate. Because so little information is available and what is available is hard to find, most visitors are simply confused by what they see. Questions to conservators who were working in the subterranean display during the 2010 summer field season included: “What is this?” “Is this a swimming pool?” “Is this the mosaic’s original location?” People were generally confused when told the panels of mosaic on display were only part of a more complete mosaic, the rest of which remains on the citadel mound.

Insufficient, inaccurate, or missing information can sometimes cause as much harm

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2 The panels are not grossly out of place. They are all oriented in the correct way. But because of the randomness of the lifting process and the spaces between all of the different panels, their placement in the display is not precise.

3 The date the sign was written and erected is unknown. The date for the creation of the mosaic that is on the sign corresponds to the original dates proposed by the archaeologist Rodney Young, (8th c. B.C.E.). It is now considered to date to the 9th c. B.C.E. It is possible that the reconsideration of the dates happened after the sign was erected and nobody change it.
The Megaron 2 Mosaic Display

to a museum object as the physical deterioration of that object. Those objects that do not have supporting histories and interesting information available to the public run the risk of being neglected because their importance remains unknown. At that point, the object falls under threat of physical deterioration. Such has been the case with the Megaron 2 Mosaic.

The loss of information about the Megaron 2 Mosaic likely happened in stages. A certain amount of information that was known about the mosaic upon its discovery would have been lost over the many years the panels were propped up in the dig house courtyard, where they slowly became permanent fixtures. The knowledge of the workmen and students, who were present at the site when it was found, has disappeared as those people have left or moved away from the site. More information would have been lost after the mosaic was installed in the museum, away from where the archaeologist lived and worked—as the old adage goes: “out of site, out of mind.”

The mosaic panels began deteriorating while they were propped up in the courtyard. Though the mechanisms of deterioration were the result of environmental pressures, (such as climate), on the materials, it was also the consequence of neglect. It is clear from the mosaic panels bonded in the display that they were not in good condition when installed. Unfortunately, its installation in the museum did not preclude further deterioration. The staff at the museum, almost certainly unaware of its former appearance, did not have any standard to maintain. As a result, the loss of a pebble here or there during the routine daily cleaning probably received little consideration.

6.2 The Problems of Lacunae
Within the field of conservation, the subject of lacunae and their subsequent compensation has been discussed extensively. This topic has been approached from every conceivable angle by both scholars and practitioners alike. The nature of mosaics—intricate creations, composed of many smaller parts that are bonded together to form a larger whole—makes them particularly susceptible to loss and so this topic is of considerable importance when discussing their conservation.

Cesare Brandi defines lacunae as, “a figure in relation to a background that then comes to be represented in a painting.”4 He supports this definition by describing an initial observation of a complex image, reflecting on the spontaneity of that moment and particularly noting the establishment of patterns, such as figure and background, within the visual image. He goes on to discuss the idea of the lacunae further:

When there is a lacuna in the structure of a painting, this unexpected “figure” is perceived as a real figure to which the painting provides a background. The image is more than just mutilated, it is also devalued, in the sense that what was born as a figure is now reduced to mere background.5

His writing may refer to paintings specifically, but the principals are applicable across a much broader spectrum. This idea is particularly relevant to the Megaron 2 Mosaic, which has a considerable amount of loss. These losses create discontinuities and attract attention, but more alarmingly they suggest a general feeling of apathy for the value of the mosaic. This devaluing process is twofold and simultaneous. The first of these processes is related

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5 Ibid.
to its physical nature. As a prominently displayed museum object, the value of the mosaic decreases simply because it is exhibited in a state of active deterioration. This suggests that the physical object is not valuable enough to maintain.

The archaeologist and theorist, Ian Hodder, wrote of the three meanings that contribute to the significance of cultural objects, these include: utilitarian meaning, symbolic meaning, and historical meaning. While each of these will vary for different objects, they all contribute to the value of that unique thing. The second of the devaluing process is that lacunae take away from the value of the whole object as a unique piece of material culture by slowly diminishing its ability to be recognized. Using the Megaron 2 Mosaic as an example: It has been removed from its original context, there is virtually no information available about it, and with any further deterioration its identity as a floor pavement will be lost.

Conservators turn to compensation and reintegration, rather than risk total loss of both the object and its value. Returning to Brandi’s point mentioned earlier, a successful compensation would depreciate the status of the lacunae, ideally to what he called a “background,” while reinstating the designation of “figure” to the object itself, in this case the Megaron 2 Mosaic. But the process is more complicated than simply saying the lacunae must be dealt with. In an article on reintegration, the Italian historian Alessandra Melucco Vaccaro listed some of the practices used by the conservation field to respond to lacunae:

Rejection of imitative restoration, respect for the traces of time and impossibility of

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6 Muñoz Viñas, Salvador. 2005. *Contemporary theory of conservation.* Amsterdam: Elsevier. Utilitarian meaning is that which comes from its original purpose. Symbolic meaning is that which places the object in its cultural context and within the structure of meanings. Historical meaning is that which is derived from it the object’s association with past history and circumstances.
erasing them from an object, using restoration to give back to an object the unity it has lost through interference and alterations, taking the original context into consideration, respect for the present context, and filling lacunae so the intervention is recognizable at close range but not from a distance.7

She went on to point out that nearly every conservator would agree with each of these principals when used individually as solutions to lacunae. However, if several or all were applied simultaneously, disagreements would arise about the effectiveness or ethicality.

In light of this discussion, the Megaron 2 Mosaic stands out as a particular challenge. The large and copious lacunae, the areas of ancient loss, (now filled with concrete, and large areas of voids between the panels create an incredibly complex situation, which is further complicated by the discrete, non-repeating patterns that are interrupted by these blank areas. To the conservator, this creates a difficult quandary. On one hand, the obvious solution seems to be to restore unity to the mosaic by replacing areas of loss with new pebbles. However, in the field of conservation, it is rarely considered acceptable to fully restore an object found on an archaeological site. The reason for this is summed up well by conservator and professor, Frank Matero, who wrote:

Conservation practice presumes an understanding of the intent of designers, builders, or users and of the effects of time and human use on that work. Conservation practice, moreover, assumes a knowledge of the treatments necessary to preserve and reintegrate that work in compliance with the principles established. Artistic replication or reconstruction, sometimes necessary to reestablish visual appearance and meaning can involve skills of a very different nature and should neither replace nor compete with the original work or the conservation process.8

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In normal circumstances these issues would require considerable deliberation and thought before any decisions could be made. However, the present state of the mosaic’s conservation is unsustainable and requires that the ethical debate take a backseat to that of reintegration. There is always a chance that areas with replaced pebbles could be interpreted as original or seen to be competing with the original artist’s works. But, right now there is a greater risk of losing the mosaic, both the physical object and its cultural meaning, as more pebbles become loose or are lost.

**6.3 Displays and Reintegration of other Mosaics at Museums**

The following section will discuss ways in which other sites have reinterpreted mosaics that were lifted and are now on display in museums. It will focus on two different, but essential aspects of the displays. First is a description of the circulation and visual access to the mosaic. This will be followed by descriptions of different conservation approaches for compensation of lost materials.

**Kayabaşı Mosaic – Gordion Museum**

In considering a new approach to the display, the Roman mosaic located down the path from the Megaron 2 Mosaic, at the Gordion Museum, is a good place to begin. This mosaic, known as the Kayabaşı Mosaic was discovered off site while digging the foundation for a house in 1989, (Figure 6.2). It remained in situ until 1999, when the decision was finally made to lift it and rehouse it at the Gordion Museum. A sign, showing photographs of the entire process, describes the transfer and conservation work that was undertaken.
During careful transfer to the Museum, the mosaic was divided into panels, numbered, and then re-laid systematically in its new place. The damaged parts were restored with new tesserae, especially produced for this purpose, and the mosaic is now in the protected environment of the garden of the Museum.9

While brief, the more signage and corresponding photographs clearly tell the story of the mosaic’s recent history: accounts for damage to the mosaic, its discovery, removal from its original site, and its installation in the Gordion Museum. Unfortunately, the sign does not mention anything about its ancient history, which is equally as important. There is no mention of even a speculative date, or anything about the people or culture that created it.

The Kayabaşi Mosaic is similar to the Megaron 2 Mosaic in the fact that it is also located in a subterranean display. Visitors can walk all the way around the area. However, there are several differences that make the Kayabaşi Mosaic more understandable in its museum setting than the Megaron 2 Mosaic.

The most noticeable difference is the low stone wall that runs around the perimeter of the mosaic. This clearly demarcates the boundary of the room where the mosaic was original located and places it in the context of a building. An opening in the wall even suggests a doorway. The tops of these walls were built to emulate what may be found on an archaeology site. Though there is no historical information about the mosaic, these small details help inform the visitor.10

9 The paper sign, which is behind glass, is now beginning to discolor. However, it does provide more information about the mosaic, which was not studied in depth, including information on post lifting damage. The hole in the center of the mosaic is from the excavation for a well. Damage to the eastern border occurred during the installation of a water pipe to a local school.

10 Since there is clear documentation showing the mosaic being lifted from its original location there is only minimal risk for visitors to get confused and think that the mosaic was in situ.
The loss of original material was dealt with in two separate ways. The reintegration of smaller sections of loss was relatively easy due to the repetitive and symmetrical design of the mosaic. The conservators chose to fill in larger areas of loss, but left areas that were missing only a few pebbles as they were. New tesserae that were slightly darker in color from the original ones were used to recreate original pattern. In these areas of fill, the new tesserae are not flush with the ancient ones, but are ever so slightly higher.

The gaping hole in the center of the mosaic stands out upon first glance. Roman mosaics often have a scene depicted in the central part and some of what was created is still visible within the frame created by darker tesserae, but the majority of it cannot be determined. In order to avoid improvising or fabricating, a conservative approach was taken in dealing with this loss: the border designs were filled in using the technique described above, and the rest of the space was edged with mortar and left unfilled.

The Great Palace Mosaic – Istanbul, Turkey

The Great Palace Mosaic, which were discussed above, have several levels for viewing the mosaics, (See Current Shelter and Recommendations for a Future Enclosed Shelter). Visitors can view the mosaic from the level above the pavements, and walk all the way around the area of the mosaics. They can also climb down a set of stairs and view the mosaics from the ground level. At this level, visitors are confined to walking along only one side of the display. Some mosaics have been lifted and are now displayed vertically on the walls. In addition to the different vantage points, there are a significant number of signs that both illustrate and
describe the history and conservation processes that have been implemented.\textsuperscript{11}

The conservation of the Great Palace Mosaic was no small task. And the problems of lacunae and voids were of major concern to those involved in the project. This topic is addressed in the publication about the conservation:

By today's conservation standards, making reconstructions of the original tessellatum is no longer a valid approach: the main point today is to preserve the surviving original substance. Based on these standards, a method to fix gaps was used that defers to the original mosaic and ensures objective readability of the (at places) highly fragmented pictures.\textsuperscript{12}

The final solution used a white, coarse mortar and white dolomite quarystone. The mortar, which matched the color of the tesserae that made up the background, was used to fill smaller areas of loss. The quarystone was used to fill areas of complete loss between areas of mosaic. The conservation team felt this was a more appropriate solution than previous applications of gray cement mortar to areas of loss, which had also caused moisture and efflorescence problems.

**Zeugma Mosaics**

The mosaics from Zeugma, in southeast Turkey, are stunning examples of the mosaicking techniques that existed in the Roman world. The Centro di Conservazione Archeologica, an Italian firm that specializes in mosaic conservation, took on the project after

\textsuperscript{11} These signs have been compiled in to a book about the conservation of the site. It is called: Istanbul, the great palace mosaic: the story of its exploration, preservation and exhibition, 1983-1997.

The Megaron 2 Mosaic Display

a publication brought to light the fact that many of the mosaics would be lost under rising waters due to a new river dam. Over 800 square feet of mosaics were conserved and many of them are now on display in the Gaziantep Museum, close to the original site.

While a number of the mosaics were lifted from the endangered site, many of them were found in very severe states of deterioration in storage areas at the Gaziantep Museum, having been lifted quite a while ago using various untraditional methods. The conservation of these mosaics employed the most up to date technology and skill and took several years to complete. Some of the mosaics that had been in storage were in fairly unstable shape and required a significant amount of work. This included removing the original backing material, cleaning the tesserae, (from the rear), creating new backing supports, flipping the mosaic back over, and leaving them to set in their new support for a number of months, (See Lifting Process). The different types of lacunae were treated approximately the same way: with in-fill mortar, colored to match the background, filled to the height of the tesserae. This method was used even in areas of repetition to clearly distinguish what is original. A particularly important aspect of the conservation was the choice to blur the cut lines that were created in order to re-lift the mosaic during the final stages of re-backing. By using meandering lines, as opposed to straight ones, once the individual panels were reintegrated the cuts are more difficult to notice.

On several mosaics the director of the project, Roberto Nardi, said the conservators had to “sin a little bit.” By this he meant they were required to fill in certain areas with new tesserae when they didn't know what existed there before. This was the case for the mosaic
depicting Metiochos and Parthenope. When it was discovered in the storage room, the two central figures were missing and considered lost forever. Fortunately, due to incredible luck, the two figures were found and safely returned to the conservators.\footnote{The short version of the story follows. A Turkish archaeologist noticed them hanging on a wall while attending a dinner party in New York City. Having known about the mosaic that was missing its central figures, the archaeologist investigated further and was able to determine that they indeed matched. The details of their re-acquisition have not been published, but the two figures were eventually returned to Gaziantep.} Since they were looted from their original context, no attempts were made to protect the in situ mosaic and the tesserae bordering the looted areas were lost. This meant that their reintegration would have left two islands of mosaicked material that would have looked very awkward and suspicious.

The “sin” that the conservation team committed was the very careful addition of new tesserae in certain areas to improve the aesthetics and create more uniformity across the mosaic. The area right above the heads of the two figures was one area where the team chose to do this because they felt confident they would not be competing with the artist’s work. The final product shows that no attempts were made to recreate anything with detail. Nardi pointed out that their process was solely one of reintegration of the two missing parts and not a full restoration, (Figure 6.3 & 6.4).

It seems that the mosaics are displayed in the museum according to where they were located on site. Those that were found in situ and lifted are displayed with other objects from the rooms from which they came. This includes both columns and painted plaster walls, which have been organized so as to emulate their positioning on site, (Figure 6.5). Those that were found in the storage of the museum have been erected vertically on wall mounts.
Antioch Mosaics

The final group of mosaics that will be discussed are those that are on display in the Hatay Museum. Today, this is in the Turkish city of Antakya, but it was originally the Roman town of Antioch. Over 300 mosaics were found during excavations in the early part of the 20th century. They are similar to those from Zeugma because they were found in a very affluent neighborhood and are exquisitely crafted. However, they date to slightly later in history—around the 2nd century C.E.

It is unclear exactly how many mosaics are on display at the Hatay Museum, but it appears to be quite a few. These are displayed either on the floor or on the walls. Some have been cut down into smaller sections to show certain elements of the mosaic. In those instances, it is possible that the mosaics were treated in much the same way as the Gordion Mosaic: particular areas were called out of the original pavements and lifted. Some of the largest and most important mosaics are displayed on the floor. There are few if any barriers to keep people off of the mosaics. Most of the mosaics are displayed on the walls, which is likely due to the sheer number in the collection and lack of adequate floor space, (Figure 6.6). There does not appear to be much signage around the rooms, though there are very small plaques next to each mosaic. One very distracting observation is that the light shines through the windows and onto the floors and moves across the tops of the mosaics during the course of the day. It is possible that the light may affect the colors of the mosaic, but it is also incredibly distracting when looking at the mosaics.

14 There are also number of mosaics from Antakya at the Baltimore Museum of Art.
The Megaron 2 Mosaic Display

It appears that the mosaics are in stable condition since they are located inside. However, the treatment of lacunae in many of the mosaics is distracting and draws attention away from the depicted scene. Inappropriate mortar colors, especially the use of dark gray and black, are particularly disfiguring, (Figure 6.7). In certain instances, the original lifted sections are articulated by the use of the black mortar, which has been used to fill in the spaces in between, (Figure 6.8). When lighter mortars were used to fill loss, there was no apparent attempt to match the colors. In some cases, the edging mortar looks to be a different color than the fill mortar.

6.4 Critique of Displays and Conservation Approaches to Lacunae

Any plans for a new display for the Megaron 2 Mosaic would do well to consider the museums and displays discussed above. It would be prudent to keep the Kayabaşı Mosaic in mind during this process. This would encourage uniformity across the two displays at the Gordion Museum and prevent the Roman mosaic from being completely forgotten.

As was the case with the discussion about the shelter, the Great Palace Mosaic seem to be the most complementary for comparison. Space limitations at the other museums were surely a factor in considering how best to view the mosaics on display. Because these mosaics are not supposed to be walked on, a vantage point from slightly above helps visitors see more of the mosaics. The multiple vantage points available for the Great Palace Mosaic certainly facilitate this. Though a slightly higher viewing platform might be advisable for the Megaron 2 Mosaic, the current subterranean display helps in this regard.

Additionally, the excellent signage, with both images and text, available around the
Great Palace Mosaic display should be used as an example for further work at Gordion. Because it was an Austrian conservation team, text was printed in columns in three different languages: German, Turkish, and English. The wordage is slightly scientific for non-conservators. Signs for each mosaic are available at the Gaziantep Museum, though the content could not be found for analysis for this report.

Some of the Zeugma Mosaics that were lifted from the site and are now on display with other objects with which they were found. These should serve as examples for the Megaron 2 Mosaic. Though this method is sure to come under criticism, it is an appropriate way to help visitors visualize the original configuration, it incorporates more artifacts into a single display, and has been used by many of the museums discussed here. Original photographs of the mosaics before lifting should be available in the museum for comparison. Together the images of the original site and the conserved artifacts in the museum give the most accurate and comprehensive description of the original context. Without one of these parts the risk of misunderstandings and wrong perceptions can be exponential for any of the objects on display, be it mosaics, wall paintings, or any other artifact.

The mosaics discussed above vary considerably in the treatment of reintegration and compensation of loss. The date which the conservation took place has a large effect on the final result and the more recent the work the more appropriate it is. The solutions employed for the Antioch Mosaics should be avoided when creating a plan for the Megaron 2 Mosaics. These mosaics serve as excellent examples of the importance of correctly choosing the color of the repair mortars. The careful attention to this with the conservation of
The Great Palace Mosaic is notable here. While the lacunae are numerous, the white mortar matches the color of the background and allows the eye to float across these areas to the interesting and colorful scenes that make the mosaic so beautiful.

Despite the varying and sometimes distracting colors of the repair mortars, only the Kayabaşı Mosaic attempted to fill in areas of loss with new tesserae. This approach is both accepted and considered controversial among conservators. Those who accept it believe in using similar tesserae to those of the original mosaic. This is carefully done so as not to confuse the line between original and new materials. Often intricate details are not conserved so as to avoid inaccurate fabrication. The result is visual unity, through the suggestion of the original pattern, without compromising the original work. Conservators, who compensated for lost tesserae while working on a Roman Floor mosaics for the Museum of Fine Arts in Boston, addressed this controversial issue:

While the curatorial and conservation team is committed to preserving the integrity of the original, the object also needs to meet the high aesthetic standards of the fine arts museum where it is presented to the public. Therefore, in this case, the mosaic requires a different level of aesthetic compensation from one that remains in an archaeological site or that is presented in an archaeological museum. It was felt that the large lacunae would distract the museum viewer, bringing the focus to accidents of time rather than to the work of art itself.15

The distinction about where the mosaic is displayed is important. Visitors to an archaeological museum would be grossly deceived if everything presented to them was spotless

and whole while viewing a fragmented object at a fine arts museum may suggest neglect. Because the Kayabaşi Mosaic is in an archaeological museum, the minor fills are often considered unnecessary.

When considering broken or fragmented objects, the conservation of that object should aim to present it in a way that the whole is suggested through the extant parts. This methodology is often used for mosaics, particularly because they often have very repetitious designs. Areas of lacunae around the boarders present fewer conservation issues simply because the patterns and designs are implied through what remains. While the new tesserae in Kayabaşi Mosaic are visible as being new, the repeated pattern in the extant parts was enough to carry the understanding of the mosaic.

None of conservation solutions for the mosaics discussed above made the egregious error of attempting to compensate for areas of loss of intricate, non-repeating detail. In all instances, areas of loss of details were simply filled in with mortar. This is the most appropriate course of action since it does not attempt to recreate what is not known. An example of this major faux pas can be found in the conservation of wall paintings from the Minoan palace of Knossos. The archaeologists conserved fragmented murals to depict particular scenes despite missing proof of its authenticity. However, further excavation yielded more fragments that provided evidence against the conserved depiction, suggesting that the scene was something altogether different.16

In terms of the mosaics discussed in this paper, large areas of loss were compensated

in several ways. The conservation of the Kayabaşı Mosaic left the large central figural scene empty and the tesserae that bordered the loss were edged with mortar. For the Zeugma and Antioch Mosaics, the losses were fill in with mortar. The Great Palace Mosaic approached the situation slightly differently. Large areas of loss within mosaicked areas were filled with white mortar and white stone chips were used to bridge the areas between sections of mosaics. These solutions rely on the extant mosaic parts to tell the story of the full mosaic—meaning that the visible details would indicate the level of detail that could be expected of the missing parts. Such is the case with the Wedding of Dionysus and Ariadne Mosaic or the Muses – Paideia, Arete and Sophia Mosaic, both from Zeugma, (Figure 6.9).

There are, of course, exceptions to filling loss with mortar. One in particular is the Metiochos and Parthenope Mosaic from Zeugma, mentioned above. The areas that were eventually filled were known to have been the result of looters. While this is still part of that object’s history, it is one that need not be highlighted. In this case, the continuity of the mosaic is greatly increased and the scar from its traumatic past is mitigated by the compensation. It is unclear if there were original images of the mosaic from before it was lifted, but had they been available, they would have further confirmed this solution and greatly assisted conservators during the reintegration process.

What becomes increasingly clear is that every mosaic poses its own distinct conservation challenges. However, after reviewing these mosaics, there are some general points that can be made about compensation of loss and reintegration. The degree of loss and the area in which the loss occurs are critically important to how the lacunae will be dealt
with. The repeated pattern in the extant tesserae provides information for what no longer exists and can facilitate understanding without intervention. Areas of detail should be carefully considered before compensations are undertaken. Sufficient and adequate information should be available to support the decision to proceed with such interventions. Conservation actions should be discreet: mortar colors should be carefully chosen and cut lines, (if lifting is necessary), should be blurred as much as possible.

6.5 Proposals for Short-Term Improvements to the Megaron 2 Mosaic Display

Just as steps will be taken to address the deterioration mechanisms causing the active conditions, so too should efforts be made to bring awareness back to the mosaic through education. A new display should be considered along side proposals and plans for a new shelter. However, there are measures that can be undertaken in the short term, while more comprehensive long-term plans are formulate. Possible solutions for both the long- and short-terms will be discussed below.

First and foremost, in order to bring attention back to the mosaic new and accurate information panels should be hung around the display area as soon as possible. Information should be displayed in two locations. A single information panel should first be put in the area right next to the northwest corner, where most visitors stop and look at the mosaic, but past which few venture, (Figure 6.10). The information available here should be simple and concise. It should clearly identify the mosaic, give its dates, provenience, and materials.

In order to encourage more people to move around the entire display area, more detailed signs should be hung on the museum wall that is on the south side of the mosaic
display, (Figure 6.11). These signs should be large enough for people to notice from the position of the first sign. Hanging them on the far side of the mosaic display will encourage circulation around the area and will also prevent a large group of people from congregating at the entrance to the display. More detailed information should be displayed here and may require four or five panels. These should include the following information: the mosaic’s discovery and location on the citadel mound, the process of lifting the “sampling” of mosaic from its original location, the panels’ tenure in the courtyard, and information about the conservation work that has and will take place, (such as the conditions survey).

The archival photographs and Jonathan Last’s watercolor painting should be used to illustrate what is mentioned in the text of these panels. It is particularly important to show images of the entire mosaic before it was lifted to reinforce how complete and beautiful it was when it was found. This will also help visitors more fully understand and visualize what they see in the museum. Comparisons photographs of the different panels, using photographs taken after they were lifted and backed and those taken for the 2010 conditions survey, may help visitors better interpret the panels as they are being conserved. In particular, this will help explain panels in multiple pieces or that have large amounts of over-grout that hides their designs. Additionally, these signs should be created in at least two languages: Turkish and English.

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17 Currently there are four photographs of carved stone animals hanging on the wall. There is no information about these artifacts and it is unclear if these carvings were actually found at Gordion, or if they are from another site. Since there is no information about them, and they are only photographs—not actual objects, removing them may not receive much resistance.
18 Increased circulation may also encourage more people to visit the other mosaic, the Gallic Tomb, and the new experimental garden that are located down a path beyond the Megaron 2 Mosaic.
6.6 Proposals for Long-Term Improvements to the Display

Longer-term fixes will require more drastic actions and should be carefully planned out and budgeted so as to be affordable and, most importantly, accomplishable. The following section proposes solutions for how to improve the display and interpretation of the Megaron 2 Mosaic. These solutions are proposed with the understanding that a permanent, enclosed shelter will be built, the active conditions eliminated, and each panel lifted, conserved, and reinstalled in a more accurate way.

Proposals for Improving the Display Area

The subterranean display is an acceptable way to display the mosaic in the future. Because the Megaron 2 Mosaic was originally located on the floor, there is no reason to consider moving it from this position. This is supported by the fact that there are no active conditions that result from the mosaic being below grade, such as salt efflorescence or accumulation of groundwater. Almost all of the mosaics discussed in this paper have areas elevated above the level of the mosaic that provide better vantage points for viewing. The current walkway around the mosaic already serves this function and could continue to do so. Maintaining the walkway and current subterranean display would also save on expenses since there would be no need to build that area up to ground level.

A fact that is overlooked completely in the current display is the significance of the building in which the mosaic was discovered. Despite being called out in the title of the

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19 This is especially important because there are strong opinions today about mounting floor mosaics on walls. This is considered to be unacceptable for many who think such a move places the mosaic out of context and can lead to confusion about original intent.
mosaic, few people are aware of the importance of Megaron 2. The mosaic is only one of many aspects, though it is the most interesting and noteworthy, that distinguishes it from other megarons on site, (See History and Context). Drawing attention to the surrounding architecture in a new display, such as was done for the Kayabaşı Mosaic, offers several benefits. First, it puts a recognizable boundary around the perimeter of the mosaic and places it in a more obvious context—inside a building. This may help to clear up confusion about what is on display. Second, one of the walls of Megaron 2 had graffiti carved into some of the stones, (these stones are referred to as “Doodle Stones”), some of which depicts a building with a pitched roof. Drawing attention to both the doodles and the stones will accomplish the following: reiterate that the mosaic was found inside a building, create a scene that will be similar to those seen in the archival images of the mosaic from the time of its discovery, illustrate an example of what a Phrygian building from the 9th century B.C.E. may have looked like, show off an interesting artifact found during excavations at Gordion, (so many of which are not on display or accessible to the public), and shed light on the history of graffiti as an age old fact of life.

An additional feature that should be incorporated into a new display is a replica of the central hearth. The central hearth is very prominent in all of the archival images of the mosaic and served a significant purpose in the use of the building during antiquity. Installation of a replica of the large hearth, which was positioned slightly off center, will act as a
point of reference and orient visitors to the location of each of the panels. It will also act as an additional indicator for the original function of the space.20

**Approaches to Reintegration and Compensation of Loss**

The Megaron 2 Mosaic will require different approaches to reintegration and compensation of loss than typical mosaics. This is mainly due to the fact that there are three separate issues, which result in a fragmented appearance that must be addressed when thinking about the appearance of the original mosaic versus what is currently on display. These include cavities, lacunae, and voids. As archival images suggest, the cavities are likely the result of ancient loss or damage. The original designs for these areas are unknown. The conditions survey puts forward the fact that the lacunae are the result of damage to the lifted panels prior to and since their installation in the museum. Archival images of the panels are incredibly useful in revealing what designs originally existed in these areas. Since only some of the original mosaic was lifted from the site, there are significant amounts of blank areas that do not contain any historic material throughout the display referred to as voids. Voids represent roughly a little less than half of the entire floor space. In thinking about how best to reintegrate the mosaic, it is clear that it is necessary to start from the small scale and work towards the large scale. This means first addressing the problems of the lacunae and cavities before moving on to those complications posed by the voids.

The Megaron 2 Mosaic is anything but systematic—the logic behind the organiza-

20 It is unclear exactly what happened to the original hearth. There is a strong chance that it is still in situ in Megaron 2.
tion of the designs remains an enigma. The selective lifting of sections of the mosaic and the erratic and random nature of the designs further complicates matters. As a result, the reintegration approach cannot rely on the extant material to help visually unify the mosaic and aid in its interpretation, as was the case with most of the mosaics reviewed above. Cleaning the over-grout off of the tops of the mosaic panels may reveal that there is actually more original material than there appears to be. This will also help determine what designs are extant. This should be the first step in the process of reintegration, regardless of the following steps. The archival images of the mosaic tell the most accurate and complete story. An additional preliminary step should be to have the images of the full mosaic from the time of its discovery professionally rectified, cleaned, and color corrected. The images of the panels shortly after they were lifted should also be rectified and cleaned up. These will then serve as an invaluable tool for future reintegration work.

Compensating for missing pebbles is essential to conservation efforts for the Megaron 2 Mosaic. The solution used for the Great Palace and Zeugma Mosaics—filling the lacunae with a similar color mortar—would be inappropriate. Filling the lacunae with mortar would compromise comprehension of the unique designs. More importantly, because only a portion of the original mosaic was lifted, filling in the lacunae with mortar would result in a larger area of blank space than mosaicked space. There is simply not enough original material present to use these approaches while maintaining the essence of the mosaic.

In-filling the lacunae with new tesserae would have positive results for several reasons. The original material will be safer if areas of loss are filled in—bringing up the surface
to a consistent height. New tesserae would provide lateral support to original pebbles that currently border lacunae and are not supported on all of their sides. Returning the panels to the state of conservation just after they were first lifted would eliminate the areas of lacunae and allow for more visual continuity across each panel. Improving each of the individual panels will help unify the entire display area. It will also increase the amount of the display area that is dedicated to showing the interesting artifact.

Careful attention should be paid to what material is used to fill the lacunae. In the past, conservators working on other mosaics have used loose tesserae to fill in areas of loss. Some of the original pebbles have come loose from the panels and have been collected, but there are enough to complete the repair. The source of the pebbles is thought to be close to the site, but collecting the pebbles could prove to be time consuming and tedious. There are suppliers that sell pebbles specifically for making mosaics and it might be possible to find one who has something similar to the original ones. New pebbles offer the benefit of being preselected by a distributor, whole and consistent, and clean.

Integrating new pebbles into the mix will likely raise eyebrows in the conservation world. There are several steps that can be taken to help mitigate ethical concerns. High-resolution photographs of each of the panels should be taken before any reintegration work begins. These should be approximately 1:1 scale and with a zoom capability of 200%. The light should be carefully monitored and controlled so that it is consistent across the display. This will provide detailed documentation that will help indicate where new material is added. Because it is often considered unethical to simply fill areas of loss without some indica-
tion of what has been added, new pebbles should be marked in some way that will indicate their age. Carving a small “x” into the top or side of the pebbles will differentiate new from original up close, but will not be noticeable from the distance of the visitors. Any new plan should also consider how to set the infill pebbles. Deciding whether to place them higher or lower than the original material will depend on what materials are chosen to be used.

Once individual panels are conserved, attention can turn towards trying to unify the panels across the entire floor. After looking at images of the mosaic, Roberto Nardi made several suggestions on how to proceed. First, he thought it was very important to remove a single panel from the display in order to do a trial run of the finalized conservation plan. Second, he suggested installing a replica of the hearth in its proper orientation. By using the rectified historic images, it would be possible to triangulate the exact location of each of the panels and suggested that if they were relatively close that they should remain where they are. Printing one of the rectified historic images at a 1:1 scale on semi-transparent polyester cloth would assist with this process. These could be printed in sheets and rolled out across the floor to help correctly locate each of the panels. If they are grossly out of place, then attempts should be made to move them. Once they were in their proper location, Nardi suggested taking a very careful look at exactly how far each panel was from the next. If there was only a small amount of space, he suggested “sinning” a little bit and filling the area with

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21 This is contingent on the fact that the mosaic will be enclosed in a shelter, and will not risk deterioration due to environmental cycling. A method to distinguish new pebbles appropriate to the conservation method should be devised during the planning process.

22 It should be noted that polyester cloth does not run the risk of shrinking, which is very critical to its use in repositioning the mosaic panels.
as few new pebbles as possible—ideally just a single or double width row—to try to stitch the two panels back together without recreating them. In areas where there was more substantial loss, he suggested using the lacunae to conservation’s advantage. Edging the borders and treating them as if they were within a panel so as to suggest small areas of loss will help connect the panels visually, but without inserting new material. This may not be possible everywhere, but could be very useful for areas where panels are close to each other but just far enough away to be considered separately.

One last area of concern is the northeast corner of the current display, where there are no mosaic panels. This area was damaged during antiquity, probably when the roof collapsed in the great fire that destroyed the site. This area takes up a large part of the display space; it is distracting and creates a feeling of incompleteness. There is no clear understanding of the designs from this area and reintegration of this area would be extremely difficult. Because there are very limited options for what to do with this space, a small viewing platform—at the level of the pavement—would be appropriate. Such an installation would have several benefits. It would fill the space so as to eliminate the largest and most distracting void. Next, it would provide a different vantage point for visitors to view the mosaic. By bringing visitors to the level of the pavement, it would encourage better understanding of its original function as a floor pavement. Additionally, it would encourage circulation around the site by encouraging visitors to enter into the display area and have a more intimate experience with the historic object.
7.0 Mosaic Conservation

7.1 Past Treatments

There is no recorded documentation outlining previous conservation efforts to the Megaron 2 Mosaic. However, the most obvious and notable was the work done by the Turkish conservator, Muzaffer Ertoren, when he lifted the mosaic. The rational behind the lifting remains unknown since there is no documentation at the Gordion Archive in Philadelphia, the dig house in Polatlı, or the Museum of Anatolian Civilization, in Ankara. What is known was deduced from analyzing archival photographs taken during the lifting process, (See Lifting Process).

The Gordion objects conservator, Jessie Johnson, remembered doing a little work on the mosaic a number of years ago, (when exactly, she couldn't remember). She recalled working with Stephen Koob on Panel 19 and that their work involved removing some of the over-grout from on top of the rosette, using scalpels to flick off the extraneous material.¹ However, Koob did not remember having ever worked on the mosaic, in an email exchange he wrote:

They did a horrible job lifting [the mosaic] with rectangular slabs of cement and then they did not position any of them properly. It is recessed below ground level, so you can walk around it and look down on it, but cannot walk on top of it. It is covered with a roof, but is otherwise open to the air and gets wet during heavy storms.

That’s about all I remember. I looked through all my reports and images, and I found no images, nor notes.²

¹ Johnson, Jessie, (Independent Conservator), in discussion with Author, (July, 2010).
² Koob, Stephen P. Email message to Author, June 11, 2010.
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Careful examination of the rosette area shows what appears to be ghosting from cementitious material. Unfortunately, there were also no notes or records in the conservation database at Gordion.

7.2 Preventative Conservation Conducted During the Summer of 2010

During the summer 2010 research season, initial steps were taken in the conservation process. Fortunately, because of its location in the museum and its apparent stability no emergency treatments had to be carried out. The mosaic was thoroughly cleaned in an effort to fully assess its conditions. This was the first time it was cleaned in at least the time since its installation in the museum. Certain measures were taken to prevent further deterioration over the winter. These included securing any loose pebbles or detached pebbles to their original location with a piece of “sticky-tack” putty and marking their position by putting a small colored sticker on the top of each pebble.  

3 A report from a visitor, who was at the site in February, noted that these stickers appeared to still be in place.

Conversations with the director of the Gordion Museum revealed that the staff is required by the authorities in Ankara to clean the display area on a daily basis. Upon arriving to the museum, it became clear that the staff swept both the areas around the mosaic and the tops of the panels. The level of care with which the mosaic was “cleaned” varied between the people
**Mosaic Conservation**

who did it—certain people were more cautious than others. While the cleaning took place and the survey was being conducted, the staff did not clean the tops of the pebbles. Upon completion of the summer research season, the director was shown the marked pebbles that were affixed to the bedding mortar with putty and asked to be the only one to preform the cleaning with a particular brush purchased for that specific purpose.

This solution was reached after learning that the staff uses a thin sheet of plastic to cover the Kayabaşı Mosaic during the winter months. This sheet is rolled out over it at night and then rolled up again during the day. This method was considered for the Megaron 2 Mosaic, but was rejected because of the amount of contact with the top of the mosaic this method would require.

No further work was done to treat or conserve the mosaic.

**7.3 Effects of a Poor Conservation Treatment on the Ability to Conserve the Mosaic**

The present state of conservation is due to the past intervention and the lack of sensitive conservation maintenance over the almost four decades since the mosaic was lifted from its original location. As noted in previous sections, there are significant ethical dilemmas associated with plans for any level of reintegration. There are additional concerns surrounding the current state of the pebbles that will help dictate the conservation of the mosaic. Because these issues only came to light recently, they are not discussed at length in this report. More in-depth sampling and testing of particular areas are necessary before a sound conservation plan can be established.
Further study should address the following issues. It must examine the effects of the high alkalinity of the concrete and cementitious over-grout on the pebbles, particularly noting the susceptibility of the pebbles to Alkali-Silica Reaction. Research should also determine the condition of the iron rebar used in all of the mosaic panels. While visual observation of these panels suggests that the rebar is stable, the actual state of the rebar on the interior of the panels should be verified. Factual confirmation of these questions, and other, will be critical to any subsequent conservation plans.4

7.4 Possible Effects of the Current Concrete Backing: Alkali-Silica Reaction

Thin sections of three pebbles: red, blue, and white in color, were prepared and examined to determine their geochemical composition. The red pebbles were identified as chert, the white as strained quartzite, and the blue of volcanic origin in a matrix of glass. This is of particular concern for the future of the mosaic since chert and strained quartzite are particularly susceptible to Alkali-Silica Reaction (ASR) a deleterious expansive reaction that occurs when reactive silica is in contact with alkali cement in the presence of water.

The ASR deterioration can be attributed, on the micro-structural level, to the formation of a hydrophilic gel from reactive silica in the aggregates (S₂⁺), alkalis in the cement klinker (namely K⁺ and Na⁺) and water in the concrete pore solution. Reactive silica is mainly provided by reactive aggregates, and alkalis by the cement klinker and other sources in the cementitious matrix. In the presence of water the gel swells, creating an increasing internal pressure in localized regions of the cementitious matrix that induce deformation, and can initiate micro- to macro-cracking, excessive expansion, misalignment of the structure, etc.5

4Nardi, Roberto. (Centro di Conservazione Archeologica, Rome), in discussion with Author, March 30, 2011).
Fortunately, the pebbles that were thin sectioned did not exhibit micro-cracking, a telltale indicator of the onset of ASR.\(^6\) However, this still poses great concern for the future of the mosaic and is a strong component to the argument that the mosaic should be put under a permanent shelter.

According to one source chert’s microstructure varies from, “fine-grained opaline silica, through cryptocrystalline silica and chalcedony, to microcrystalline quartz.”\(^7\) However, it is unclear how these different microstructures relate to ASR. Swamy notes that more research needs to take place before sound conclusions can be drawn.

Quartzite is also considered to be reactive with alkaline materials. Quartzite is listed alongside gneiss, schist, and metagraywacke as rock types that are, “slowly reactive and are known to have exhibited deleterious reactivity with high-alkali cements only after five or more years of service.”\(^8\)

Due to time constraints some critical information could not be gathered for this report. The exact classification of the blue, volcanic stone was not determined. This is important because it is in a matrix of glass, which may make it susceptible to ASR. Existing fissures in some of the volcanic pebbles that were brought back for research purposes did not appear to be the result of ASR.\(^9\) Determining their origin and composition should be a priority for future research. The alkalinity of the concrete will also be important to deter-

\(^6\) Walsh, John. (Testwell Laboratories), in discussion with Author, February 2011.


\(^9\) These cracks were thought to have originated when the mosaic was serving its time in the courtyard of the dig house. Because of their dark color, they might have experienced higher rates of thermal expansion and cracked because they were encased in a hard concrete.
mine, as this is a factor in the onset of the reaction.

7.5 Concerns Surrounding the Removal of the Current Concrete Backing

Discussions with conservators who have worked extensively with mosaics, suggest that future conservation work on the mosaic should try to maintain the current concrete backing. There are several reasons this has been recommended. First and most importantly, the removal of concrete from the backside of any mosaic can be an incredibly risky and highly damaging process. Next, it is extremely time consuming and costly. Lastly, it is a very difficult process that should be undertaken by skilled conservators, trained in the conservation of mosaics.

While this technique was performed on certain mosaics at Zeugma, Roberto Nardi commented that it was an incredibly stressful process that should not be approached lightly. He noted that he chose to keep the original concrete backing on some of the Zeugma Mosaics because of the complexity, amount of time, and cost replacement would entail. Additionally, conservator Kent Sever, expressed concern about the process. In an email, he asked, “Are you sure you want to go for re-backing? If the problems with the current backing aren’t huge, it might be worthwhile treating just those problems and learning to live with the cement.”

Most conservators consider the use of cement an irreversible treatment. Even if most of the concrete can be removed manually from the pebbles, which is risky, there is a chance that some residues will remain on the surfaces of the pebbles. Until further tests are

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Sever, Kent. Email message to Author, March 2, 2011.
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condenced, it is unclear how much cementitious material is necessary to trigger deterioration of the pebbles. After approximately 50 years, thin sections show that they appear unaffected, (Figures 7.1 – 7.6). Petrographer John Walsh cautioned that it could take as long as 60 years for visible signs to emerge.11 This raises more concerns across the board. If the bulk of the concrete can be removed, but the minimal amount is all that is necessary to elicit deterioration, than is it worth the risk to remove any of the concrete? If further tests prove that the pebbles are stable at present, the question remains: will there be a time in the future where the pebbles will start to be affected? Another major concern is for the unknown variables—the sufficient factors—that are or will enable the deterioration.

All of these points must be considered carefully during the planning process for the mosaic’s conservation. However, the decision to remove the concrete backing should largely rely on the results of the additional studies, outlined above. If the results of those tests prove that deterioration is occurring on a large enough scale because of either the concrete or iron rebar then more dramatic interventions should be proposed. What is clear is that full-scale removal of the current concrete backing should only be chosen if all other options can be ruled out.

The process used for the Zeugma Mosaics is the most recently reported method of removing concrete.12 The process starts by positioning the mosaic face down of a solid surface. The depth of the base of the pebbles and the level of the rebar in the concrete should then be

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11 Walsh, John. (Testwell Laboratories), in discussion with Author, February 2011.
12 The Roman City of Zeugma (Turkey) Conservation Project.” Last modified November 30, 2010. Http://www.youtube.com/watch?v=X86xDggjMs
determined. This will help to set the blade height for the saws so as to leave ample space between the embedded pebbles and the saw blade. A rotary saw, with the blade depth set appropriately, can be used to cut parallel lines into the concrete. Once that is complete, a second pass of cutting should cut perpendicular lines across the same area. This will leave small squares of concrete on the reverse side that can be chiseled off using hand tools. Additional tools to help remove the concrete should include: micro-vibrators, micro-sandblasters, and rotating micro-drills. In a lecture at the University of Pennsylvania’s Museum of Archaeology and Anthropology, Nardi again reiterated the destructiveness of such a process.

7.6 Published Methods for Re-backing

Recent efforts by many conservation organizations have aimed to reduce the number of mosaics lifted from sites and focus on in situ conservation. Re-backing is often considered a remedial treatment to the initial lifting process and not seen as a necessary topic on which to publish. The International Committee for the Conservation of Mosaics (ICCM) dedicated a large section of their second publication from 1978, *Mosaics 2*, to this problem.13 This publication is the only one found that compares and contrasts different methods and costs.14

The initial planning process is just as important as the actual implementation of treatments and before any old material is removed, a solid plan should be in place as to how to

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14 Because it is over 30 years old, it is not clear how accurate the data presented in this publication still is. It is highly likely that the cost of certain materials, such as aluminum honeycomb, has gotten less expensive.
Among other things, it is important to establish how and where the mosaic will be displayed, the materials available, and the environment in which the conservation work will be preformed. A report entitled, *A Modified Technique for the Lightweight Backing of Mosaics*, by S.M. Bradley, R.M Boff, and P.H.T Shorer, outlines the criteria for re-backing a mosaic.  

1. Appearance should not be adversely affected by remounting  
2. The mosaic should be capable of being mounted vertically as well as horizontally.  
   - Desirable because horizontally displayed mosaics become dirty very quickly  
   - Vertically oriented mosaics take up less space  
   - Can be viewed with greater ease  
3. Backing system should allow the mosaic to be divided into sections that are easily handled by a very few number of people (one or two)  
4. Should not involve the application of heat to the tesserae and should be easy to use and apply  
   - Do not want to cause heat shock to tesserae/pebbles  
   - Resins should cure moderately quickly at room temperature  
5. Mounting technique should be reversible  
   - Properties of resins may loose their initial physical properties (this could jeopardize the mosaic in the long term)

In general, these specifications are applicable for the Megaron 2 Mosaic at the Gordion Museum. There are a few points that differ slightly. Some objection may arise from the second criterion. There is very little risk that the Gordion Mosaic will be hung vertically in the future since it already occupies a large footprint in the museum and it is quite large in both length and width. Sentiments in the conservation world tend to favor maintaining the

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orientation of the original context for mosaics; this is so that people do not confuse floor mosaics as being wall mosaics.\textsuperscript{16}

An additional point should be added to the specifications outlined in the fourth criterion. Resins that cannot or do not cure in hot temperatures should not be considered. This is because there is a high likelihood that conservation work done on the mosaic will take place at the museum during the summer, where there is no temperature control or air conditioning and it can get quite hot in direct sunlight. It is also important to consider the service lives of any proposed materials. As well as possible effects aging may have, such as discoloration. While the hope is that the mosaic will be put under an enclosed shelter, the fluctuations in temperatures between summer and winter and may put additional strains on certain materials. Because conservation efforts are more difficult to undertake in Turkey and because funding can often be limited, any interventions should plan to use materials that have long service lives.

Concerning materials for re-backing, in almost all of the recent reports on the conservation of mosaics, either lifted or in situ, there is a strong undercurrent that the use of cement in treatments is highly inappropriate. One particular report entitled, \textit{Roman Mosaic Conservation: The Role of Portland Cement}, investigated a mosaic that had such a treatment. The author described the process, which entailed an application of a 4 – 5 cm coat of cement to the back of a mosaic, and concluded with the following thoughts.

\textsuperscript{16} Of particular concern for many museums is the amount of space consumed by placing mosaics on the floor. While perhaps not the most ideal situation, this often leads to having to hang mosaics on the walls.
Today we recognize the consequences of this treatment, as its irreversibility and its incompatibility with other materials, which resulted in deterioration. By studying and understanding old treatments a more reliable and correct approach to all the problems can be developed in the future.17

Mosaics 2 notes, “Movable Slab of Cement Concrete in Direct Contact with the Tesserae” as a method that had been used in the past to back mosaics. However, the author makes it very clear that this method is out of date and inappropriate and lists numerous disadvantages, including: Almost irreversible, Very serious damage in case of accidents, and great difficulty in reworking previous restorations, (Figure 7.7).18 The section concludes with, ‘Observations:’ “For all the reasons described, concrete should never come in direct contact with the tesserae. This method should, therefore, never be used.”19

There are a handful of reports that have published on techniques used for re-backing mosaics. The methodology differs for several reasons: the level of urgency, the ability or inability to get specific materials, the location—in a museum versus out in the field, and the plans for the mosaic’s final display or storage. The methods described below were selected as case studies because of their relevancy for Gordion’s Megaron 2 Mosaic. All of these methods follow adequate documentation of the extant mosaic and materials previously used for conservation.

From: A Modified Technique for the Lightweight Backing of Mosaics20

19 Ibid.
The mosaic discussed in this paper was treated and is on display at the British Museum. It was originally in four separate parts with a traditional plaster backing. The process was implemented quickly because the materials were widely available and the process easy to perform. The non-traditional use of epoxy/vermiculite as a backing was tested for reversibility, but in no instance was the resin completely soluble.

1. The front of the cleaned mosaic was “faced-up” with two layers of cotton scrim and polyvinyl acetate emulsion (Williams No. 3967)

2. The mosaic was turned onto its face, the old backing was removed, and then the backs of the tesserae were coated with PVA emulsion and a think layer of superfine casting plaster incorporating at least one layer of hessian scrim

3. After the plaster hardened, the plaster was coated with a 10 mm layer of Araldite MY753/HY956 containing 22% by weight of vermiculite

4. Two sheets of galvanized steel weld mesh (BRC5516) were incorporated into the two subsequent layers of resin/vermiculite. Two and a half hours elapsed between the applications of each layer. These two layers were misaligned in the horizontal plane by 45°.

5. The depth of the resin/vermiculite backing was checked to ensure sufficient space, approximately 30mm.

6. The bolts used to support the mosaic were embedded in the resin/vermiculite layer prior to curing, and were positioned so that they passed through both layers of weld mesh so as to act as a load spreader in addition to a stiffening material. The exact locations for the bolts were determined by reference to a square grid drawn up from a datum line used for the entire mosaic. U-section aluminum alloy channel (50mm x 50mm) was drilled to accept the bolts, so that the channels are oriented vertically when the mosaic is in the vertical position. The span can be reduced to increase support as necessary.

From: The Conservation of the Orpheus Mosaic at Paphos, Cyprus

21 Getty Conservation Institute, and Cyprus. 1991. The Conservation of the Orpheus Mosaic at Paphos, Cy-
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This method was implemented by the Getty Conservation Institute to conserve the beautiful Orpheus Mosaic in the early 1990s. This mosaic, which is currently on display in an open shelter, was conserved in one large piece that is very difficult to move.

1. The mosaic was lifted using the rolling process. Once it was completely lifted, the original backing was removed so as to give a better preparatory layer for the new backing. This was done using the following tools: wood chisels of various sizes, small saws, rasps, stainless steel brushes, natural and synthetic hard-fiber brushes, and scalpels. Manual tools were, which allowed greater control over the depth of the work to avoid damaging the underside of the tesserae, were therefore preferred.

2. Once the thicker pieces of mortar were removed, work continued using more precise tools, including: fine stainless steel awls, dental drills with microfraises (rotating cutters), and vibrating cutters with the tip modified to a chisel shape. The residues from the cleaning process were vacuumed up and a biocide was applied by brush to the back of the mosaic. It was covered during the winter to protect from the elements, vandalism, and theft.

3. The following summer, the winter protection was cleared and the mosaic was cleaned. All friable tesserae were consolidated using Paraloid B72 dissolved in toluene, (between 3% and 10%). Lacunae were filled using mosaic material recovered on site. Compensation for larger areas was accomplished using a thin white mortar, (slaked lime, marble powder, and a small quantity of white cement to give the mortar a greater coherence.

4. A mortar consisting of five parts white cement, two parts marble powder, one part brick dust, one part aerated pozzolana, and one part Lafarge hydraulic lime was applied to the back of the mosaic. The mortar was wetted continuously for one week.

5. New panels were made of Aerolam lightweight “F”-boards manufactured and supplied by Ciba-Geigy (UK). Each board was 2.44 m x 1.22 m and approximately 5 cm thick. They are ready-made bonded honeycomb sandwich panels.

22 Because work had to stop for the winter months, a temporary shelter was built to protect the mosaic. The mosaic was put face down on a concrete platform and edged with wood. A nylon net was laid over top of it. Next, a thick layer of inert, expanding clay was added, followed by another nylon net. A layer of local gravel was put on top of the second net. Lastly, a grid of tubular scaffolding was laid on top to discourage theft.
consisting of a core of Aeroweb aluminum honeycomb between plastic skins reinforced with woven glass fiber.

6. The panels were laid out first to ensure the edges of each panel lined up appropriately. Epoxy resin was then mixed in a ration of five parts resin to one part hardener. Marble powder, in the ratio of one part powder to two parts epoxy resin, was mixed in. This mix was then added to the back of the mosaic. The fiberglass sheets were laid in place and coated with the same resin mix.

7. After both surface had cured, they roughened with a mechanical grinder. The panels were laid on top of the mosaic. Each was systematically lifted and more epoxy applied, then the panels were replaced.

8. The final step involved affixing aluminum reinforcement to the backside of the support with epoxy, applying L-shaped aluminum sections to the edges of the mosaic for support, and flipping the mosaic over once the epoxy had cured. The final weight of the mosaic and support was about 1000 kg, and so a crane was required in order to flip it over.

From: The Great Palace Mosaic (İstanbul Büyük Saray Mozayiği)\textsuperscript{23}

Though the mosaic was quite large when found, the conservators created a number of smaller panels for both ease of treatment and for future maintenance and management. The mosaic was cleaned with the JOS process—a micro-abrasive process.

1. The conservators determined that the mosaic needed to be lifted from its original bedding mortar. The tessellatum was glued to a transparent and elastic material and divided into segments, either along image borders or across gaps, of 0.5 to 1 square meters. The panels were detached from the old mortar bed with flat bars and placed upside down on flat panels.

2. The original mortar was removed and a layer of intervention mortar was applied. Segments were stabilized and joined by a lining in the form of a light-

weight sandwich structure, (honeycombed aluminum laminate panels). The panels were then turned right side up again and the lining removed.

3. The mosaic surface was then cleaned using the JOS process: A rotating whirl jet made up of air, water and dolomitic rock flour with an application pressure of less than 1 bar. It does not affect the substance, is fully controllable, and removes the crust of dirt with utmost gentleness. In addition, chemical methods were used for specific dirt spots, and mechanical tools such as surgical knives and pneumatic micro-chisels were required to extract cement mortar fillings.

From: “The Roman City of Zeugma (Turkey) Conservation Project”24

This project took place in southeast Turkey and demonstrates that highly skilled work can be done in areas where materials are difficult to acquire. While time consuming, this method is the most recent published and has received wide acclaim.

1. The mosaic was turned on its face, the concrete was removed, and the backsides of the tesserae were cleaned using micro drills and other similar equipment.

2. A thick layer of clay was applied to the cleaned backside and the mosaic was flipped. This allowed conservators to repair any damage. Original tesserae that were found with the mosaic were used for repairs. Additionally, what wasn’t available was produced using local stone.

3. The mosaic was re-lifted, as if for the first time, using natural glue and cotton. Post lifting, the cloth was cut with meandering lines so as to try and blur the cuts once the individual parts are reassembled.

4. The backing material used is aluminum honeycomb panels. These were laid out across an area that was the size of the original mosaic. The edges of the new parts were traced and then the aluminum honeycomb was cut to the size of each of the parts.

5. A volcanic grit was laid down first on the panels. A liquidy lime-based mor-

tar—following the formula determined for the original mortar composition—was applied to the top of the grit. Then a more firm lime-based mortar was added. The mosaic, with a very thin coat of the liquidy mortar on its backside, was slid into place on its new support.

6. Hot vapor was used to help remove the glue and cloth from the front side. A paper poultice was also applied to help lift dirt and other incrustations. And additional repairs were performed.

7. The newly back panels were left for several months to allow the mortars to set. Each piece was small enough and light enough so that it could be moved by a very few number of people (two or three).

8. The final step of the project was to take rectified images of each of the mosaic parts. These were then stitched together to form a digital montage of the mosaic.

7.7 Recourse for the Megaron 2 Mosaic

The methods described above serve as excellent models for how re-backing should be conducted. However, none of these plans are entirely appropriate because of the very different nature of the state of preservation and the types of materials present in the Megaron 2 Mosaic. The following is a discussion of different aspects of those methods and how they may affect the mosaic.

**Cleaning**

The risk of ASR developing within the transferred mosaic panels is high. This means that any cleaning plan should attempt to use little to no water. As with the Zeugma Mosaics, the Orpheus Mosaic, and the Great Place Mosaic, cleaning with micro-chisels, micro-vibrators, and scalpels will be necessary to begin removing the concrete and areas of stubborn over-grout. However, other procedures will be necessary to remove the concrete film, dirt,
and other accretions. These processes should be tested on small areas first so as to determine their effectiveness and safety to the mosaic.

There are several cleaning techniques that are available that could prove effective for the mosaic. The first is the system used as part of the cleaning process for the Great Palace Mosaic—the JOS/Quintek Microabrasive System. This system was described in a paper that discussed the benefits of microabrasive cleaning.

The JOS/Quintek System uses a low-pressure blasting apparatus that combines different types of fine, nonreactive microabrasive media with a minimal amount of water in what the manufacturer refers to as a swirling “vortex” motion. Compressed air forces fine media through hoses into a nozzle, where it is combined with water into a stream before being applied to a selected surface.25

The fact that it uses water might seem alarming at first, but the amount is very minimal and for a one time cleaning procedure should probably have very little effect. This system also can be performed without water, as was the case with the conservation of the Ayyubid City Wall in Cairo, Egypt. This method is suitable for use on a variety of materials, including stone, however the exact pressure and micro-abrasive should be carefully tested before this method is implemented. High pressures can cause some erosion of stone material and could force water into the pores of the cement.26

A second process, called Sponge-Jet System, has been adapted from industrial cleaning methods and has proved success for masonry cleaning on a range of scales: from very

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delicate to aggressive. This process is described as follows:

The pliant nature of Sponge Media abrasives allow its particles to flatten on impact, exposing the abrasive. After leaving the surface, the media expands, creating a vacuum—entrapping most of what would normally have become airborne contaminants.27

While there has not been much information published on the use of this product in conservation, it is low cost, recyclable, environmentally friendly, and does not require water. However, in a mockup that compared this method with the one described above, the JOS/Quintek System was considered to give better results.28

In either case, it will be important to determine what the surface of the soiled pebbles looks like. The shape, size, and density of the soiling will help determine the best abrasive for the task. According to the book *Practical Building Conservation*, by John and Nicola Ashurst, there are certain factors that should be considered when using compressed air abrasive cleaning systems, such as those lifted above.

The significant factors relating to compressed air abrasive cleaning are air pressure, nozzle size and type, type of abrasive, amount of flow of abrasive, skill of the operative, and supervision of the work.29

Consideration must also be paid to the nature of the soiling. This will help to determine what abrasives are the most appropriate for the task. Hard and brittle soiling is best removed with round abrasives, such as shot, glass beads, or some kinds of sands. For soft and

resilient soiling, angular abrasives—like grits, quartz sand, or flit grit—work better. Dolomite and olivine as abrasives are considered to be safe.\textsuperscript{30} The abrasive chosen should be less hard than the pebbles to reduce damaging them during the cleaning process.

There are other factors that must be planned and considered if one of these cleaning processes is chosen. These include how dust and water will be managed during the process and the availability of qualified operators and the protective gear that they require. One last consideration is for the museum—will the cleaning process put limitations on the use of the mosaic area due to the needs of the process or the amount of noise and dust?

**Embedment Layer**

All of the re-backing methods described above have been applied to mosaics made of glass, ceramic, or stone tesserae. In all instances, the original bedding material was lime-based mortar and so was a clear choice for conservators implementing treatments. This is not the case for the Gordion Mosaic, which was found in a bed of clay. In considering the conservation of the mosaic, the largest concern is for the safety of the pebbles. The high reactivity of the chert and quartzite means that the use of mortars and cements, which can cause ASR, is not advisable for the conservation of the mosaic. Not only would the use of these materials put the pebble's physical nature at risk, it would also jeopardize the integrity of the entire mosaic since the loss of even a few pebbles compromises its understanding and value. Research into suitable alternatives needs to take place before conservation can begin.

\textsuperscript{30} Ibid.
Size and Weight

The Mosaic at the British Museum, the Great Palace Mosaic, and the Zeugma Mosaics were all divided into smaller sections during their conservation treatments. There are considerable advantages to this system. Dividing a mosaic into a number of individual panels reduces risk of damaging the mosaic because it reduces the number of people required to move it and makes it more maneuverable. If one panel is damaged, it is confined to a single panel and is more easily treatable. If the mosaic is transported or put in storage, less space is needed since the panels can be carefully stacked on each other and requires less area. A critical factor to the smaller panels is the use of a lightweight, strong, durable support. Many projects, including all of the ones discussed above, have turned to aluminum honeycomb panels for this task, (See Aluminum Honeycomb Supports).

As one of the most unique objects in the Gordion Museum’s collection, the Megaron 2 Mosaic will likely always have a display space in the museum. Yet, the ease of maneuverability is still important. For better or worse, the mosaic is already divided into panels. However, shortly after they were lifted off of the site, the archaeologist Rodney Young described them as being incredibly heavy and cumbersome to move. If the decision is made to remove the current concrete backing, a priority should be to reduce the weight of the panels to something that is more manageable. However, further division of the panels is not advisable.

Aluminum Honeycomb Supports

In recent years, the use of aluminum honeycomb as a support has become very popular with conservators. It has been widely used to re-back mosaics, but it has also found its
way into fine arts conservation. Conservators Marion F. Mecklenburg and Judith E. Webster wrote an article entitled, *Aluminum Honeycomb Supports: Their Fabrication and Use in Painting Conservation*, which lists a number of reasons why this material is becoming so prevalent.

A material impervious to moisture variation, yet stable enough through a controlled range of temperature variation, is essential. Aluminum fulfills these requirements and, unlike natural materials, has known uniform physical properties, which permit the analytic determination of structures. An all-aluminum structure has performance characteristics that can be predicted.\(^3\)

In addition, the panels have a long service life and are lightweight, durable, resistant to deformation, chemically stable, and can be cut to the necessary size. It is no surprise that the general attitude now favors the use of this material as a new support for lifted mosaics. And, thanks to the efforts at Zeugma, it is now available in Turkey.

There are a large variety of honeycomb supports available on the market today and are used for many different functions. The company Hexcel offers over 700 different materials and are available around the world. Their product guide, *HexWeb™ Honeycomb Attributes and Properties: A Comprehensive Guide to Standard Hexcel Honeycomb Materials, Configurations, and Mechanical Properties*, was consulted for information about honeycomb supports.\(^3\) Options for honeycomb are divided into the following groups.

- Material (fiberglass fabric reinforced honeycomb, Aluminum Commercial Grade honeycomb, etc.)


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- Cell configuration (hexagonal, OX-Core, Flex-Core, etc.)
- Cell size (Cell sizes range from 1/16” to 1”, with 1/8”, 3/16”, 1/4”, and 3/8” being the most common.)
- Alloy and foil gauge (aluminum honeycomb only)
- Density (Honeycomb densities range from 1.0 lb/ft³ to 55 lb/ft.)

Some benefits of the aluminum honeycomb are that it is: relatively low cost, has the greatest strength to weight, the thinnest cell walls, and smooth cell walls. Fiberglass honeycomb has the multidimensional strength of a woven structure and has insulating properties. In tests, the Aluminum Honeycomb received ratings of excellent for flammability resistance and moisture resistance, and good for impact resistance, fatigue strength, and corrosion resistance. The fiberglass received ratings of excellent for flammability resistance, moisture resistance, and corrosion resistance. It received rankings of good for fatigue strength, but only fair for impact resistance.33

Before a specific support material can be specified for use in re-backing the Megaaron 2 Mosaic, certain information must first be gathered. This should include the approximate dimensions of each of the mosaic panels and a close approximate of the weight of each of the panels. Any adhesives or resins that might be applied to the surface of the material should be noted. The environment—whether the material will be inside or outside—and the material on which the panels will rest are also important to consider.

7.8 Final Thoughts on Conservation

33 Both the Aluminum and Fiberglass were tested and ranked by Hexcel.
It is virtually impossible to determine the correct course of action without the mosaic underfoot. The nuances and particulars of hands-on work will guide the planning process in ways that researching past treatments and re-backing methods cannot. Therefore, this report should be used as a guide for how to begin testing and creating mockups that will provide empirical data on the best course of action for future conservation work.
8.0 Conclusion: Phased Conservation program

A phased program is proposed to direct the conservation, display and interpretation of the Gordion Mosaic over the next several years. It should be seen as preliminary and contingent on future research, funding, and time. It is an essential part of the project in that the final goal is a more complete historic narrative, the reintegration of the mosaic panels, and a new, enclosed shelter.

8.1 Summary of Work to be Accomplished

Year 1:

Summer Field Season:

- High quality scan and rectification of archival images from the archive
- Print rectified archival images at 1:1 scale on semi-transparent polyester cloth (non-shrinkable)
- Hang information boards
- Lift one panel for investigative and testing purposes
- Design and begin testing cleaning procedures
- Additional high-resolution photographs of the entire floor
- Install data collectors to monitor temperature, humidity, and dew point in and around the mosaic display
- Determine locally available materials
- Determine source of pebbles
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- Begin planning with the Gordion team for a new, fully enclosed shelter

Academic Year:

- Further investigate ASR as it relates to the pebbles from the mosaic
- Determine if removing the current concrete backing is absolutely necessary
- Find and test materials that are compatible with the pebbles and can serve as a new backing
- Create mockups of potential re-backing methods using materials available in Turkey

Year 2:

Summer Field Season:

- Finish cleaning the surfaces of the mosaic
- Finish full documentation of each of the panels
- Determine the correct location of the original hearth and install a replica
- Use the new hearth and 1:1 scaled, semi-transparent polyester cloth map to determine how far off each of the panels is from its original location
- Use the panel that was lifted during the previous summer’s work to test any new backing strategies
- Begin drawing new plans for a fully enclosed shelter

Academic Year:

- Continue working on drawing for a new fully enclosed shelter
- Analyze the information collected on the data collectors from the past year and use the findings to help aid the design

Years 3 & 4:
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- Lift the mosaic panels from the current display
- Finalize and being construction on a new enclosure
- Conserve and reintegrate areas of loss on the mosaic panels
- Reinstall panels in their new display once construction is complete
- Publish the new methodology

8.2 Detailed Description of Work to be Accomplished

Year 1:

There is a considerable amount of work to do during the 2011 summer field season and following academic year. First, and before work in the field commences, higher quality scans should be made of the archival images of the mosaic from the time of its discovery. A professional should be hired to clean and properly rectify these. These will provide very accurate information for future work on the mosaic—from moving panels to compensating lacunae, cavities, and voids. These images should then be printed at full scale on semi-transparent polyester cloth, which can act as a map for the original locations of the panels now on display in the museum.¹

The first task upon arriving in Turkey will be to hang information panels. These will provide information to the tourists visiting the site about the history of the mosaic, its current condition, and the work that is being planned to improve the situation. They are the

¹ In an in depth conversation with the author, Roberto Nardi strongly recommended that more attention be paid to the archival images. He was adamant that money should be spent to get them cleaned and rectified by trained professionals because they will prove to be the most accurate record of the mosaic from the time of its discovery and will be invaluable for future conservation work.
first step to improving the current situation because they will begin to bring attention and interest back to this important mosaic.

Next, one panel should be lifted for investigative and testing purposes. First, the rebar should be tested to ensure that it is not actively corroding. If it is more than 40-50% corroded, it should be removed. This is a highly destructive process and should be done carefully. Examination of pebbles covered with over-grout and concrete for symptoms of ASR should take place at this time as well. These include dark reaction rims, the presence of gels, and micro fissures and cracking, (some of these may not be visible to the naked eye and might require thin sectioning more pebbles). A good candidate for this may be Panels 31 or 33. These are not located immediately next to other panels, have significant amounts of over-grout and concrete, (their designs are not immediately visible), and are on the far side of the display from the entrance, (See Appendix A: Photographic Montage).

This panel should then be used to begin testing possible cleaning regimes. This will include manual removal of over-grout and concrete first using scalpels and other small hand tools. For more difficult areas to clean rotating micro-drills, micro-vibrators, and other such tools may be necessary. Though these will require extreme care because of their very destructive nature. Vacuums and compressed air should be available to suck up any debris that is loosened since water cannot be used to clean the panels. Actual cleaning of the surfaces of the pebbles should take place once the larger areas of extraneous material are removed. Different systems should be tested to determine what will produce the best results and be the least damaging.
Once the cleaning is finished, high-resolution images should be taken of the entire floor to more adequately document the current condition of the mosaic.\(^2\) Images should be taken at a 1:1 scale and should be clear at 200% zoom. While individual pebbles are visible in the montage that was created during the 2010 season, it does not allow for such a high zoom capability. New images showing the mosaic with a clean surface will help reintegration and compensation planning. These images will become the records of the current state of the mosaic and will be available as references for what was done after conservation takes place.

So as to ensure adequate information is available, data collectors should be installed in several locations around the mosaic display. The data collected will be very informative to the design of the new enclosure by indicating micro-climates and conditions of the current setting throughout the year. Beginning monitoring early will provide more information for the architects when the time comes to begin making design proposals. Monitors should collect temperature, humidity, and dew point and should run for at least a year. There should be approximately six monitors, the placement of which should be discrete so as not to be disturbed. Two should be placed within the mosaic basin—one on the eastern wall and one on the western wall. These can be compared to see how the open side of the display compares to the more shielded side. Two should be placed on metal roof post, about five feet off of the ground. These will monitor the environment that visitors experience while they visit the mosaic. Lastly, several monitors should be placed along the underside of the roof. These will record how hot the roof gets during the days and will help inform air

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\(^2\) Cleaning the surfaces will probably take longer than one summer field season. In which case, high-resolution documentation will be required during the second year as well.
circulation for any new designs.

Because of all of the recent conservation projects in Turkey, a large range of products have become available. Time should be spent finding and pricing different options for materials and obtaining samples for testing. This should include scoping out what is available in both Polatlı and Ankara. Locating the geologic source of the pebbles should also be a priority. However, because of the uncertainty of what will be found and how long it may take to collect pebbles, a new source of commercially available pebbles should be established. Samples of both pebbles and other materials should be returned to the University of Pennsylvania to be tested during the following academic year. Mosaics are a popular way of decorating new construction throughout Turkey, so it is possible that there may be mosaic specialists in Ankara who can supply pebbles similar to those used in the original mosaic. Alternatively, if the source is found and the pebbles are obvious, gathering pebbles from the original site may be a way to involve people from the village in the conservation project. It would serve as an excellent opportunity to educate them about its importance at the same time.

The summer field season is a time when the majority of the Gordion research community is present on site. This opportunity should be taken to begin discussing the need for a new enclosed shelter. Funding options, governmental restrictions and permissions, and design requirements should all be discussed. Gordion’s government representative should be included in these discussions, as should friends of the site who work in the Museum of Anatolian Civilization so as to make the process as seamless as possible.

Unfortunately, the realization that ASR is a serious potential threat was only recent-
ly identified and there was not enough time to fully investigate other options for securing the pebbles. This should be a high priority for future research and the work that should be accomplished during the following school year should include the following. It should focus on ASR as it relates to chert and quartzite. The petrography of volcanic pebble should be researched further to determine its exact composition and susceptibility to ASR. Research should determine how much concrete must be present on the pebbles to initiate a reaction and if some residual residues are permissible or if it must all be cleaned off. Examination of pebbles without much concrete seemed to indicate that they were in good condition, but examination of pebbles with more concrete should be conducted to determine if this is the exception to the rule. Answering these questions will help indicate whether the removal of current concrete backing is necessary.

If the decision is made to remove the concrete, research must also look into the compatibility of any new material with the pebbles. Any new materials should, at minimum, exhibit similar qualities to those of lime-based mortars and should be: softer than the pebbles, re-treatable, and able to be pigmented, (so as to simulate the original bedding material). This research can be supplemented by creating mockups of potential backing systems.

**Year 2:**

The information gathered over the previous academic year will help guide the work for the 2012 summer field season. Finishing cleaning the surfaces of the mosaic should be the top priority. This should start where work ended the previous year, following or improving upon the methodology already implemented. Like before, detailed documentation
Mosaic Conservation

should occur as each panel is fully cleaned.

A replica of the hearth should be created based on archival images and notes from Rodney Young’s records. This should be placed in its proper location in the middle of the display. Once that is properly located, the rectified archival image—printed on a 1:1 scale on semi-transparent polyester cloth—should be overlaid on top of the current panel configuration to determine how far off each panel is from its exact location.

If it is decided that the pebbles are at risk from ASR because of the old backing then the new backing methodology, devised over the course of the academic years, can be implemented using the panel that was lifted for investigation and testing during the previous summer. All new materials necessary should be acquired before work commences. Because removal of the concrete is an extremely risky task, a trained and experienced mosaic conservator should approve the methodology. Ideally, the same person should be present on site to oversee and help implement the new backing system.

Finally, an architect should be hired to begin designing a new shelter. This person or firm should be familiar with the theories and practices of archaeology and conservation and the needs and design implications associated with both fields. Again, as many of the stakeholders as possible should be present at these meetings so that plans can move forward as smoothly as possible, without conflicting interests slowing the process down. This work will need to continue into the academic year. At this time the data from the monitors should be collected and analyzed as it could provide insight or have implications on the design.
Years 3 & 4:

Further work on the mosaic will be contingent on the planning process for the new enclosed shelter. Ideally, the conservation of the panels will coincide with the construction of the new shelter. All of the panels should be lifted from the current display only as construction starts. There are two reasons why lifting them too far beforehand is not ideal. First, the panels could risk a similar fate as their during their first removal. Second, if work is done simultaneously, then the mosaic is only removed from its display for as long as construction takes, which—as a significant artifact to the history of Gordion—is important to both the mosaic and the museum. A temporary work/storage space should be set up to facilitate the conservation efforts. If the decision had been made to leave the concrete backing then this time could be used to compensate for the lacunae. Otherwise, it can be used to re-back the panels.

The panels should be reinstalled when the bulk of the construction of the new enclosed shelter is complete. It should be a top priority to return the mosaic panels to their display as soon as possible. This is contingent on the stability of the panels. In creating a conservation plan, it may be appropriate to designate which stages can be done publicly, and which cannot. This will bring visitor interest to the mosaic, but it will also ensure that the mosaic will not be forgotten again.

Once the final pebbles are reintegrated and a new, enclosed shelter is constructed it is essential that the process be written up and submitted for publication. The complex project will address many of the issues facing conservators working on mosaic around the
world—from open versus enclosed shelters, alternative embedment solutions, compensa-
tion and reintegration of loss, and displaying within context. Not only will it appeal to con-
servators, but it should also be informative for both archaeologist and architects—for man-
aging and designing solutions for cultural heritage off of historic sites. For these reasons, it
will be important to share this project with the academic and professional communities.
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9.0 Figures
Figure 2.1: Aerial view of the Gordion Höyük, (2010).
(Digital Gordion – http://sites.museum.upenn.edu/gordion/history.)

Figure 2.2: Image of Jonathan Last drawing the mosaic, (1963).
(Gordion Archive, University of Pennsylvania Museum)
Figures – Lifting Process

Figure 3.1: Workmen clear the temporary dirt cover from the top of the mosaic, (1963). (Gordion Archive, University of Pennsylvania Museum)

Figure 3.2: Workmen clear the temporary dirt cover from the top of the mosaic, (1963). (Gordion Archive, University of Pennsylvania Museum)
Figure 3.3: Conservators brush glue onto the tops of the mosaic before laying the muslin down, (1963).
(Gordion Archive, University of Pennsylvania Museum)

Figure 3.4: Conservators use crowbars to begin prying up the pebbles, (1963).
(Gordion Archive, University of Pennsylvania Museum)
Figure 3.5: Conservators and workmen during the lifting process, (1963).  
(Gordion Archive, University of Pennsylvania Museum)

Figure 3.6: Loose pebbles are visible in the clay as conservators lift the mosaic, (1963).  
(Gordion Archive, University of Pennsylvania Museum)
Figure 3.7: The workmen in the rear moves the pallet closer to the lifted pebbles so that they can be laid flat and made stable before backing, (1963). (Gordion Archive, University of Pennsylvania Museum)

Figure 3.8: The impression of the wooden boards and muslin is visible in the concrete, which is flush with the tops of the pebbles, possibly indicating an area of ancient loss. (E. Tiffin Thompson)
Figure 3.9: The grid of rebar visible due to the deterioration of the concrete.
(E. Tiffin Thompson)
Figures 3.10 & 3.11: These images compare Panel 29. The top image is from shortly after it was lifted. The bottom is the same panel in its current condition.
(Gordion Archive, University of Pennsylvania Museum; E. Tiffin Thompson)
Figures 4.1 & 4.2: These images compare Panel 12. The top image is from shortly after it was lifted. The bottom shows the level of deterioration that has occurred since it was backed.

(Gordion Archive, University of Pennsylvania Museum; E. Tiffin Thompson)
Figure 5.1: The supports and Warren trusses of the current shelter.
(E. Tiffin Thompson)
Figure 5.2: Light shines through the holes in the roof over the mosaic.
(E. Tiffin Thompson)

Figure 5.3: Holes in the roof allow light to shine onto the mosaic.
(E. Tiffin Thompson)
Figure 5.4: Glass panels bridge the gap between the roof of the mosaic and the main museum building.
(E. Tiffin Thompson)
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(E. Tiffin Thompson)
Figure 5.6: A view of the shelter over the Terrace Houses at Ephesus.
(E. Tiffin Thompson)

Figure 5.7: A view from the floor above of the Great Palace Mosaic.
(E. Tiffin Thompson)
Figure 5.8: The Hexashelter being constructed over the Orpheus Mosaic, (foreground).

Figure 5.9: The shelter over the Monumental Mud Brick Structure (MMS) at Sardis.
(E. Tiffin Thompson)
Figure 5.10: The semi-transparent polycarbonate roof evenly disperses the light throughout the covered space.

(E. Tiffin Thompson)
Figure 5.11: Uneven light, because of the adjacent trees, on the mosaic panels on the east side of the display.
(E. Tiffin Thompson)
Figure 5.12: Uneven light, because of the adjacent trees, on the mosaic panels on the east side of the display.
(Gordion Archive, University of Pennsylvania Museum)
Figure 5.13: The Great Palace Mosaic Museum (red) are accessible through the adjoining market (blue). The museum’s hipped roofs all have large skylights that help bring light into the display area.
(Gordion Archive, University of Pennsylvania Museum)
The Gordion Mosaics

During excavations at Gordion pebble mosaic floors were found in the buildings known as Megaron I and Megaron II. The mosaic floor in Megaron I was badly damaged by collapsed roofing.

The mosaic floor in Megaron II, also known as the "Mosaic Building", is particularly remarkable. This mosaic is executed with natural pebbles of dark blue, dark red and white arranged in the form of geometric motifs such as hourglass, cross, meander and rosette. The mosaic in this building was laid down in rectangular shape with a central circular form. The other motifs are arranged around this circular form. The main colours attested on the mosaic are also colours observed on kilns. It is probable that this mosaic was a Phrygian innovation inspired by kilns made in the same style and used on the floors before the laying of the mosaic. Grey patches on the mosaic indicate where repairs have been carried out.

This mosaic is the oldest known in Anatolia. According to associated finds, the building is dated to 750 BC and was in use for approximately 90-80 years. The earliest known mosaics from the Near East are from Til Barsip and Arslantepe, which are dated to the 9th century BC, or at the latest to the second half of the 8th century BC, by their excavators and have been compared with the mosaics at Gordion. In light of this information, the Gordion mosaics may also be dated to the 8th century BC.

Figure 6.1: The sign for the Megaron 2 Mosaic.
(E. Tiffin Thompson)

Figure 6.2: The Kayabaşı Mosaic from the Gordion Museum.
(E. Tiffin Thompson)
Figure 6.3: The Metiochus and Parthenope mosaic after it was conserved.
(Zeugma Mosaics : A Corpus, Mehmet Önal)
**Reintegration process for the Metiochos and Parthenope Mosaic, Zeugma, Turkey**

*Figure 6.4: The reintegration of the Metiochos and Parthenope Mosaic*
Figure 6.5: Artifacts on display around the mosaic help to interpret its original context.
(The Zeugma Mosaics: Gaziantep’s Crowning Glory: http://comenius-legends.blogspot.com/)
Figure 6.6: Mosaics are displayed on the wall at the Antioch Museum.

Figure 6.7: Inappropriate mortar colors detract from the mosaic.
Figure 6.8: The reintegrated sections of the lifted mosaic are articulated by poorly colored mortar.
(Antioch Mosaics: http://cti.itc.virginia.edu/~jjd5t/ant-pics/)

Figure 6.9: The conserved Muses Mosaic that depicts – Paideia, Arete, and Sophia.
(Zeugma Mosaics : A Corpus, Mehmet Önal)
Figure 6.10: An information panel should be put by the entrance to the mosaic display, where visitor congregate.
(E. Tiffin Thompson)

Figure 6.11: Information panels can be hung on the southern wall.
(E. Tiffin Thompson)
Figure 7.1: Photomicrograph of the stable edge of the chert pebble, (400x magnification).
(E. Tiffin Thompson)

Figure 7.2: Photomicrograph of the interior of the chert pebble, (400x magnification).
(E. Tiffin Thompson)
Figure 7.3: Micrograph of the interior of the quartzite pebble, (400x magnification).
(E. Tiffin Thompson)

Figure 7.4: Micrograph of the stable edge of the quartzite pebble, (400x magnification).
(E. Tiffin Thompson)
Figure 7.5: Micrograph of the interior of the volcanic pebble, (400x magnification). (E. Tiffin Thompson)

Figure 7.6: Micrograph of the interior of the volcanic pebble, (400x magnification). (E. Tiffin Thompson)
Figure 7.7: A graphic illustrating that concrete should never be used on mosaics. (Mosaics 2)
Appendix A: Photographic Montage
Appendix A: Photographic Montage

Photographic montage of the Megaron 2 Mosaic composed of over one hundred images.
(E. Tiffin Thompson)
Appendix B: Conditions Glossary & Survey
**Appendix B: Conditions Glossary & Survey**

**Gordion Megaron 2 Mosaic Pavement: Conditions**

- **Cavity**: Areas of sub-surface loss
- **Concrete Fill**: Areas where the original pebbles were missing and the lacunae have been filled with large aggregate cementitious mortar during re-installation.
- **Cracks**: Linear breaks visible at the surface of the mosaic.
- **Detached Pebbles**: Pebbles that are still in their original location, but have lost their adhesion to the bedding layer.
- **Deteriorated Pebbles**: Pebbles that display damage as cracking and partial loss.
- **Dimensional Loss**: Areas of total loss of both pebbles and bedding mortar.
- **Exposure of the Support**: Areas where the support is exposed.
- **Exposed Bedding**: Areas where the bedding is exposed but the pebbles are still in their original location.
- **Exposed Rebar**: Areas where the ferrous reinforcement of the mosaic is exposed.
- **Guano**: Accumulation of bird excreta from overhead perching on the shelter frame.
- **Lacunae**: Areas where pebbles are missing.
- **Moisture**: Presence of moisture and moisture stains due to the presence of moisture.
- **Micro-flora**: Presence of algae and fungi due to excess moisture.
- **Over-grout**: Areas that have been covered over by a thin coating of cementitious grout.
- **Over-tiling**: Areas that have been over-tiled.
- **Partial Loss**: Areas where the pebbles have been partly removed or eroded away.
- **Surface of the Mosaic**: Areas of surface loss.
- **Surface Staining**: Discoloration of the mosaic due to the presence of moisture.
Appendix B: Conditions Glossary & Survey

Gordion Megaron 2 Mosaic Pavement: Conditions Visual Glossary

- Lacunae
- Detached Pebbles
- Cavity
- Cavity
- Concrete Fill
- Cracked
- Exposed Rebars
- Guano
- Moisture Staining
- Overgrowth
- Dimensional Loss
- Detached Pebbles
- Micr-Flora

Gordion Site Conservation Program

Megaron 2 Mosaic Pavement: Conditions

Gordion, Turkey

SOS Recording: SUMMER 2010
Data Input: 2010

Project Director: Frank G. Mayerl, University of Pennsylvania
Documentation: E. Tiffin Thompson

Architectural Conservation Laboratory and Research Center
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University of Pennsylvania

SPACE: Gordion Museum
SCRIPT No. 02
Appendix B: Conditions Glossary & Survey
Appendix B: Conditions Glossary & Survey
Appendix B: Conditions Glossary & Survey

PANEL 2

Gordion Site Conservation Program
Megaron 2 Mosaic Pavement: Conditions
Gordion, Turkey

SITE RECORDING: SUMMER 2010
DATA INPUT: 2010
PROJECT DIRECTOR: FRANK O. MATERA, UNIVERSITY OF PENNSYLVANIA
DOCUMENTATION: E. TIFFIN THOMPSON
DIGITAL RECORDING: E. TIFFIN THOMPSON

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SPACE: Gordion Museum
SHEET No.
05
Appendix B: Conditions Glossary & Survey

Panel 3

- Lacunae
- Over-grout
- Concrete
- Cavity
- Moisture Staining
- Guano
- Rebar
- Deteriorated Pebbles
- Loose Pebbles
- Micro-flora
- Dimensional Loss
- Rebar

Gordion Site Conservation Program
Gordion, Turkey

Site Recording: Summer 2010
Data Input: 2010

Project Director: Frank G. Matero, University of Pennsylvania
Documentation: E. Tiffin Thompson
Digital Recording: E. Tiffin Thompson

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University of Pennsylvania

Space: Gordion Museum
Sheet No.: 06
Appendix B: Conditions Glossary & Survey

GORDION SITE CONSERVATION PROGRAM
Megaron 2 Mosaic Pavement: Conditions

GORDION, TURKEY

SITE RECORDING: SUMMER 2010
DATA INPUT: 2010

PROJECT DIRECTOR: FRANK O. MATERA, UNIVERSITY OF PENNSYLVANIA

DOCUMENTATION: E. TIFFIN THOMPSON

DIGITAL RECORDING: E. TIFFIN THOMPSON

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SPACE: Gordion Museum

SHEET No. 07

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Appendix B: Conditions Glossary & Survey

Gordion Site Conservation Program
Gordion, Turkey

Megaaron 2 Mosaic Pavement: Conditions

Gordion Museum
Gordian, Turkey

Panel 5

Lacunae
Cavity
Concrete
Overgrout
Guano
Moisture Staining
Micro-flora
Dimensional Loss

Rebar
Crack
Deteriorated Pebbles
Lose Pebbles
Concrete
Over-grout
Cavity
Lacunae

Feet
Meter

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School of Design
University of Pennsylvania

SITE RECORDING: SUMMER 2010
DATA INPUT: 2010

PROJECT DIRECTOR:
F. M. Materia, University of Pennsylvania

DOCUMENTATION:
E. Tiffin Thompson

DIGITAL RECORDING:
E. Tiffin Thompson

SPACE:
Gordion Museum

SHEET No.
08
Appendix B: Conditions Glossary & Survey

GORDION SITE CONSERVATION PROGRAM
GORDION, TURKEY

Megaron 2 Mosaic Pavement: Conditions

SITE RECORDING: SUMMER 2010
DATA INPUT: 2010

PROJECT DIRECTOR: FRANK G. MATERL, UNIVERSITY OF PENNSYLVANIA
DOCUMENTATION: E. TIFFIN THOMPSON
DIGITAL RECORDING: E. TIFFIN THOMPSON

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SPACE: Gordion Museum
SHEET No. 09
Appendix B: Conditions Glossary & Survey

GORDION SITE CONSERVATION PROGRAM
GORDION, TURKEY

SUMMER 2010

CONDITIONS GLOSSARY & SURVEY

- Lacunae
- Over-grout
- Cavity
- Concrete
- Moisture Staining
- Guano
- Deteriorated Pebbles
- Loose Pebbles
- Micro-flora
- Rebar
- Crack
- Dimensional Loss
- Feet
- Meter

PANEL 7

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
SCHOOL OF DESIGN UNIVERITY OF PENNSYLVANIA

DATA INPUT: 2010

PROJECT DIRECTOR: FRANK O. MATERA, UNIVERSITY OF PENNSYLVANIA

DOCUMENTATION: E. TIFFIN THOMPSON

DIGITAL RECORDING: E. TIFFIN THOMPSON

SPACE: Gordion Museum

SHEET No.: 10

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Appendix B: Conditions Glossary & Survey

Gordion Site Conservation Program
Gordion, Turkey

Megalos 2 Mosaic Pavement: Conditions

Gordion Museum, Turkey

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER
University of Pennsylvania

PROJECT DIRECTOR: FRANK G. MATTEI, UNIVERSITY OF PENNSYLVANIA
DOCUMENTATION: E. TIFFIN THOMPSON
DIGITAL RECORDING: E. TIFFIN THOMPSON

SPACE: Gordion Museum
SHEET No. 11

Lacunae
Over-grout
Concrete Cavity

Moisture Staining
Guano

Deteriorated Pebbles
Loose Pebbles

Rebar
Crack

Dimensional Loss
Micro-flora

Concretion

Panel 8

Feet
Meter

PANEL 8

8

Cavity

Moisture Staining

Guano

Deteriorated Pebbles

Loose Pebbles

Crack

Dimensional Loss

Micro-flora

Concretion

Panel 8

Feet
Meter

Cavity

Moisture Staining

Guano

Deteriorated Pebbles

Loose Pebbles

Crack

Dimensional Loss

Micro-flora

Concretion

Panel 8

Feet
Meter

Cavity

Moisture Staining

Guano

Deteriorated Pebbles

Loose Pebbles

Crack

Dimensional Loss

Micro-flora

Concretion
Appendix B: Conditions Glossary & Survey

Gordion Museum
Gordion Site Conservation Program

Megaron 2 Mosaic Pavement: Conditions

- Lacunae
- Over-grout
- Cavity
- Concrete
- Moisture Staining
- Guano
- Deteriorated Pebbles
- Loose Pebbles
- Rebar
- Micro-flora
- Dimensional Loss
- Rebar

PANEL 10

Gordion Site Conservation Program
Gordion, Turkey

Architectural Conservation Laboratory and Research Center
Graduate Program in Historic Preservation
School of Design
University of Pennsylvania

Project Director:
Prasko G. Mazer, University of Pennsylvania

Documentation:
E. Tiffin Thompson

Digital Recording:
E. Tiffin Thompson

Space:
Gordion Museum

Sheet No.
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Appendix B: Conditions Glossary & Survey

Gordion Site Conservation Program

Megaron 2 Mosaic Pavement: Conditions

Gordion, Turkey

Site Recording: Summer 2010

Data Input: 2010

Project Director: Frank G. Matero, University of Pennsylvania

Documentation: E. Tiffin Thompson

Digital Recording: E. Tiffin Thompson

Architectural Conservation Laboratory and Research Center

Graduate Program in Historic Preservation

School of Design

University of Pennsylvania

Space: Gordion Museum

Sheet No.: 14

PANEL 11

- Lacunae
- Over-grout
- Cavity
- Concrete
- Moisture Staining
- Guano
- Deteriorated Pebbles
- Loose Pebbles
- Rebar
- Micro-flora
- Dimensional Loss

Feet

Meter
Appendix B: Conditions Glossary & Survey

Gordion Site Conservation Program
Gordion, Turkey

Moisture Staining
Micro-flora
Guano
Deteriorated Pebbles
Lacunae
Concrete
Over-grout
Cavity

PANEL 14

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Appendix B: Conditions Glossary & Survey

The image contains a diagram with various symbols and annotations. The symbols include:
- Lacunae
- Over-grout
- Cavity
- Concrete
- Moisture Staining
- Guano
- Deteriorated Pebbles
- Rebar
- Micro-fauna
- Dimensional Loss
- Loose Pebbles
- Crack

The diagram is labeled as "PANEL 15" and is part of the Gordion Site Conservation Program:
- Megaron 2 Mosaic Pavement: Conditions
- Gordion, Turkey

The diagram includes a key for the symbols used and a color-coded legend. The text on the page indicates the presence of various conditions and their respective symbols on the map.
Appendix B: Conditions Glossary & Survey

Gordion Museum
Gordonia Site Conservation Program

Megalom 2 Mosaic Pavement: Conditions

Lacunae
Over-grout
Concrete
Cavity

Moisture Staining
Deteriorated Pebbles
Guano

Dimensional Loss
Rebar

Concrete

Panel 16

Gordion, Turkey

Architectural Conservation Laboratory and Research Center

Sheet No. 19

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Gordon Museum

ARCHITECTURAL CONSERVATION LABORATORY AND RESEARCH CENTER

MUSEUM OF DESIGN

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Appendix B: Conditions Glossary & Survey

Gordion Museum, Turkey
Gordion Site Conservation Program
Megaron 2 Mosaic Pavement: Conditions

Panel 17

Legend:
- Lacunae
- Over-grout
- Concrete
- Cavity
- Moisture Staining
- Guano
- Deteriorated Pebbles
- Micro-fauna
- Rebar
- Crack
- Dimensional Loss
- Loose Pebbles

Gordion Site Conservation Program
Gordion, Turkey

Mosaic Recording: Summer 2010
Data Input: 2010

Project Director:
Frank G. Mather, University of Pennsylvania

Documentation:
E. Tiffin Thompson

Digital Recording:
E. Tiffin Thompson

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Graduate Program in Historic Preservation
School of Design
University of Pennsylvania

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**Gordion Museum**

**Gordion Site Conservation Program**

**Appendix B: Conditions Glossary & Survey**
Appendix B: Conditions Glossary & Survey

Gordion Site Conservation Program
Megaron 2 Mosaic Pavement: Conditions

Gordion, Turkey

DATA INPUT: 2010

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Gordion Site Conservation Program
Gordion, Turkey

Mегарон 2 Mosaic Pavement: Conditions

OVER-GROUT

Cavity

Concrete

Moisture Staining

Guano

Lacunae

Dimensional Loss

Micro-flora

Deteriorated Pebbles

Loose Pebbles

Rebar

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- Lacunae
- Over-grout
- Concrete Cavity
- Megaron 2 Mosaic Pavement
- Conditions Glossary & Survey
- Gordion Museum, Turkey
- Gordion Site Conservation Program
- Summer 2010

- Dimensional Loss
- Micro-flora
- Moisture Staining
- Guano
- Deteriorated Pebbles
- Loose Pebbles
- Rebar

**GORDION SITE CONSERVATION PROGRAM**

Megaron 2 Mosaic Pavement: Conditions

**GORDION, TURKEY**

DATA INPUT: 2010

PROJECT DIRECTOR: FRANK G. MATRA, UNIVERSITY OF PENNSYLVANIA

DOCUMENTATION: E. TIFFIN THOMPSON

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ARCHITECT: Gordion Museum

BUILDER: Gordion Museum

DINER: 1965

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Gordion Museum

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Megalos 2 Mosaic Pavement: Conditions

GORDION, TURKEY

HAR DRAW 2010

DATA: FRANK E. MATERA, UNIVERSITY OF PENNSYLVANIA

DOCUMENTATION: E. TIFFIN THOMPSON

DIGITAL RECORDING: E. TIFFIN THOMPSON

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Appendix B: Conditions Glossary & Survey

Gordion Site Conservation Program

Gordion, Turkey

Megaron 2 Mosaic Pavement: Conditions

DIMENSIONAL LOSS

MOISTURE STAINING

GUANO

DETERIORATED PEBBLES

REBAR

CWEAT

CONCRETE

OVER-GROUT

LACNUA

Gordion Museum

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Gordion Site Conservation Program

Gordion, Turkey

Megalos Mosaic Pavement: Conditions

Site Recording: Summer 2010
Data Input: 2010

Project Director: Frank G. Matese, University of Pennsylvania

Documentation: E. Tiffin Thompson

Digital Recording: E. Tiffin Thompson

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Space: Gordion Museum

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Gordion Site Conservation Program
Megaron 2 Mosaic Pavement: Conditions

Gordion, Turkey

Site Recording: Summer 2010

Data Input: 2010

Project Director:
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Documentation:
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Digital Recording:
E. Tiffin Thompson

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Gordion Museum

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GORDION SITE CONSERVATION PROGRAM
Gordion, Turkey

SITE RECORDING: SUMMER 2010
DATA INPUT: 2010

PROJECT DIRECTOR: FRANK G. MAYER, UNIVERSITY OF PENNSYLVANIA
DOCUMENTATION: T. TIFFIN THOMPSON
DIGITAL RECORDING: T. TIFFIN THOMPSON

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Appendix B: Conditions Glossary & Survey

Panel 30

Gordion Site Conservation Program
Megaron 2 Mosaic Pavement: Conditions

Gordion, Turkey

Site Recording: Summer 2010
Data Input: 2010

Project Director: Frank G. Matera, University of Pennsylvania
Documentation: E. Tiffin Thompson

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University of Pennsylvania

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Appendix B: Conditions Glossary & Survey

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<td>Deteriorated Pebbles</td>
<td>Gray</td>
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<td>Micro-fracture</td>
<td>Green</td>
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GORDION SITE CONSERVATION PROGRAM

Gordion, Turkey

 Megaron 2 Mosaic Pavement: Conditions

SITE RECORDING: SUMMER 2010

DATA INPUT: 2010

PRODUCT DIRECTOR: FRANK G. MAYER, UNIVERSITY OF PENNSYLVANIA

DOCUMENTATION: E. TIFFIN THOMPSON

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