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Worldwide Hallmarks

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Abstract (EN)

The aim of this research is to document how specific processing hallmarks and their use in built structures are prevalent around the world. The fundamental premise is, the shown hallmarks exemplify a worldwide building system, ability and a shared understanding existed in the past, between 2500 BCE - 15th century CE, and that these hallmarks are to be thought as a global system of skills, methods and understanding.

Their building system aspect is derived from the observation that builders across cultures had the capacity to achieve a specific hallmark, suggesting that their constructional expertise was likely at a comparable level, perhaps utilizing comparable or equivalent methods and equipment. The ability aspect comes from the observation that each culture was able to execute a certain hallmark in such a way that if they were to be exchanged in between these cultures, they would not demonstrate a significant difference. The shared understanding aspect comes from the observation the hallmarks are found all across the world.

In architectural terms, the hallmarks can be discussed as a set of distinctive features or design elements that are found in various buildings across different cultures and time periods, indicating a shared global architectural and engineering system, as well as a common understanding of construction methods and materials used to achieve specific features of the hallmarks.

Abstract (DE)

Das Ziel dieser Forschung ist eine Dokumentation der weltweiten Verbreitung spezifischer Verarbeitungsmerkmale und deren Verwendung in gebauten Strukturen. Als grundlegende Prämisse gilt dabei, dass die gezeigten Merkmale weltweit auftretende Konstruktionssysteme, Fähigkeiten und ein gemeinsames Grundwissen in der Vergangenheit, zwischen 2500 v. Chr. und dem 15. Jahrhundert n. Chr., veranschaulichen und dass diese Merkmale als ein globales System von Fähigkeiten, Methoden und Kenntnissen zu betrachten sind.

Der Aspekt des Bausystems ergibt sich aus der Beobachtung, dass die Bauleute in allen Kulturen in der Lage waren, bestimmte Merkmale zu entwickeln, was darauf hindeutet, dass ihr bautechnisches Fachwissen wahrscheinlich auf einem vergleichbaren Niveau lag und sie vielleicht vergleichbare oder gleichwertige Methoden und Geräte verwendeten. Der Aspekt der Fähigkeit ergibt sich aus der Beobachtung, dass jede Kultur in der Lage war, bestimmte Merkmale so auszuführen, dass ein Austausch zwischen diesen Kulturen keinen signifikanten Unterschied ergeben würde. Der Aspekt des gemeinsamen Verständnisses ergibt sich aus der Beobachtung, dass die untersuchten Merkmale überall auf der Welt zu finden sind.

In architektonischer Hinsicht können diese untersuchten Spezifika als eine Reihe von charakteristischen Merkmalen oder Designelementen diskutiert werden, die in verschiedenen Bauwerken in unterschiedlichen Kulturen und Zeiträumen zu finden sind, was auf global übereinstimmende architektonische und technische Konzepte sowie auf ein gemeinsames Grundwissen von Konstruktionsmethoden und Materialien hinweist, die zur Erreichung bestimmter Merkmale der untersuchten Charakteristika verwendet wurden.

Worldwide Hallmarks

An Observational Study into the Global Processing Remainders

The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them.

— Sir William Lawrence Bragg

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Introduction

A. What is this research about?

For anyone who is even remotely interested in art and architecture, one of the most striking things to be recognized is how there are similar structures and artistic representations to be found all over the world. These similarities could consist of the application of fundamental construction principles, artistic depictions and perhaps even a direct imitation of a certain edifice.

An example for the fundamental construction principles, it can be given the pyramids found at least in three different continents, starting with the pyramid in Chichen Itza in Mexico in North America (left), pyramid of Djoser in Egypt in Africa (middle) and pyramid at the Sukuh Temple in Indonesia found in Asia (right). Even though these structures are not identical, they display formal and structural resemblances, making them eligible to be classified as pyramids and facilitating the evaluation of their traits based on these commonalities.

Figure 1 pyramid in Chichen Itza in Mexico (left), pyramid of Djoser in Egypt (middle), pyramid at the Sukuh Temple in Indonesia (right)

An example for the artistic depictions, it can be given the statues found around the world, in which these statues are made depicting a certain pose. These statues can be found in Göbekli Tepe in Turkey (left), Lore Lindu in Indonesia (middle) and in Easter Island in the Pacific Ocean (right). Their pose depicts the arms and hands of the statues to be positioned around the navel/genital area. Again, these statues are not identical but they share a common motif.

Figure 2 Göbekli Tepe statue (left), Lore Lindu statue (middle) and in Easter Island statue (right)

An example for the imitation, it can be given the Parthenon which is originally found in Athens in Greece (left) and its replica which is found in Nashville in U.S.A. (right). The original Parthenon in the Athenian Acropolis, Greece, which was dedicated to the goddess Athena, was built during the fifth century BC whereas the Parthenon in Nashville, Tennessee is a full-scale replica and was designed by architect William Crawford Smith and built in 1897. It is safe to state that ancient Greeks did not travel to U.S.A to build one of their temples but as a result of imitation, we have, in this specific case, identical structures in different parts of the world.

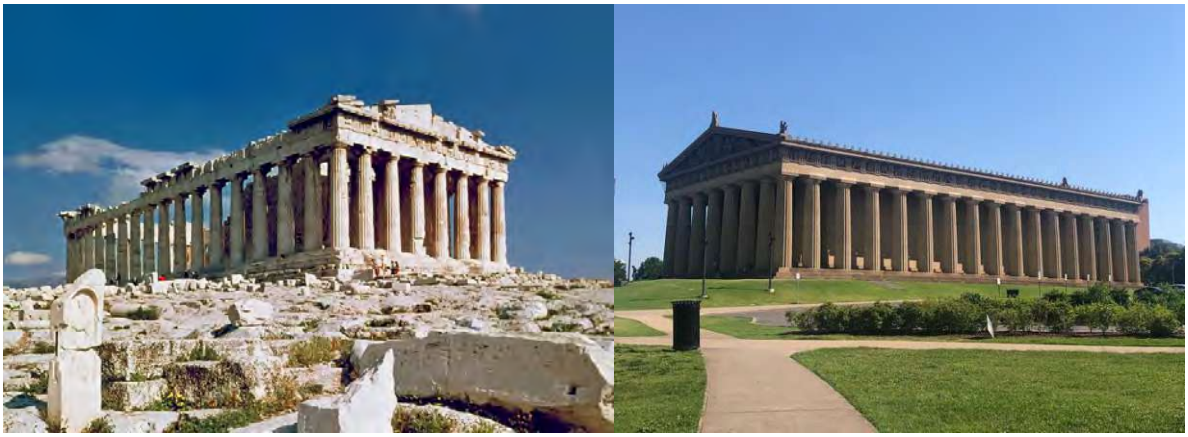

Figure 3 Parthenon in Athens in Greece (left) Parthenon replica in Nashville U.S.A. (right).

The question then becomes; what is there to acknowledge when we spot these similarities? And what is meant by similarity?

In architectural terms, similarity can refer to the degree of resemblance or likeness between two or more architectural elements or features. This can include similarities in shape, form, style, proportion, texture, and color. In structures found in different areas of the world, similarity can refer to the shared characteristics, design principles, or building techniques. For example, many cultures around the world developed similar structural systems, such as the use of columns, of arches and domes to support their buildings. Many cultures then have developed unique building styles and decorative motifs that are specific to their region or local environment, which would be incorporated in their built structures and as cultures have interacted and exchanged ideas throughout history, there have been instances of architectural influence and borrowing between different regions, and for that an example can be given about the influence of Islamic architecture of the Middle East on the architecture of Spain[1].

In this research similarity will be regarded as formal parities and will be compared based on styles of execution.

In the examples mentioned above, for the case of direct imitation, the explanation can be rather simple. It can be presumed, if an edifice is so influential or valuable, it is incorporated into another culture by any means. And what can be said in the case of pyramids or the statues? How come they are in their formal execution similar but stylistically different? Do these similarities and differences occur as a result of a cross-cultural game of telephone? What are the possible explanations?

1 https://humanities.byu.edu/arab-muslim-influence-on-the-iberian-peninsula/

B. In the tracks of…

Prof. Erich Lehner, in his book *Wege der Architektonischen Evolution* explains; "Such comparisons of the architectural evolution of different cultures, which were not in intellectual exchange with each other, i.e., could develop independently of each other, form the basis of all studies dealing with the emergence of elementary building forms. Accordingly, I would like to call a discipline that deals with this area of architectural history Comparative Architectural History."[2]

He, due to the fact that he is investigating pyramidal structures found in different continents, then expands on this by stating; "[…] There are obviously great formal and functional differences between these pyramid buildings, and the term "pyramids", which is commonly used in cultural studies, seems to be a negligent generalization; however, it will become clear in the course of the investigation that these seemingly so different buildings showed certain parallels in their typological development, which justifies their grouping under one term - even if, unfortunately, this term at the same time designates a geometric body, the definition of which is different"[3].

Following his lead in the discipline of Comparative Architectural History, I will be focusing on, not on the elementary building forms, but rather the processing marks which are utilized in a built structure. In the examples which will be presented in each chapter, these processing marks are almost always found on and/or executed with ashlars, which are defined as "a squared building stone finely dressed on all faces adjacent to those of other stones so as to permit very thin mortar joints"[4] and can be found in many diverse structures.

To also gather the observed phenomenon under one roof, the term "hallmark" is used, which is defined as "a quality, ability, etc., that is typical of a particular person or thing"[5]. The term hallmark implies that the observed phenomenon is a distinctive feature, and due to the fact that these distinctive features are ubiquitous, it is suggestive of these processing marks are a common and recognizable feature of the architecture in question. In this sense, the chosen term highlights that the observed phenomenon is a common occurrence in different cultures and continents.

It is important to acknowledge that the display of the hallmarks will be regarded as a paramount consideration during the building process. Thus, the emphasis is primarily placed on the hallmark itself, while the choice of construction material, be it rubble fill, ashlar or adobe mud, assumes a secondary role. Consequently, the priority is given to the display of the hallmark rather than its execution in a particular material or with a certain tool/technique.

The unique feature outlined above enables a complete separation between the material and technical components of the construction process. This separation eliminates the necessity of examining the type of tools or materials utilized or their relevance to the process.

2 Erich Lehner. Wege der Architektonischen Evolution. Phoibos Verlag, 1998, p. 14-15 (Translated from German to English with deepl.com)

3 Id, p15-16. (Translated from German to English with deepl.com)

4 Francis D.K. Ching, Mark Jarzombek, Vikramaditya Prakash. A Global History Of Architecture. John Wiley & Sons, 2011, p.799.

5 https://www.britannica.com/dictionary/hallmark

C. Hallmarks against the backdrop of…

Upon observation, two certain aspects should be highlighted as an underlying principle and the first ones are Diffusionism and Evolutionism in archaeological terms and the second aspect is the "problem of universals".

Archaeological Diffusionism and Evolutionism are explained by renowned archaeologist Colin Renfrew in his book *Before Civilisation* as follows; "[…] On the one side were scholars like Worsaae and Montelius who believed that most of the important innovations and advances in human culture occurred only once and were transmitted by contact to other areas. And on the other side were evolutionists such as Gabriel de Mortillet who believed similar developments in different places were due to "the like working of minds under like conditions", the products of a universal process determined by the very nature of man."[6]

Another explanation for these two aspects comes from Leslie A. White, quoting Lewis H. Morgan in his essay Evolution and Diffusion, explaining Evolution; "[…] man was a common and constant factor the world over and throughout history; his needs were uniform and the means of satisfying them were much the same everywhere. Therefore, the results of man's behavior, the cultures of mankind, were alike in their fundamental features. There was a natural logic of the human mind, argued Morgan, that brought about similarities of cultures on different and even disconnected continents"[7].

White continues by explaining Diffusionism; "[…] To the diffusionists, on the other hand, man was by nature uninventive. Novelty was rare and only a peculiarly favorable concatenation of factors could produce new cultural features. When they were produced, however, they could spread easily from one people or region to another."[8] White then makes the conclusion by saying; "It is now clear that both of these processes of culture change are universal and fundamental; each one merits as much respect as the other."[9]

The purpose of introducing the aspects of archaeological diffusionism and evolutionism is to provide a foundation for readers to comprehend the worldwide spread of the phenomenon being observed. While looking at the hallmarks, it is important to keep in mind what the diffusionist and evolutionary approaches, and their combination as concluded by White, offer as these set of hallmarks are seen on different continents, in similar and different spans of time frames. Although additional research beyond the diffusionist and evolutionist explanations may be necessary and perhaps already is done, the focus of this research is primarily on the architectural aspects, with an implicit acknowledgement that they are a global phenomenon.

The abundance of these hallmarks across multiple continents indicates that they are not merely coincidental or limited to isolated instances of special treatment. This widespread prevalence leads to questions about the degree to which these cultures had connections with one another. Additionally, the fact that these phenomena are present in diverse regions of

6 Colin Renfrew. Before Civilisation, the Radiocarbon Revolution and Prehistoric Europe. Penguin Books Ltd, 1973, p. 18.

7 Leslie A. White. Evolution and Diffusion. Antiquity, Cambridge University Press, 1957, p. 215.

8 Id., p. 216.

9 Id., p.218.

the world suggests that they were not confined to the regional abilities of individual cultures. It is also worth mentioning how coincidence is defined, which is “a situation in which events happen at the same time in a way that is not planned or expected”[10].

Second aspect will be considering the "problem of universals" when observing the hallmarks. Although the problem of universals relates more to metaphysics, it is an effort to define the mental connections a person makes when they understand a property such as shape or color to be the same in nonidentical objects.[11] This explanation should be considered as an attempt continue where Leslie A. White left off by stating both those processes (diffusionism and evolution) of culture change are universal and fundamental.

Walter J. Lonner defines psychological universals as; "[…] any phenomenon of human mind or action that is shared by sentient individuals regardless of both place and time.”[12] Lonner continues what can be defined as universal by stating; "Claims of universality may be made when the same psychological result, observation, or phenomenon emerges across large and widely divergent cultures, a methodological principle that cross-cultural researchers have wholeheartedly supported for many years."[13] He then offers a way to approach these universals by saying; "Thus, to study a phenomenon in any given culture without regard to what it may mean or how it functions in other cultural settings nullifies concerns about its universality."[14]

The hallmarks will be presented and should be acknowledged against the backdrop of the two aforementioned aspects. Although this research will not claim to have the final verdict on the explanation how the hallmarks happen to be a global phenomenon, it will guide the readers towards a uniform way of seeing how certain formal parities and styles of execution in the observed hallmarks are shared globally and how their applications can span across time, place and cultures, and although the cultures in which these hallmarks were found are distinct, they share a connection based on their utilization of a given hallmark, which eventually found its way into a built structure.

D. How it all came together?

One very important factor which makes this work possible is the internet. Before the internet, discovering any ancient site would most probably require, more than anything, being on site, which is often expensive and time consuming. However, with the advent, wide spread use and technological advancements of the internet, a vast amount of information on ancient sites belonging to different cultures and historical periods has become readily accessible to anyone with an internet connection. Now, with the help of digital archives anyone can explore and learn about sites from anywhere in the world and particularly, satellite images, such as from Google Maps and Google Earth, have also made it much easier to access and view ancient sites that were previously inaccessible, hard to reach or even unknown.

10 https://www.britannica.com/dictionary/coincidence

11 https://plato.stanford.edu/archives/win2017/entries/universals-medieval/

12 Walter J. Lonner. Universals. The Encyclopedia of Cross-Cultural Psychology, John Wiley & Sons, 2013, p. 1.

13 Id., p. 2.

14 Id., p. 1.

The internet has opened up new opportunities for anyone who wants to study and document any given site in detail and compare them to other cultural and historical contexts. Additionally, the internet has made it much easier for people to connect and collaborate with others who share similar interests in discovering and cataloging ancient sites. Social media platforms have become a hub for sharing images about various cultural and historical sites, leading to a greater understanding and a richer documentation possibility of the worlds' diverse heritage. The internet has definitely revolutionized the way we discover, explore and study ancient sites. It has made previously hard to get information and hard to reach locations available to a much wider audience, allowing us to gain a deeper understanding of our shared cultural and historical heritage.

While the internet has undoubtedly opened up new opportunities for exploring and learning about ancient sites, it is important to acknowledge that it also has certain limitations and restrictions. For instance, the texture and precise locations of the edifices may not be accurately depicted in digital archives, leading to abstract interpretations of the findings. Furthermore, relying solely on images and digital archives may not provide a complete understanding of the edifice, as some aspects of the edifice may be inaccessible through digital means. It is important to acknowledge these limitations when using the internet as a tool for studying and documenting ancient sites, as it is necessary to approach digital archives with a critical eye and use them as a supplement rather than a replacement for on-site research.

The emergence of spotting and cataloguing the hallmarks as a research endeavor was driven primarily by the efforts of independent researchers who were exploring ancient sites from a forensic perspective. People such as Hugh Newman and Brien Foerster documented numerous sites and structures in detail and provided hundreds of hours of video footage on their respective YouTube channels. As these researchers continued to document different locations, over time they began to observe repeating features in the sites and structures they documented which stood out as an enigma in their analysis.

It is important to acknowledge that the value of the footage does not reside in the opinions conveyed therein, but rather in the visual material they have captured. This is the very reason why I have referenced their work in my research.

A community was formed, primarily through the means of online interactions, based on the following of these above-mentioned researchers. In this community, the focus was placed on the occurrences and the worldwide spread of the hallmarks which was initiated by the above-mentioned researchers and a database has been formed as a result of contributions from each person as photos and/or videos. With time, the number of photos and videos increased, along with the locations and the sites and structures in each location. At the same time the quality of footage and resolution of the available footage improved, which eased the way to document and catalogue the observed phenomena.

After examining hundreds of photographs and going through many hours of video footage from various sources, I have selected 8 hallmarks. The selection of the hallmarks is based on formal parities which are in accordance with what has been defined as similar previously. This approach is essential for ensuring that the selection is consistent and accurate. The formal

parities refer to the similarities in the shapes, arrangements, and styles of execution which are embedded in the hallmarks. By considering these aspects, the selection provides a comprehensive understanding of the characteristics of the identified hallmarks.

The names for the hallmarks were arrived at through community discussions and were chosen based on how succinctly they could describe the feature. If there is an already available academic designation for a given hallmark, it will be mentioned in the chapters but for most of them it is done so to depict their formal physical appearance and to refrain from attributing any specific functions or purposes to them.

There are 7 main hallmark categories and 1 sub-category. The hallmarks are; Ashlar with drafted margins, Nubs/Knobs, Filler blocks, Trapezoidal openings/niches, Chakana/Stair step motif, Anchor holes, Dowel/Square holes and Joint/Corner holes. Thus, the hallmarks are named using simple and memorable terms to facilitate their identification and classification.

The rationale behind the classification as main and subcategories, is based on the observation that, while the other 7 hallmarks, are prevalent worldwide and can be found on every continent, Joint/Corner holes seems to be restricted to the Mediterranean/Middle East region, based on the available visual material. Despite the fact that it shares similarities with Dowel/Square holes, its geographical constraints warrant its classification as a subcategory.

The hallmarks can be divided into additional different categories based on their purpose and significance. Hallmarks, such as ashlars with drafted margins, nubs/knobs, and dowel/square holes, are found on ashlars and can be thought as processing marks that may not necessarily be integral to the structure itself. Others, such as filler blocks, which are executed with ashlars, can be thought as structural features. Trapezoidal openings/niches and chakana/stair step motif, can be thought as architectural features/stylistic executions and be considered integral to the structure. Finally, anchor holes and joint/corner holes, can be considered as alterations and can be seen as later additions to the original structure.

The examples of shown hallmarks find themselves in a time frame between 2500 BCE - 15th Century CE. This time frame is formed organically, that is to say after the collection and categorization of hallmarks, the structure and/or site in which the hallmark is found researched and dated accordingly. It should be noted that the dating is provided only to give context to the structures in which the hallmarks are found and not to make any chronological or developmental attributes to the hallmarks themselves.

E. The goal of this research

All in all, the scope of this work can be defined as an introduction synopsis for the ancient worldwide spread architectural hallmarks. The emphasis is not only on noticing the hallmarks but also acknowledging what their implications and significance could be. The primary method will be to look at the physical evidence and make connections through the hallmarks themselves.

In architectural terms, these hallmarks encompass a collection of unique characteristics and design elements present in diverse buildings throughout different cultures and historical eras,

while serving as tangible evidence of a certain technical expertise possessed by builders. They also reveal a shared understanding of construction techniques and material knowledge employed to achieve these specific architectural features.

Furthermore, these hallmarks represent a cumulative knowledge passed down through generations of architects, engineers, and craftsmen. The existence of similar hallmarks across different regions and time periods implies an exchange of ideas, techniques, and innovations between cultures, contributing to the development and evolution of architecture as a universal language of human creativity. By studying these hallmarks, architects could gain insights into the enduring principles learned from the past and the global interconnectedness of human civilization.

The end result of this observational study is not meant to be conclusive, but rather should act as a magnifying glass to highlight certain propositions such as;

- What is the explanation for their global occurrence?
- What does the existence of a hallmark say about the structure it is found on?
- Are the hallmarks just engineering, processing, architectural marks or do they signify something else?
- What insights do the hallmarks provide into the manufacturing techniques and tools used in their creation?

In the following chapters, each hallmark will be examined and explained. The photographs for the hallmarks will not be listed based on an order or chronology. This is done so to not make any strict attributions regarding their origins or developmental phase.

1. Ashlars with Drafted Margins

In this hallmark, certain portions on the surface of the ashlar which are usually facing outside are shaved away. The remaining area is usually slightly protruding and in other cases they are level with the rest of the ashlar, but a margin is set around them to mark the areas where processing is made. These protrusions are usually rectangular.

Another way to describe them would be, in CAD terms, as if the rectangular ashlar was offset inside and this offset was extruded slightly.

The term “ashlar with drafted margins” comes from a paper written in 2011 by Maria Philokyprou from the Department of Architecture, University of Cyprus.[15] Below is a schematic display of the ashlar with drafted margins.

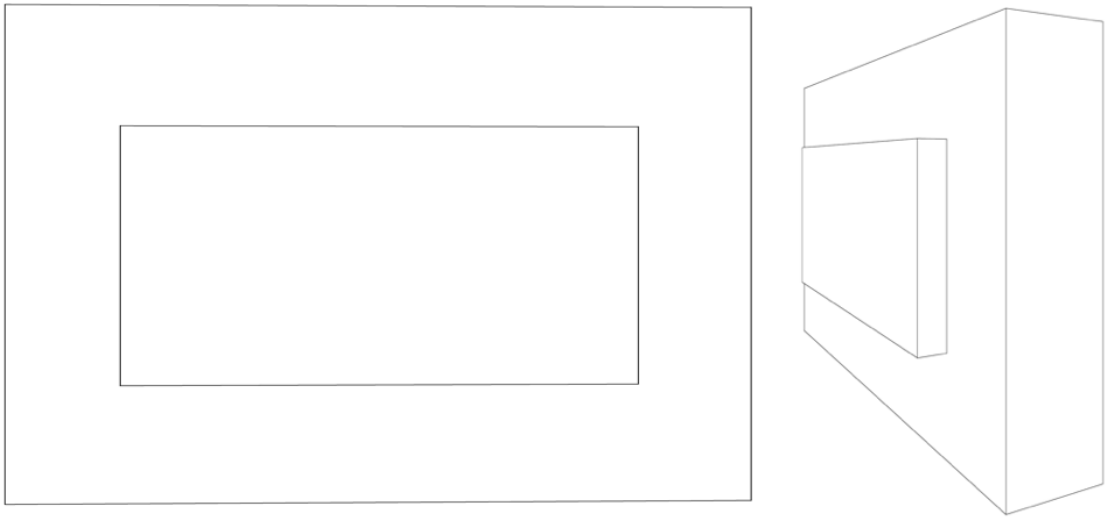

Figure 4 Schematic views of the ashlar with drafted margins; frontal view (left) perspective view (right)

A good example to start with comes from the Jerwan Aqueduct in Iraq, dating between 703-690 BC[16]. A good amount of ashlars mirror what the schematic view displays. The blocks seem to be uniform in shape and size which also seems to be the case for the drafted margins.

It is noteworthy that a certain number of ashlars located on the bottom row do not exhibit the drafted margins. There are several explanations for this, such as the possibility that the builders chose not to put drafted margins on these particular blocks, or that a reconstruction attempt was made and the blocks were placed facing the wrong direction. Alternatively, the blocks may have eroded or been damaged due to natural or other external causes.

Thorkild Jacobsen and Seton Lloyd state in their report, evidence of masons working on-site can be seen in the deep layer of stone chips placed at the base of each façade. A similar effect is achieved through the masons shaping the stones in a way that they align with their

15 Maria Philokyprou. The initial appearance of ashlar stone in Cyprus. Issues of provenance and use. Mediterranean Archaeology and Archaeometry, Vol. 2011, 2011. No. 2, p. 43.

16 https://www.atlasobscura.com/places/aqueduct-of-jerwan

neighbors only at the joints. This leaves a rugged protrusion in the center, creating the illusion of intentional rustic design. In a specific area to the northwest, this technique appears more intentional, with well-crafted stone faces, yet all edges are uniformly reduced to a lower level. This style of masonry has a notably modern and sophisticated look, which is unusual for an early structure. However, it's intriguing to observe the haphazard distribution of these two types of rustic elements on the facades. Occasionally, a single stone with defined margins stands amidst a large section of neatly cut ashlar work. While in contemporary designs, more pronounced rustic features tend to be positioned lower on the structure, in one instance, even stones on the parapet exhibit this treatment.[17]

Figure 5 Jerwan Aqueduct, Iraq

Moving to Ksar el Koua in Algeria dating to 3rd Century CE[18], there is a distinct feature revealed. The surface of the ashlars appears "pillowy," characterized by rounded bulges. Notably, the ashlar in the bottom left corner (highlighted in red) displays less rigid drafted margins than those observed in the Jerwan Aqueduct.

This divergence evokes an "organic" quality, evident in the presence of curves and rounded edges. This contrast in appearance prompts speculation about potentially varied methods of ashlars' production at this site. The absence of straight lines and angular edges might imply an alternative technique employed by builders.

17 Thorkild Jacobsen and Seton Lloyd, Sennacherib's Aqueduct in Jerwan, University of Chicago Press 1935, p.9.

18 https://pleiades.stoa.org/places/285472

Figure 6 Ksar el Koua, Algeria

Moving to Djemila, also known as Cuicul, in Algeria, dating between 96-98 CE[19], it can be seen that the ashlars with drafted margins look similar to what is seen in Jerwan Aqueduct in Iraq, that the ashlars seem to be uniform in shape and size which also applies for the drafted margins. What sets them apart, is that they seem to have a dotted surface treatment, which could be a stylistic choice.

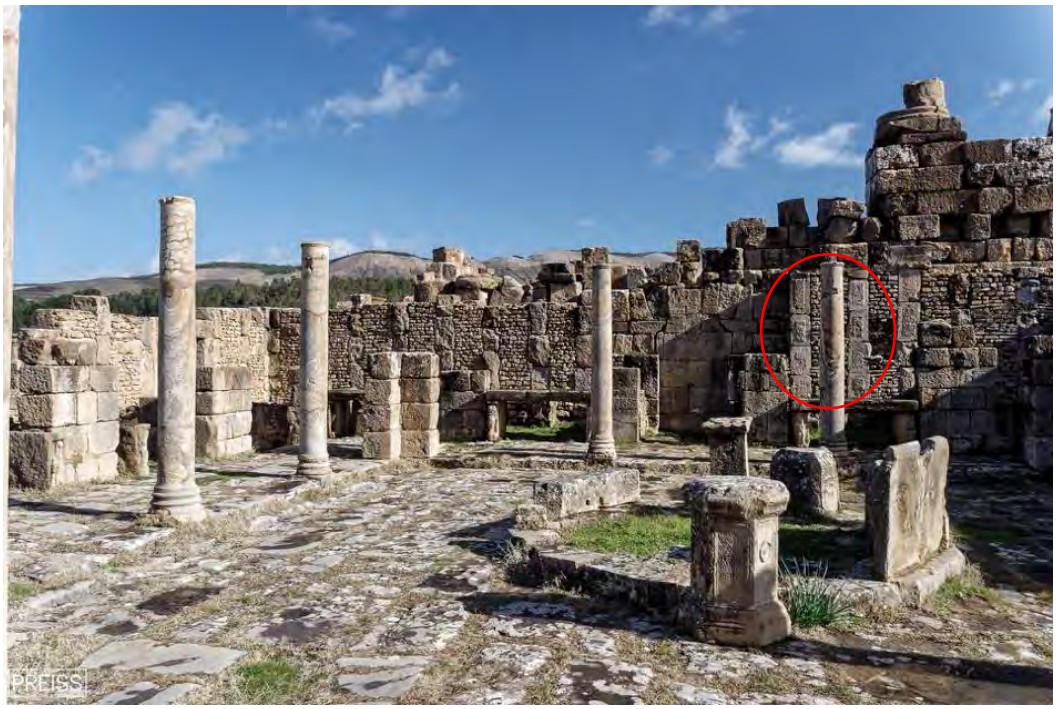

Figure 7 Djemila (Cuicul), Algeria

19 https://whc.unesco.org/en/list/191/

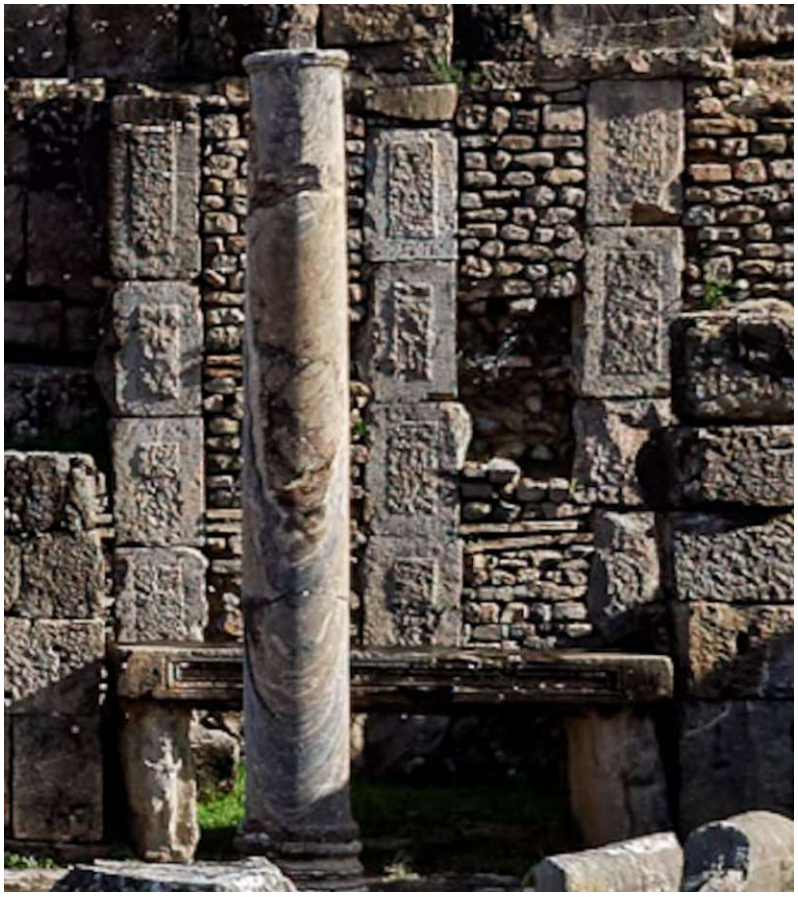

Figure 8 Red marked area zoomed in, in Djemila (Cuicul), Algeria

Staying in Djemila, seen from a different location in the same site, we can see on the left side ashlars, again with more “organic” looking drafted margins, meaning that they do not show the clear-cut geometry (marked in red). One thing to note here, we also see filler blocks here (marked in yellow), which is going to be explained in the third chapter, which puts two hallmarks in conjunction.

Figure 9 Another location in the same site, Djemilla (Cuicul), Algeria,

Figure 10 Red marked area zoomed in, in Djemila (Cuicul), Algeria

Figure 11 Yellow marked area zoomed in, displaying filler blocks, in Djemila (Cuicul), Algeria

Moving to Masinissas Tomb, also known as Soumaa d'El Khroub, in Algeria, dating to 2nd century BCE[20], it can be seen that the drafted margins on the ashlars look "rough" and not at all uniform (marked in red).

20 https://whc.unesco.org/fr/listesindicatives/1776/

These can be explained perhaps by natural wind and rain erosion or due to some external damage caused by various sources. It is also worth noting that again not all the blocks display the drafted margins.

If this is not a result of a reconstruction attempt, in which rest of the ashlars with drafted margins placed facing a different direction, then it should be taken into account that the builders choose different surface treatments for certain blocks, meaning that some had flat surfaces and some had drafted margins.

Figure 12 Masinissas Tomb, Algeria

Figure 13 Red marked area zoomed in, displaying various states of drafted margins, in Masinissas Tomb, Algeria

Moving to Carcassonne in France, dating to 12th Century CE[21], we can see, especially on the right side of the structure, that there are a lot of ashlars with drafted margins but also some without, especially the ashlars in the entire middle part. The top part of the right side probably

21 https://www.remparts-carcassonne.fr/

has repair attempts because mortar can be seen in between ashlars and the bottom part seems to be dry laid, which is probably original construction.

The question then becomes, why do we not see drafted margins on every ashlar? Is it a stylistic choice? Or a result of destruction and reconstruction? Perhaps natural causes like wind and water erosion? Maybe a little bit of everything?

One explanation would be the hierarchically subordinate components or those intended to appear “rough” are intentionally not smoothed. For instance, on the left and right side much of the wall is not smoothened, whereas the middle wall is smoothened and decorated with niche relief, which can be attributed to the compartmentalized functions these walls possess.

Figure 14 Carcassonne, France

Moving to Nessebar Bulgaria, dating between 6th to 2nd century BCE[22], we are faced with a peculiar situation. On the left side (marked in red), it can be seen that the ashlars resemble the ones from Jerwan Aqueduct or Djemila, meaning that they are somehow uniform in their shape which are mostly rectangular but some ashlars are square. The drafted margins however resemble the ones seen in Ksar el Koua, although they seem rectangular-ish, they have curves and rounded edges and bulges. We have to go with the assumption that these buildings were complete and were in use, so the surface treatments of the drafted margins we see on the ashlars on the left side must be the final decision of the builders, meaning that they did not take the extra step to "fine tune" them, like the ones in Jerwan Aqueduct.

Looking at the right side in Nessebar (marked in yellow), we see ashlars in completely different dimensions compared to the left side. These ashlars resemble with their "pillowy" and "organic" drafted margins, the ones in Ksar el Koua.

In between these two sides, there is another style of construction which consists of much smaller stone blocks, rubble fill (which can be seen at the very top) and red bricks. On the bottom part of the middle round structure, we can see traces of plaster which probably used to cover the stone blocks. In any case, there are 3 different styles of construction present at Nessebar.

Figure 15 Nessebar in Bulgaria

Figure 16 Red marked area zoomed in (left) and yellow marked area zoomed in (right), displaying different versions of ashlars with drafted margins, in Nessebar, Bulgaria

22 https://whc.unesco.org/en/list/217

Moving to the Royal Kurgen of Kerch in Ukraine, dating to 4th Century BCE[23], we can see the drafted margins resemble the ones seen in in Ksar el Koua in Algeria and perhaps the ones in Nessebar, being that they do not have a clear-cut profile like the ones seen in Jerwan Aquaeduct and rather they have rough surfaces and irregular forms, that some drafted margins protrude more than others and some are shallow.

The masonry of the mound is made dry, from smoothly processed ashlars. The central part of the ashlars is decorated with rustication, and on each slab the rustication is framed by smooth stripes about 0.8 - 0.1 m wide along the perimeter of the entire stone surface. But not all ashlars have rustication. As the stepped coverings approach the wall of the crypt, where the entrance opening leading to the crypt is located, the laying of slabs with rustication is replaced by smooth slabs. The structure of the dromos roof and the burial chamber is a stepped vault. Inside the burial chamber, all masonry is made of smooth slabs without rustication.[24] This can be interpreted as an intentional design choice or a sign of unfinished smoothening process.

Figure 17 Royal Kurgen of Kerch, Ukraine

23 https://www.atlasobscura.com/places/tsarsky-kurgan

24 Information taken from the information board photographed on site and translated with deepl.com; https://goo.gl/maps/RNyNWRs8RJjDQy2HA

Moving to the Temple of Hathor in Dendera in Egypt, dating between 54-20 BCE[25], we see on the first and second row ashlars with very shallow margins, which are still distinguishable based on their demarcation lines and have again special surface treatments like the ones in Temple of Isis in Philae. On the third row however, it is again seen ashlars with rough and "bulky" drafted margins. Below that seems to be the bedrock. One can only speculate why these stylistic changes occur.

Figure 18 Temple of Hathor, Egypt

Figure 19 Red marked area zoomed in, displaying stylistic differences on ashlars with drafted margins, in Temple of Hathor, Egypt

25 https://www.atlasobscura.com/places/hathor-temple

Again, in Egypt, but this time in Temple of Isis in Philae in Egypt, dating between 285-246 BCE[26], we see the ashlars and the drafted margins are uniform like the ones seen in Jerwan Aqueduct. Additionally, there are surface treatments applied which can be seen in the form of diagonal lines on the drafted margins. These could very well be processing remainders of the tools used to create the drafted margins or perhaps they were thought as decorative/ornamental applications.

Figure 20 Temple of Isis in Philae, Egypt

Moving to Amphipolis Tomb, also known as the Kasta Tomb, in Greece, last quarter of the fourth century BCE[27], we see ashlars with drafted margins in quite pristine condition, which are buried under a considerable amount of sediment. In another perspective, we see on the bottom part at least one very small nub (marked in red), which is another hallmark which will be explained in the next chapter.

The wall is constructed using more than 2500 sizable blocks of marble sourced from the Aegean Island of Thassos, forming its facing stones.[28] During the early Hellenistic era, drystone walls featuring ashlar blocks with meticulously crafted margins are notably distinctive. The margin series of blocks that were drafted are in line with the masonry style known as "Isodomic Ashlar: Tooled Face, Bevelled Edge," as described by Robert Scranton in his 1941 monograph titled "Greek Walls." Scranton indicates that this particular masonry type was

26 https://www.britannica.com/place/Philae-island-Egypt

27 https://www.archaeology.org/issues/161-1501/features/top10/2785-greece-amphipolis-tomb-unearthed

28 Andrew Michael Chugg, The Identity of the Occupant of the Amphipolis Tomb Beneath the Kasta Mound Macedonian Studies, Australian Institute of Macedonian Studies 2021, p. 42-43.

prevalent during the period from 320 BC to 270 BC, and the majority of dated examples are linked to the structures and fortifications built by Macedonian rulers during that era.[29]

Figure 21 Amphipolis (Kasta) Tomb, Greece

29 Ibid p.69

Figure 22 Another perspective showing people as scale and a small nub from Amphipolis (Kasta) Tomb, Greece,

Moving to Pasargadae in Iran, dating to 6th Century BCE[30], there is a rich case to be seen with the conjunction of 3 hallmarks. The entire wall seems to consist of ashlars with drafted margins and on two ashlars there are nubs, which are going to be explained in the next chapter and also the joint/corner holes which are going to be explained in the last chapter.

The geometry of the drafted margins in Pasargadae can also be compared with the ones seen in Jerwan Aqueduct in Iraq, where the ashlars and the drafted margins seem to have a uniform and clear-cut rectangular geometry.

In Achamenid Persia, ashlar masonry can be observed exclusively in prestigious structures such as the temples and palaces of Persepolis and Pasargadae, as well as in tombs like the monumental tomb of Cyrus in Pasargadae. Carl Nylander's work in 1970 extensively explored Persian ashlar masonry, leading to the following conclusions:

Ashlar masonry emerged abruptly and fully developed during the sixth century B.C. Due to the state of preservation, this construction technique is only known to have been used in podiums and tomb monuments, serving as a facing for large stone fills. The blocks were consistently arranged as stretchers, without any attempt to bond the facing with the fill. Typically, the edges were finely dressed using a flat chisel. Margins were present on all four sides and maintained a uniform width. The central portion was either intentionally left unfinished and rough or flattened and textured with a toothed tool. Nylander argues that the former style was not deliberate but rather a consequence of incomplete construction. Anathyrosis, a technique involving the jointing of blocks, was employed. The blocks themselves bear marks indicating the use of lifting and adjusting tools. Claims and dowels were extensively used for bonding. Interestingly, the last five features mentioned are commonly found in Greek construction but conspicuously absent in the specific masonry style under discussion. The resemblance between Persian and Lydian construction is particularly noteworthy. Nylander concludes that the royal Achamenid construction likely took place under Greek influence, potentially involving Lydian craftsmen.[31]

Figure 23 Pasargadae, Iran

30 https://whc.unesco.org/en/list/1106/

31 Ilan Sharon, Phoenician and Greek Ashlar Construction Techniques at Tel Dor, Israel, Bulletin of the American Schools of Oriental Research, No. 267. 1987, p.34.

Figure 24 Red marked area zoomed in, displaying, nubs (marked in yellow) and joint/corner holes (marked in green) in Pasargadae, Iran

Moving to Crac des Chevaliers in Syria, built between 1142 to 1271 CE[32], where the majority of the structure was built using limestone sourced from a nearby quarry located a few kilometers away. In contrast to the twelfth-century style, which featured protruding stonework, the thirteenth-century construction showcases a smooth and precisely cut flat ashlar, where the mortar joints are barely noticeable due to its fine craftsmanship.[33] This type of stonework, which is categorized as characteristic Crusader masonry featuring drafted margins and raised centers. It is possible that the inspiration for this style originated from ancient masonry styles.[34]

Upon closer look, a nuanced arrangement is revealed regarding the drafted margins of the ashlars. Notably, not all the ashlars exhibit these defined edges. Focusing on the the arched opening also reveals a notable feature, that specific ashlars showcase drafted margins that correspond to the curvature of the arch itself. This alignment between the margins and the arch's shape suggests that a reconstruction attempt is unlikely to account for the presence or absence of drafted margins, as these intricately fitted ashlars would be challenging to manipulate into such precise positions during a reconstruction.

On the upper section, an additional layer of evidence emerges in the form of a rubble fill, presumably concealed by the ashlars adorned with drafted margins. This feature corroborates the notion that these ashlars were most likely deliberately positioned to encase the underlying rubble fill.

32 https://whc.unesco.org/en/list/1229/

33 Hugh Kennedy, Crusader Castles, Cambridge University Press 1994, p.159.

34 Ibid, p.65.

Figure 25 Crac des Chevaliers, Syria

Figure 26 Red marked area zoomed in, in Crac des Chevaliers, Syria

Moving to Warangal in India, dating to 13th Century CE[35], a sort of pattern can be seen on the wall in the way it was built. It starts with large smooth ashlars on the bottom and in the second row it switches to smaller ashlars with drafted margins. Same thing can be seen in the third and the fourth row which are then capped different shaped ashlars. Although the blocks seem to have a rectangular shape, the lines they form at the joints are definitely not straight so it can be concluded that the wall has a polygonal nature to it. The drafted margins resemble the ones seen in in Ksar el Koua in Algeria, that they have a certain "organic" nature to them, given that they are not clear cut like the ones in Jerwan Aquaeduct or Amphipolis Tomb.

35 https://indianculture.gov.in/node/2761046

Figure 27 Warangal, India

Figure 28 Wall close up, another location in the same complex, Warangal, India

Staying in India but moving to the Dhamekh Stupa, which was built in 500 CE as a replacement of a structure commissioned by Mauryan king Ashoka in 249 BCE[36], we see on the bottom

36 https://www.uptourism.gov.in/en/page/dhamek-stupa

right part ashlars with drafted margins (marked in red), which transition into ashlars with smooth surfaces to the left. This transition can be viewed as, if there was a smoothening process, that it is not being complete or as a deliberate choice to leave certain ashlars as unsmoothened as a stylistic choice.

Figure 29 Dhamek Stupa, India

Moving to Koh Ker in Cambodia, dating to 10th Century CE[37], on the bottom left row (marked in red), we can see only certain ashlars have drafted margins.

Figure 30 Koh Ker, Cambodia

37 https://whc.unesco.org/en/tentativelists/6458/

Moving to Kanazawa Castle in Japan, built in 1580 CE[38], we can see very faint drafted margins on polygonal masonry. The form of a given ashlar is offset approximately 2-3 cm inside and this area received then a surface treatment. Although the drafted margins part do not protrude outwards like the previous examples, their execution can be compared to the ones seen in Temple of Hathor in Egypt, where the top row similarly had very shallow margins and the surface of the margins were dotted and/or chiseled with diagonal lines.

Figure 31 Kanazawa Castle, Japan

Figure 32 Red marked area zoomed in, displaying the faint demarcation lines, in Kanazawa Castle, Japan

38 https://www.ishikawatravel.jp/en/spots/kanazawa-castle/

Moving to Vilcashuaman in Peru, dating between 1400-1500 CE[39], we can see very distinct styles of construction. The church at the very top, is an edifice which can be traced back to the Spanish conquest[40], which is built on top of polygonal Incan masonry. In the front, we see the ashlars with drafted margins (marked in red). Here, comes in a bit of speculative brain storming.

Whatever their origin, they undeniably bear a resemblance to ashlars found in the Middle East or Europe. In other words, if we were to substitute these ashlars with those from Temple of Isis, Jerwan Aqueduct or even Amphipolis Tomb, the disparities would be minimal.

Now, let us entertain some conjecture. Did the Spanish construct this edifice during or after their conquest as a declaration of dominance? Is it possible that they transported these ashlars from Europe? Alternatively, might they have employed these ashlars as a homage to ancient European structures? Or could it be that the Incans themselves were utilizing ashlars with drafted margins in their constructions? If that were the case, how did they manage to execute them in such a strikingly similar fashion to those found in the Middle East or Europe? Alternatively, could these ashlars be contemporary creations, manufactured in modern times to emulate ancient ones?

Figure 33 Vilcashuaman, Peru

Staying in Peru, moving to Machu Picchu in Peru, dating to 15th Century CE[41], we see one ashlar with drafted margins (marked in red). The way of its execution seems quite different than the other examples presented so far. We see that the lines of the drafted margins fade

39 https://www.arqueologiadelperu.com.ar/vilcashuaman.htm

40 https://www.worldhistory.org/article/1920/the-iberian-conquest-of-the-americas/

41 https://whc.unesco.org/en/list/274/

out and we do not see any other margins on any other ashlar. Additionally, towards the top, we can see nubs on certain ashlars (marked in yellow), which is going to be presented in the next chapter, which puts two hallmarks in conjunction.

Figure 34 Machu Picchu, Peru

To conclude, placement of ashlars plays a crucial role in the feature of smoothened and unsmoothened wall surfaces. Before placement, ashlars must be smoothened at all junctions with adjacent ashlars, including the bottom, top, left, and right surfaces. In the case of solid walls composed of several ashlars, the rear surface must also be smoothened. However, the front surface of the ashlars only needs to be smoothened precisely at the edges due to their exact placement in connection with neighboring blocks. The middle part of the front face does not need to be smoothed for structural reasons.

Therefore, it would be a fair assessment to say that the drafted margins are a mere stylistic/artistic surface treatment on the ashlars and not a structural (or even functional) one, because the ashlars with drafted margins could have easily been created without them and they would not lose anything from their structural integrity. They are most probably created to enhance the visual appeal of the ashlars, rather than providing any structural or functional benefits. It is clear that we can observe various execution styles which could be attributed to cultural influence but the underlying principle is the same overall, that is the edges of the ashlars are offset inwards to create (in most cases) a raised border.

In the above-mentioned examples, the reason for some parts of the ashlar walls being smoothened and other parts not smoothened could be the fact that after the completion of ashlar walls, the entire face is smoothened, or "polished," which is most probably done in a from top to bottom fashion. In many cases, this results in upper wall zones being smoothened while lower zones are left unsmoothened, which can clearly be observed in Masinissas Tomb and Dhamek Stupa. Such buildings are not considered to be finally finished. In cases where drafted margins appear to be present in the entire structure, such as in Royal Kurgen of Kerch and Pasargade, it can be said that this polishing process has not taken place or intentionally

not done for stylistic reasons. Additionally, the drafted margins could have been intentionally left unfinished as a reference to show a comparison between the original thickness of the ashlar and the amount of smoothening which was done.

What is peculiar is that the application of drafted margins is found all around the world, in one form or another, and it would be interesting to explore how drafted margins became a worldwide phenomenon. This could involve examining the historical and cultural contexts in which the technique developed and/or spread, as well as investigating any possible practical or symbolic reasons for its use. For example, some cultures may have used drafted margins as a way of distinguishing their architectural style or expressing their cultural identity. Similarly, drafted margins might have been used as a way to distinguish or emphasize a structures purpose and/or function, for example, buildings with religious significance may have featured more elaborate drafted margins as a way of conveying their importance and sanctity.

2. Nubs/Knobs

In this hallmark, we see protrusions on ashlars in various shapes and sizes. The term nub is used for small sized protrusions and knob for bigger ones.

In architectural terms, these protrusions can be referred to as bosses or apergon. Bosses are usually found in the ceilings of buildings, particularly at the keystones at the intersections of a rib vault.[42] They can also be used as lifting aids which are called lifting bosses. An apergon is referred to the additional thickness left around the block and remained unworked to protect the final surface from possible damage.[43]

In a way, nubs/knobs could also be described as more shaved off versions of drafted margins. The placement of nubs/knobs seem to be random in most examples, that is to say they are found in the corners, center, off-center etc.

To refrain from attributing a specific purpose or function to this hallmark, the terms nub and knob are used, which are mainly used to describe their physical appearance.

Below is a schematic display of the nubs/knobs.

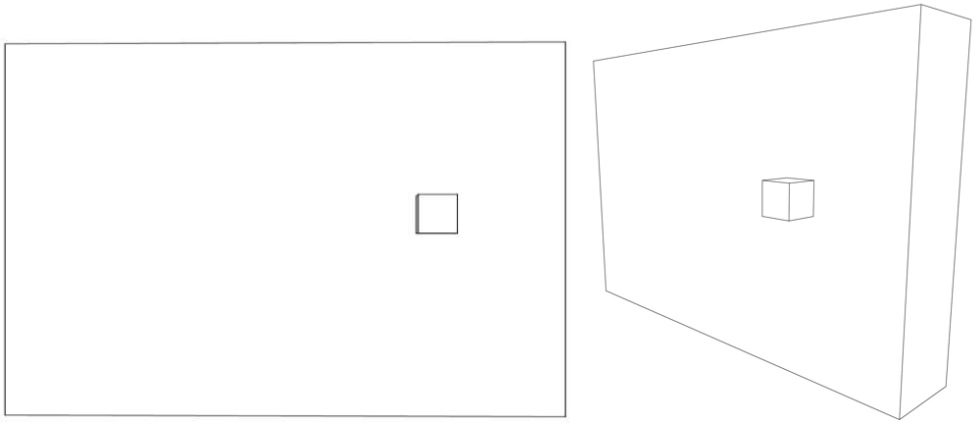

Figure 35 Schematic views of the nubs/knobs; frontal view (left) perspective view (right)

A good example to start with comes from Athens Acropolis in Greece, dating from 5th century BCE[44]. Each ashlar seems to be uniform in shape and size, which is also the case for the nubs, and the nubs are placed somewhat in the center. On some ashlars, especially towards the top, the traces of nubs can be seen and their absence could be attributed to some form of outside force which broke them off or they were smoothened after the ashlars were placed.

One very obvious use which can be attributed for the nubs/knobs, is that they are lifting bosses. In this specific case in the Athens Acropolis, the nubs could very well be used as lifting or moving aids, given to their standardized form and somewhat in center placement. Here, towards the top, there are also dowel/square holes, which are going to be explained in the sixth chapter, which puts two hallmarks in conjunction.

42 Francis D. K. Ching. A Visual Dictionary of Architecture. John Wiley & Sons, 1995. p. 263.

43 https://www.e-flux.com/journal/66/60754/monumentaries-toward-a-theory-of-the-apergon/

44 https://whc.unesco.org/en/list/404/

Figure 36 Athens Acropolis, Greece

Staying in Greece but moving to Delphi, Mount Parnassus, dating to 2nd Century BCE[45], it can be seen that only some ashlars have nubs on them (marked in red). We could speculate that due to a reconstruction attempt, the rest of the ashlars with nubs are facing the other direction, but this would be an odd reconstruction attempt to selectively display some ashlars with nubs facing one direction and the rest to another direction. Or perhaps they were broken off like the ones in Athens Acropolis but no traces can be seen.

It is also worth noting that the diagonal surface treatment lines can also be seen on the ashlars, resembling the ones seen on the drafted margins in Temple of Isis in Philae in Egypt, and in some blocks this surface treatment seem to have a dotted version. The peculiar thing is that these surface treatments do not seem to go over the nubs.

It has to be acknowledged in order to make a nub one has to remove all the rest of the mass around it. In this sense, the nubs can be considered as high relief carvings. They are not elements which could be added later onto the ashlar, as if they are a product of pottery. So, the builders carefully went around the nubs with the surface treatment, which could also indicate that they did not want to remove the nubs.

45 https://whc.unesco.org/en/list/393/

Figure 37 Delphi,Greece

Staying in Greece but moving to Dodona, which is inhabited since the 15th century BCE but rose to prominence around 319-272 BCE[46], we see a similar phenomenon like in Delphi, that almost all the ashlars which can be seen in the background do not have nubs. If they are indeed used for lifting, then all ashlars which are at the same size as the ones which have nubs or larger, should have them. We could only speculate if there was a selective surface treatment for certain ashlars, that being the nubs were shaved off after certain ashlars were placed to make them smoother and others continued to have the nubs.

Figure 38 Dodona, Greece

46 https://www.worldhistory.org/Dodona/

Figure 39 Dodona, Greece

Moving to Heraclea Sintica in Bulgaria, dating to 4th Century BCE[47], we see a similar phenomenon, that the ashlars on the bottom get smoother towards the right as if the builders were in the process of smoothening the ashlars but suddenly stopped and not every ashlar has nubs.

Figure 40 Heraclea Sintica, Bulgaria

47 https://www.academia.edu/49418608/Heraclea_Sintica_and_Some_of_Its_Recently_Found_Marble_Sculptures

Moving to Temple of Garni in Armenia, dating to 1st Century CE but was reconstructed between 1969-1975 CE[48], we see that the nubs are found on column segments instead of ashlars. According to the historian and archaeologist Babken Arakelyan, in 1679, a powerful earthquake destroyed the temple, which subsequently became gradually covered in earth and overgrown with trees. During his visit in the 1830s, Dubois de Montpère reconstructed the northern facade of the temple and provided several sketches detailing its features.[49] Perhaps there were more nubs on columns and even on ashlars but due to the temple's destruction, these were also damaged and refined during the reconstruction. Also, on the foundations, we see Joint/Corner holes, which will be explained in the last chapter, which puts two hallmarks in conjunction.

Figure 41 Temple of Garni, Armenia

Figure 42 Red marked area zoomed in, displaying nubs on column segments, in Temple of Garni, Armenia

48 https://www.worldhistory.org/Temple_of_Garni/

49 Babken Arakelyan,The Archaeological Expedition of the Institute of History of the Academy of Sciences of the Armenian USSR 1949-1950, Archaeological Excavations in Armenia, No. 3.,p.15

Moving to Segesta in Italy, dating to 420 BCE[50], the nubs seem to be concentrated on the foundation. If they were used for lifting, perhaps one could also expect them to see also on the column segments or even on the ashlars placed on top of them. On another note, archaeologist Robert Ross Holloway, classifies the temple as unfinished, noting the columns not being fluted, and, referring the nubs as lifting bosses, noting that they still remain on many of the foundation blocks.[51]

Figure 43 Segesta, Italy

Figure 44 A drawing by Luigi Mayer displaying the temple from the other side in Segesta, Italy

50 https://www.atlasobscura.com/places/temple-of-segesta

51 Robert R. Holloway, The Archaeology of Ancient Sicily, Routledge 2000, p.120

Moving to Plouarzel in France, looking at Menhir of Kerloas, which was erected over 4000 (roughly 2000 BCE) years ago. The Menhir, (maen-hir", literally meaning "long stone"), which is 6,2 m. in circumference and thought to be 12 m. tall in its original form (now 10 m., since a portion of it was damaged after a lightning strike) and has an estimated mass of between 100 and 150 tons.[52] This menhir is occasionally referred to as the "Hunchback" due to the nubs on its sides. In the 19th century, a peculiar tradition revolved around these nubs: newlywed couples would visit the menhir and rub their bellies against the protrusions. The man sought the blessing of male offspring, while the woman aimed to establish her authority within the household.[53]

Figure 45 Menhir of Kerloas, France

52 Information taken from the information board photographed on site; https://goo.gl/maps/UGudceaWnswYo5a47

53 Information taken from the information board photographed on site; https://goo.gl/maps/ya9KUVjXoNBp9rby9

Figure 46 Close up of the nub at Menhir of Kerloas, France

Figure 47 Close up of the nub at Menhir of Kerloas, France

Moving to Pasargadae in Iran, 6th Century BCE[54], it can be seen that not all the blocks have nubs. A possible repair attempt with rubble fill and mortar can be seen between ashlar blocks on the upper left part and the ashlars we see are probably facade elements to cover the rough shaped ashlars which can be seen on top.

The peculiar thing about the nubs in Pasargadae, is that they are found not directly on the ashlars but rather on drafted margins. As mentioned before, in Pasargadae, there are three hallmarks in conjunction, namely the ashlars with drafted margins, nubs and joint/corner holes which will be explained in the last chapter.

What should be noted here is the peculiar case of the presence of nubs on only two specific ashlars while the rest seems to be devoid of them. It is possible that these nubs were used for lifting or moving (or any kind of helping aid) the ashlars during construction, but then why were they not present on all of the ashlars that were likely moved or lifted in the same manner? Furthermore, if the nubs were shaved off after the placement of the ashlars, why do some of them still have nubs? Were they simply forgotten? Or were they left there to have secondary functions? This inconsistency raises questions about the purpose of the nubs and their use in the construction of the ashlars.

In his first preliminary report, David Stronach states that the overall work is incomplete due to the nature of the surface treatment of individual stones, which exhibits significant variation, meaning that numerous stones retain intriguing masons' marks or square protruding knobs, which hold the potential to unveil further insights into the Achaemenian masons and their techniques in the future.[55]

Figure 48 Pasargadae, Iran

54 https://whc.unesco.org/en/list/1106/

55 David Stronach, Excavations at Pasargadae: First Preliminary Report, British Institute of Persian Studies 1963, p.31

Figure 49 Red marked area zoomed in, displaying, nubs (marked in yellow) and joint/corner holes (marked in green) in Pasargadae, Iran

Moving to Temple of Osirion in Egypt, which is thought to be a cenotaph of Seti I[56] who ruled between 1290 to 1279 BCE[57], we see one rectangular nub on one of the ashlars (marked in red). This nub seems too shallow in its protrusion, meaning that it is sticking out only very slightly, which is not enough to be considered as a substantial lifting mechanism.

There could be various factors that may have played a role in the shallow nature of the nub. One plausible explanation is that the nub was never intended for lifting in the first place, but rather it had a different function, such as serving as a decorative element or providing additional stability to the ashlar, like a balancing feature. The decorative purpose of the nub could have been to enhance the overall aesthetic of the ashlar or to signify the status of the structure in which it was used. The nub could have also been designed as an interlocking mechanism with an adjacent ashlar or another element to provide stability, thereby reducing the likelihood of slippage or collapse.

Another factor that could have contributed to the shallow nature of the nub is the natural process of erosion. Over time, exposure to weather elements and other environmental factors can lead to erosion, causing the nub to become less pronounced than it was initially. The erosion process can result from the mechanical action of wind or water or which then gradually would dissolve the surface of the stone. Additionally, there also might have been intentional damage done by people for example an active way of destructing a protruding feature or even an accidental damage.

On the left side, in between two blocks, we see a filler block (marked in yellow), which is going to be explained in the next chapter, which puts two hallmarks in conjunction.

56 https://www.britannica.com/place/Abydos-ancient-city-Egypt

57 https://www.britannica.com/biography/Seti-I

Figure 50 Temple of Osirion, Egypt

Staying in Egypt, moving to Trajan's Kiosk in Philae dating between 98-117 CE[58], there is almost a haphazard way of distribution of the nubs, suggests a lack of order or planning in their placement.

Upon closer examination, it becomes apparent that the nubs are predominantly clustered on the right side of the structure, with only one nub found in the middle. The absence of nubs on the blocks below and on the left side of the structure raises questions regarding their purpose and arrangement. One plausible explanation for this uneven distribution of nubs is that they may have served as aiding mechanisms for lifting and moving specific parts of the structure. This could have been a deliberate choice made to minimize the aesthetic impact of these functional elements. Alternatively, the builders initially intended to add more nubs but, for some reason, abandoned the idea or simply forgot to incorporate them. There is also the possibility that these nubs were not solely utilitarian in nature, meaning that some may have been left in specific areas as decorative features, serving an aesthetic function as well. These decorative nubs could have been incorporated to add visual interest or symbolism to the structure. Moreover, it is conceivable that, over time, some of these nubs were repurposed as functional protrusions for attaching additional features or elements to the ashlars. These could have been used to affix decorations, inscriptions, or even additional structural components, thereby evolving from their original utilitarian role into elements with both functional and decorative significance.

58 Ian Rutherford. Island of the Extremity: Space, Language, and Power in the Pilgrimage Traditions of Philae. Brill, 1998, p. 233.

Figure 51 Trajan's Kiosk in Philae, Egypt

Figure 52 Another perspective of Trajan's Kiosk in Philae, Egypt

Moving to Brihadisvara Temple in Thanjavur in India dating to 1003-1004 CE[59], it can be clearly seen, whatever the function or purpose of the nubs may be, that not all blocks "required" them.

Extending the assumption made in Nessebar Bulgaria regarding existence of rough seeming ashlars with drafted margins, it has to be that these buildings were complete and were in use, so the surface treatments of having certain blocks with nubs and certain blocks without nubs must be the final decision of the builders. This implies that the placement or non-placement of the nubs must have been a deliberate decision made by the builders, rather than a result of an incomplete construction process. Whether there is a functional and/or aesthetic reason behind this, would be another matter of speculation.

Figure 53 Brihadisvara Temple in Thanjavur, India

Moving to Airavatesvara temple in Kumbakonam in India, dating to 12th Century CE[60], we can see one little nub at the bottom left. Perhaps it was forgotten to be shaved off?

If the ashlars were indeed created intentionally with nubs, then it is unlikely that the nub was simply forgotten. However, if the object was supposed to have all nubs removed, then the presence of a single nub could suggest that the shaving process was not completed thoroughly, and this nub was overlooked by the builders.

It could also have been left as a decorative feature, serving as a unique characteristic that sets this specific ashlar apart from others in the structure.

59 https://whc.unesco.org/en/list/250/

60 Ibid.

Figure 54 Airavatesvara temple in Kumbakonam, India

Moving to Ghanpur temples, locally known as Kota Gullu, in India, built in the late 12th and early 13th century[61], we can see slightly larger nubs compared to the ones seen in Brihadisvara Temple and Airavatesvara Temple.

It begs the question, if the nubs indeed have a function, such as a helping aid, why is there not a standardized way of producing and placing them? The ashlar marked on the upper left side of the structure and the one next to it, which is clearly smaller, has the same number of nubs. There is also one ashlar which does not have any nubs? How come there is a selectiveness?

In contrast to the structure being observed, which has nubs on certain ashlars, there is additionally a similarly constructed structure in the second row which displays no nubs. There is the possibility that the nubs on the structure in the second row could be located on the other side of the structure. However, this raises questions about the functionality of the nubs. If the nubs were used helping aids (lifting, moving etc.), it would be unlikely that they would be placed on only certain ashlars which are facing certain directions. Lifting bosses would typically be placed on the front and rear side of the object to ensure that it can be lifted securely. Alternatively, if the nubs were used for decorative purposes, it would still be unlikely that they would only be placed on one side of the structure, as this would result in an uneven appearance.

The absence of nubs on the similarly constructed structure raises questions about why they were present on the other structure in the first place. It could be that the nubs on the

61 https://bhoopalapally.telangana.gov.in/tourist-place/kotagullu/

observed structure served a specific function or were intended to create a particular visual effect, while the lack of nubs on the other structure may indicate a different purpose or design.

In another perspective of the Kota Gullu structure, shows clearly that the nub placed on the lower left part of the structure, belongs to another ashlar and the one next to it, which is clearly larger, required no nubs.

Figure 55 Ghanpur teples (Kota Gullu), India

Figure 56 Another perspective of the same structure in Ghanpur temples (Kota Gullu), India

Moving to Hazara Rama Temple in India, dating to 15th Century CE[62], we see on the bottom right, there are three small nubs. If we were to follow along the line to the left, we cannot see any other nub. Perhaps at the other parts of the structure one can observe this, but even from this perspective alone the selective appearance of the nubs begs the question; why were they placed (or left) like this?

At the top of the structure, there are dowel/square holes (marked in yellow), which will be explained in the sixth chapter, which puts two hallmarks in conjunction.

Figure 57 Hazara Rama Temple, India

Moving to the Yangshan Quarry in China, dating to 1405 CE[63], we can see knobs which are in relation to nubs, are much larger in their size and dimension. The knobs seen here find themselves on a monolithic bedrock which is approximately 10 meters tall, 20 meters wide and 8.5 meters thick, which gives the block a volume of 1700 m^3 and a weight around 4200 tons[64]. Have the builders indeed removed all the rest of the mass around the knobs to create them? If so, what happened to the material removed from the monolith?

If the builders did indeed remove the mass around the knobs, it would have required significant effort and skill to carve and shape the monolith. The removed material must have been substantial and it would be reasonable to assume that it was repurposed in some way rather than simply discarded, given the amount of effort that would have gone into shaping the monolith, it seems unlikely that the builders would have wasted such valuable resources.

62 https://www.penn.museum/sites/VRP/html/Ramachandra.html

63 https://archive.ph/20121128231558/http://www.tsxc.gov.cn/ziyuan.asp

64 Guilio Magli, Sacred landscapes of Imperial China, Springer, 2020, p. 106.

And what exactly is the purpose of the knobs at the Yangshan Quarry? Did the builders intend to lift the 4200 ton monolith with these knobs? Or is there an aesthetic reason behind it?

Figure 58 Yangshan Quarry, China

Moving to the Boulder Batholith in Montana in U.S.A., exact dating rather unclear, we see nubs which are placed on a boulder.

Figure 59 Boulder Batholith in Montana, U.S.A

Figure 60 Close up from Boulder Batholith in Montana, U.S.A

Moving to the shrine of Yuraq Rumi in Vilcabamba in Peru, dating to late 1300 to mid-1400 CE[65], we see again a monolith but this time with nubs on them. Situated at the heart of the shrine compound, Yurak Rumi, an intricate rock formation named after the Quechua words for "white" (yurak) and "rock" (rum). The rock, crafted from a single block of white granite, boasts an oval shape with a slightly pyramidal structure. Over time, it has acquired a darkened appearance due to the presence of black lichen. Yurak Rumi spans approximately 21 x 10 meters. On the northern face, Yurak Rumi impressively rises 8 meters above the surrounding ground level, presenting a sheer vertical surface. This facade features a series of ten square protrusions, with seven of them aligned in a single row, accompanied by subtle, step-like carvings near its base.[66]

This arrangement suggests an intentional design element rather than a random occurrence. However, this raises a critical question: How were these nubs created? If the builders indeed removed the surrounding material to carve out these protrusions, where is the excess material that was removed? This would highlight an important aspect of the monolith's construction and opens up possibilities for understanding the tools and techniques that might have been used by the builders to shape such a massive piece of stone.

65 https://www.academia.edu/6220108/The_Destruction_of_the_Yurac_Rumi_Shrine_Vilcabamba_Cusco_Department_

66 Brian S. Bauer, Vilcabamba and the Archaeology of Inca Resistance, The Cotsen Institute of Archaeology at UCLA 2015, p.44

Figure 61 Shrine of Yuraq Rumi in Vilcabamba, Peru

Moving to the Rumicolca in Cusco in Peru, which may have been occupied from 500 to 1000 CE[67], we see nubs in different variations in terms of their size, shape and placement. It is also peculiar that although the ashlars seem to have more or less the same size, some ashlars have one nub on them and some have two and some have none.

Rumicolca is also known as for being a quarry for a dark-colored rock called andesite, which turns into a rich chocolate-brown shade exposed to weathering. This andesite was commonly cut into rectangular blocks, sometimes arranged in regular patterns, and other times in irregular configurations and it was extensively utilized in notable Inca structures. When dealing with oversized stones which could not be carried, a method involving rollers, wooden pry bars, and large teams of men pulling ropes was employed. The blocks were elevated by constructing an inclined plane made of earth and stones, reaching the desired height of the wall, and then rolling the blocks into place using the rollers. Protuberances were often intentionally left on the stone blocks to facilitate the use of pry bars. In many instances, these protrusions were not removed and were likely regarded as decorative, reminiscent of similar practices seen in ancient Greece during the 4th century B.C. These raised sections are typically found near the bases of the blocks.[68]

Another explanation comes from Jean-Pierre Protzen, who is specialized in Inca construction methods. He states, the presence of various carved protuberances on the surface of the stones played an undoubtedly significant role in their handling. These protuberances, which can be found in different sizes and shapes, are typically located on the lower part of a block once it has been placed in position. It is possible that these projections were used as attachment points for ropes or as leverage points for applying force with a lever. It appears that these projections were specifically carved at the construction site and were intended for

67 https://www.atlasobscura.com/places/rumicolca

68 Julian H. Steward, Handbook of South American Indians Volume 2, Smithsonian Institution Bureau of American Enthnology 1946, p.226

the purpose of handling stones there. Interestingly, none of the abandoned blocks along the transport routes possess such protuberances, suggesting that these projections did not play a role in transporting the blocks to the construction site.[69]

Figure 62 Rumicolca in Cusco, Peru

To conclude, based on the examples presented in the chapter, it becomes apparent that the nubs found on various structures or edifices lack a universal function or purpose. Their application varies significantly among different instances, making it difficult to determine a consistent role for nubs in general.

To understand the function or purpose of a nub on a particular structure or edifice, it is essential to consider its cultural context and the specific meaning it holds in that setting. In other words, the significance and purpose of nubs cannot be generalized without taking into account the cultural nuances and variations associated with their usage. This requires acknowledging that although similar applications and executions of nubs can be found worldwide, their significance and purpose might differ significantly depending on the cultural context in which they are employed.

Considering another aspect; if the nubs were indeed created with a certain purpose in mind and the purpose of these nubs involved things like moving, lifting etc., and even if they were created using different methods based on the level of ability of each given culture, one could then argue that it is indicative of a widespread global connection.

69 Jean Pierre Protzen, Inca Stonemasonry, Scientific American 1986 Vol. 254, p. 104

In other words, if the nubs are some sort of purposeful mark on any structure or edifice that the builders use for moving or lifting that would be because the builders are using a similar level of technology, or at least the same idea in terms of building approach, to create and utilize the nubs. So, if these nubs are to be found across the world, one could argue that it is more supportive evidence that the cultures had a widespread global connection/communication with one another.

Also, nubs could have potential secondary functions after the fact that which might be described as "byproduct of manufacturing", but a byproduct that the builders utilized secondarily. The builders could have left them on deliberately after the fact, as they could obviously create smooth surfaces as well, which indicate that there could be another aspect to them. So, the fact that some blocks have nubs and some do not, could mean that their placement was indeed intentional and they served another purpose, other than lifting, moving etc. aids.

3. Filler Blocks

In this hallmark, at the corner of a usually L-shaped stone block, is a smaller stone filling in the gap created by that L-shaped stone block, hence the coined term filler block.

Below is a schematic display of filler blocks.

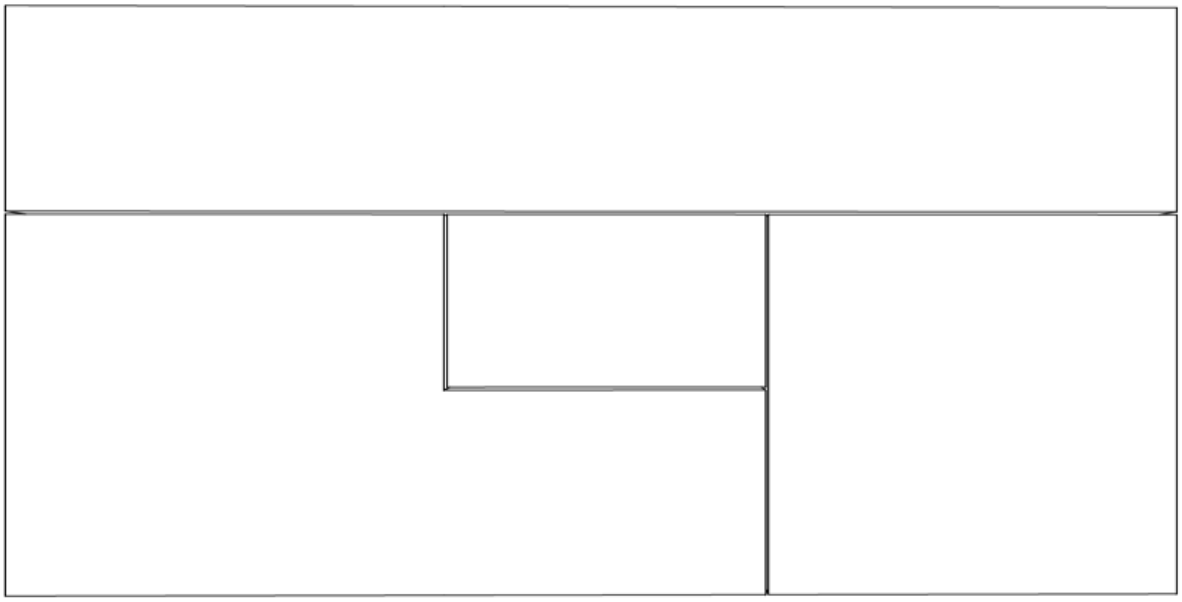

Figure 63 Schematic frontal view of filler blocks.

A good example to start with comes from Machu Picchu in Peru, dating to 15th Century CE[70] and right away an important detail can be seen and that is, the area which is occupied by the filler block slightly extends on the corner to the block on the right.

One possible explanation would be that this could be a repair attempt for broken corners. But if this is not a repair attempt, the question then arises why did the builders not make the ashlars in their complete form? In this particular example, it can be seen that ashlars have rectangular and polygonal geometries. This polygonal geometry is particularly observable on the left ashlar, where the filler block is placed. It can therefore be said, that the builders could have executed the ashlars in a way which would not require creating an area between them to be filled with a smaller rectangular ashlar. Still, whether this is a repair attempt for broken/damaged corners or if it is original in the design is hard to tell.

Another thing to notice is the nubs on the upper left and right side of the filler block (marked in yellow) and a trapezoidal niche on the left side (marked in green), which is going to be explained in the next chapter, which puts three hallmarks in conjunction.

70 https://whc.unesco.org/en/list/274/

Figure 64 Machu Picchu, Peru

Moving to Daorson in Bosnia, dating to 4th Century BCE[71], the same application of the filler block can be seen but this time only occupying one main block. On the left side, an actual damaged corner can be seen which is not repaired, which of course could be recent.

Figure 65 Daorson, Bosnia

71 https://whc.unesco.org/en/tentativelists/5282/

Staying in the same continent but moving to Jelsa in Croatia, which is thought to have been built in the 4th or 3rd Century BCE[72], the overall construction consists of ashlars which are mostly rectangular and some square, which vary in their dimensions.

In 1834, the Austrian Empire introduced the inaugural cadastral map of Dalmatia, featuring the enduring depiction of Tor tower and its corresponding cadastral parcel 396. Nearly four decades later, Jakov Boglić, a historian hailing from the town of Hvar, documented his findings on the ancient walls in Stari Grad, expressing the following sentiment:[73]

> "[…] At the time of Pribojević (1525), there was a small door on the south side, which later collapsed (author's emphasis), and only three sides remained, which would be worth preserving better. Shepherds destroyed one part, gradually tearing down the blocks, which had been placed one above the other without mortar, so that they could more easily be moved. […]"[74]

Given to this statement, it could be claimed, after the original configuration of the tower was lost, where there is no matching ashlar available, the gap is filled with smaller ashlars. However, it is important to note that these filler blocks are not to be considered as part of the design, but are simply being used to fill an already existing gap.

Figure 66 Jelsa, Croatia

In Segni at podium of the temple of Juno in Italy dating spanning between 750 BCE-640 CE [75], the filler block on the bottom left could be compared with the one in Machu Picchu in Peru, being that it extends to two blocks in the area which it occupies. The other filler blocks could be attributed to the blank spaces created due to the polygonal structure of the masonry. In other words, if no matching stones are available, the space will be filled with smaller filler blocks, meaning the gap itself is not intentionally formed but rather, it naturally exists and

72 https://visitjelsa.hr/en/5022/tor-hillfort-and-historic-watchtower/

73 https://www.academia.edu/102694347/The_ancient_tower_of_Tor_on_the_island_of_Hvar_a_retrospective p.75

74 Ibid.

75 https://pleiades.stoa.org/places/866779647/temple-of-iuno-moneta

must be filled. In this case, these filler blocks, cannot be considered as intentional design elements.

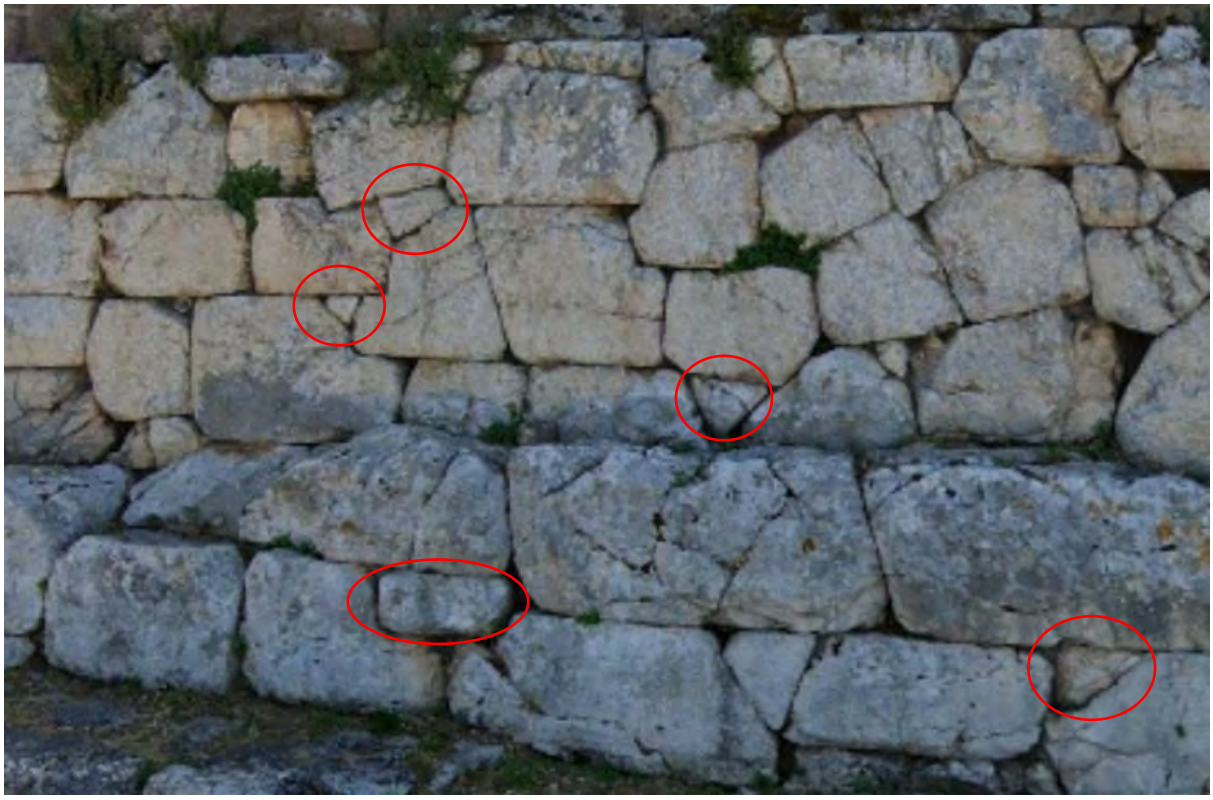

Figure 67 Temple of Juno in Segni, Italy

In Phellos in Lycia in Turkey, dating to 4th Century BCE[76], it is seen again that the area occupied by the filler block extends to two ashlars, similar to Machu Picchu. Again, whether this is a repair attempt for broken/damaged corners or if it is original in the design is hard to tell. It is also worth noting the ashlars with drafted margins on the upper left and bottom right, which displays two hallmarks in conjunction.

It is also worth noting, in this particular example, there is a sort of "pattern", which the filler blocks find themselves in. To the left there is a square ashlar which has a small L-shaped area on its top right and next to it there is a rectangular ashlar which is slim and vertical. The filler block is placed on top of these two blocks. This "pattern" is repeated two times as it can be seen on the photograph.

This entire formation could have easily been replaced by one single rectangular ashlar, which would have had little to none effect on the structural integrity of the whole masonry. This can be interpreted as the builders made a deliberate choice to execute the masonry like this, which could very well be a stylistic choice. Alternatively, here the polygonal geometries are not present as it was observed in Machu Picchu, but rather the ashlars display uniform rectangular geometry. It can be concluded that the builders worked with different sized stones and the filler blocks were used because there was not any suitable large stone at hand.

76 https://antalya.com.tr/en/discovery/history/ancient-cities/phellos-ancient-city

Figure 68 Phellos in Lycia, Turkey

Moving to Koh Ker in Cambodia, dating to 10th Century CE[77], an instance can be seen and a claim can be made where the filler blocks are most probably used as a repair attempt.

Figure 69 Koh Ker, Cambodia

77 https://whc.unesco.org/en/tentativelists/6458/

Moving to Ahu Vinapu in Rapa Nui in Easter Island in the Pacific Ocean, dating spanning between 10th to the 16th Century CE[78].

Dressed or purposefully shaped building stones, referred to as cut stones, can be found everywhere in the archaeological landscape of Rapa Nui. They appear in various sizes, finishes, and contexts. The Rapanui people identify two categories of dressed or cut stones, each with its own designated name. The first and more widely recognized category is known as paenga, as in hare paenga, which is used to describe the curbstone foundations of houses, including those inhabited by elites and communal feast houses. The second category, less familiar, is referred to as pae, representing smaller, unfinished stones used in the construction of stone-lined earth ovens and foundations of houses occupied by commoners.[79] Both paenga and pae dressed stones served multiple purposes, including the construction of house foundations, ahu platforms, and earth ovens.[80]

Since these stones are referred to as cut stones because they are shaped intentionally for a specific purpose, the filler block can be assumed as part of the design. It can also be seen, that the area occupied by the filler block extends to two blocks but this time to the upper block and not the block next to it (similar to Machu Picchu).

Figure 70 Ahu Vinapu in Rapa Nui, Easter Island

The origins of this unique masonry have sparked extensive debates due to the striking similarities observed between the finest examples found on Rapa Nui, such as the seaward wall of Ahu Vinapu, and mortarless block masonry structures in the highlands of the Andean region in South America.[81] Perhaps the next example could highlight some of these claims.

Moving to Sillustani in Peru, dating to ca. 15th Century CE[82], we can see a very similar execution like the one in Ahu Vinapu in Easter Island. It is almost hard to see the filler block

78 https://whc.unesco.org/en/list/715/

79https://www.academia.edu/11813974/The_dressed_stone_manufacturing_technology_of_Rapa_Nui_A_preliminary_model_based_on_evidence_from_the_Rano_Kau_Maunga_Tararaina_and_Ko_Ori_quarries p.7

80 Ibid. p.8

81 Ibid. p.6

82 https://www.atlasobscura.com/places/sillustani

because of how well it fits. On the ashlars which are on top, we can see nubs, which puts two hallmarks in conjunction.

Figure 71 Sillustani, Peru

Staying in Peru, moving to Coricancha, the construction of which is attributed to Pachacuti Inca Yupanqui who lived between 1438-1471 CE[83], we see one of the smallest possible filler blocks placed on a wall (hand for scale). A question would be if this piece has the depth of the wall or is it just covering the surface? Regardless of the answer, we see here precision on a very small scale in which the builders had to deal with minute tolerances to get it in there. This can be considered as a repair attempt, due to the dimensions of the executed filler block can be considered as a time saving necessity solution.

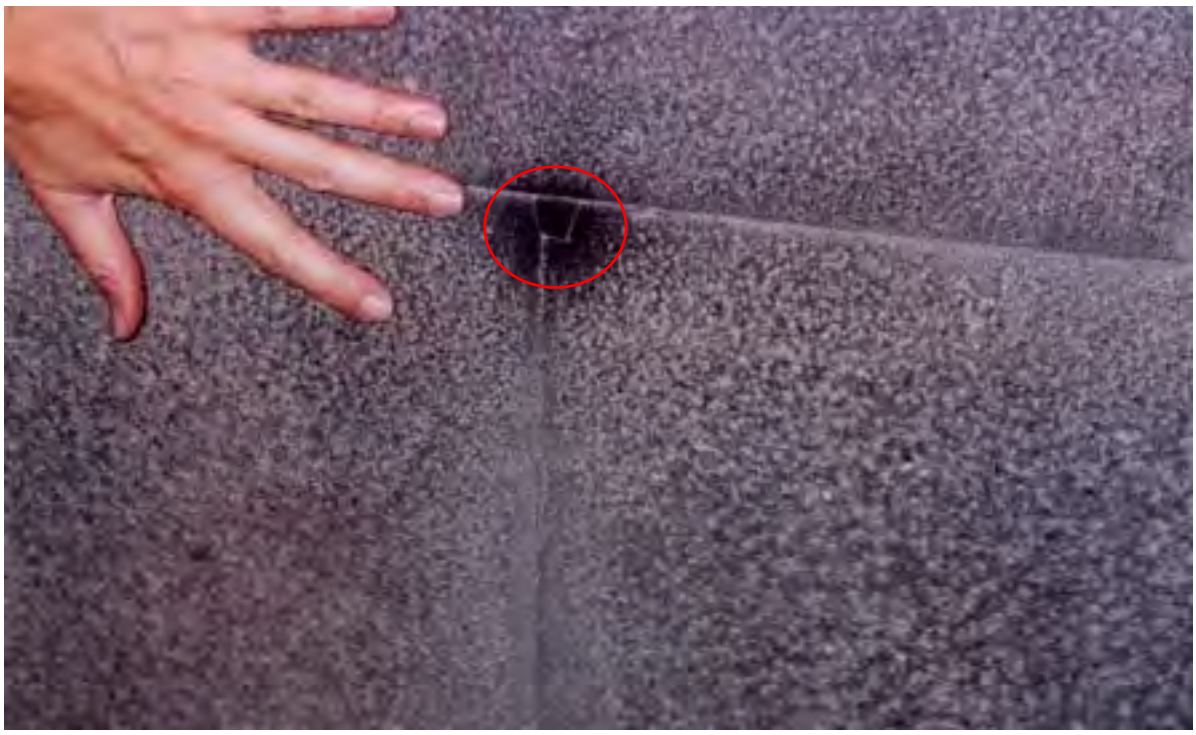

Figure 72 Coricancha, Peru

83 https://www.worldhistory.org/Coricancha/

Moving to Shore Temple in Mahabalipuram in India, dating between 7th and 8th Century CE[84], the same phenomena can also be observed here.

Figure 73 Shore Temple in Mahabalipuram, India

Staying in India, moving to the Durga temple complex in Aihole, dating between 6th – 8th Century CE[85], it could be presumed that the filler blocks seem to be part of the original design given to their uniform fitting and same material appearance.

Figure 74 Durga temple complex in Aihole, India

84 https://whc.unesco.org/en/list/249/

85 https://whc.unesco.org/en/tentativelists/5972/

Moving to Temple of Osirion in Egypt, dating to 1290 to 1279 BCE[86], it can be seen several areas where filler blocks were used. One thing to note, if filler blocks are indeed used as a repair for broken/damaged areas, that these areas happen to be found exclusively at the corners and joints and not on the surfaces of the ashlars.

Figure 75 Temple of Osirion, Egypt

Figure 76 Another perspective of the same wall, displaying filler blocks along with a nub (marked in green) in Temple of Osirion, Egypt

86 https://www.britannica.com/biography/Seti-I

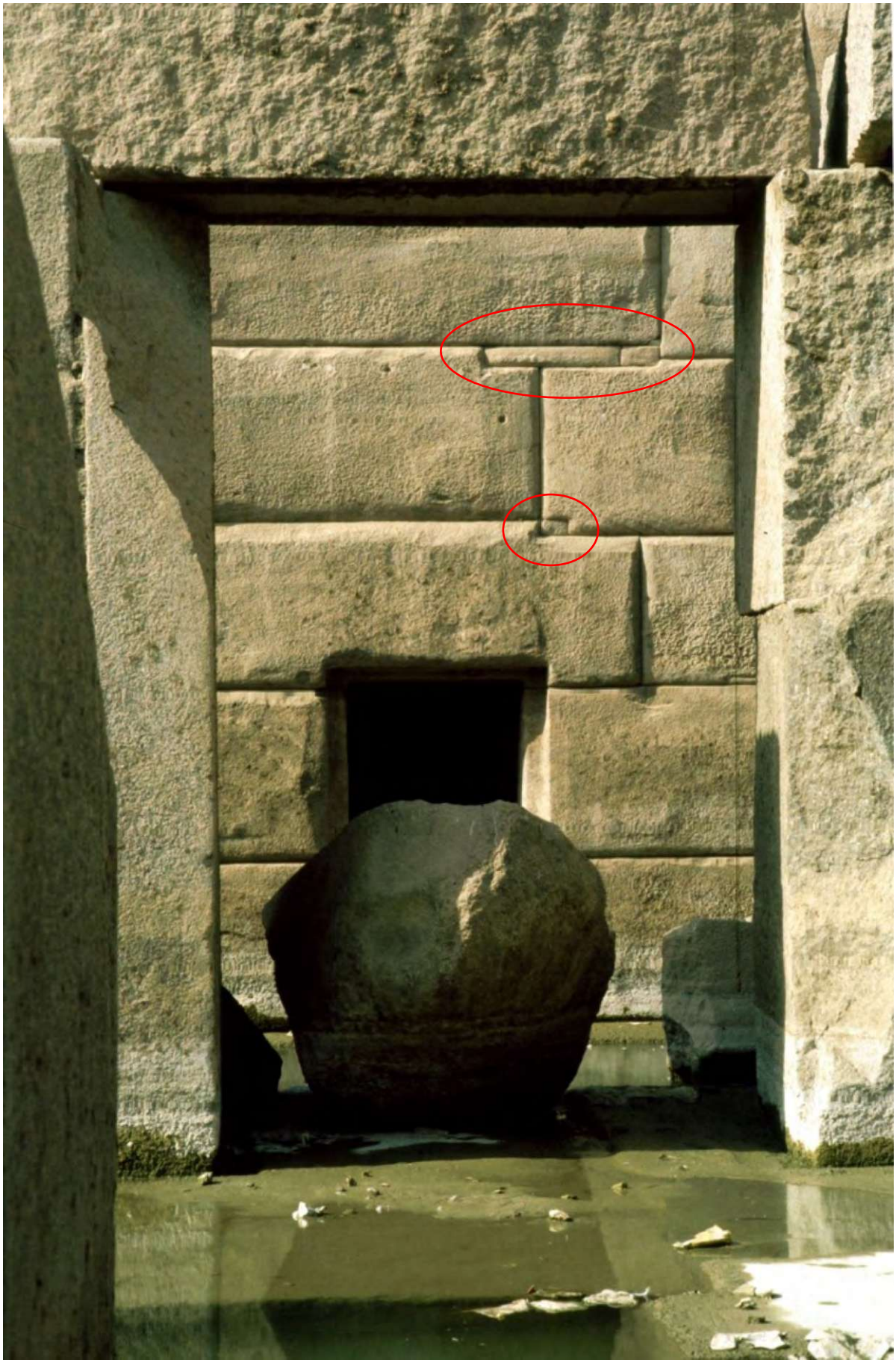

Figure 77 Another perspective showing the yellow marked area from the previous photo from Temple of Osirion, Egypt

Moving to Eleusis in Greece, where settlement began around 1900 BCE and was destroyed and rebuilt around 5th Century BCE[87], we see a different configurations of filler blocks in terms of their shapes. Towards the left side they are more triangular and the one on the right is more rectangular. The choice of different shape execution would make sense if the masonry was polygonal, like the one in Segni.

Figure 78 Eleusis, Greece

Moving to Euromos in Turkey, where settlement can be dated back to 5th Century BCE[88], a filler block can be observed, boundaries of which set around four ashlars. Although it is safe to conclude that we are not observing the structure in its entirety, the filler block is rather placed in a manner which acts as a focal point.

Figure 79 Euromos, Turkey

87 https://www.worldhistory.org/Eleusis/

88 Date taken from the information board photographed on location.

Figure 80 Close up of the filler block in Euromos, Turkey

Moving to Ishibutai burial mound (kofun) in Asuka in Japan, dating to 7th Century CE[89], we can observe the same phenomenon of a filler block. Since these would be considered as megaliths rather than ashlars[90], and if the corner of the given megalith is indeed damaged and needed repair, it would be easier to create a stone block to replace the damage than to make the entire megalith again.

Figure 81 Ishibutai burial mound in Asuka,, Japan

89 https://www.asukanet.gr.jp/ASUKA2/ASUKAKOFUN/isibutaiK.html

90 https://www.japan-experience.com/all-about-japan/nara/attractions-excursions/ishibutai

Staying in Asuka, Japan but moving to the Iwayayama tumulus, dating again to the 7th Century CE[91], the same phenomenon can be observed although the filler blocks here are smaller in scale but nevertheless finds itself in a megalithic construction.

Figure 82 Iwayayama tumulus in Asuka, Japan

Figure 83 Iwayayama tumulus in Asuka, Japan

91 Information taken from the information board photographed on site; https://youimg1.tripcdn.com/target/0ww1x120008ytc6405F19_C_900_600_Q70.webp

One question that arises is whether the use of filler blocks is a deliberate design choice or a repair attempt, and whether it could be both depending on the specific case?

One possible explanation in architectural conservation terms, is known as dutchman repair, which is known as *Vierung* in German.

Dutchman repair refers to a method used for partially replacing a small damaged area of stone by inserting a new piece, which can be made from natural stone or a pre-cast material. To perform a dutchman repair, the original stone must first be carved or hollowed out. The new stone is then either wedged into place or secured using an adhesive. It is crucial to keep the joint between the new and old stone as narrow as possible in order to maintain the appearance of a seamless surface. However, one downside of this approach is that the surrounding stone material needs to be altered or removed to accommodate the dutchman repair, resulting in its destruction.[92]

On the below photo, the area marked in red on the left, demonstrates possible filler block executions. Additionally, examples such as seen in Durga Temple, Euromos, certain parts of Temple of Osirion could very well fit to this description.

Figure 84 Dutchman repair (Vierung)

Another term which is associated with castle ruins is known as Auszwickelung.[93] This term refers to the small stones that fill missing parts and gaps within the wall structure.[94] Examples such as seen in Koh Ker, Iwayayama tumulus, certain parts of Temple of Juno could very well fit to this description.

92 European Illustrated Glossary of Conservation Terms for Wall Paintings and Architectural Surfaces, Hornemann Institut 2018, p.175

93 Since no adequate English translation has been found, the term is used in its original language, German.

94 https://www.hohenburg-lenggries.de/burgruine/

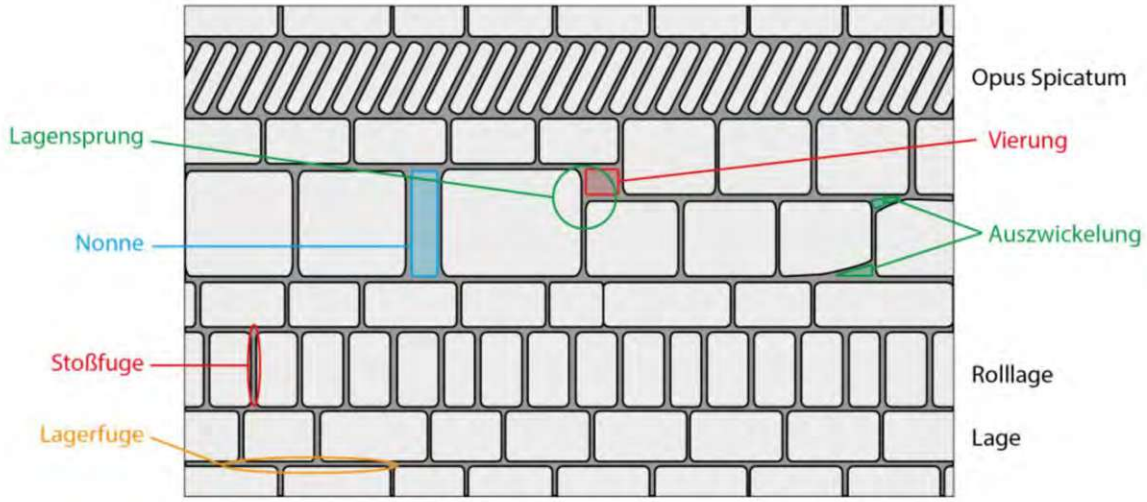

Figure 85 Diagram showing both Vierung and Auszwickelung

Based on the terminologies explained above, it is possible that the usage of filler blocks is a result of reconstruction attempts, contemporary and/or ancient, where the original configuration of the structure was lost or forgotten.

If the filler blocks are a result of damage, it begs the question of what kind of damage could have caused it? It is possible that different types of damage could be responsible, like, earthquakes, weathering, or even human activities could all contribute to damage. If we were to assume that corners and joints are the weak spots of ashlars, it is unclear why similar damage is not seen on more ashlars? In other words, why do some ashlars require filler blocks to maintain their structural integrity, if at all, while others do not? That is why, the lack of damage in other areas of a given structure suggests that damage alone may not be a sufficient explanation for the usage of filler blocks.

Also, in examples where the filler blocks seem to be a part of the original design such as in Ahu Vinapu, Machu Picchu and Phellos, due to their placement, the filler blocks could have acted as a feature which would break the horizontal continuity of the joints to prevent the ashlars from shifting, for example in the case of an earthquake.

However, if they are not used for this purpose, we should acknowledge that the builders could have easily made a square or a rectangular ashlar instead of leaving the corner blank in an L-shaped fashion, or instead of making a patterned nature like in Phellos, only to fill it with a smaller block. That would be indicative of a signature way of executing a masonry, which perhaps could be a design choice intended to enhance the visual appearance of the structure.

4. Trapezoidal Openings/Niches

In this hallmark, we see trapezoidal openings and niches. Their characteristic comes from that their top part is slightly narrower than their bottom part, which as a result give them their trapezoidal shape. These types of openings/niches are mainly attributed to Incan architecture[95]. Although there are not many examples to display for this hallmark, due nature of each hallmark, they can be spotted globally.

A good example to start with comes from Huanuco Pampa in Peru, which is believed to be constructed after 1460 CE and abandoned around 1539 CE[96]. Here we see, that individual ashlars were used, which were shaped in order to achieve the trapezoidal form.

The distinctive vertical trapezoid shape found in Inca walls, including doorways, windows, and niches, serves as a recognizable signature of their architecture. Often compared to a keyhole, this shape is believed to contribute to the structural stability of the buildings, particularly in the face of earthquakes.[97]

The exact origins of the widely prevalent trapezoidal form in Inka architecture remain uncertain, lacking clear evidence. Trapezoidal doorways had already been employed by various pre-Inka civilizations, and their usage continues in certain regions of the Andes. Therefore, it is questionable whether the trapezoidal form can be attributed solely to the Inka civilization as an original invention. Regardless of its source, the Inkas elevated this form to a position of renown and distinction, establishing it as a defining characteristic and symbol of their architectural legacy.[98]

Figure 86 Huanuco Pampa, Peru

95 https://www.worldhistory.org/Inca_Architecture/

96 https://www.atlasobscura.com/places/huanuco-pampa

97 https://www.khanacademy.org/humanities/art-americas/south-america-early/inca-art/a/introduction-to-the-inka

98 John Hyslop, Inca Settlement Planning, University of Texas Press 1990, p25.

Moving to Dragon Houses in Euboea in Greece, for which the dating and the function is not known[99], we see the same phenomenon. In this case, in contrast to Peru, the trapezoidal from is given by lateral stone slabs rather than ashlars.

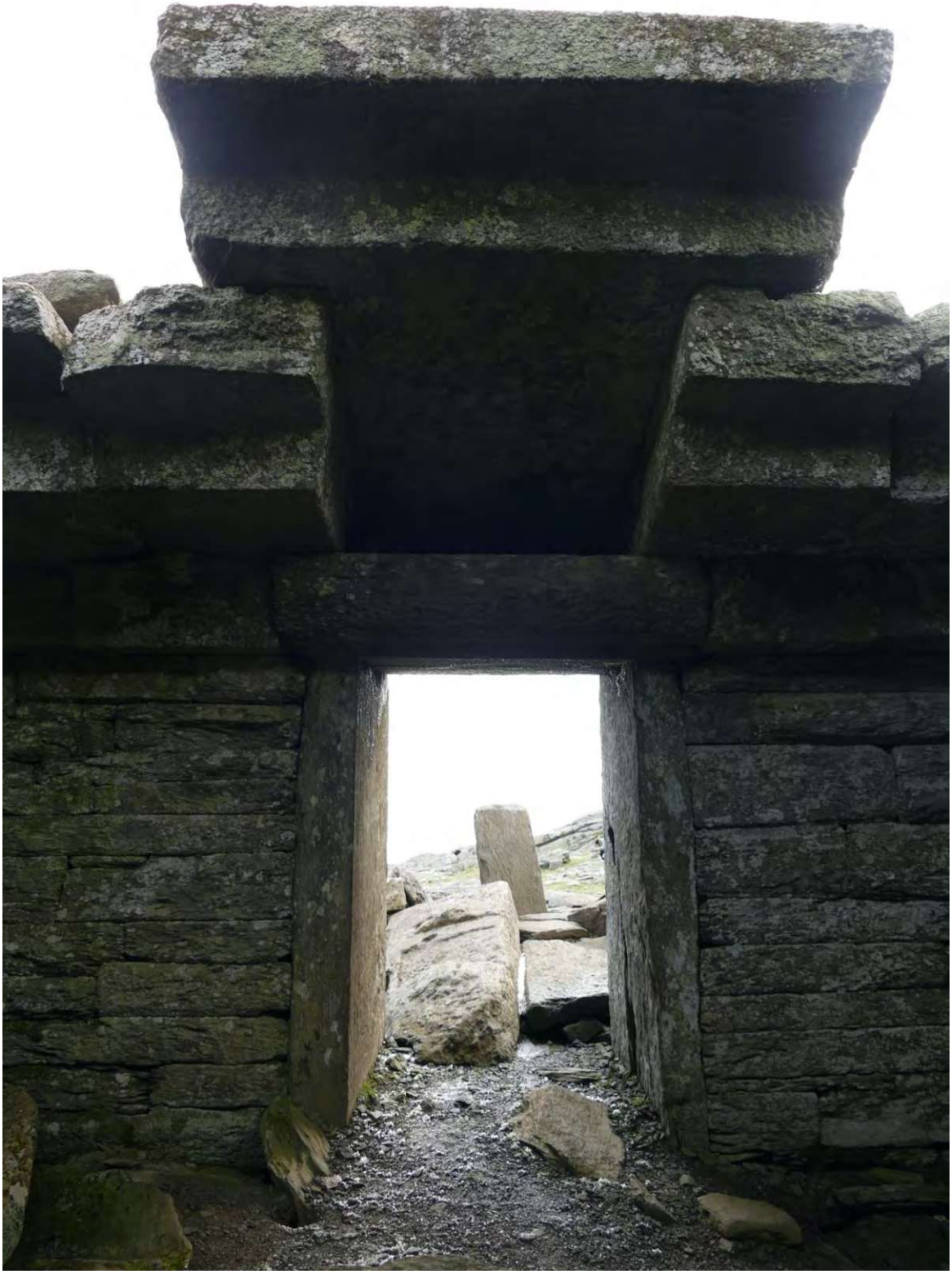

Figure 87 Dragon Houses in Euboea, Greece

99 https://www.esag.swiss/regional-studies-surveys/drakospita/

Moving to the Cerveteri Necropolis in Italy, dating from the 9th to the 1st Century BCE[100], we see a trapezoidal opening accompanied with two trapezoidal niches. In this case, the openings and niches are carved into the bedrock.

Figure 88 Cerveteri Necropolis, Italy

Moving to Tulum in Mexico, where first settlement is dated in the 6th century CE and prospered under Mayapán influence from ca. 1200 CE[101], we see trapezoidal openings, this time constructed probably with rubble fill (better seen above the openings) which was then plastered over.

Figure 89 Tulum, Mexico

100 https://whc.unesco.org/en/list/1158/

101 https://www.worldhistory.org/Tulum/

Moving to India, looking at various entrances in the Barabar Caves complex, dating to 3rd Century CE[102], we see the same phenomena here. In this case, these are cut into the bedrock, just like in Cerveteri Necropolis, and not shaped by individual stone blocks or ashlars.

Figure 90 Entrance of Sudama Cave in Barabar Caves, India

Figure 91 Entrance of Vapiyaka Cave in Barabar Caves, India

102 https://jehanabad.nic.in/en/tourist-place/barabar-caves/

Figure 92 Entrance of Lomas Rishi Cave in Barabar Caves, India

For a trapezoidal opening, to utilize separate stone blocks rather than just one solid cut seems far more difficult. Even the trapezoidal shape itself is rather more challenging than straight lines. One would have to appreciate that it would be far easier to cut a bunch of square or rectangular ashlars of the same exact dimensions and then stack them upon each other into the design of a doorway but when going the route of a trapezoidal design each block is a different shape than that of the one above and below it, in order to achieve the symmetrical angle (does not apply for the cases in Italy and in India).

One could also argue that the narrow top part of the trapezoidal opening would act as a feature to distribute weight, which would make sense for the cases in Peru, Greece and Mexico because there the trapezoidal openings are executed through individual ashlars or stone blocks. The maintenance of passage width at the bottom would serve functional purposes. In contrast, the span width of the lintel above is reduced for structural reasons. This design consideration is necessary to ensure the structural integrity and stability of the trapezoidal opening. By reducing the span width of the lintel, the load-bearing capacity of the

is increased, thereby improving its overall stability. Therefore, this design consideration is an essential factor that must be taken into account during the planning and construction stages.

When we look at the examples, we see various ways and styles of execution. What is constant among them is the trapezoidal shape. I therefore suggest that the trapezoidal openings/niches/doorways are an indicator for the function and/or the purpose of the built structure.

5. Chakana/Step-stair Motif

In this hallmark, we see a symbol displayed similar to Chakana, which can also be described as the stair step motif. The stair step motif can also be described as only the top or the bottom half of the Chakana. The Chakana, also known the Andean square cross, is a stepped symbol that denotes the transition between the three worlds. In Quechua, "chakana" means "bridge" or "to cross from one place to another."[103]

There are various styles of execution when it comes to their display, as they can be low, sunk and high relief carvings, made with stone blocks and made with adobe mud/plaster. Their placement is also various as they can be found above entrances, on stairs, as foundations and as mere stylistic elements.

Below is the schematic display of the Chakana.

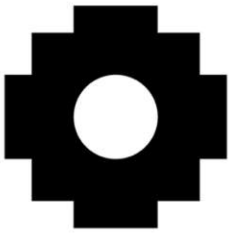

Figure 93 Chakana

A good example to start with comes from Taq-e Bostan in Iran, dating between 3rd to 7th Century CE[104]. In this example, the areas made with stone blocks and the areas between those, display the Chakana/Step-stair motif.

Figure 94 Taq-e Bostan, Iran

103 Steven R. Gullberg: Astronomy of the Inca Empire: Use and Significance of the Sun and the Night Sky. Springer Nature, 2020, p. 77.

104 https://www.britannica.com/place/Taq-e-Bostan

Staying in the same area, we can see similar executions in Apadana Staircase in Tehran, which is attributed to be the audience hall of Darius I who reigned between 522–486 BCE[105] and Mashki Gate in Nineveh in Iraq, dating to ca. 700 BCE[106]. In both cases it can be assumed that these are decorative elements which are placed in front of entrances.

Figure 95 Apadana Staircase in Tehran, Iran

Figure 96 Mashki Gate in Nineveh, Iraq

105 https://www.britannica.com/place/Persepolis

106 https://www.britannica.com/place/Nineveh-ancient-city-Iraq

Moving to Petra in Jordan, where occupation is dated back to 1200 BCE up until 12th Century CE[107], we see high relief carvings above almost all entrances. Towards the bottom left, we also see dowel/square holes, which are going to be explained in the next chapter, which puts two hallmarks in conjunction.

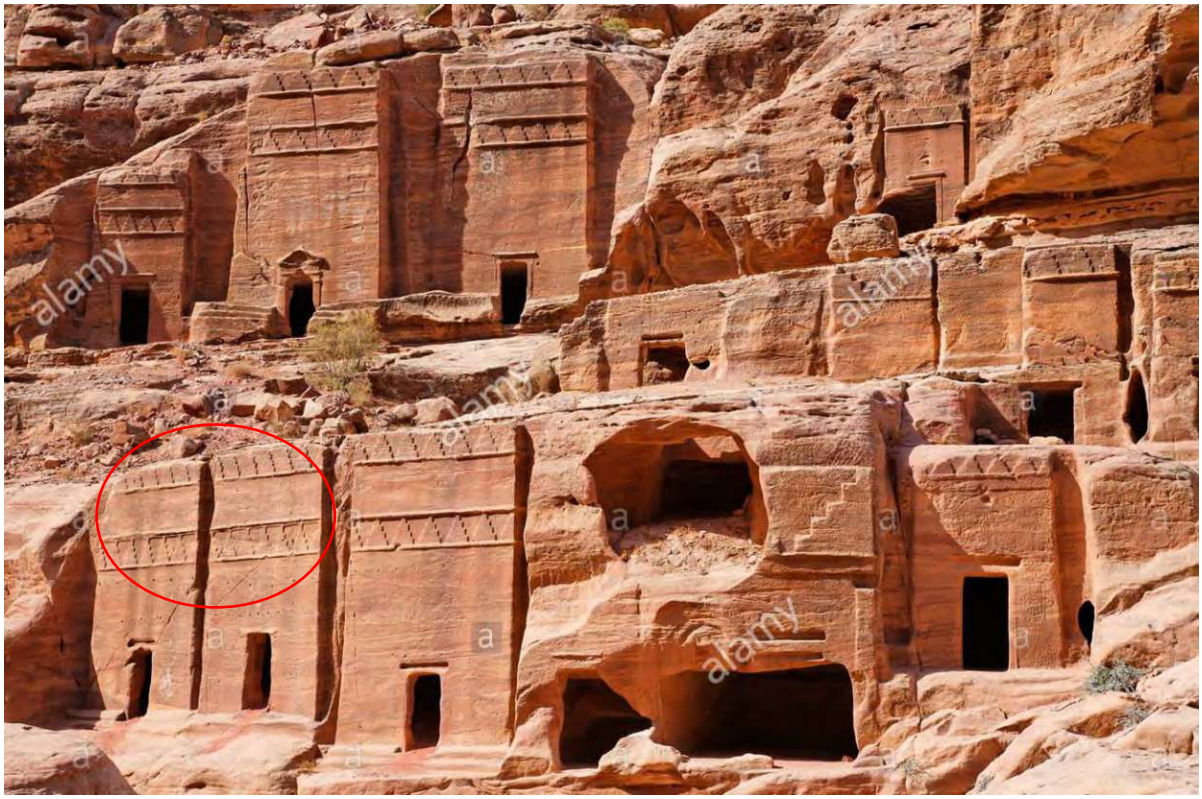

Figure 97 Petra, Jordan

Figure 98 Red marked area zoomed in, showing Chakana and dowel holes in conjunction, in Petra, Jordan

107 https://www.britannica.com/place/Petra-ancient-city-Jordan

Moving to Pumapunku, built by the Tiwanaku, whose civilization thrived in what is now Bolivia between 500-950 CE[108], it can be seen the sunk relief carvings of the Chakana/Step-stair motif. They give the impression of sockets and perhaps these ashlars were used as top parts where they were interlocking with matching ashlars.

Figure 99 Pumapunku, Bolivia

Moving to Inaq Uyu in Bolivia, dating to 1000-1500 CE[109], it can be seen the Chakana/Step-stair motif is above the big and the small niches. These are probably made with adobe mud/plaster. In between these niches, where the construction is visibly made by smaller stone blocks, we can also see the remnants of the Chakana/Step-stair motif but these are either heavily eroded or damaged.

It is also worth noting the trapezoidal openings on the upper left and right corners of each big niche, which gives us again the conjunction of two hallmarks.

Figure 100 Inaq Uyu, Bolivia

Moving to Ollantaytambo in Peru, which was conquered by the Inca emperor Pachacuti around the mid-15th century[110], the low relief carvings of the Chakana/Step-stair motif can be seen, where the right side of the motif seems to be eroded or shaved off. Also, it is worth

108 https://www.smithsonianmag.com/smart-news/crumbling-temple-bolivia-reconstructed-3d-printing-180971047/

109 http://www.ourancientworld.com/Settlement.aspx?id=647

110 Jean-Pierre Protzen. Inca Architecture and Construction at Ollantaytambo. Oxford University Press, 1993, p. 19

noting that the thinner stone blocks between the larger monoliths and the monoliths themselves have nubs on them (marked in yellow), which puts 2 hallmarks in conjunction.

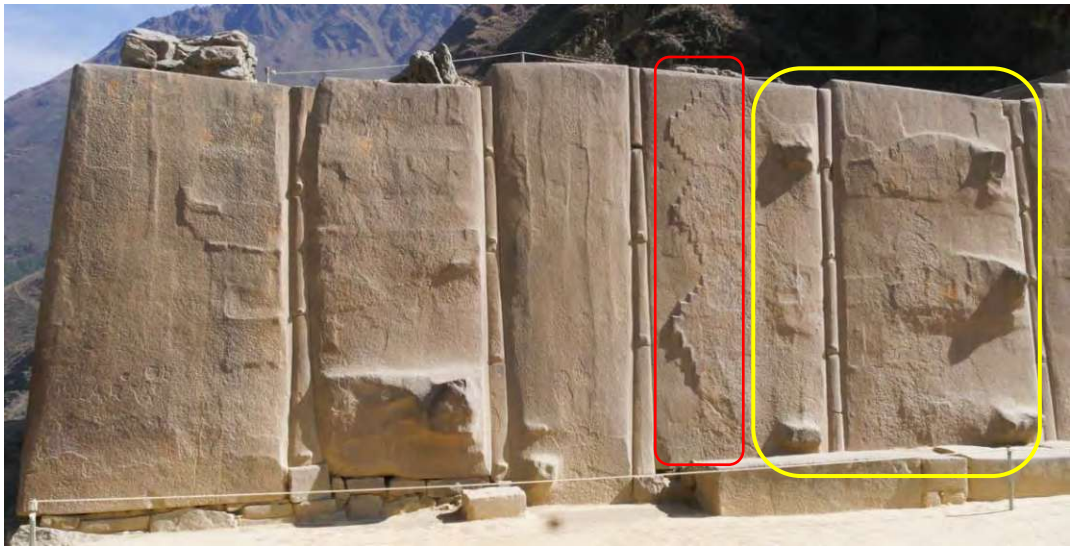

Figure 101 Ollantaytambo, Peru

Moving to Chan Chan in Peru, which was the capital of the Chimú civilization, which lasted from 850 to around 1470 CE[111], a similar approach like the one in Inaq Uyu can be seen, where the Chakana/Step-stair motif is probably made by adobe mud/plaster.

Figure 102 Chan Chan, Peru

111 https://www.smithsonianmag.com/travel/endangered-site-chan-chan-peru-51748031/

Figure 103 Chan Chan, Peru

Moving to the temple complex of Pyramid of Sahure in Abusir in Egypt, dating between 2490-2477 BCE[112], it can be seen low relief carvings of the Chakana/Step-stair motif.

Figure 104 Temple complex of Pyramid of Sahure in Abusir, Egypt

Moving to Warangal, looking at the Thousand Pillar Temple, built in 12th Century CE[113], where we see the Chakana motif this time as the foundation/pedestal of the temple.

112 https://www.worldhistory.org/image/5733/pyramid-of-sahure/

113 https://hanumakonda.telangana.gov.in/tourist-place/thousand-pillar-temple/

Figure 105 Thousand Pillar Temple in Warangal, India

Staying in Warangal in India, looking at another edifice in the same temple complex, it can be seen the Chakana/Step-stair motif is most probably used as a decorative motif.

Figure 106 Warangal, India

Moving to Gwalior fort in Neminath in India, for which the construction date is unknown but nevertheless existed in the 10th Century CE[114], it can be seen that the Chakana/Step-stair motif is used next the openings Most probably this fort is carved out of bedrock and the motifs are high relief carvings.

Figure 107 Gwalior fort in Neminath, India

114 Konstantin Nossov, Brian Delf. Indian Castles 1206–1526: The Rise and Fall of the Delhi Sultanate. Osprey Publishing, 2006, p. 11.

Moving to Hegra, also known as al-Hijr or Madāʾin Ṣāliḥ in Saudi Arabia, dating from the 1st Century BCE to the 1st Century CE[115], we can see, in terms of the execution, this example can be compared to Gwalior fort in Neminath, but it is larger in scale.

Figure 108 al-Hijr, Saudi Arabia

Moving to Ethiopia, looking at the Biete Ghiorgis, also known as House of St. George, building of which is attributed to King Lalibela in the 12th Century CE[116], it can be seen again, like in Warangal, Chakana as the foundation/pedestal on which the church was built.

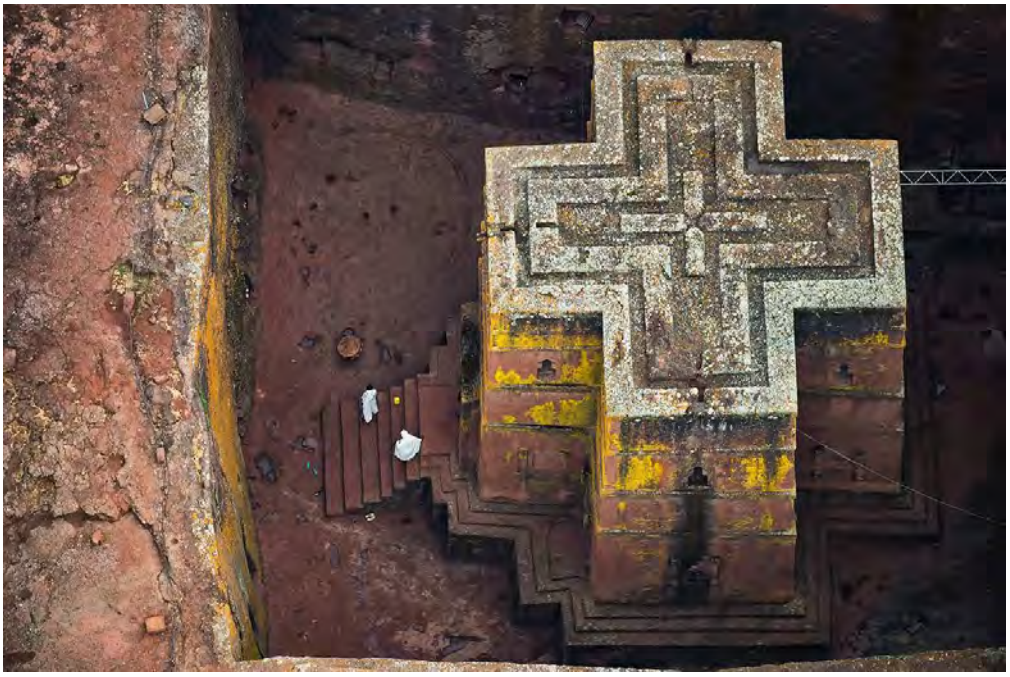

Figure 109 Biete Ghiorgis, Ethiopia

115 https://whc.unesco.org/en/list/1293

116 https://whc.unesco.org/en/list/18/

To conclude, in Nabatean architecture this feature is called crowstep. This motif is seen in the rock-cut facades in Petra, and it is believed to have originated from several civilizations including Mesopotamia, Egypt, Persia, Parthia, and Arabia.[117]

Some early studies suggest that the Nabataeans inherited the fundamental concept of the crowsteps motif from Mesopotamia. The form of the crowsteps symbol may have a connection to the Sumerian ziggurat, which also shares similarities in form with the step mastabas found in Egypt, which predate it. Thus, it is plausible to associate the crowsteps symbol with the Egyptian step mastaba form as well. The influence of ancient Egypt is evident in the arts of Syria and the early civilizations of Jordan, such as the Moabites and Ammonites. The architectural influence of Egypt on the Nabataeans can be seen in their utilization of the Egyptian cavetto cornice on the Hegr tombs.[118]

The crowsteps motif in Nabataean architecture is believed to have both sacred and secular meanings. On the sacred side, the hypothesis suggests that the presence of crowsteps motifs among the Nabataeans might have fulfilled sacred purposes by establishing a connection between the Nabataeans and their departed loved ones with the divine realm. This connection is symbolically established by associating the crowsteps with the concept of the 'high place' or mwtb, which represents the throne. On the secular side, it served as a symbol of constructing and representing the identity and connectivity of the Nabataean people. It revolves around the notion of heterotopias, in which the installation and multi-functionality of ancient Nabataean funerary architecture is analyzed, where they acted as nuclei within Nabataean society, as the social organization around the ancestral leader created a sense of hierarchy during tribal meetings.[119]

Another explanation would be that the architectural motif referred to as the "crowstep motif" in Nabataean sepulchral architecture finds its inspiration not in ziggurats or pyramids, but rather in the crenellation and battlements of defensive structures such as city walls, commonly seen in Mesopotamia, Persia, and Egypt during that era. This is exemplified by the battlements seen on the walls of Nineveh and Persepolis (examples of that are shown in this chapter). However, the term "crowstep" appropriately applies solely to the monumental tombs of the Nabataeans. In the less elaborate tombs, which constitute the majority of Nabataean tomb architecture, the absence of gables is notable; instead, a representation resembling layered battlements adorns the upper edges of the visible façade. Had the intention been to depict ziggurats, stepped pyramids, or mastabas, the stepped motif would logically have faced inward rather than outward. It is worth noting that the prevalence of this crowstep crowning across city walls, defensive towers, and castles in the Assyrian, Babylonian, and Persian regions is an unexplored topic. The reason for this wall crowning is not questioned despite its prevalence. Originating as functional battlements for defense, these features gradually evolved into decorative motifs serving as ornamental upper wall elements, akin to a "crowning" of the outer walls. This evolutionary trajectory is observable not only in ancient West Asian cultures but also across diverse global civilizations. While interpreting the crowstep motif as symbolic of wall crowning connected to rulers or spiritual

117 Shaher Rababeh, Rama Al Rabady, The Crowsteps Motif in Nabataean Architecture: Insights Into Its Meaning and Use, Arabian Archaeology and Epigraphy 2014, p.22

118 Ibid. ,p.24

119 Ibid p.26-33

realms is valid, linking it directly to ziggurats is undermined by the motif's portrayal with its apex downward and its side-by-side arrangement, often halved at the edges. This would imply viewing the numerous stepped battlements on Mesopotamian city walls as an array of adjacent ziggurats. Examining analogous wall crowns in Nabataean-connected cultures like Iraq's Nineveh, Iran's Persepolis, Jordan's Petra, and Saudi Arabia's Madain Saleh demonstrates that these crowsteps symbolize battlements derived from fortified structures' defensive or decorative functions. Importantly, the appearance of "half" battlements at corners in these depictions actually corresponds to the three-dimensional form of battlements encircling corners; hence, in two-dimensional renditions on rock tomb facades, these corner crenellations appear as "half" elements. Thus, comprehending the upper embellishment of Nabataean rock tombs can be achieved without resorting to hypotheses such as the depiction of an inverted ziggurat in negative relief.[120]

At this point I will follow a speculative path and ask; What if we were to think of a connection between the motif, be it the crowstep or the Chakana/Step-stair, and certain built structures. Could there be a correlation between the motif and the structure? Since Chakana is referred as the Andean cross, perhaps it would be suitable to look for an example in South America to demonstrate what is meant by the statement above.

Below is a satellite image of the Akapana pyramid in Tiwanaku in Bolivia, dating between 500 and 900 CE, where only the lowest of retaining walls and part of one of the intermediate walls survive intact[121], we can see a partial Chakana motif displayed by the remnants. Perhaps it would be safe to assume, that if the whole of the structure remained intact, we would be seeing a complete Chakana.

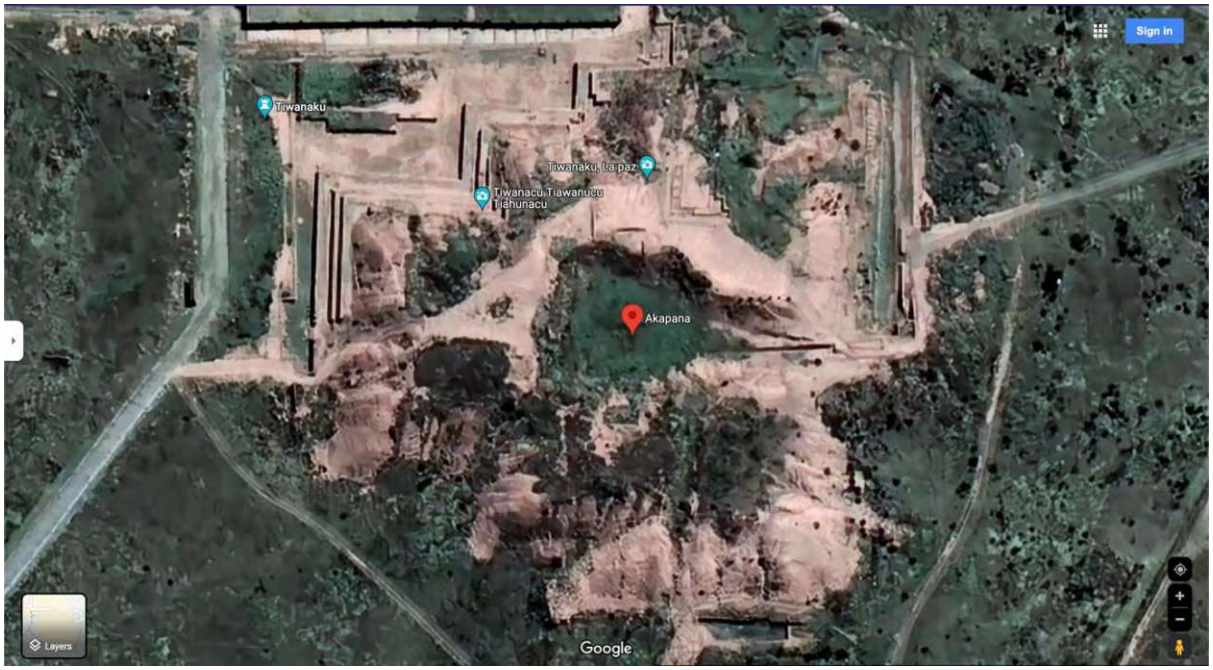

Figure 110 Akapana Pyramid in Tiwanaku, Bolivia

120 From email correspondence with Prof. Erich Lehner, on 11.08.2023 and on 13.08.2023

121 https://whc.unesco.org/en/list/567/

Similarly, if we were to go to Java in Indonesia, to take a look at the Borobudur Temple we would observe the same phenomena. Bodobudur Temple is a Buddhist temple, dating from the 8th and 9th CE.[122] Here, different from the Akapana pyramid, the temple is executed in the manner of Mandala instead of Chakana.

A Mandala, which means "circle" in Sanskrit, is a geometric symbol used for spiritual, emotional, or psychological purposes to focus one's attention, and it represents higher thought and deeper meaning in art. The origins of this image can be traced back to India and the Hindu text Rig Veda, which was written between 1500 BCE and 500 BCE.[123]

Below is a side-by-side comparison of the Mandala, bird eye view and the schematic drawing of the Borobudur Temple.

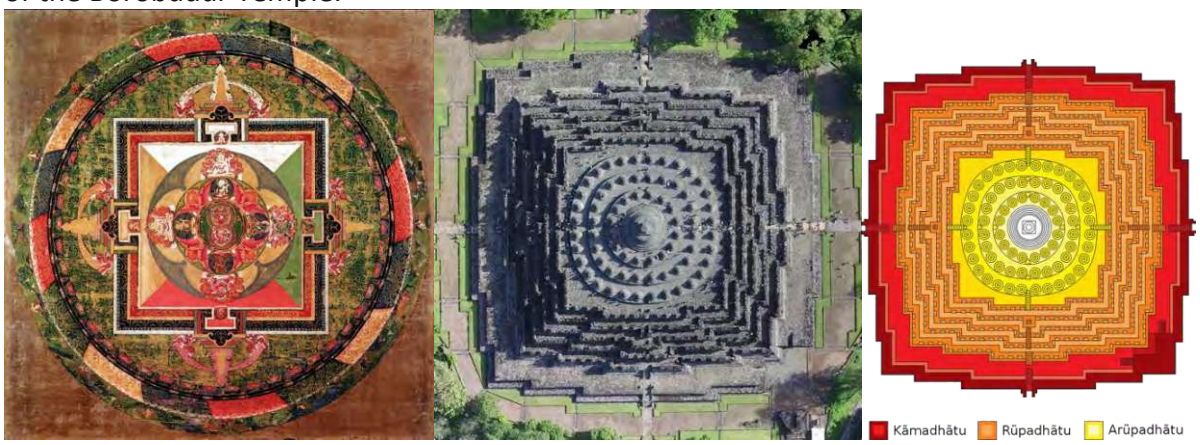

Figure 111 Mandala (L), bird eye view (M) and the schematic drawing of the Borobudur Temple (R)

In this scenario, I would propose that the Chakana/Step-stair motif, and by extension the Mandala, may be indicating functions and/or purposes, since they are incorporated as a whole to the Akapana pyramid and Borobudur Temple respectively.

The comparison between the Akapana pyramid and the Borobudur Temple, and the Chakana and Mandala symbol respectively, reveals interesting similarities. Both structures (symbols) are symmetrical with a square outside and a circle inside, and have projections according to cardinal directions. These similarities suggest a shared symbolic meaning, despite the distance and the temporal difference between the two cultures. The comparison suggests that there are universal principles of geometry and symbolism that transcend cultural boundaries.

This suggests that the Chakana/Step-stair motif may have been used as a way of symbolically connecting different structures and civilizations across time and space, and may have served a deeper purpose beyond just visual decoration. For example, the foundation/pedestal Chakana in Warangal and the one found in Ethiopia may represent a connection between these cultures, even though these cultures existed in different regions and time periods.

The idea of a correlation between the Chakana/Step-stair motif and other structures would raise interesting questions about the shared knowledge and cultural exchange between

122 https://whc.unesco.org/en/list/592

123 https://www.worldhistory.org/mandala/

different civilizations. If the motif was indeed indicating functions or purposes adopted from other structures, this could suggest a level of technical and perhaps a scientific knowledge being shared between different civilizations. Alternatively, the use of the motif as a form of homage could suggest a sense of cultural respect and admiration for other ancient civilizations and their achievements.

6. Anchor Holes

In this hallmark, we see holes usually made on the sides or corners of blocks, but often times also on the surface, as if they are used for anchoring a rope or chain etc. One can analogously think as if the corners were playdough and was pinched with a thumb and index finger. This is again just to describe their physical appearance and not to attribute any function or purpose to this hallmark.

Below is the schematic display of the Anchor Holes. Hidden lines are also displayed to show the holes made are joined at the back.

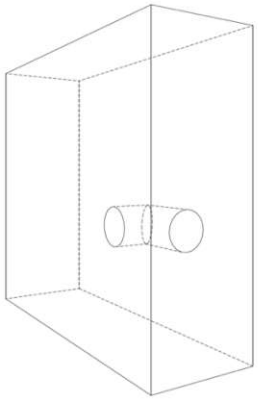

Figure 112 Schematic perspective view of anchor holes.

A good example to start with comes from Beilin Museum in China, initially established in 1087 CE and holds a large collection stone stele of different periods, from the Han Dynasty (206 BCE - 220 CE) to the Qing Dynasty (1644-1911 CE)[124]. At the bottom of one stela, the anchor hole can be clearly seen.

Figure 113 Beilin Museum, China

124 https://www.chinadaily.com.cn/regional/2016-06/27/content_25868688.htm

Moving to Temple of Karnak in Egypt, which was in constant development and use between the Middle Kingdom (2080–1640 BCE)[125], we can see two distinct displays of anchor holes. On the statues we see anchor holes on the hip, on the arm and on the breast of the statues. The question then arises, why would the builders put them here in this orientation on these statues? Are they used for tying up animals before they were sacrificed? Or perhaps hanging things like tapestries, curtains, flags, awnings etc.? Their placement could indicate their use.

If they are indeed for a hanging banner or a tapestry etc., it is rather peculiar because the anchor holes are not in a uniform placement. Also, placing these holes purposefully on the statues might ruin their aesthetics, if the statues were not to be decorated by complimentary things which were supposed to be attached to the anchor holes.

Or are the anchor holes perhaps damages done during some war or looting of the temple? If they are, with what kind of tools are they made? It would be odd to imagine a person to take the time during a war or looting, and carve a hole through stone. It would be hard to imagine that these are modern projectile damages like bullets or shrapnel, since there is no projectile that can create a curvature in a stone body.

Figure 114 Temple of Karnak, Egypt

Second display at the Temple of Karnak is found on an artwork which is odd because it again destroys the aesthetic and it begs the question, if this was done by the original builders, what kind of attitude they had that they would place something like this on top of ornamentation? Or perhaps the anchor hole is used for transportation and it was later on covered with plaster and they are now visible since plaster fell off?

Additionally, apart from the anchor holes (marked in red) the rest of the holes can be classified as dowel & square holes, which are going to be explained in the next chapter, which put two hallmarks in conjunction.

125 https://www.wmf.org/project/karnak-temple

Figure 115 Temple of Karnak, Egypt

Staying in Egypt but moving to El-Sawayta limestone quarry near Samalut, dating to New Kingdom to Late Period (range between 1550-332 BCE)[126], one anchor hole can be seen. It begs the question; What is it doing here all by itself? Was it used to hang the working equipment or lanterns?

126 https://per-storemyr.net/2015/05/20/new-ways-of-looking-at-highly-organised-stone-quarrying-in-ancient-egypt/

Figure 116 El-Sawayta limestone quarry near Samalut, Egypt

Moving to Cappadocia in Turkey, where the first signs of monastic activity date back to the 4th Century CE until beginning of the 13th Century CE[127], we see anchor holes placed almost in a symmetrical manner, indicating that perhaps they were used to attach something to hide the wall, on which there were paintings.

The covering may have been a textile or other material, for which the anchor holes seem a bit too hefty, that was used to protect the painted surface from damage or deterioration. Alternatively, there could have been a decorative element in its own right, designed to enhance the appearance of the wall or to conceal a previous layer of decoration, which was attached here with the help of the anchor holes.

127 https://whc.unesco.org/en/list/357/

Figure 117 Cappadocia, Turkey

Staying in Turkey, but moving to the Ancient City of Stratonikeia, where settlement can be dated from the Late Bronze Age (1500 BC) to the present day[128], we have two contrasting examples of anchor holes.

In the first example, we can see that the anchor hole is placed on a stela, on which there is writing. If the anchor hole is indeed placed by the builders who made the stela with the writing

128 https://whc.unesco.org/en/tentativelists/6041/

on it, their choice would be rather peculiar since the placement of the anchor hole obstructs the writing. The anchor hole could have been done by some other culture as well, which perhaps conquered the city or inherited its ruins after a long time, with a functional need in mind or perhaps with the intention to destroy the stela.

Second example displays the exact opposite, where we see an anchor holes, placed on a megalith rather than an ashlar, which is completely devoid of anything written or decorative, at least on the side where the anchor hole is placed. Also there is a slight angle in the placement of the anchor hole. In this case, its placement would probably be functional.

Figure 118 First example from the Ancient City of Stratonikeia, Turkey

Figure 119 Second example from the Ancient City of Stratonikeia, Turkey

Figure 120 Close up of the first example from the Ancient City of Stratonikeia, Turkey

Figure 121 Close up of the second example from the Ancient City of Stratonikeia, Turkey

Moving to Temple Mount in Jerusalem in Israel, where the First Temple was built by King Solomon in ca. 1000 BCE, the Second Temple was expanded and refurbished by Herod in the first century BCE and sacked and burned by Titus in 70 CE[129], an anchor hole can be seen towards the top of the structure.

Important thing to note here, is that the anchor hole is in conjunction with ashlars with drafted margins and a nub on the right side (marked in green). Also, it is worth noting that the ashlars with drafted margins at the bottom are finely dressed, which could be due to the structure being buried and preserved because of that and the top parts were subject to outside factors and eroded and/or damaged. Perhaps, in this sense, a comparison can be made between the Amphipolis Tomb in Greece, where due to its burial, the ashlars with drafted margins were also in very good condition.

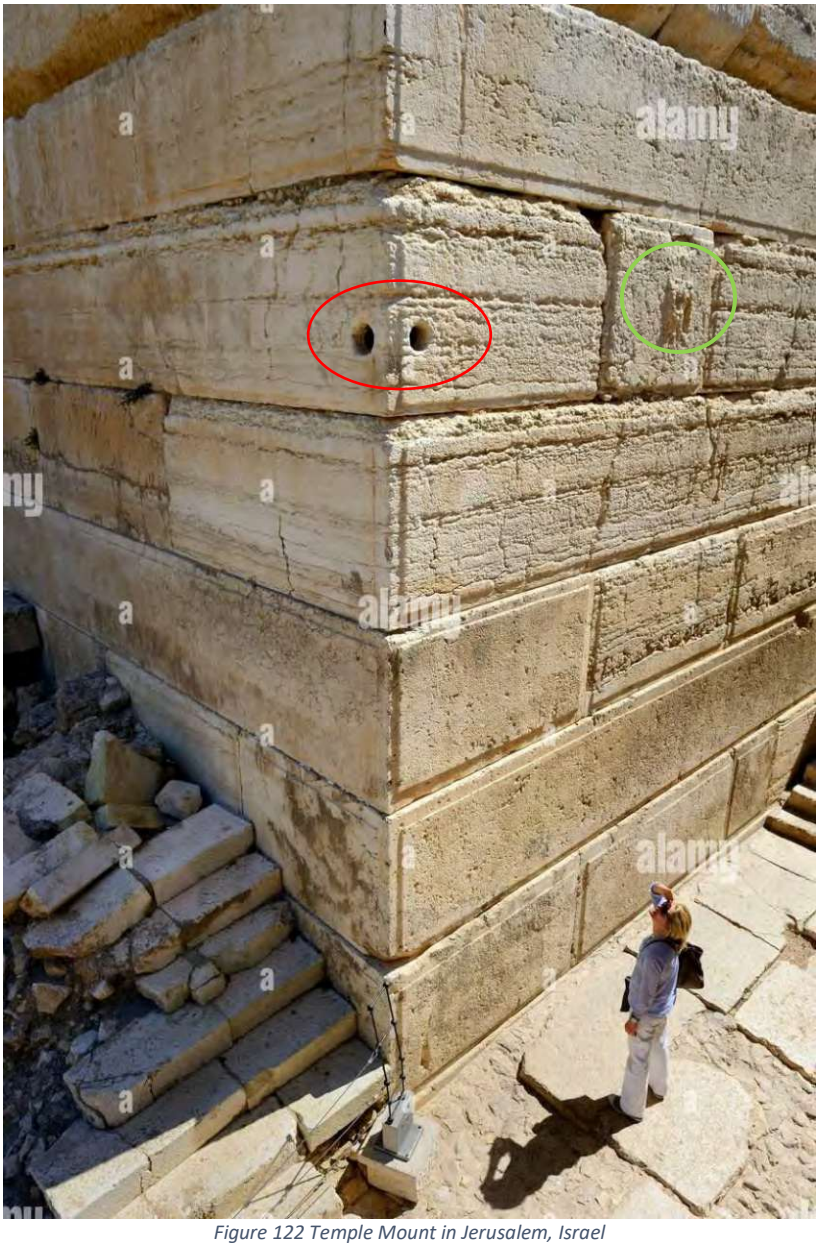

Figure 122 Temple Mount in Jerusalem, Israel

129 https://www.smithsonianmag.com/history/what-is-beneath-the-temple-mount-920764/

Moving to Jabal Umm Al-Biyara in Jordan, where we see niches attributed to Nabateans[130] who inhabited the modern-day Jordan between the 4th century BCE and ca. 106 CE[131], one could claim that these anchor holes, although they seem a bit hefty, were indeed used to hang a type of curtain to hide the "shrines", since the remaining anchor holes seem to be level in their placement.

In this case, one would want to give anchor holes some kind of rudimentary explanation, like in the presence of niches and that we see a row of these holes above them, one could picture in their head a rope going across which holds a curtain maybe to hide these niches on a ceremony day, when somebody would pull back the curtain and everybody worships and then the curtain is closed. But even then, that would be a quite permanent way of executing and this instance can be compared with what is seen in Cappadocia. Also, the remainder on the middle (marked in green) could be a non-complete anchor hole attempt.

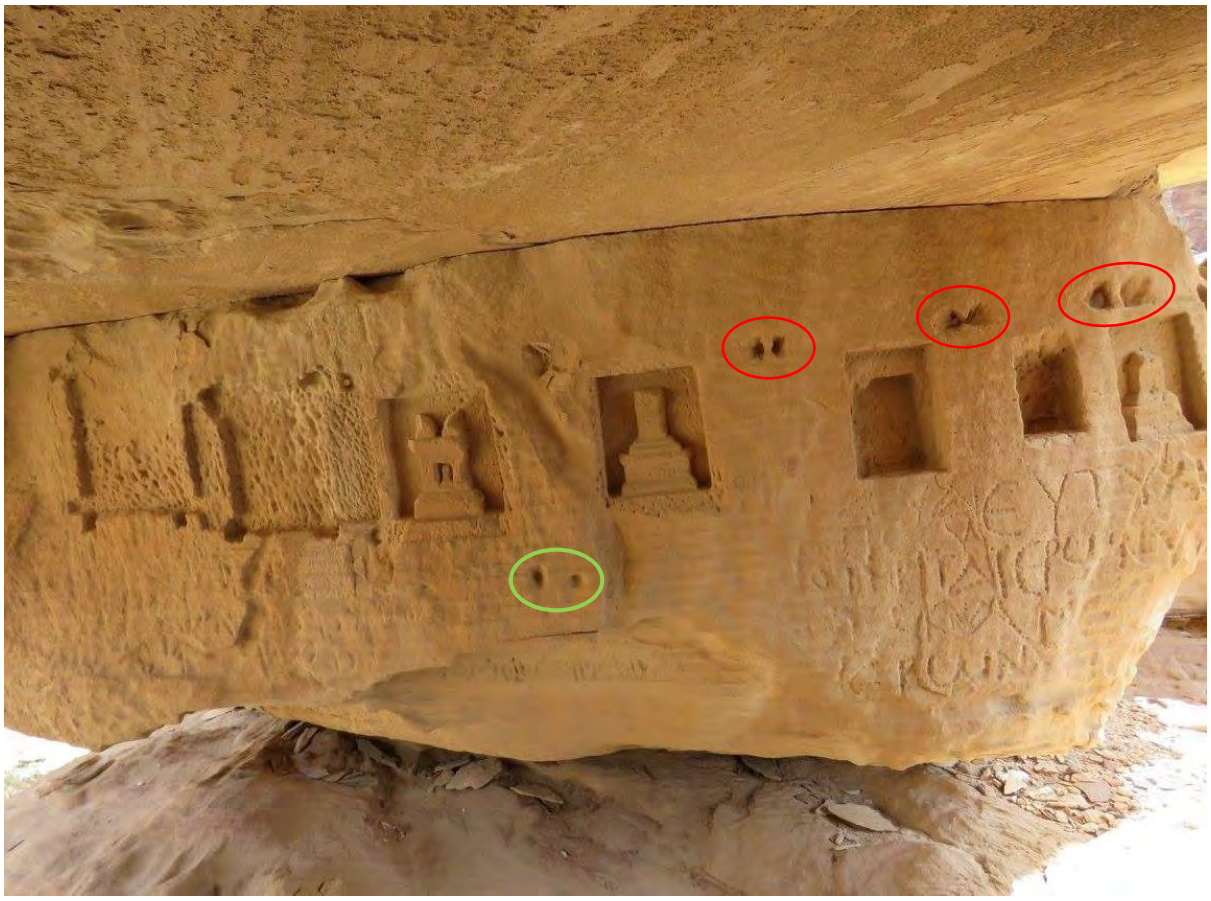

Figure 123 Jabal Umm Al-Biyara, Jordan

Moving to Paphos, Tomb of Kings in Cyprus, where inhabitance can be traced back to the Neolithic period (6th millennium BCE)[132], one anchor hole can be seen on the column.

130 https://acorjordan.org/2015/11/03/umm-al-biyara-petras-hidden-jewel/

131 https://www.worldhistory.org/Kingdom_of_Nabatea/

132 https://whc.unesco.org/en/list/79/

Figure 124 Tomb of Kings in Paphos, Cyprus

Moving to Ellora caves in India, dating to 600-1000 CE[133], the anchor holes can be seen on the floor and on the wall. These might have been used for tying up animals but given another look, the margin of the holes does not seem too thick. A sizeable animal with enough force could have easily broken these off. Of course, they could have been used for attaching other things.

Figure 125 Ellora caves, India

133 https://whc.unesco.org/en/list/243/

Moving to Hal Saflieni Hypogeum, dating spanning between 4000 BCE and 2500 BCE[134], and Hagar Qim in Malta, which is part of the megalithic temples of Malta constructed during the 4th millennium BCE and the 3rd millennium BCE[135], in Malta, it can be seen that the anchor holes are placed next to the openings. Tying up animals or anything else in front of or next to an opening would rather seem counter intuitive. If they are for hanging tapestries, curtains etc., their placement is again peculiar since they are not placed on the same level.

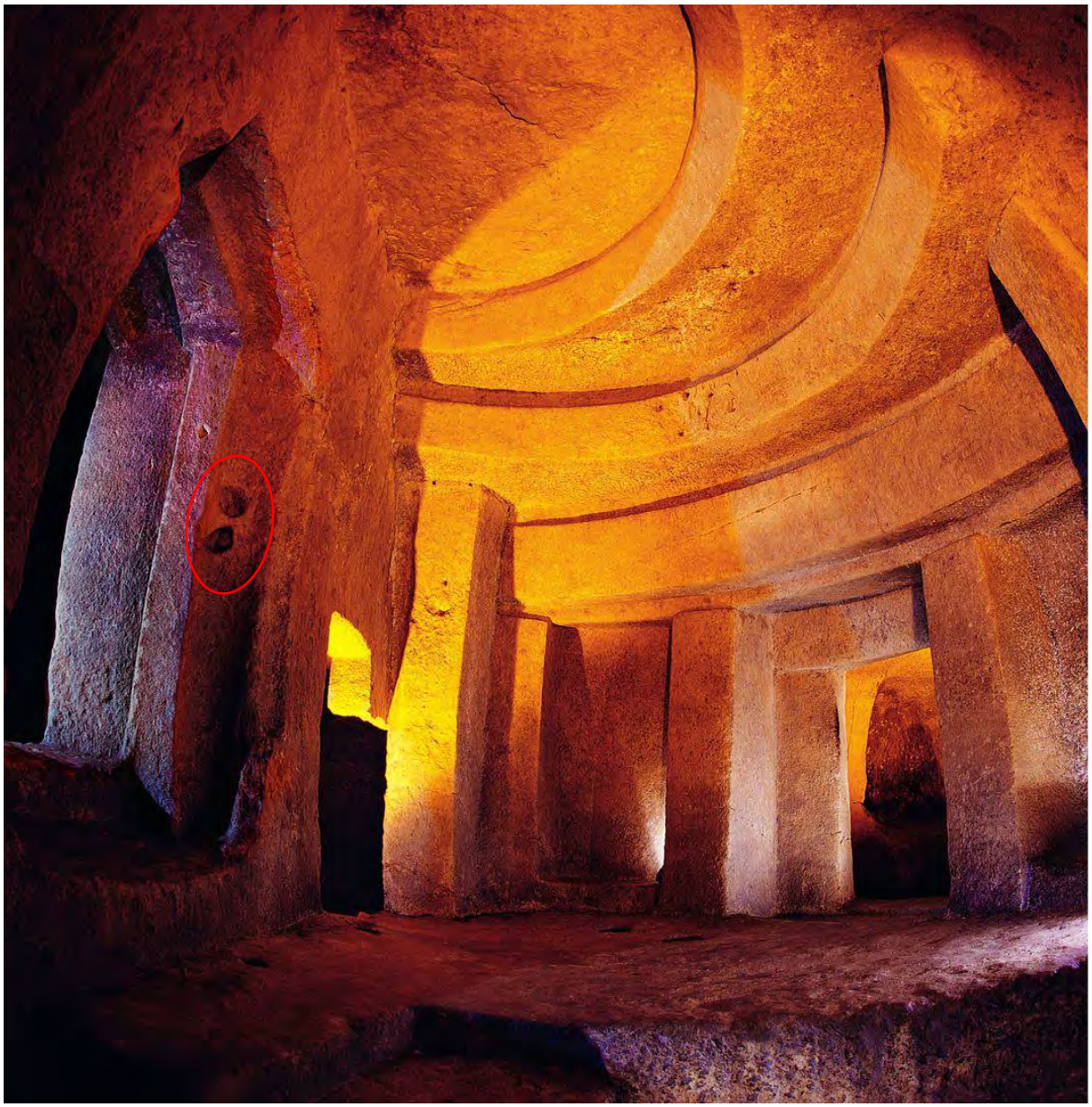

Figure 126 Hal Saflieni Hypogeum, Malta

134 https://whc.unesco.org/en/list/130/

135 https://whc.unesco.org/en/list/132/

Figure 127 Hagar Qim, Malta

Moving to Santo Domingo in Cusco in Peru, dating rather unclear, the anchor holes placed on the edge of the ashlars and in some cases the sunken carvings extending from certain holes, indicate a possible interlocking mechanism involved in the construction of the structure.

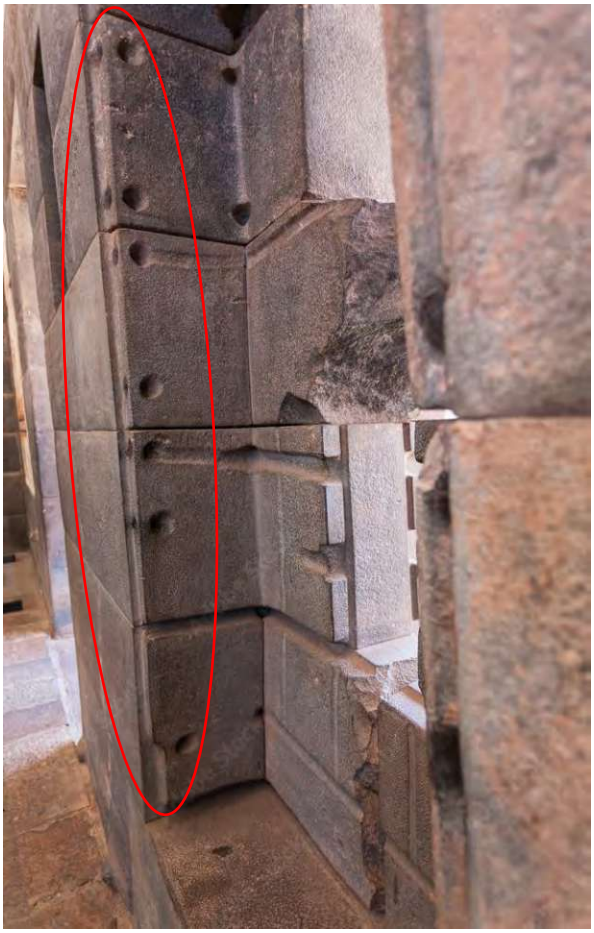

Figure 128 Santo Domingo in Cusco, Peru

Moving to Pumapunku in Tiwanaku in Bolivia, dating between 500 and 900 CE[136], a similar anchor hole execution and placement can be seen, which can be compared with Santo Domingo.

Figure 129 Pumapunku in Tiwanaku, Bolivia

Figure 130 Pumapunku in Tiwanaku, Bolivia

136 https://whc.unesco.org/en/list/567/

To conclude, while it is not entirely clear whether the anchor holes were created during the original construction in a certain site or added at a later time, their placement and context can provide clues about their purpose and use.

The anchor holes may have been created during the initial construction in a site as a deliberate design feature, which can be observed if the holes are placed in a symmetrical or even a regulated way, for example in Cappadocia or Jabal Umm Al-Biyara, which might suggest that a covering or decorative element was meant to be placed on the surface. Alternatively, they may have been added at a later time to accommodate new uses or decorative features, which can be observed if the holes are irregularly or oddly placed, for example in El-Sawayta limestone quarry or Temple Mount. Additionally, they could have also been formed as a result of some damage, which could have the appearance of an anchor hole, for example in Tomb of Kings in Paphos.

7. Dowel & Square Holes

In this hallmark we see square and in certain cases due to natural causes such as weathering rectangular or circular holes. Most of these holes have a certain structure and pattern in their arrangement and due to this characteristic, they can be classified as if they were made for doweling, which will be referred as dowel holes. In other cases, there are holes which do not belong to any pattern, so they stand out individually, which will be referred simply as square holes.

Below is the schematic display of the Dowel and Square holes.

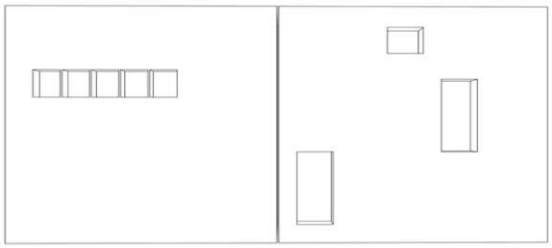

Figure 131 Schematic frontal view of Dowel (left) and Square (right) holes.

A good example to start with comes from Udayagiri and Khandagiri Caves located in Odisha in India, dating to 2nd Century BCE[137]. In the first example, on the top left side of the entrances, it can be seen dowel holes which are level in their placement and they seem to be placed in a row. It can be assumed that these were used for doweling and something was attached here like a cornice or a statue etc.

Figure 132 Udayagiri and Khandagiri Caves in Odisha, India

In the second example, below what seems to be an entrance, there can be seen holes, again level in their placement and seem to be placed in a row, which are most probably used for attachments. They seem bigger compared to the holes seen in the previous example, so perhaps it was used for scaffolding or some sort of gate etc. Additionally, there are 3

137 https://odishatourism.gov.in/content/tourism/en/discover/attractions/temples-monuments/udaygiri-and-amp-khandagiri-caves-temple.html

square/rectangular holes placed above the entrance which seem to not follow any pattern or row. Perhaps they were used as shrines.

Figure 133 Udayagiri and Khandagiri Caves in Odisha, India

Moving to Great Chaitya cave in India, dating to 120 CE[138], we can see square indentations, which were most probably thought as features of the built structure. They could have been used as shrines or niches to hold statues. Upon closer look, there seems to be a pattern following the square indentations at the bottom row. Starting on the left side, we see two small vertical slits placed on the right side of the square indentation, which moves to the left side on the second column, which again moves to the right side on the third column and finally ends on the left side on the fourth.

Figure 134 Great Chaitya cave, India

138 https://collections.vam.ac.uk/item/O175904/interior-of-the-great-chaitya-photograph-edmund-david-lyon/

Figure 135 Red marked area zoomed in, showing the pattern placed next to square indentations at Great Chaitya cave, India

Moving to Preah Vihear Temple in Cambodia, dating to to the first half of the 11th century CE[139], where at first glance, the holes appear to be scattered randomly across the surface of the ashlars, but upon closer look, it becomes evident that they are placed in a somewhat organized fashion. The holes seem to be quite small and shallow, so perhaps a structural purpose for their presence can be ruled out. One possibility is that the holes were used to hold decorative ornaments made out of metal or wood which would have adorned the exterior of the temple. It is possible that these ornaments were later looted or rotted away, leaving only the holes behind as a reminder of their existence.

In certain areas we can see filler blocks (marked in green) which puts two hallmarks in conjunction.

Figure 136 Preah Vihear Temple, Cambodia

139 https://whc.unesco.org/en/list/1224/

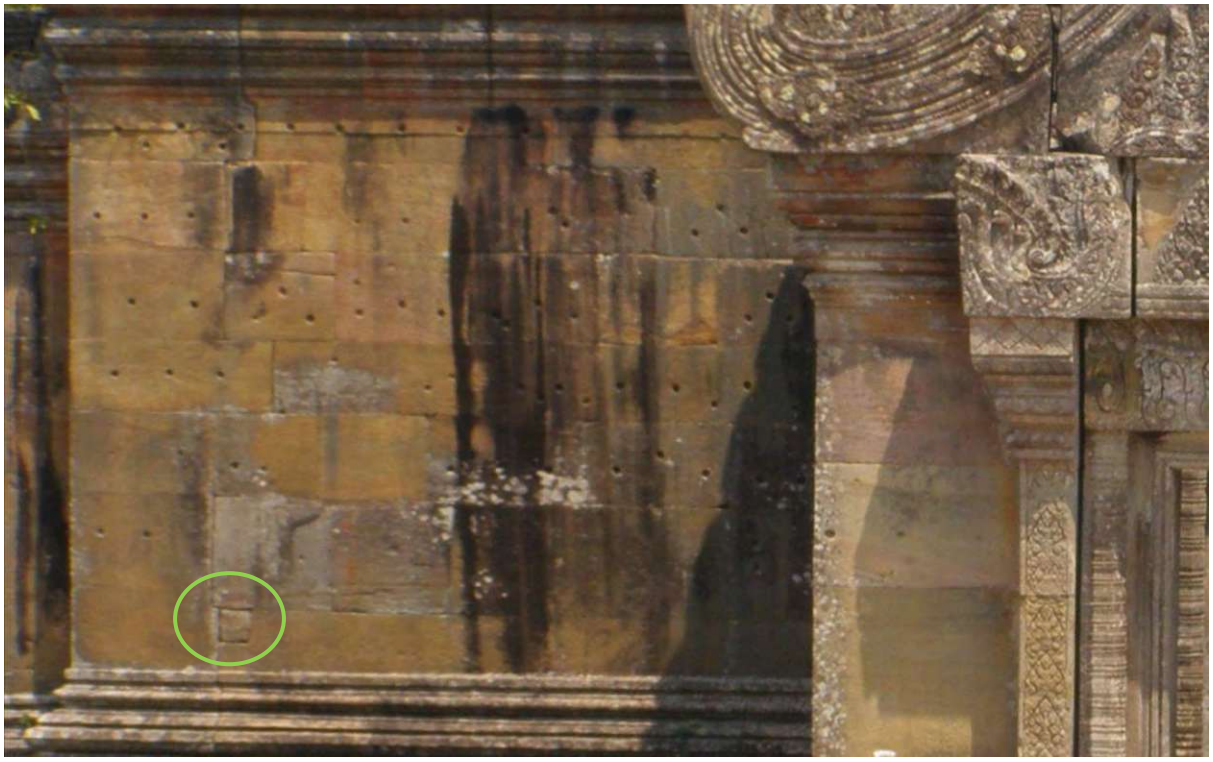

Figure 137 Red marked area on the left zoomed in, in Preah Vihear Temple, Cambodia

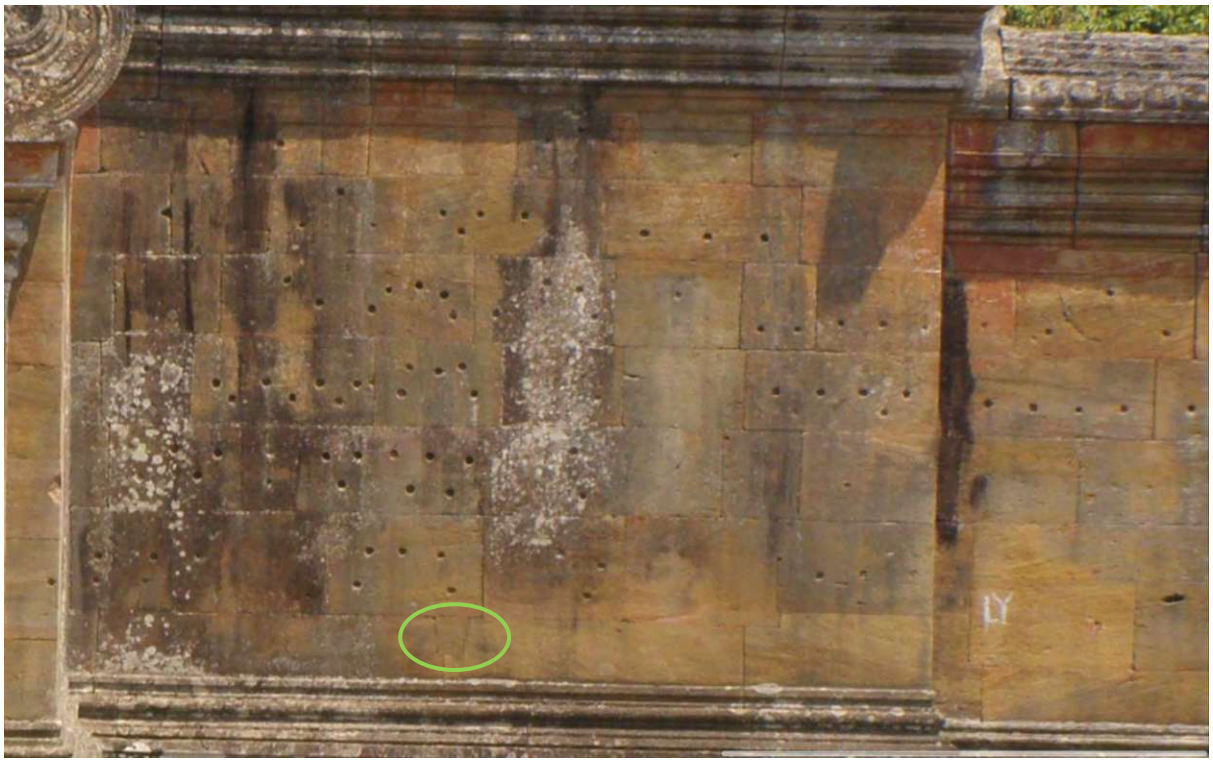

Figure 138 Red marked area on the right zoomed in, in Preah Vihear Temple, Cambodia

Staying in Cambodia but moving to Koh Ker, dating to 10th Century CE[140], we see square holes above a doorway. Here I will suggest that the square holes are done after this edifice was built and they are not the result of fallen ashlars. Here we can trace the margins of the square holes, just like in certain filler block cases, in which they extend towards other ashlars. The

140 https://whc.unesco.org/en/tentativelists/6458/

builders could have, and in my opinion must have, completed the structure with uniform ashlars. The square holes in this example are from wooden purlins for the roof of the porch, which is common feature of Khmer temples.[141]

Figure 139 Koh Ker, Cambodia

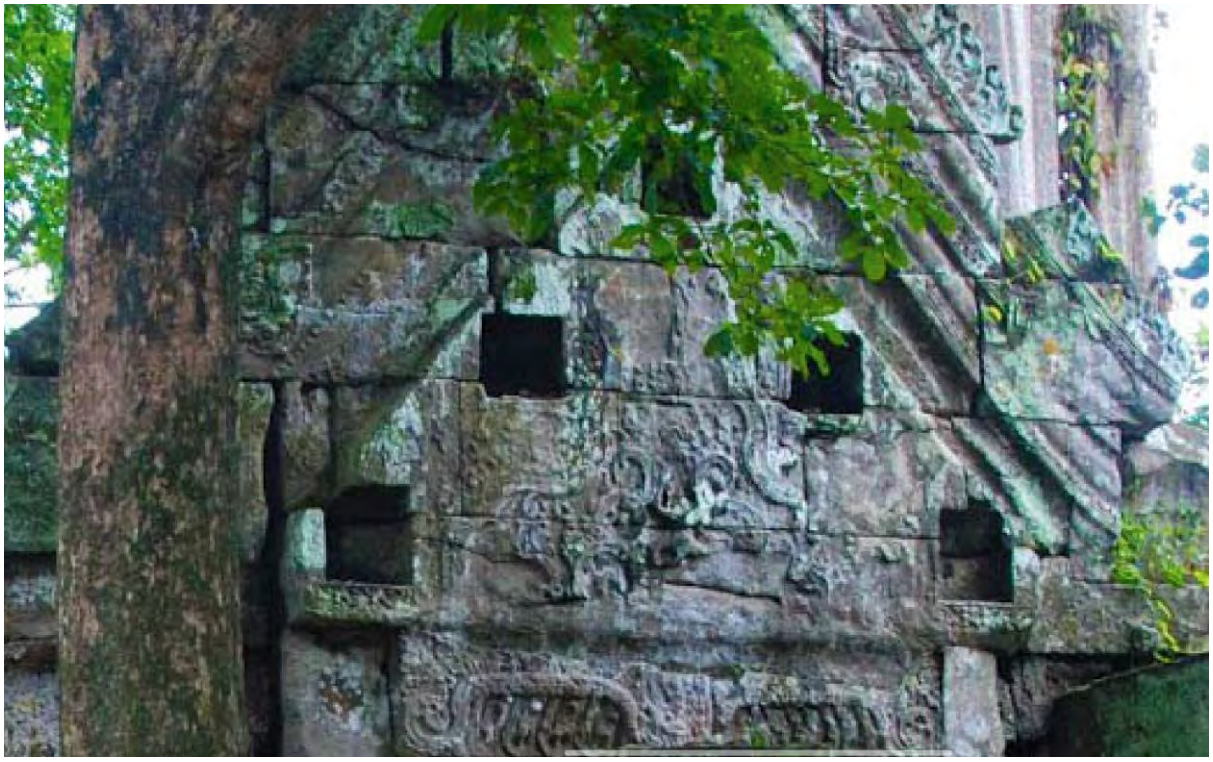

Figure 140 Red marked area zoomed in, in Koh Ker, Cambodia

141 From email correspondence with Prof. Erich Lehner, on 11.08.2023

Moving to Butrint in Albania, which, until the arrival of the Romans, from 800 BCE, was influenced by Greek culture and became a Roman colony in 44 BCE[142], it can be seen square holes in places one would expect to see filler blocks.

Figure 141 Butrint, Albania

Moving to Temple of Apollo in Syracuse in Italy, dating to 6th Century BCE[143], we see a partially eroded wall on the left side which has a lot of square holes placed on them. The configuration of the square holes on the wall suggests that something could have been once attached to them, such as a cornice or other decorative element. The holes are placed in a row and follow a certain line, indicating that they could have been a part of a larger design.

Figure 142 Temple of Apollo in Syracuse, Italy

142 https://whc.unesco.org/en/list/570

143 https://warwick.ac.uk/fac/arts/classics/intranets/students/modules/greekreligion/database/clumbi

Moving to Pont du Gard in France, built in the middle of the 1st Century CE[144], we see square holes, which could have been attachment points for the ashlars which are sticking out of the structure or for a cornice like element since most of them are placed in an organized fashion but there are also a couple of them which stand out individually.

Upon closer look, we can observe that these holes are in conjunction with ashlars with drafted margins and a filler block (marked in green).

Next to the filler block, we also see a square indentation, which could not have been used as an attachment point because it is too shallow. Perhaps the builders may have given up on cutting the hole all the way through the ashlars, due to difficulties in achieving the desired shape or size. Alternatively, the square indentation could have had some symbolic or decorative significance.

Figure 143 Pont du Gard, France

Moving to Temple of Karnak in Egypt, dating between 2080-1640 BCE[145], we can see holes which are square and circular in their shape. These holes are could have held decorative elements which complemented the sunk relief carvings.

144 https://whc.unesco.org/en/list/344

145 https://www.wmf.org/project/karnak-temple

Figure 144 Temple of Karnak, Egypt

Staying in Egypt but moving to the Temple of Isis in Philae, dating to 285-246 BCE[146], we see various combinations of square holes with various possible implications.

On the façade of the main entrance (red marked area), towards the top where the low relief carvings are, we have square blocks which could be remnants of fallen and/or destroyed ashlars. At the very top of the façade on the right side, we have square holes which could have been used for drainage but the same application is missing on the left side. This suggests that the holes may have had some other purpose, such as holding decorative elements or serving as attachment points for other features. Again, on the right façade, towards the middle, we have a conglomeration of square holes. Their arrangement is not suggestive of what they might have been used for. At the back (yellow marked area), which is possibly another façade from the same temple complex, there are a row of square holes, which could be used for attaching ornaments or decorations to compliment the low relief carvings, along with other configurations of dowel/square holes which could have been served for the same or other functions.

All these suggestions are written in order to give an idea what the most obvious explanation might be. It is not to state that the purpose and the function of the square holes are solemnly those.

On the left side, the wall is constructed with ashlars with drafted margins, which put two hallmarks in conjunction.

146 https://www.britannica.com/place/Philae-island-Egypt

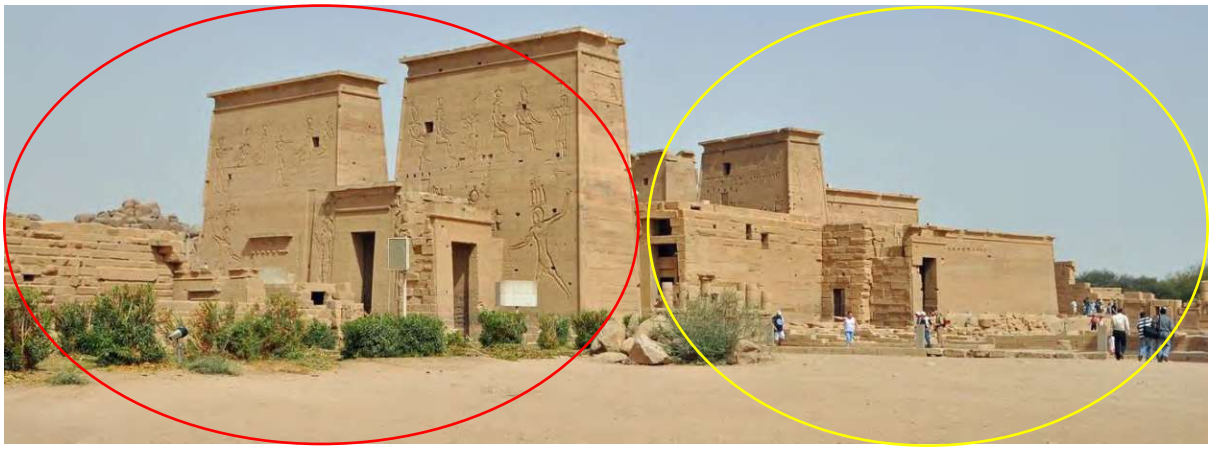

Figure 145 Temple of Isis in Philae, Egypt

Figure 146 Red marked area zoomed in, in Temple of Isis in Philae, Egypt

Figure 147 Yellow marked area zoomed in, in Temple of Isis in Philae, Egypt

Staying in Egypt but moving to the Trajan's Kiosk in Philae, dating to 98-117 CE[147], it can be seen square holes under the columns which are indicative of something like a cornice was attached there, and in other cases like the square area which is on the top middle row (marked in yellow), could be indicative of damage. Trajan's Kiosk was also mentioned for nubs so there are again 2 hallmarks in conjunction.

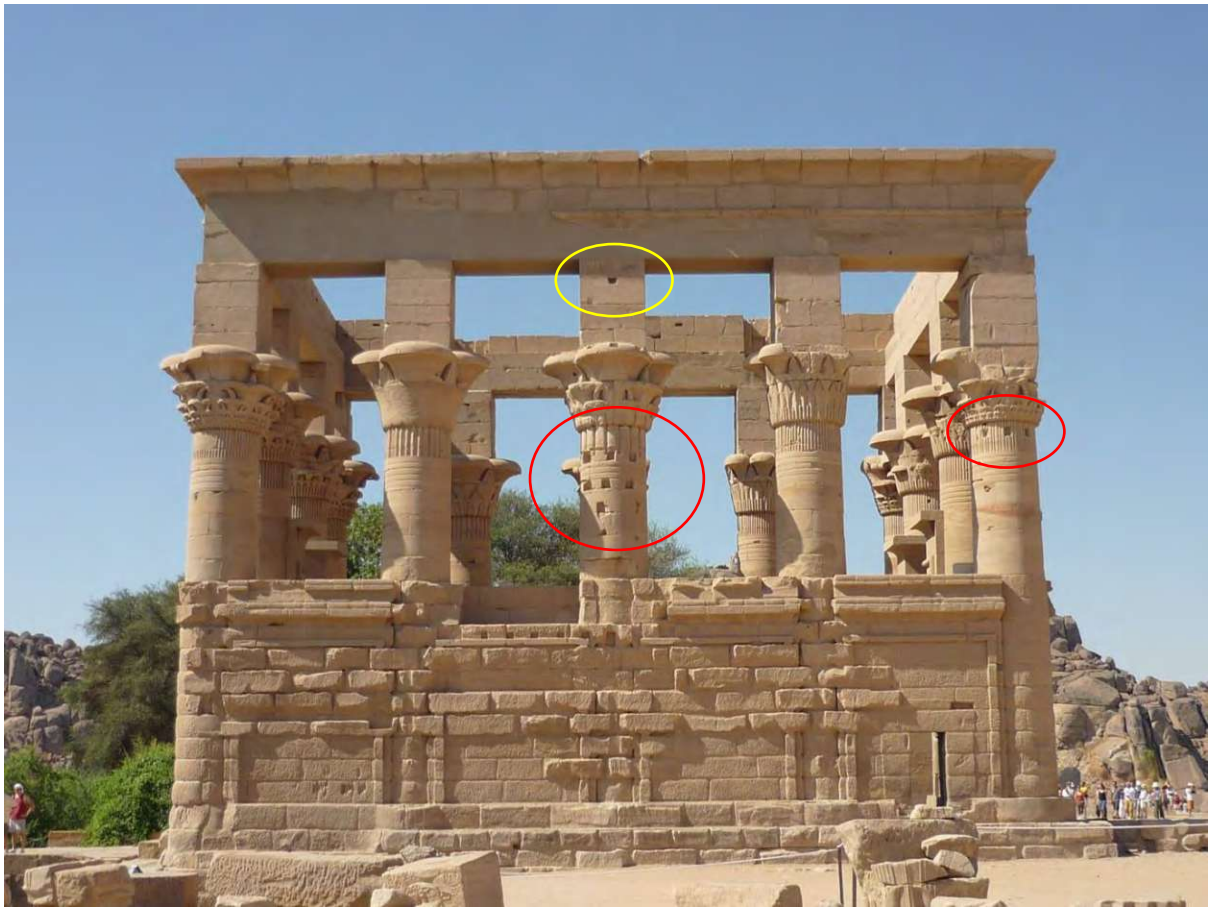

Figure 148 Trajan's Kiosk in Philae, Egypt

Moving to Leptis Magna in Libya, foundation of which dates back to the 7th century BCE by Phoenicians, which was later occupied by the Romans and fell into ruin after the Arab conquest of 642 CE[148], it can be seen circular holes "scattered" on the ashlars, just resembling very much the ones seen in Preah Vihear Temple in Cambodia, so perhaps their function and purpose can also be similar, meaning that the holes seem quite small and shallow, ruling out a structural purpose for their appearance, which gives more possibility to that the holes were used as attachment points to hold decorative ornaments made out of metal or wood which would have adorned the surface of the ashlars. Again, this would make it possible that these ornaments were looted or rotted away, leaving only the holes behind as a reminder of their existence.

147 Ian Rutherford. Island of the Extremity: Space, Language, and Power in the Pilgrimage Traditions of Philae. Brill, 1998, p. 233.

148 https://www.britannica.com/place/Leptis-Magna

Figure 149 Leptis Magna, Libya

Figure 150 Red marked area zoomed in, in Leptis Magna, Libya

Moving to Oval Forum in Jerash in Jordan, which was built in the beginning of the 2nd Century CE[149], it can be seen holes on column segments. Some of them could be due to damages but one hole in particular, which is the vertical rectangular one on the below column segment,

149 https://www.worldhistory.org/image/8250/the-oval-forum-and-cardo-maximus-of-gerasa/

suggest that this was placed intentionally. Also, it is worth noting that some columns towards the back have nubs on them on the top, which is again a conjunction of 2 hallmarks.

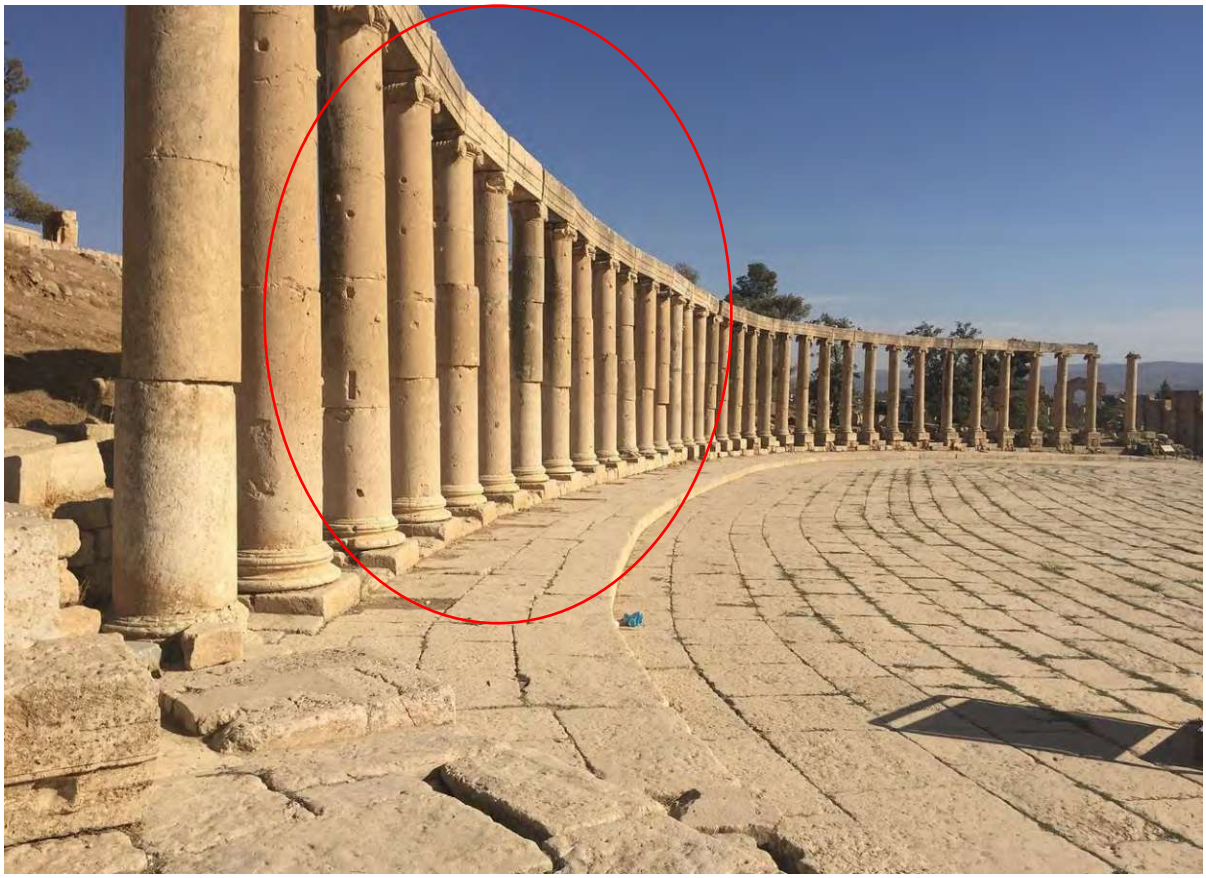

Figure 151 Oval Forum in Jerash, Jordan

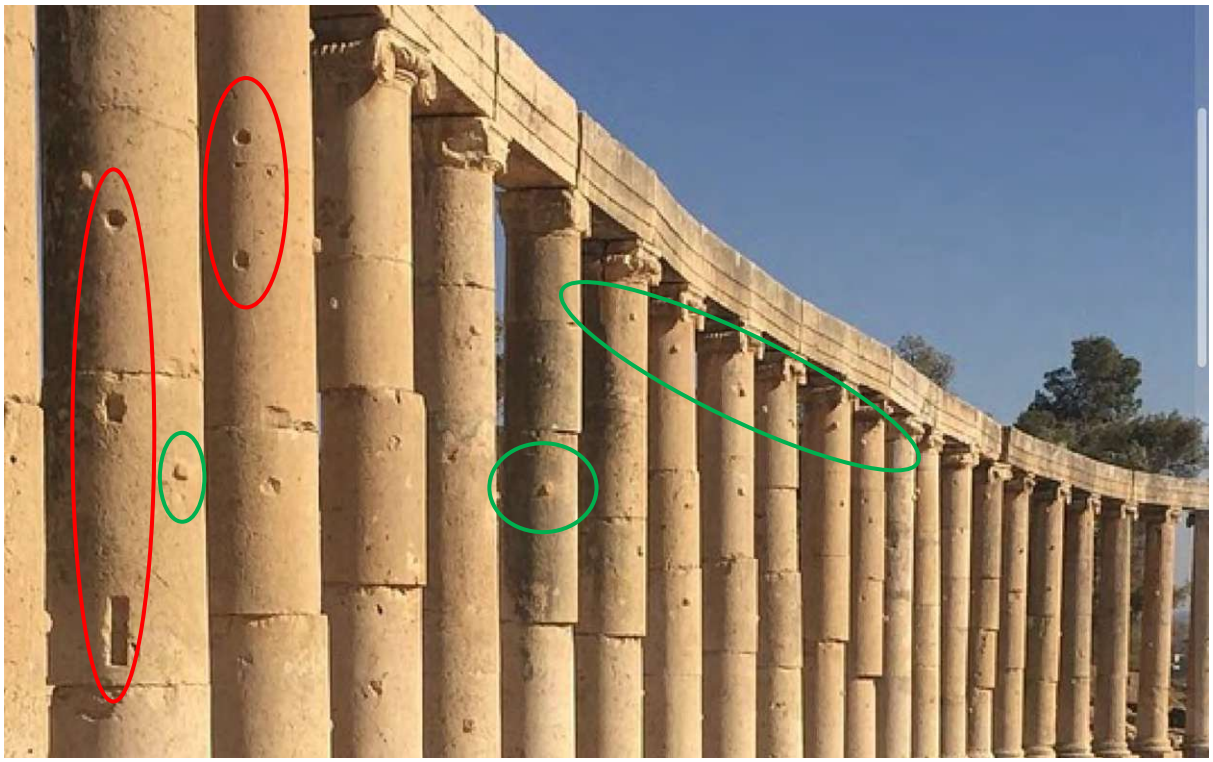

Figure 152 Red marked area zoomed in, displaying the square holes (marked in red) and nubs (marked in green) in Oval Forum in Jerash, Jordan

Moving to the Temple of Jupiter in Lebanon, dating to 2nd Century CE[150], we see quite a lot of square holes which are placed in a row. If they are indeed used as attachment points, what was attached here which required so many holes? At the bottom of the columns and also at certain areas on the wall, we see square holes, which stand alone or are coupled one or two more holes. Were they also attachment points?

Friedrich Ragette states in his book *Baalbek*, that the installation of the column components, entablatures, and peristyle slabs required the implementation of dowelling techniques. In ancient Greece, they would add protruding knobs on the column drums or create loop-shaped grooves on the vertical faces of blocks. These features allowed them to attach ropes for lifting purposes. On the other hand, the Romans developed a more advanced method using a device called the lewis hole. This hole had trapezoidal dimensions, approximately 20 cm long, 8 cm wide, and 29 cm deep, with inclined undercut walls. By inserting two metal pieces with matching inclined sides and a straight piece in between, the side pieces could not be easily removed. Thanks to the high-quality Baalbek stone and the efficient design of the lewis hole, which minimizes bending forces, each hole could bear a weight of approximately 5 tons. The number of lewis holes required depended on the weight of the specific block being lifted. In the case of heavier stones, the holes were typically grouped together at necessary minimal distances.[151] Are these the remnants of lewis holes as suggested by Ragette?

On another note, a significant portion of the ancient settlement had been devastated by an earthquake. A German expedition took place from 1898 to 1903, during which the two immense Roman temples (Temple of Jupiter and Bacchus) were excavated and efforts to reconstruct the ruins commenced. Substantial clearing and restoration work were carried out under the French mandate, followed by further efforts by the Lebanese government.[152] Perhaps these are modern toolmarks which were made during the reconstruction?

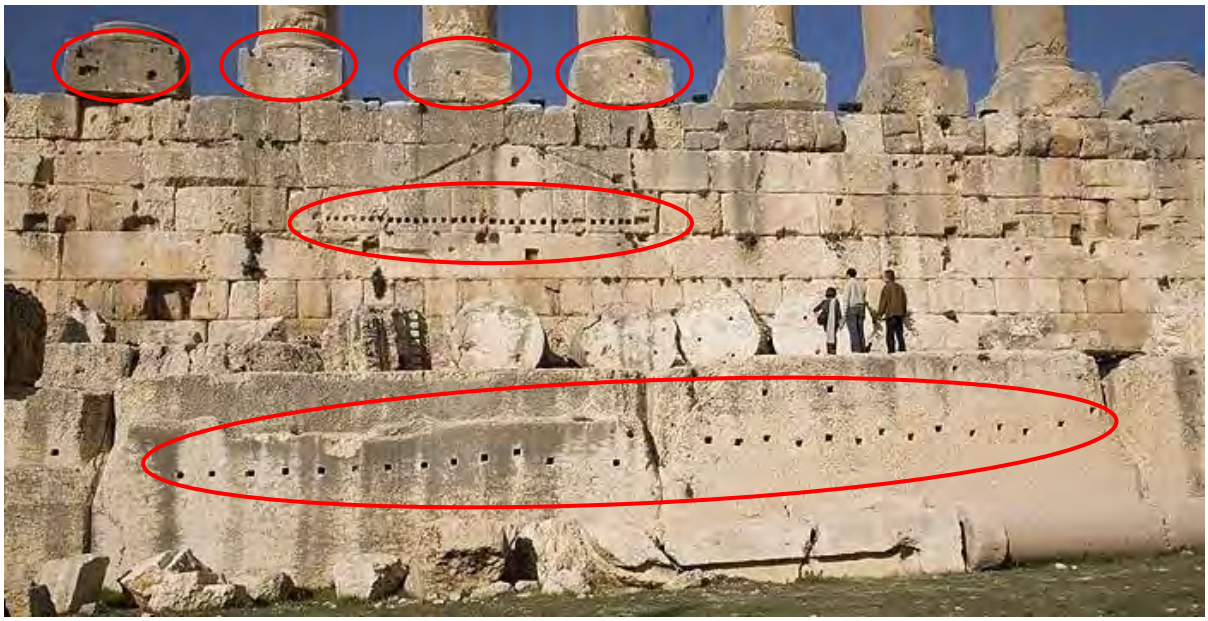

Figure 153 Temple of Jupiter, Lebanon

150 https://www.britannica.com/place/Baalbeck

151 Friedrich Ragette, Baalbek, Noyes Press 1980, p. 116-117

152 https://www.britannica.com/place/Baalbeck

Moving to Western Wall in Temple Mount, dating to 1000 BCE[153], we see this time rectangular holes. One thing to note, is that the rectangular holes find themselves also on the ashlars with drafted margins at the bottom. If the ashlars with drafted margins did indeed have an aesthetic purpose, putting holes on them would seem counterintuitive.

From another perspective, we see certain objects stuck into some of the square holes on the bottom and they also find themselves in what could possibly be a plaster cladding which probably covered the entire wall. The question raises itself again, if the wall would be covered with plaster (or whatever the material is), why make ashlars with drafted margins at the bottom? In the end, having drafted margins is not a requirement for the holes to be placed, as we can see above them on the smooth surface. Could this then be done by a later culture, which came after the original builders?

Figure 154 Western Wall in Temple Mount, Israel

153 https://www.smithsonianmag.com/history/what-is-beneath-the-temple-mount-920764/

Figure 155 Western Wall in Temple Mount, Israel

Moving to Ethiopia, looking at the House of St. George which dates to the 12th Century CE[154], we see on the right side, dowel holes organized and placed in a manner which is similar to the ones seen in Preah Vihear and in Leptis Magna. They seem too shallow to hold anything structural, such as scaffolding, so perhaps there were decorations attached there.

Figure 156 House of St. George, Ethiopia

154 https://whc.unesco.org/en/list/18/

Moving to Pisac in Peru, dating rather unclear but the original settlement of which probably pre-dated the Incas[155], we see a similar configuration of the square holes, like the ones seen in Great Chaitya cave in India, that these holes could have been purposed to be shrines or even hold lanterns to light the entrance area. From another perspective, we see a nub and a filler block on the bedrock, which puts three hallmarks in conjunction.

Figure 157 Pisac, Peru

Figure 158 Another perspective displaying the nub and the filler block on the bedrock in Pisac, Peru

155 H. W. Kaufmann, J. E. Kaufmann. Fortifications of the Incas: 1200–1531. Oxford: Osprey Publishing, 2008 pp. 38–39.

Staying in Peru but moving to Sacsayhuaman, dating to 1438-1471 CE[156], we see this time not square holes per se, but still indications of perhaps that it was tried. The ashlar on the top left side has very clear square indentations on it, as if it was done by a branding iron.

Figure 159 Sacsayhuaman, Peru

At this point I will follow a speculative path and suggest that the shape and the placement of the dowel holes are indicative of whether they are caused by damage or put there for a purpose. In most cases, these holes can be categorized as if they are used for lifting the ashlars, scaffolding, fastening cladding, connecting points for bars, timbers or that they are used for attaching ornamentation etc. and it should be acknowledged that these holes are important for dating purposes, as remnants of wood, or any other material based on the intended purpose of the holes, can often be found within them and can be dated accordingly with available methods. Square holes, seen in examples such as Great Chaitya cave or Pisac, are examples that these are placed clearly with a purpose, like a niche or shrine, so damage or accident in their creation can be ruled out.

I will also propose that the holes, such as the ones seen in Leptis Magna or Preah Vihear Temple, are not due to some damage. A possible conclusion would be that these holes are a result of some projectile damage like bullets or shrapnel but given to their shape, size and placement, this can be ruled out. Below is a good example from the University of the Philippines Rizal Hall in Manila, dating to 1947[157], which shows how projectile damage would look like. It can be clearly seen that the profiles and the placements "made" in the case of dowel holes are quite clearly different than the profiles and placements "caused" by projectile damage. In the case of dowel holes, the shapes are neat and their placements are more in an organized fashion but in the case of holes caused by projectile damage, it can be seen that the shapes and the placement of the holes are haphazard.

156 https://www.worldhistory.org/Sacsayhuaman/

157 https://cas.upm.edu.ph/~pjperez/items/coll018.html

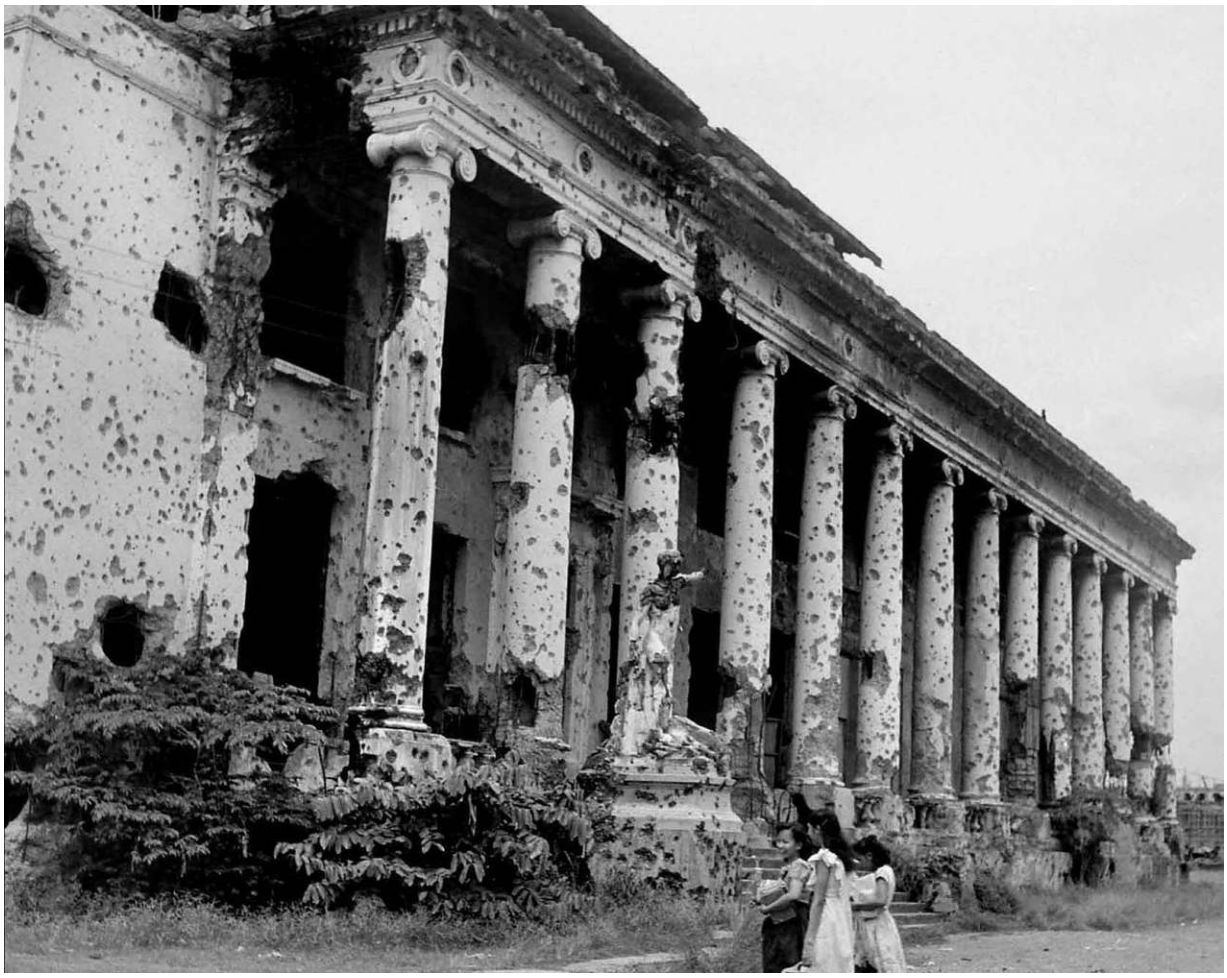

Figure 160 Rizal Hall in Manila, Philippines

8. Joint/Corner Holes

In this hallmark we see holes exclusively on the intersections where ashlars meet, i.e., joints and/or corners. These holes can be analogously thought as bugholes, which are holes on the surface of a setting concrete caused by the expansion and eventual outgassing of trapped pockets of air. This hallmark is a sub-category of Dowel and Square holes, since it appears to be only located in the Mediterranean/Middle East area.

Below is the schematic display of the Joint/Corner holes.

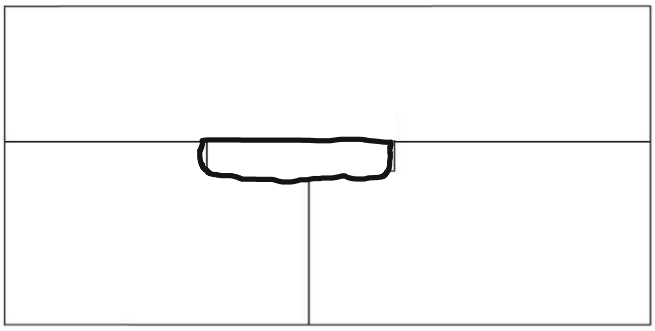

Figure 161 Schematic frontal view of Joint/Corner holes

A good example to start with comes from Caparra in Spain, dating to 74 CE[158]. It can be seen, as stated before, that these holes are exclusively on the places where ashlars meet, namely the joints and/or corners and not on the surfaces of the ashlars. The holes have a destructive look as if something was prized out or somehow the joints/corners exploded.

Figure 162 Caparra, Spain

158 https://www.turismocaceres.org/en/turismo-cultural/roman-ruins-caparra

Moving to Temple of Claudius in Italy, dating to 54 CE[159], the same phenomenon can be observed here.

Figure 163 Temple of Claudius, Italy

Moving to Pergamon in Turkey, which was founded in the 3rd Century BCE as the capital of the Attalid dynasty and later on occupied by Roman, Byzantine and Ottoman Empires[160], the same phenomena can also be observed here.

Figure 164 Pergamon, Turkey

159 Andrea Carandini. Atlas of Ancient Rome. Princeton University Press, 2017, p. 347.

160 https://whc.unesco.org/en/list/1457/

Moving to Garni Temple in Armenia, dating to 1st century CE[161], on the foundations of the temple, the joint/corner holes can be seen. It is worth noting that, nubs on column segments are also present at the Garni Temple, which shows again a conjunction of 2 hallmarks.

Figure 165 Temple of Garni, Armenia

Moving to Temple of Ba'al in Palmyria in Syria, which was first mentioned in the archives of Mari in the 2nd millennium BCE and later came under Roman control in the mid-first century CE[162], the same phenomena can also be observed here. It could be thought that these holes are used for scaffolding. If that was the case, why were they not repaired afterwards? Also, it would be a safer choice to place the holes on the surfaces of the ashlars and not on joints/corners.

If the holes were used for scaffolding during the construction process, it is possible that they were intentionally left open or only partially filled in for practical reasons. However, even if the holes were used for scaffolding, they would not have been completely neglected after construction was completed. In some cases, the holes may have been filled in with mortar or other materials to improve the appearance of the structure.

It is also worth noting the Chakana/Step-stair motif on the top of the temple, which shows again a conjunction of 2 hallmarks.

161 https://www.worldhistory.org/Temple_of_Garni/

162 https://whc.unesco.org/en/list/23/

Figure 166 Temple of Ba'al in Palmyria, Syria

Figure 167 Another perspective of Temple of Ba'al, also displaying the Chakana/Step-stair motif on top, in Palmyria, Syria

Moving to Pasargadae in Iran, dating to 6th Century BCE[163], the same phenomena can be observed. Here, as stated before, there is the conjunction of 3 hallmarks, which are ashlars with drafted margins, nubs and joint/corner holes.

Figure 168 Pasargadae, Iran

At this point I will suggest that joint/corner holes have a specific trace to them. They exclusively appear at corners and/or joints of the blocks which is where one could expect to find the filler blocks. It also has to be considered that these might be damage holes due to scavenging in order to get the metal clamps which are located between blocks, so hacking the blocks at their corners would be a way to get them.

Figure 169 Metal clamps in ashlars (left) and how they are possibly made (right)

163 https://whc.unesco.org/en/list/1106/

The examples provided in this chapter are indicative of that the Joint/Corner holes were not created with an intended constructional measure, but they are rather indicative as the result of removal or theft of metal dowels, which occurred after the structure they are found on became non-functional. Ashlars were originally connected to each other by dovetail dowels, which were often made of stone, but these were found to be risky to break, especially in historic structures in Southeast Asia where a great many of them have been broken. To overcome this problem, ashlars were often connected with metal clamps made out of bronze, copper or iron were fixed into the stone with lead. However, these materials were valuable and subject to looting and robbing. In places where dowels were suspected, ashlars were chiseled out from the outside and the metal dowels were removed. Metal clamps were longer than dowels and harder to take out. That is why, it is also conceivable that lead dowels could have been removed by fire, but usually, it was not necessary because dowels were not very large and could relatively easily be coiled out through a chiseled hole. The Joint/Corner holes are irregularly hewn out and never rectangular, and are always below the horizontal joints, with the exception of the Garni temple, where they were cut above the horizontal joint because of the plinth cornice.[164]

Certain joint/corner holes also show a "leaking" profile (as if letter D turned 90 degrees to the right), which is more noticeable on structures from Caparra, Pergamon and Pasargadae. These could very well be traces of molten metal, if they were harvested as a result of using fire and melting, as mentioned above.

These holes are obviously not created as a result of musket or cannon fire or any kind of projectile damage but they are rather an erosion in between the ashlars. The effects of projectile damage can be seen in the photograph from the University of the Philippines in Manila, shared in the previous chapter. It just seems not probable that projectile damage would hit the corners and joints of the ashlars that many times that accurately without ever damaging the surface. The occurrence of these holes is something which is attributable to the structures themselves.

Another aspect which needs to be mentioned regarding the joint/corner holes, is the fact that their occurrence seems to be limited, based on the available visual material, in the Mediterranean/Middle East area, so they are not a worldwide phenomenon compared to the rest of the hallmarks.

The rationale behind why the joint/corner holes are included is because it is a matter of conjunction. For example, in Pasargadae, Iran we observe three hallmarks together: Ashlars with drafted margins, nubs, and joint corner holes. Similarly, at the Temple of Garni, Armenia we find nubs on the columns and joint/corner holes. The main intention here is to establish a connection. We have nubs in the Temple of Garni in Armenia and also in South America along with many other examples which makes the nubs a worldwide phenomenon. Additionally, Temple of Garni in Armenia has joint corner holes, whereas there seems to be none in Peru based on the available visual material. However, considering the common denominator of nubs, is it possible that Peru also has joint/corner holes? Perhaps the ashlars in Peru were also connected with one another with the help of metal dovetails?

164 In correspondence with Prof. Erich Lehner (Zoom meeting, on 13.03.2023)

In another words, since nubs are found worldwide, they can be considered a global phenomenon. On the other hand, joint/corner holes are not as widespread, but they do exist in conjunction with nubs. It begs the question whether joint/corner holes can also be considered a global phenomenon when they occur in conjunction a global phenomenon.

Noteworthy Hallmarks

The focus of this brief chapter is on hallmarks that are either unique to specific locations or occur in only a few places. These hallmarks are not commonly observed in more widespread contexts. However, it is important to note that these unique hallmarks coexist with previously mentioned hallmarks in the locations where they are found.

A. Rounded Corners

In this example, we see at the corners, not two ashlars meeting which one would normally expect, but rather one ashlar which is "trimmed" on the inside to receive the corner shape. A small portion of the ashlar extends to the wall which it meets. This can be attributed to ashlars going around the corner giving more stability to the endangered corner zone or as a result of polishing.

First example is taken from the Temple of Osirion in Egypt dating to 1290 to 1279 BCE[165] and the second example is taken from Coricancha in Peru dating to 1438-1471 CE[166], Another example from the same region comes from Machu Picchu in Peru, dating to 15th Century CE[167].

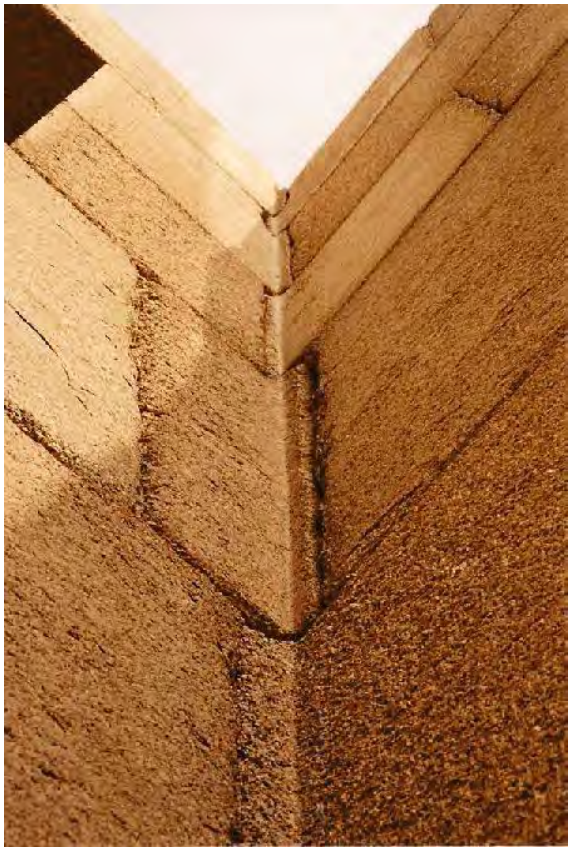

Figure 170 Corner at Temple of Osirion, Egypt

165 https://www.britannica.com/biography/Seti-I

166 https://www.worldhistory.org/Coricancha/

167 https://whc.unesco.org/en/list/274/

Figure 171 Close up of corner at Temple of Osirion, Egypt

Figure 172 Corner at Coricancha, Peru

Figure 173 Rounded corner at Machu Picchu, Peru

B. 4 Nubs Around Openings

This one is a very specific example, in which two nubs on the top and two on the bottom placed around openings. The first example is from Machu Picchu in Peru, dating to 15th Century[168], second one is from the House of St. George in Ethiopia, dating to the 12th Century CE[169] and the third one is the Sanctuary of Apollo and Demeter from Naxos in Greece 8th Century BCE[170].

In all three examples, the nubs are placed in a specific configuration around openings in the structure. The purpose of these nubs is not entirely clear, but they may have served as a decorative feature, or they might have had a functional feature, such as a way to anchor some other architectural element around the opening.

Two things to note; in the example from Naxos, is that although with the ashlars below the opening there are in total 6 nubs, it could very well be that this is a reconfiguration. The opening elements still exhibits 4 nubs placed around them. The other thing is example from House of St. George highlights the imitation in rock architecture of the traditional wall construction technique of Ethiopia that utilizes a timbered wooden skeleton filled with stone. This method is characterized by the transverse timbers of the skeleton beams protruding from the wall surface, resulting in what is known as "Monkey head construction."[171]

168 Ibid.

169 https://whc.unesco.org/en/list/18/

170 https://www.naxos.gr/the-ancient-sanctuary-of-apollo-and-demeter-at-gyroulas-sagri/?lang=en

171 In correspondence with Prof. Erich Lehner (Zoom meeting, on 13.03.2023)

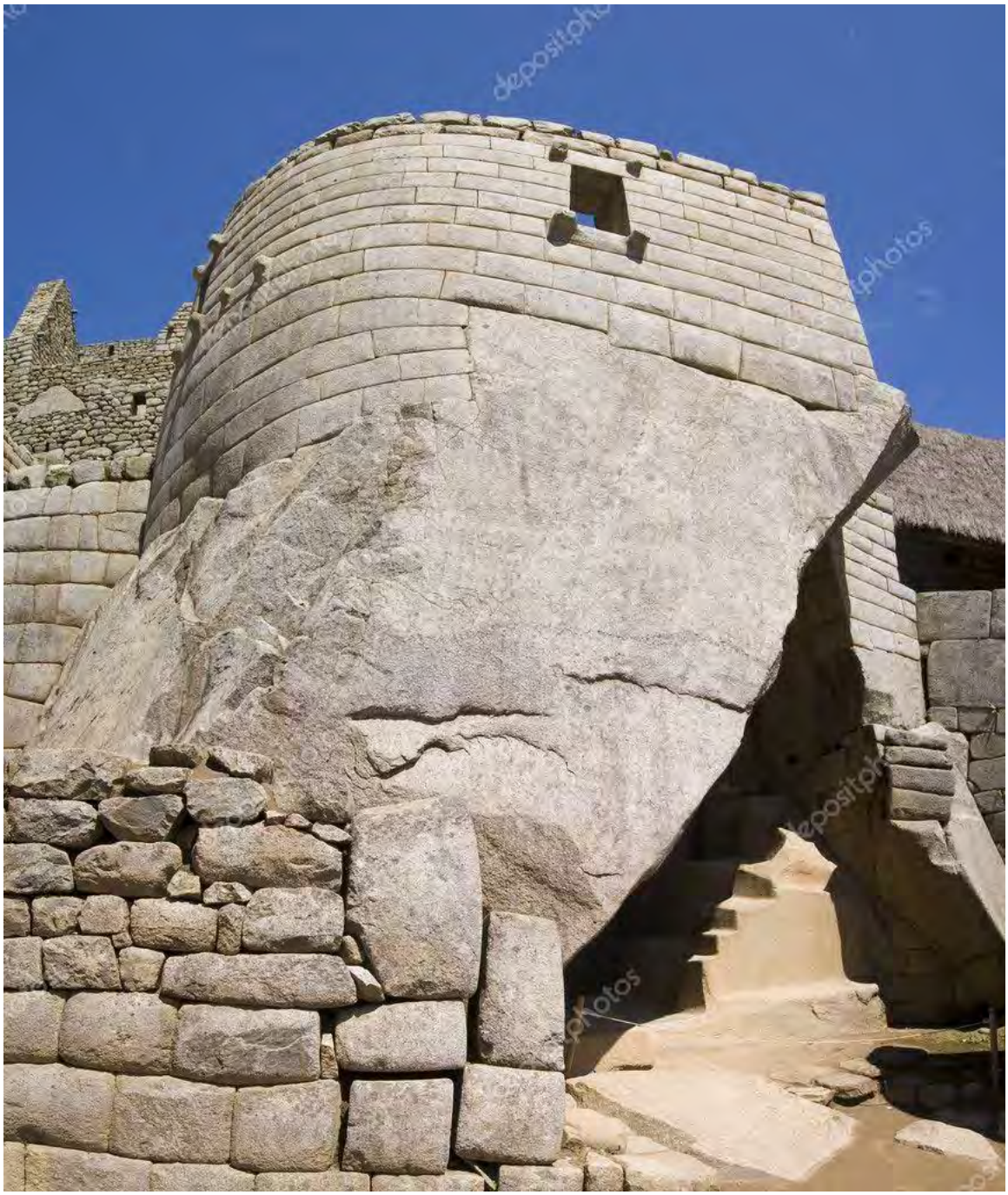

Figure 174 Nubs around an opening in Maccu Picchu, Peru

Figure 175 Nubs around an opening from the House of St. George, Ethiopia

Figure 176 Nubs around an opening in Nexos, Greece

C. Incised Motif

In this example, we see a contour placed around the opening, which is offset inwards three times and in certain cases more. These could very well be stylistic implementations, but also, as it was claimed in the trapezoidal opening/niches chapter, that they are indicative of what the built edifice is for.

First example is taken from Behistun, also known as Bisotoun, Iran, most of its significant period was from the 6th Century BCE to the 6th Century CE[172]. second example is taken from the Sun Gate in Tiwanaku in Bolivia, reached its apogee between 500 and 900 CE[173], third example is taken from Limyra Turkey, which has evidence of settlement since the 5th century BCE[174] and the fourth example is taken from the Elephanta caves in India, which were constructed about the mid-5th to 6th Centuries CE[175].

All these instances serve as transformations, or more accurately, reproductions, of wooden architectural designs using stone as the primary material. These advancements can be observed in numerous cultures across the globe, where their initial architectural expressions were shaped by wooden structures. The replication of these architectural styles in stone construction is particularly noticeable in structures of religious and commemorative significance, where the lasting nature of the buildings holds significant importance.[176]

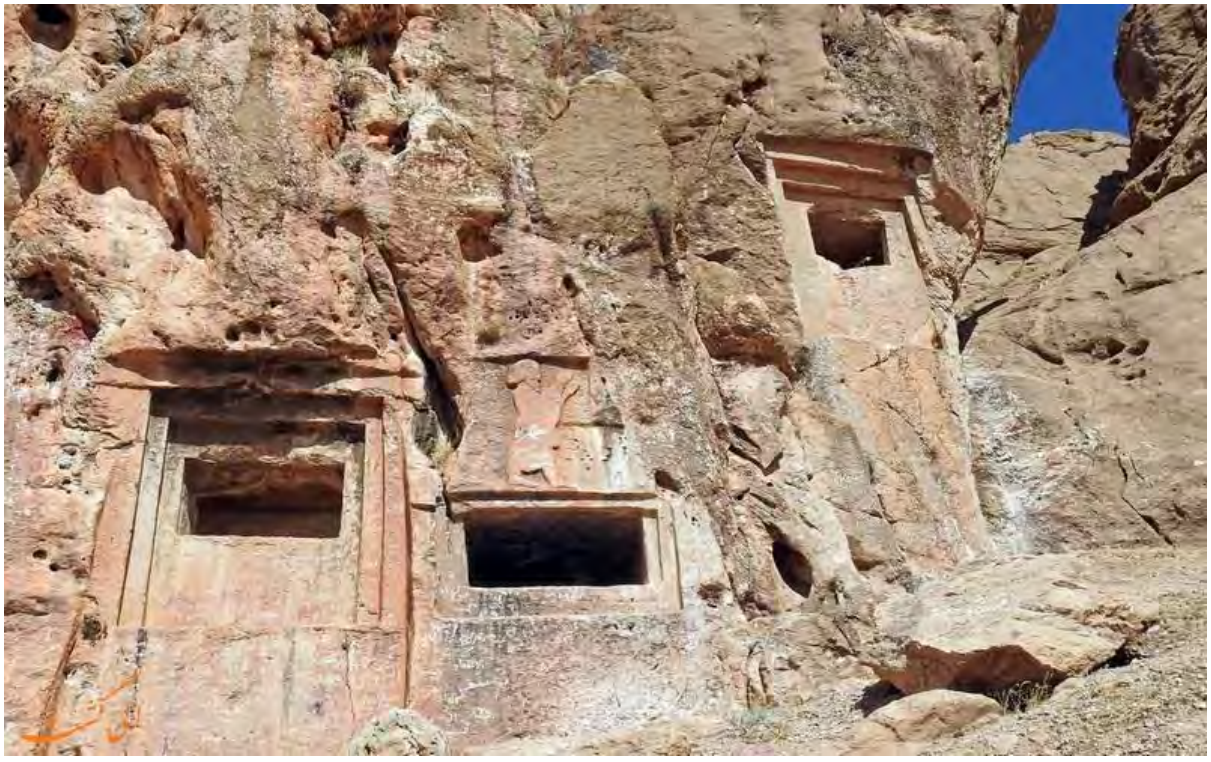

Figure 177 Behistun, Iran

172 https://whc.unesco.org/en/list/1222/

173 https://whc.unesco.org/en/list/567/

174 https://antalya.com.tr/en/discovery/history/ancient-cities/limyra-ancient-city

175 https://whc.unesco.org/en/list/244/

176 From email correspondence with Prof. Erich Lehner, on 11.08.2023

Figure 178 Sun Gate in Tiwanaku, Bolivia

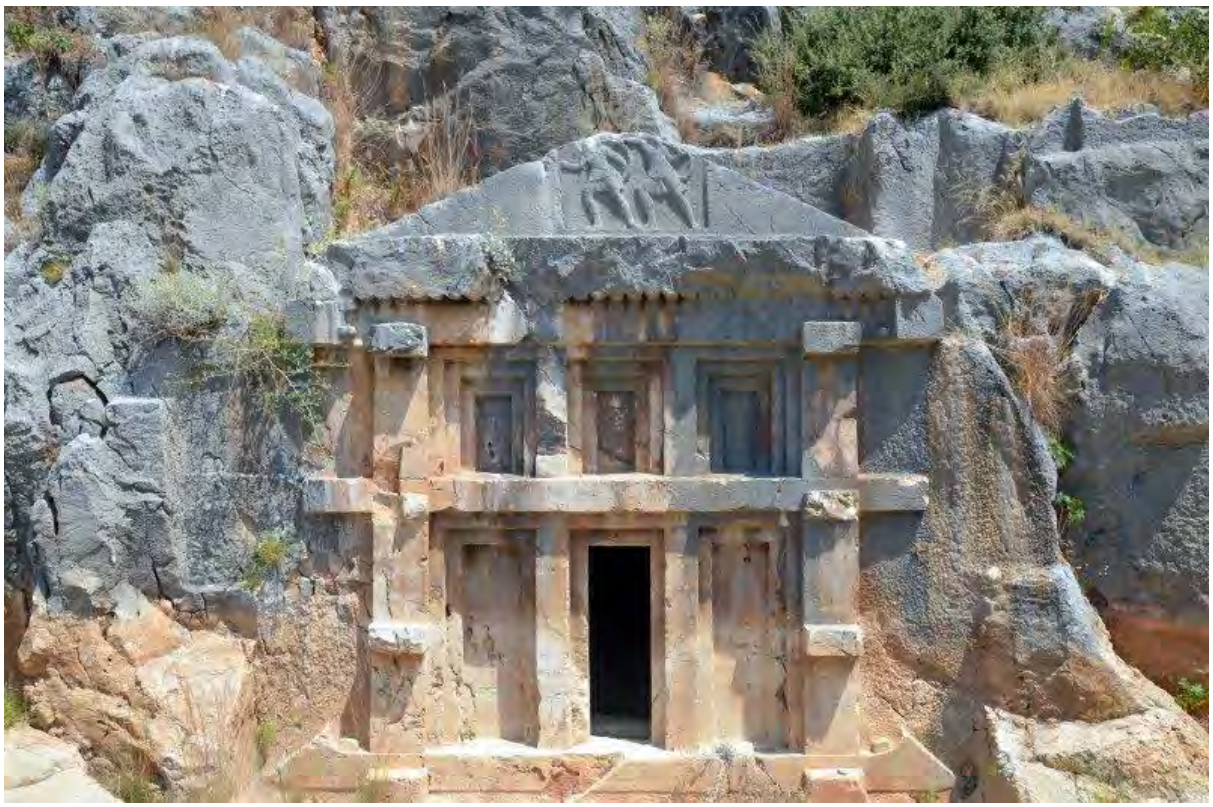

Figure 179 Limyra, Turkey

Figure 180 Elephanta caves, India

D. Ashlar surface smoothening

In this specific example we see smoothening of the ashlar surfaces. First example is from Temple of Osirion in Egypt, dating between 1290 to 1279 BCE[177], and the second example is from Coricancha in Peru, dating between 1438-1471 CE[178].

In his excavation report Henry Frankfort states that the rugged texture of the stones and the unadorned appearance of the walls, devoid of any embellishment aside from their raw material, were valued differently by the ancient builders compared to us. They did not intend for these features to be permanent. Instead, all the walls were meant to be smoothed out and adorned with sculptures, similar to the east wall and the southern architraves. In fact, on the western face of the central pillar in the southern row, faint traces of the sculptor's preliminary sketch can still be seen in red ink. This sketch likely depicts a kneeling male figure, most likely the king.[179]

If the smoothing is indeed deliberate, this could be for aesthetic purposes, as a smoother surface may be more visually appealing, or for functional purposes, such as creating a more stable base for additional layers of construction like plastering. It is important to note that the smoothing appears limited to a portion of the structure, or in other words, not complete. This suggests whatever the cause of this smoothening was, has not been applied thoroughly, which is a bit more obvious in the example seen from the Temple of Osirion.

177 https://www.britannica.com/biography/Seti-I

178 https://www.worldhistory.org/Coricancha/

179 Henry Frankfort, The Cenotaph of Seti I at Abydos, The Egypt Exploration Society 1933, p.17

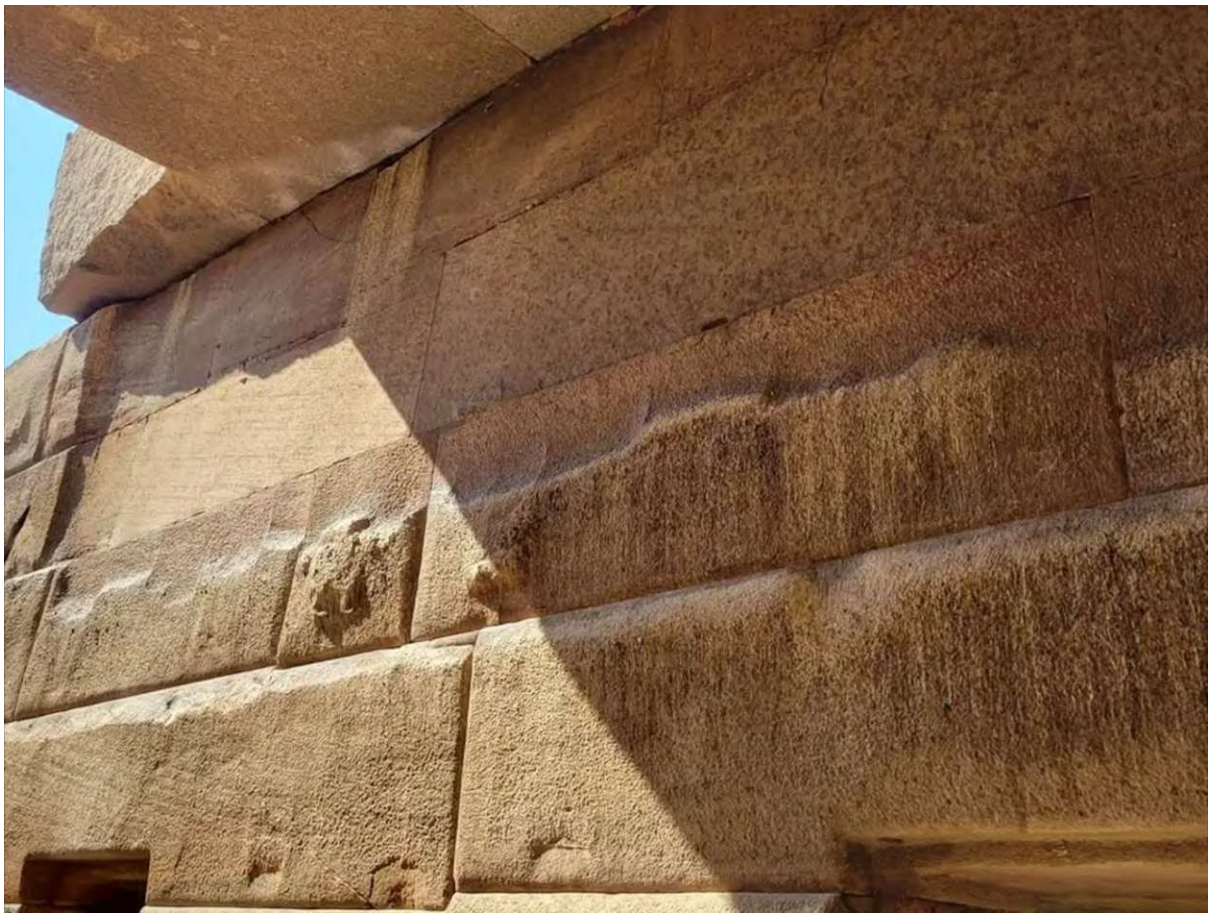

Figure 181 Temple of Osirion, Egypt

Figure 182 Coricancha, Peru

Techniques Involved in Stone Construction

In this chapter, a comprehensive overview of techniques involved stone construction is presented, drawing upon insights from a diverse array of sources. Central to this analysis is the historical backdrop in which these techniques have emerged, revealing the evolution of stone construction practices, along with elucidating the methods integral to the accomplishment of stone construction tasks and aiming to unveil the core principles and subtleties that have defined such practices across epochs and civilizations. A salient feature of this analysis involves the juxtaposition of these techniques within their distinctive cultural, geological, and technological milieus, thereby facilitating the emergence of a comprehensive understanding of the subject matter.

Mesopotamia

The study of stone usage in Mesopotamian construction is significantly lacking. It has been commonly observed that the availability of stone was quite limited, and its incorporation into buildings was seen as an exception. Consequently, there is no comprehensive record of stone masonry practices in Mesopotamia. Interestingly, suitable building stones are abundant throughout the region, including accessible limestone outcrops in the alluvial south. However, stone was sparingly utilized as a structural material, primarily reserved for specific requirements such as quays, wharves, and other evident necessities.[180]

Despite the prevailing notion of limited stone construction in Mesopotamia, an unexpected trend emerges when examining the archaeological record. During the late prehistoric era (4th millennium BC), there was a remarkable concentration of stone usage, which was most significant compared to other periods, except for a later derivative use of stone in the 1st millennium BC.

Reports indicate that walls were entirely built with stone during this period, and some stone was quarried rather than using field stones or boulders for foundations, which was more common in the 5th millennium BC. The quarry stone was typically employed in two ways: foundations were made using large irregularly shaped slabs, retaining their original quarry face without further dressing, while in upstanding walls, the stone blocks were finely dressed.

The significance of these discoveries lies in the technological history. They suggest that during the 4th millennium BC, Mesopotamian masons developed a refined technique of stone dressing to create small blocks that resembled the familiar mud bricks. Whether this was done for aesthetic or structural purposes, or simply as a continuation of tradition, remains uncertain. Nonetheless, it represents the earliest instance of a technique that would become prominent in later building history, known as small block stone masonry or petit appareil.

It is noteworthy that this practice of fine stone dressing seemed to fade out of use in Mesopotamia over time, only to resurface in other regions at a later date. There is a possibility

180 G.R.H. Wright Ancient Building Technology, Volume 1: Historical Background, Brill 2000, p.45.

that it might have been influenced by Mesopotamian practices in those areas where it reappeared. [181]

Consequently, the Mesopotamian building approach persevered, nearly unchanged, for almost three millennia, while neighboring regions developed distinct building styles over time. Although certain aspectual elements were later adopted from other cultures, the fundamental construction techniques in Mesopotamia remained consistent. This architectural tradition is often referred to as the "Massive Mud Brick Style." In which each successive generation ambitiously built upon the ruins left by their predecessors.[182]

Egypt

Egyptian building is globally renowned for its awe-inspiring and enduring stone monuments, like the grand temples in Thebes with towering columns and monumental gateways. The Giza pyramids, reaching approximately 150 meters in height, were the tallest structures until 20th-century skyscrapers. Egypt introduced the world to monumental, finely dressed stone masonry, creating the popular impression of its remarkable architectural legacy.[183]

Often overlooked is the late emergence of advanced stone masonry in Egypt, despite its renown for stone monuments. Few realize that monumental stone construction developed relatively late in Egypt's history. The transformation of rough stone into impressive structures using basic tools requires social capital and labor. The rapid appearance of monumental stone buildings in Egypt around 2600 BCE can be attributed to efficient central administration and vast resources. Although the exact origin of advanced stone techniques in Egypt is unclear, the innovative shift is exemplified by Zoser's stone complex at Saqqarah, built with the guidance of Imhotep, the royal architect.[184]

The ancient building technology of the Egyptians contrasts with traditional European practices. They aimed to use the largest possible stone units to create strong connections quickly. This resulted in very large, sometimes irregularly shaped blocks. Stone dressing was often done after placing the blocks, minimizing stone and construction time. The main motivation for this approach was the need for efficient construction given the contemporary social circumstances.[185]

Harder stones were quarried using hand-held balls of even harder stone to pound out circumferent channels. The transport of these large masses, often from distant locations, was facilitated by using the river as a transportation route. In some cases, ad hoc canals were dug from the river to the quarry and building site. Alternatively, blocks were hauled on sleds by manpower over prepared tracks and causeways. Some surviving causeways demonstrate substantial viaducts with stone walls. The critical question is how to lift a 20-ton block to a height of 20 meters on the wall face. No block and tackle lifting devices were known, but some wooden wheels and counterweighted balance arms (a devide known as shadouf) have been

181 Ibid p. 45-46

182 Ibid p.47

183 Ibid p.48

184 Ibid p.58-59

185 Ibid p.61

found. However, there is no direct evidence of their use for lifting. Construction ramps and embankments were common on monumental building sites, suggesting blocks were hauled into position on ramps. However, local difficulties arise as the ramp gradient cannot be steep, requiring very long ramps for considerable heights, which may be impractical on some sites.[186]

The Egyptians used familiar masonry tools and instruments for their stone masonry procedures. Hard igneous rocks like granite were worked with even harder stone tools, while soft limestone was worked with metal tools made of copper or bronze. Struck tools like chisels, droves, and punches were favored over striking tools like picks, hammers, and axes for normal purposes. The limit of hardness where bronze and copper tools were practical was understood, and alloying and tempering techniques were used to improve their durability. It is possible that stone tools were more widely used than previously thought, and the distinction between hard and soft rock is not entirely clear. Hard sandstone and hard limestone might have been worked with stone cutting tools, but there is limited knowledge on this matter. [187]

Around 2500 BCE, Egypt's advanced stone masonry influenced nearby regions like Palestine, Syria, Anatolia, the Aegean, and the Mediterranean. Stone dressing methods there often paralleled Egyptian practices, including small and occasionally large block masonry. However, this trend only became widespread in the middle of the second millennium BCE, around a thousand years after Egypt's adoption. The possibility of direct transmission from Egypt is debated due to masons' mobility and Egypt's insular focus. While Egypt saw native advancement in stone dressing, a significant shift occurred in the middle of the third millennium BCE when they began using massive stone blocks for monumental structures. Intriguingly, Western Europe and Malta had similar megalithic practices for two millennia prior, suggesting European megalithic building was not influenced by Egypt, and vice versa might also be true.[188]

Levanto-Aegean

The geographical definition of this category is too broad and imprecise to be valid. However, when compared with building construction in Mesopotamia or Egypt, surprising uniformity (if not identity) of practices can be observed across a region encompassing Palestine, Syria, Anatolia, and the Aegean. Despite being in contact with Mesopotamia and Egypt, these areas maintained their traditional construction methods from the Neolithic era, lacking sophisticated architectural orders, which makes it challenging to identify certain structures like temples.[189]

During the Early and Middle Bronze Age, stone was mainly used for building as field stone or random rubble. Dressed stone was limited and did not challenge the dominance of rubble masonry. However, during the mid-2nd millennium BCE, there was a significant shift as quarried and dressed stone became widespread. The reason for this change is unclear but

186 Ibid p.62

187 Ibid p.64

188 Ibid p.66-67

189 Ibid p.69

could be related to the expansionist policies of New Kingdom Egypt. The Levanto-Aegaean region adopted a pleasing and adaptable style, incorporating fine stone masonry instead of a monumental building order like Pharaonic Egypt. This included discreetly using columns, typically made of wood with stone bases and capitals, though not well-preserved.[190]

In Levanto-Aegaean construction, finely dressed stone masonry was used as a base to support a superstructure made of less noble materials like rubble or mud brick, distinguishing it from the Egyptian masonry. Two main forms of this stone base can be observed: standard coursed masonry and an ordonnance of orthostates on a plinth course. Both types have the same structure, with the finely dressed stone acting as a facing for a core made of different materials, usually rubble masonry or mud brick. Despite appearing finely jointed from the front, the stones are not closely jointed, and their rear side is dressed away, resulting in open joints within the wall. The use of dowelling or cramping to fix the blocks together is limited or absent.[191]

Regarding the use of mortar; Limestone and rock gypsum are rocks primarily composed of calcium carbonate and calcium sulfate, respectively. Crushed to a powder and mixed with water, they form adhesive pastes suitable for building plasters or mortars. Burning removes elements and yields a more adhesive residue when mixed with water or other materials. Gypsum is more water-soluble than lime, but burnt gypsum can revert to its original composition when mixed with water and exposed to air, making them indistinguishable without tests. Archaeological reports lack clarity in differentiating the use of limestone and gypsum in ancient buildings. Recent investigations show both were used since early Neolithic times in the Middle East. The region can be broadly divided into an eastern area favoring gypsum and a western area favoring lime. However, this analysis is plaster-based, and cementitious mortars' usage in Cyprus and Phoenicia lacks exploration and supporting evidence from classical authors. Neolithic rubble walls used mud mortar, and even with sophisticated masonry, mortar composition remained unchanged. Gypsum mortars gained prevalence later, especially for fine stone masonry in Syria and Cyprus during the Late Bronze and Iron Ages. Cyprus notably stood out as a gypsum source. [192]

Achaemenid Persian Building

Around the middle of the 3rd millennium BCE, Egypt experienced rapid development in highly accurate stone construction. However, for the following two thousand years, building technology in the ancient world remained largely unchanged. In the middle of the 1st millennium BCE, sudden advancements in fine stone masonry emerged, fully realized around the 6th century BCE. Notably, these developments occurred independently in two different regions, leading to similar techniques but distinct overall building styles. Both cases involved a transition from more manageable materials like wood to fine stone masonry, similar to Egypt's developments two millennia earlier. These changes in building were influenced by significant social and political shifts, including the availability of global material resources due to a world empire's emergence and a release of human resources driven by a humanist,

190 Ibid p.74

191 Ibid p.74-75

192 Ibid p.75-76

anthropocentric culture. The discussion focuses on the development of Achaemenid Persian building and Classical Greek building. While Achaemenid building is addressed first for convenience, it does not imply technological precedence, as the influence of Classical Greece is more apparent. Moreover, the subsequent history of the two styles differs greatly, with Classical Greek building leaving a lasting impact worldwide even today.[193]

Urartian buildings featured a highly developed mixed construction style, with sturdy load-bearing walls made of finely dressed masonry stone at the base (known as "bastard ashlar") topped by a mud brick or rubble superstructure. Alongside these walls, tall wooden columns were common, especially in forested mountain regions. Moreover, the fine stone masonry system typical of Urartian buildings was replaced in Achaemenid structures with large blocks of finely dressed stone, set without mortar and secured with metal cramps. These changes were distinct from the earlier Urartian style and represented an evolution in architectural techniques. Achaemenid monuments focused on lateral stability rather than load-bearing strength. They employed stiff mud brick walls reinforced with heavy stone masonry framing for doors and windows, along with various monolithic pillars and piers. This technique, influenced by Levantine Aegean construction, utilized finely dressed stone blocks to stiffen the walls and was later introduced to the Western Mediterranean by the Phoenicians as Opus Africanum. At Persepolis, these stone features were elaborately sculpted with relief art. [194]

Achaemenid masonry is characterized by closely jointed stone facing on great platforms, fixed with metal cramps. There is a noticeable difference between the masonry at Pasargadae and Persepolis. Pasargadae has uniform, regularly coursed blocks, while Persepolis follows the style of Egyptian large block masonry. The irregularly coursed blocks at Persepolis create stronger bonding, suitable for handling horizontal thrusts in retaining walls. However, it is interesting to note that the retaining walls of the Achaemenid platforms do not use true polygonal masonry, which would have been the strongest type. The difference in masonry between Pasargadae and Persepolis may indicate both structural development and the influence of different masonry traditions. The availability of resources from Egypt likely influenced the masonry style at Persepolis.[195]

The difference in masonry form between Pasargadae and Persepolis indicates significant variations in masonry practices. At Pasargadae, the retaining walls were constructed with regularly coursed orthogonal stone blocks, dressed before being set in place. The joints were finely dressed on the bench, while the facing was completed after the blocks were set. However, at Persepolis, the retaining walls consisted of large irregularly shaped blocks, requiring on-site dressing and jointing during the setting process. It is widely accepted that by the end of the 6th century BCE, a crane or hoist operated by block and tackle was developed, revolutionizing the construction process. This innovation led to smaller and more manageable construction units, like drums for columns. Before this invention, construction relied on raising the ground level and using large units, similar to the Egyptian method used for massive monuments.[196]

193 Ibid p.79

194 Ibid p.80-81

195 Ibid p.83-84

196 Ibid p.84-85

Like the modern Russian Empire, the Achaemenid Empire had both an eastern front toward Further Asia and a western front toward the "Ancient World." There is a possibility that Achaemenid architecture influenced later building styles in Central Asia and India. For instance, Hindu temples in South India resemble Persepolis in design, albeit on a smaller scale and dating much later. Thibet could also be an area where Achaemenid building influences are likely.[197]

Classical Greek Building

Studies suggest that the formation of Classical Greek building is not solely tied to material sources, but rather to the human resources available in 6th century Greece. Monumental building, especially those using finely dressed stone, requires a stable society with a surplus of finances beyond subsistence needs. The historical lesson shows that once these conditions are met, a monumental building style quickly emerges as an expression of the society's identity, without the need for a long evolutionary background. Sixth-century Greece possessed these necessary factors due to its well-established city-state regime, trade, and monetary economy. The development of monumental building in 6th century BC Greece, with its remarkable quality, resulted from considerable intellectual understanding and a well-organized labor market, enabling educated men to apply their specialized skills as contractors, wage-earning workers, and stone masons. Greek society had to possess sufficient resources to pay for these projects in cash, rather than relying on forced labor. As a result, Classical Greek building rapidly developed and standardized its capacities by around 500 BC, sustaining its entire life cycle.[198]

Classical Greek masonry utilized blocks that were not as massive as those in Egypt but still too heavy for one or two men to handle easily (unlike rubble masonry). Special blocks, such as architraves, could weigh several tons. To address this, a mechanical device called the "hoist" was invented during the 6th century BCE. It used a wheel-based pulley system to lift and precisely position heavy loads, regardless of the height above the ground. This hoist became an essential tool on building sites, although there are no ancient representations of its use in Classical Greek construction. However, Roman depictions and evidence from cuttings on blocks suggest its application during Greek times. With this device, a few men could efficiently position massive blocks at considerable heights, reducing clutter and debris on the building site. This invention allowed for the avoidance of hauling heavy building units, which, in turn, affected the size of the building units. Hauling large units at once was more cost-effective than multiple trips for smaller units, but the block and tackle used for lifting had its limitations, making extremely massive units impractical in Classical Greek buildings. Consequently, monolithic columns were generally replaced by columns made from drums, with heavy units only occasionally lifted using the old hauling method in emergencies.[199]

Monumental Greek buildings are constructed using load-bearing blocks of high-quality sedimentary stone, mostly limestone (often marble). These sizeable blocks, ranging from about a meter to half a ton in weight, are meticulously dressed, set, and fixed together to

197 Ibid p.87-88

198 Ibid p.92-93

199 Ibid p.95-96

create a monolithic structure. Every surface is precisely worked to ensure seamless contact with adjacent blocks, forming hair-line joints without the need for mortar. To counter stresses like earthquakes that might pull the units apart, metal ties such as cramps and dowels are used to secure the blocks to each other. Greek builders preferred constructing their masonry down to bedrock or, if necessary, creating artificial foundations with the same impeccable masonry as the main structure. This meticulous approach often preserved jointing harmony, enabling the restoration of a temple's ground plan from foundation masonry three courses below the surface. This illustrates the classical Greek builders' understanding of foundation engineering, which has now evolved into a separate scientific discipline. [200]

In Greek ashlar masonry, blocks were not only dressed on the bench but also received finishing work on-site to protect them during construction, leaving a protective stone covering. This covering, was later dressed away as the final step in building operations known as in situ facing. Similarly, upper bed joints of blocks were commonly dressed on-site after assembly. In situ dressing was prevalent, particularly for facing blocks, where the central panel remained roughly dressed while the edges were carefully defined. This marginally drafted appearance eventually evolved into the aesthetically virtuous style known as "rusticated" masonry, which is still present today.[201]

Although ashlar masonry is the prominent type of masonry in Greek architecture, they also utilized two other distinguished types known as "polygonal" and "Lesbian" masonry. Unlike ashlar, these masonry styles were primarily used for retaining walls rather than upstanding walls, providing functional strength against lateral thrust. The polygonal masonry features large blocks with irregular polyhedra form, while the Lesbian masonry incorporates curved sides in addition to similar block forms. The fine jointing in these masonry styles requires skilled work with metal templates, and pliable lead strips were used for the curved faces of Lesbian masonry. These styles are not earlier or formative to ashlar masonry but serve distinct functional purposes.[202]

Classical Greek masonry excelled in technical expertise, employing iron tools instead of bronze. These tools can be categorized as "striking" (picks, hammers, adzes, axes) and "struck" (punches, points, chisels). The Greeks favored "struck" tools, possibly inventing serrated chisels, which left distinct marks on stone, especially marble. In contrast to Egyptian large block masonry and Levantine bastard ashlar, Greek masonry showcased innovation by using standardized parallelepiped units with close jointing, combining strength and addressing structural weaknesses of the latter. Both Greek and Egyptian masons favored "struck" tools, while Levantine masons preferred "striking" tools like adzes and picks.[203]

Roman Building

Republican Rome evolved during its later stages as a distant extension of the Hellenistic World. In the fourth century BC, the Greeks acknowledged Rome as a "Greek City," yet Rome's

200 Ibid p.97-98

201 Ibid p.99

202 Ibid p.100

203 Ibid p.100-101

position and its people's traditional disposition set it apart. Despite its archaic nature, Rome, an outlier, ultimately dominated and transformed the Hellenistic World. Through territorial expansion and a society free from constraints, capitalism flourished. By the republic's end, ambitious individuals amassed substantial wealth, reshaping society through available investment opportunities. Population growth, migration, and an increased servile class led to proletarianization, especially in urban areas. Urban property became a prime investment, significantly influencing the construction industry and related technologies.[204]

The building programs included diverse innovations beyond religious and funerary structures. They encompassed various constructions like apartments, commercial centers, offices, and cultural edifices. Public projects such as roads, bridges, aqueducts, and drainage systems were also significant. Unlike the focus on temples in Classical Greek practices, Roman building methods had a broader scope. They constructed temples resembling Greek ones and even finished grand-scale Greek temples with meticulous masonry. However, Roman building technology goes beyond this type of construction. While Greeks consistently used solid ashlar for monumental structures, Romans used it selectively, showing regional differences. In the Eastern Roman territories where Greek was spoken, refined load-bearing stone masonry remained common for grand projects. In the Western regions without Greek influence, its use was limited. Roman ashlar masonry's development within the Greek tradition is apparent, with no significant technical differences. However, variations emerge when comparing load-bearing ashlar masonry from both cultures, notably in Anatolia. Roman blocks are taller with nearly square faces, while Classical Greek blocks are elongated rectangles. Romans preferred softer, less crystalline stone, possibly due to different tools. Romans used striking tools like axes, adzes, and picks, while Greeks used chisels and punches. As a result, Roman ashlar joints are less finely detailed than classical Greek marble masonry joints.[205]

Extensive archaeological findings have provided modern researchers with valuable insights into Roman concrete construction. However, there's another significant advancement made by Roman builders that lacks surviving evidence and hasn't received much attention. The pivotal role of lifting mechanisms like cranes and hoists in construction is evident. Their early invention in classical Greek building influenced the use of construction units to strike a balance between monumental Egyptian-style masses and portable elements seen in the Ancient Middle East. These mechanical devices persisted through Roman times, being essential on building and quarry sites. Their frequent appearance in ancient depictions solidifies our understanding of their historical significance. Roman builders occasionally employed extremely large to colossal construction units, like monolithic granite columns seen in structures like the Pantheon. These units could weigh up to 100 tons or even more. Handling such massive units with the cranes depicted in reliefs was impractical; instead, evidence suggests the use of scaffolding or hauling mechanisms. While the influence of local practices is not clear, Roman builders displayed their ability to manage even the largest structural elements, as evidenced by the transportation of Egyptian obelisks. This skill

204 Ibid p.110-111

205 Ibid p.113

was lost in Western Europe, re-emerging only during the Renaissance, highlighting the decline of ancient building traditions.[206]

South America

The Inca stonemasons achieved remarkable precision and beauty in their constructions despite lacking iron tools and knowledge of the wheel. The process of cutting, fitting, and erecting stones without these technologies is intrigueing. The Incas' selection of challenging and distant quarry sites underscores the significance of rock choice. The well-organized layout of these quarries, indicates that quarrying held substantial importance for the Incas, going beyond a mere routine task.[207]

The quarries have specific rock types corresponding to their areas. For example, the quarry of Kachiqhata have north and south quarries which yield coarse-grained red granite. At the quarry in Rumiqolqa, the it produces flow-banded andesite. At Kachiqhata, the Incas did not quarry conventionally. They did not cut or detach stone from bedrock. Instead, they selected blocks from a rockfall, minimally dressed them, and finished the intricate work at the construction site.[208]

Inca quarrymen might have employed bronze pry-bars, similar to those displayed in Cuzco and Lima museums, or possibly wooden sticks, as seen with modern quarry workers. On some of the blocks, there are holes with irregular forms, rounded edges, channel curves, and pit marks which imply pounding rather than chiseling. This contrasts with the cleanly split rock in Machu Picchu's quarries, showing precisely cut wedge-holes but no channel. These holes were likely cut with metal chisels, indicating more recent splitting. The absence of channels and wedges doesn't rule out Inca use but suggests the technique wasn't widespread, contrary to common belief.[209]

The tools involved in the process of cutting and dressing are simple river cobbles used as hammerstones. They were found loosely strewn about the chippings of andesite or partially buried in them. These hammers are easily recognizable due to their shape and petrological traits. They range from pure quartzite to granite and olivine basalt. Weights ranged from 200g to 8kg, spanning two intermediate groups at 2-3kg and 4-5kg. All hammerstones had a minimum hardness of 5.5 on Mohs' scale[210], comparable to the andesite they worked on. These hammers were sturdier than andesite, known for fracturing on impact. Hammerstones likely originated from the nearby Vilcanota River. The biggest hammer was employed to flake and square the blocks from the quarry face. Medium-weight hammers cut surfaces, while smaller 200-600g ones shaped edges.[211]

206 Ibid p.125-126

207 Jean-Pierre Protzen, Inca Quarrying and Stonecutting, University of California Press 1985, p.162.

208 Ibid. p.164-165.

209 Ibid. p.168-169.

210"One standard measure of hardness is called the Mohs scale. On the Mohs scale talc, the softest mineral, has a rating of 1 and diamond, the hardest, a rating of 10." Taken from Jean Pierre Protzen, Scientific American 1986 Vol. 254, p. 99

211 Ibid. p.170.

The experiments demonstrate efficient stone mining, cutting, and dressing with simple tools and minimal effort. Pit scars are present on all Inca walls, regardless of rock type. Limestone surfaces reveal whitish spots from heat generated by hammerstone impacts. Pit marks are finer at edges and joints, indicating the use of smaller hammers for edge work. While pounding was the primary stone dressing method, evidence suggests Inca stonemasons were familiar with other techniques. Numerous blocks, such as in Ollantaytambo, display polished sections on faces and edges amid the usual pit marks. This polishing might done by pumice bars, supported by discovered fragments.[212]

Masonry joints encompass two primary types: bedding joints for weight transmission between courses and lateral joints within the same course. In Inca walls, during construction, the bedding joints of a new course were cut atop the underlying course. Stones typically had slightly convex faces, resulting in concave depressions for accommodating upper stones. These concave depressions refute the notion of grinding neighboring stones together for a precise fit. To understand the fitting process, an experiment was conducted using andesite blocks. A smaller block was placed on a larger one, and its outline was traced. After removing the smaller block, a depression matching the smaller stone's bottom shape was created by pounding. This pounding generated dust, which served as an indicator. When the upper block was repositioned, it left an impression of its lower surface in the dust. Compressed dust indicated a tight fit, while less compressed indicated a loose fit. After removing the stone again, pounding was focused on the compressed areas for a tighter fit. Repetition of this process allowed for achieving the desired fit.[213]

Regarding transportation of the blocks; If blocks were dragged along ramps, a significant labor force would have been necessary, especially for the largest stones. The required force depends on friction, ramp slope, and block weight. For example, the heaviest blocks in Ollantaytambo weighs around 140,000 kilograms, requiring about 120,400 kilograms of force to pull up the ramp. If a person could exert 50 kilograms of force, it might have taken approximately 2,400 men to move the block, consistent with historical accounts. However, this scenario raises unanswered questions. Inca ramps were narrow (6 to 8 meters wide), making it unclear how a large workforce could have contributed to pulling, and how workers were arranged on the road. Other challenges include rope tying techniques and stone maneuvering. Additionally, the finely dressed blocks, such as from Rumiqolqa quarry, likely were not dragged, as they lack drag marks and a finely dressed face would not likely be dragged on a stone ramp. This prompts the question of how these dressed blocks were transported.[214]

India

The earliest Indian records of Hindu architecture, known as vastu which appear in chapters within larger, date back to the 4th century CE when temple construction began. Later, comprehensive works called Vastushastras compiled architectural information including building, sculpture, and painting. These texts are likely theoretical rather than practical

212 Ibid. p.175-176.

213 Jean Pierre Protzen, Scientific American 1986 Vol. 254, p. 100-104

214 Ibid. p.105.

manuals, authored by learned brahmans. The individuals responsible for constructing temples, crafting sculptures, and painting did not typically document their traditions in writing, as building techniques were passed down through generations in oral traditions. The task of recording architectural and artistic practices was mainly undertaken by the brahmans, who aimed to regulate design and execution processes by putting them into written form. The Mayamata, an early text on temple construction, suggests that stone or wood is suitable for gods, brahmans, kings, and hermits. However, other texts allow stone for all temples regardless of builders or worshippers. Color and material are sometimes linked to Hindu social classes, with white stone for brahmans, red for kshatriyas, yellow for vaishyas, and black for shudras. Gender associations also exist, with stone and brick for male deities, brick and wood for females, and all three for neutrality. Sacredness is attributed to stone which is highly recommended over wood or brick. Materials lose associations through rituals and become linked to the residing deity. Reusing materials from old temples is discouraged due to identity, favoring new materials, although historical reuse was common.[215]

Hindu architecture finds its distinctive form in stone, employing techniques like rock excavation or dry stone masonry where stones are stacked without mortar. Cutting and carving stone blocks were significant achievements in the history of Hindu temples across India and other Hindu Asian regions. Variations in available stone types influenced carving and decorative styles, seen in materials like granite, sandstone, and volcanic stone. Temples were often covered in colored plaster for unity, hiding varying materials like granite and brick.[216]

The methods of carving directly into stone are evident in incomplete caves. Tools used, mainly a pointed chisel and iron mallet, are inferred from marks on the rock. Initial steps involve polishing the rock with chisels, sketching and incising the sanctuary facade. For tall chambers, a tunnel was driven into the rock below the ceiling site, then widened with steps. Rough work was followed by cleaning and polishing on each level. In Mahabalipuram's unfinished rock cut caves from the 7th century CE, artisans incised a colonnade on the polished facade and created square panels by cutting grooves, removing protrusions. After rough shaping, walls and columns were polished.[217]

In constructing structural temples, a systematic building process was followed. Bricks were baked on-site or nearby, while local stone was typically quarried. Reliefs on temples and a discovered manuscript about building the Konarak Surya temple reveal transportation methods, including elephants dragging stone on wooden rollers or floating it on barges along waterways. On site, masons shaped stone blocks, hoisting them with pulleys or using ramps for heavy elements. Tasks were divided among craftsmen like stonemasons, carvers, and sculptors. Iron clamps and wedges secured stone slabs, allowing intricate corbelling for decorative ceilings. Stone and occasionally iron beams were employed. Stone columns supported systems of beams, sometimes with repeating secondary beams for continuity. Timber was used for doors, and pierced stone screens imitated timber bars for windows.[218]

215 George Michell, The Hindu Temple: An Introduction to its Meaning and Forms, University of Chicago Press, 1988 p.78-79

216 Ibid. 79-80

217 Ibid. 81-82

218 Ibid. 84-85

The significant interaction of craftsmanship styles across different Hindu kingdoms greatly influenced the evolution and innovation of Hindu sacred architecture. Factors such as available raw materials and climate strongly shaped craftsmanship styles. Raw materials played a central role in construction and carving methods. These materials often came from outside a kingdom's borders, and the quality of stone led to distinct artistic traditions. Stone quality affected carving precision; hard rock hindered detailed carving, while soft stone allowed intricate work. Diverse stones, like those used by Hoyshala architects, influenced molding techniques. Where good stone was scarce, brick building traditions persisted, influencing temple styles. Each material's characteristics impacted local architectural traditions.[219]

219 Ibid. 88-89

Conclusion

A. Main Remarks

Here I will summarize and discuss educated guesses based on the observations of each hallmark, provide insights into their collective meaning, and address the propositions mentioned in the introduction.

Prof. Erich Lehner states in his book *Wege der Architektonischen Evolution* the following;

> "This selection of examples already shows that the probability of cultural contacts can only be judged to a limited extent by the criterion of spatial distance; although this is a measurable quantity, it is nevertheless a factor that must be interpreted correctly: Migrations of peoples, trade relations, and missionary activities were able to transfer cultural ideas over astonishingly long distances. Thus, spatial distances cannot always be evaluated as meaningful justifications for development processes proceeding in isolation from one another - these must additionally be proven on other levels, but in extreme cases they are nevertheless admissible as weighty arguments."[220]

What needs to be emphasized in his words is that assessing the probability of cultural interaction based on spatial proximity is not enough. Even though spatial proximity can be measured, it needs to be interpreted correctly. People's migrations, trade relations, and religious missionary activities have proven that they can transmit cultural ideas over vast distances. Hence, spatial distance alone cannot justify the occurrence of independent development processes. To support these claims, other evidence must be provided.

He then elaborates;

> "An essential factor to be taken into account in theories about possible influences of intercultural contacts on architectural development processes is the temporal correspondence. Diffusionist hypotheses of the transfer of building forms, which ignore the trivial circumstance that the corresponding building forms were no longer or not yet in use in the mother culture at the propagated time of their transfer, need not be discussed further. On the other hand, however, a contemporary occurrence of building forms in different areas of the world does not prove a priori that contacts had actually taken place between the cultures concerned."[221]

In some exceptional cases, such evidence can still be considered compelling. When constructing theories about the impact of intercultural contacts on the evolution of architecture, the temporal aspect is crucial. Hypotheses that overlook the temporal factor of the transfer of building forms are not worth discussing because these hypotheses neglect the fact that the building forms in question were either already in use or not yet being used in the original culture at the time of the transfer. However, observing the simultaneous occurrence

220 Erich Lehner. Wege der Architektonischen Evolution. Phoibos Verlag, Wien, 1998., p. 514-517 (Translated from German to English with deepl.com)

221 Id., p. 517.

of building forms in various parts of the world does not automatically prove that cultural interactions took place.

One proposition stated in the introduction is regarding the explanation for the global occurrence of the hallmarks. Whatever the proper explanation for the spread, adoption and use of these ideas, all the hallmarks observed in this study, except for the joint/corner holes, are demonstrably global which indicates that these cultures were connected in terms of their civilization.

If we were to expand on widespread features in architecture, as an example also mentioned in the introduction in regards to similarity, it is essential to choose an example that accurately embodies the concept. For instance, while arches and vaults have their merits, they do not encapsulate the breadth of architectural widespread. Instead, considering the prevalence of stepped buildings like pyramids could provide a more fitting illustration. Such stepped structures are found across Europe, Asia, the Americas, North Africa, and Oceania, or the use of corbelled vault, demonstrating a truly global architectural phenomenon. The common denominator for the use of these structural architectural features would be the physical laws, like gravity, pressure, thrust etc. and given these laws are the same all around the world, one could argue regarding the uniformity of these features, meaning that there are only so many ways to construct a a stepped pyramid or a corbelled vault which would be efficient to withstand these physical forces, which at the end defines its form as well. Once this is established, each culture would then add its own cultural expression on top of this shared architectural knowledge which later would become their burgeoning style.

What fundamentally matters in terms of the hallmarks presented in this study, is the execution, because in the case of the hallmarks presented in this study, a structural claim cannot be made, meaning each edifice in which the hallmarks find themselves, could have easily been built without them. An exception can be made for nubs and dowel & square holes, and that is only if they have been actually used for doweling and attaching things and for lifting/moving etc.

So, if one were to look at the hallmarks in a purely artistic point of view, they are an abstract idea shared by numerous different civilizations and all the built edifices are connected through the knowledge in which they were executed. It is this shared knowledge which is the common denominator across these cultures, which are not only separated in place but also through time.

In another words, the hallmarks are not unique to any one culture or civilization, but they are rather a shared idea that has been used across different regions and time periods. This suggests that there is a common knowledge or a shared design idea that has influenced the development of architecture across many different cultures. In this way, the hallmarks should be interpreted as signifiers of cross-continental communication.

It can also be postulated that, formal correspondences in architecture may not depend on cultural contact, but instead may be attributed to physical correspondences of building materials and natural principles that have universal applicability. Furthermore, technical and craftsmanship abilities are not necessarily determined by cultural contacts, but are influenced

by the development stage of the specific building culture. Therefore, it is suggested that the formal correspondences in architecture are also rooted in these factors rather than cultural contacts alone.

It seems, at a minimum, given to the widespread nature of these hallmarks regardless of the ages of these hallmarks or who made them, there could be far more to the story of what we thought about the relations of ancient cultures since there is a shared knowledge embedded in their architecture. When one looks at the hallmarks all together, as opposed to individually, because one could dismiss each hallmark on its own as a coincidence, it is quite the confirmation that ancient cultures were in fact a lot more connected, perhaps maybe even more then they are given credit for. Perhaps it would be also good to pick up and elaborate what is meant by coincidence here, as it was mentioned and defined in the introduction.

If a person were to travel to Athens Acropolis in Greece, that person would come across the nubs presented in page 34. If that person were to later visit Rumicolca in Cusco in Peru, that person would again observe nubs presented in page 50. Without coming across any other nub at any other side, that person could very well conclude that the presence of the nubs in Greece and in Peru is a coincidence.

However, if the same incident were to happen over and over again, as it was presented in this study with seven of the hallmarks, this is where things get complicated, because the circumstances surrounding the given occurrence could vary and even those occurrences, for example how a given hallmark is executed etc., could also have a set of circumstances of their own.

In another words, the complexity of a given occurrence which is regarded as a coincidence, is increased by the circumstances surrounding it, which are also subject to deviation, which additionally creates a set of interlinked factors that are difficult to explain. That is why, coincidence should not be used as an explanation until the laws governing what is meant by coincidence are defined and tested.

Another proposition stated in the introduction is, what the existence of a hallmark would say about the structure it is found on. Even in the case of noteworthy hallmarks, we see very specific styles of execution and motifs in areas which are culturally and spatially separated from each other. Since other hallmarks which were worldwide are found in these cultures, they happen to be in conjunction with noteworthy hallmarks, so even based on these alone, it can be concluded that there is indeed a connection amongst these cultures.

In other words, in certain sites, where there are overlapping hallmarks which would tie whatever was going on in Egypt to Peru, whatever was going on in Turkey to India etc. Whatever this phenomenon is and whatever it means, it is global and it needs to be treated as such.

At the end, what is decisive is not in what form a structure was built but rather in which way it was built, which implies the schematics the builders used is universal. In other words, what matters is not the particular form of the built structure themself, but rather the way in which they were constructed. The schematics used by the builders were not unique to their

particular culture or civilization, but rather were shared across different cultures. This suggests that there was a common template that was shared across different civilizations, even if the forms and functions of the built structures differed.

Also, to give a certain insight whether the hallmarks just engineering processing marks or do they signify something else, along with manufacturing techniques and tools used in their creation, as these were proposed in the introduction; if one knows the level of ability of the people in a certain culture and what their culture was about, then one knows what their engineering preferences were and it could be said why the hallmarks were made the way they were made. Understanding the cultural background and level of ability of a society can provide insights into their engineering preferences, which can in turn explain the design choices and construction methods. However, given the diverse range of cultures that have produced similar hallmarks with similar execution styles over time, it is difficult to determine the technological advancement of each society in relation to the others. Therefore, the existence of these hallmarks serves as a great equalizer, providing a common ground for comparison and analysis.

Nonetheless, the technological advancements of each society cannot be easily compared. For instance, the pyramids of Egypt were built over a period of several centuries, during which the society may have undergone significant technological changes. Similarly, the Gothic cathedrals of Europe were built over a period of several hundred years, during which time the technology used in construction may have changed significantly. Despite the challenges in comparing the technological advancements of different cultures, the existence of the hallmarks provides a common ground for comparison and analysis to explore the similarities and differences in the ways that different cultures executed them.

The existence of hallmarks raises questions about how they came to be used in different parts of the world, and this is where the archaeological aspect comes in. Archaeologists are interested in studying how different cultural practices, technologies, and ideas spread across different regions and time periods. They use a range of methods, including analyzing artifacts and excavating sites, which help them trace the origins and movements of cultural practices.

In the case of the hallmarks presented in this study, as also explained in the introduction, there are two broad aspects that archaeologists use to explain their global distribution, which are diffusionism and evolution. Diffusionism posits that cultural practices and ideas spread through direct contact between cultures, while evolution suggests that similar practices can emerge independently in different cultures through a process of cultural adaptation.

Based on these aspects, it is assumed that each given hallmark either originated somewhere and later on found its way into other cultures through diffusion, or that it was independently invented in different cultures through an evolutionary process of cultural adaptation. It is essential to emphasize the global nature of the hallmarks observed in this study, which requires an explanation of how they came to be a worldwide phenomenon, which can be explained within these and/or any other archaeological aspect(s).

However, it is important to note that the archaeological explanation regarding the existence of hallmarks is a separate field of study, and cannot be fully covered within this research.

Nevertheless, it is important to acknowledge the archaeological context in which hallmarks are studied, and the theories and methods that are used to explain their distribution.

Additionally, when considering the "problem of universals" in the context of the hallmarks, this problem arises because it is unclear whether each culture had the same need or meaning behind a given hallmark when they were creating and using it.

As mentioned in the introduction, Lonner's definition of psychological universals suggests that there are certain phenomena of human behavior and cognition which are shared across cultures, regardless of time or place. This means that there may be some underlying psychological processes or mechanisms that are common to all humans, leading to the emergence of similar behaviors or patterns of thought across different cultures. However, Lonner also recognizes that claims of universality can only be made when the same psychological phenomenon or result emerges across large and widely divergent cultures.

In other words, it is not enough to observe a behavior in one culture and assume that it is universal without considering how it functions or what it means in other cultural settings. Therefore, when observing a hallmark in a particular culture, it is important to gain understanding about their specific meaning and function in that culture. This means acknowledging that although similar applications and executions of the hallmarks can be observed globally, their significance and purpose might vary depending on the cultural context in which they are used.

This is again a separate field of study and its implications cannot be fully covered within this research.

To conclude, this study has revealed that there are notable similarities in details in built structures across different cultures and historical periods. These shared similarities can be attributed to the universal principles of building materials and natural phenomena, such as physical forces, as well as the technical and craftsmanship abilities that transcend cultural boundaries. The implications of these findings are significant, as they suggest that there are processing forms and techniques that can be universally applied to articulate all kinds of diverse expressions by people of various cultures.

B. Further Research

Further research is essential to gain a deeper understanding of the hallmarks presented in this study. This research should adopt an interdisciplinary approach, specifically incorporating archaeological, along with anthropological and even psychological perspectives to explore this phenomenon in greater detail. Through archaeology, valuable insights into the origins, evolution, utilization, and prevalence of each hallmark can be uncovered. Additionally, anthropology and psychology can shed light on the cognitive processes underlying human architectural practices, providing an understanding of how these hallmarks are influenced by the human mind. Incorporating these disciplines will contribute to a more comprehensive analysis of the hallmarks and enhance the knowledge in this area.

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