THE STONE IN MEDITERRANEAN ARCHITECTURE

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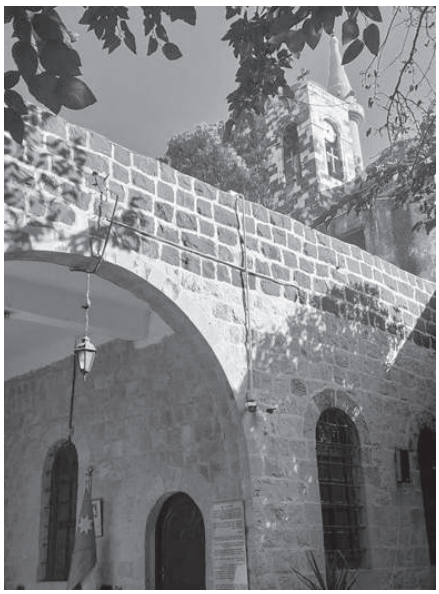

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Premise

“The first act of making architecture is not to put stone on stone, but to put stone on earth. This primary act, this act of foundation, this principle element of every architecture emblematically describes how architecture itself is an activity of man capable of transforming a condition of nature into a situation of artifice, therefore of transforming a condition of nature into a condition of culture.”

Mario Botta, *Almost a diary*

The volume *The stones in the Mediterranean Architecture,* realized thanks to the commitment of the curators Ali Abu Ghanimeh and Olivia Longo, represents a text of significant importance that makes us aware of the difficulty of being able to highlight with an exhaustive preface. It is in fact a long and fruitful work carried out by the signatories of almost thirty interventions that, together with the texts, propose project drawings, often with architectural details and valuable images that promote knowledge of the subject treated. All held together with an endless bibliography that testifies to the vastness of the subject addressed and the interest poured into it by a vast multitude of authors. The interventions, despite having as their central focus the question of stone, in this particular area of the globe, so different from all the others, are intertwined by addressing individual facets of a sort of precious stone, a brilliant that only by observing it in its integrity offers the whole, the full unfolding of the question.

We can start from the recovery of settlements in historical sites with the text by Alessio Proietti and Giovanna Lucia Piangiamore that deals with those affected by destruction due to landslides and earthquakes, Events that periodically devastate the territory, causing the consequent depopulation. In some cases, after the drama of the collapses, reconstruction has slowly taken place, as demonstrated by experiences that evidence the excellent recovery implemented in small mountain villages in Liguria and Umbria. Such interventions can constitute possible paradigmatic examples with respect to the too many abandoned villages that, especially in southern Italy, still today have not been brought back to life after the catastrophic natural phenomena.

Gianfranca Mastroianni tackles a similar topic to the previous one, highlighting the experience of a rural masseria that shows the typical construction tradition of the Mediterranean areas, where the value of the stone, in this case the grey tuff, used with lime and pozzolana, constitutes the structural system of the agricultural buildings erected to meet the needs of families in what, at the time of the Romans, was the *Campania Felix* . In this case the intervention, carried out by the same author of the text, has brought the building and the environment back to life, thanks also to the support of the Pontinpietra Academy .

Giuseppe Elefante’s text allows us to deepen our knowledge of a particular construction system that concerns buildings in the Apulian countryside. In fact, it puts under the spotlight what happens in the provinces of Brindisi and Lecce where a way of creating roofs called *star vaults was invented*. It concerns ceilings where, as documented in the text, a wide range of variants are highlighted. These make their classification and the description of this particular structural typology intricate and complex. The vaults that make up this system do not have a specific name but in reference to the morphological aspect of the structures they are called “star vaults”.

May Abu Taleb reminds us that since ancient times stone has played a fundamental role in the history of construction. He cites as an example the Flavian Amphitheatre, located in the centre of Rome and known as the Colosseum. Built during the reign of the Flavians, under the emperor

Vespasian, between 70 and 72 AD, it represents the largest entertainment facility ever built in the world because it could hold up to 87,000 people. More than one hundred thousand cubic metres of Roman travertine were used to raise the external wall of the facility alone.

Sandro Raffone notes that stone buildings express a modernity capable of crossing history and geography because they are made of the material closest to the earth, capable of showing the work of those who built them. He recalls Marguerite Yourcenar who, in *Memoirs of Hadrian* , attributes to the Emperor the phrase: "Building means collaborating with the earth, leaving the imprint of man on a landscape that will remain forever modified; also contributing to that slow transformation that is the very life of cities."

Gaetano Ginex analyses the cities represented in the mosaic of the Church of Santo Stefano in Umm er Rasas in Jordan. This is a collage that demonstrates the presence of urban topographies capable of underlining the architectural characteristics of some cities in Palestine and ancient Jordan, in a timeless Mediterranean. The author digitally redraws the urban features of those present in the mosaic and reworks a digital and analog model of each individual scene. The aim is to graphically return a new architectural and formal vision of the mosaic floor that attests to the building activity of the area.

Asel Rababah, Muna M. Alibrahim and Ayman Hassan AL- Qudah contribute with an essay that traces the history of the city of Cordoba, a UNESCO World Heritage Site, read through the use of its stones. They come to the conclusion that stone material has the eyes to observe what happened here, as in other cities. Urban life can be read through that experienced by stones.

In Cordoba there was a clash of cultures, from the Roman, the first to be known, to that which is recognized in the Umayyad regime. At that time Cordoba was known as the most beautiful city in the world thanks to the construction of the bridge and the mosque. Political and religious events are documented by the stones used in the construction of these two emblematic works that create a kind of timeless rite of passage. A canon that runs through the history of cultures, allowing us to trace the development of the city that, despite the wars that have destroyed some of its fantastic buildings, still preserves a unique architecture.

Angelo Vecchio, designer of SCAU Studio and author of valuable architecture not only on the island, in addition to pointing out the combination of black lava stone and white stone of Syracuse, used in Sicilian architecture, typical of many buildings of the Baroque era, presents a particular aspect of the Sicilian landscape. It is what rises on the slopes of Etna, where there is a strong presence of lava stone that is diversified with terraces made of dry-stone walls. UNESCO has declared them a World Heritage Site and included them in the list of intangible elements capable of creating a landscape developed over time with the perfect interpenetration between the work of man and that of nature.

Danilo Lisi tells us about the experience of a small village of foundation in Puglia, in the province of Foggia: Segezia. Built for the reclamation and population of the countryside during the years of fascism between 1939 and 1942, about 12 km from the city of Foggia, along the road to Benevento. It features a Greek cross plan developed on a north-south and east-west axis that converges on the central square. The model is that of medieval squares where the functions of political, administrative and religious representation are contained. The Town Hall takes up the loggia style while in the smaller streets there are minimal residences with gardens and vegetable gardens at the back.

The text by Francesco Iodice and Antonio Vobbio identifies the last great season of Italian architecture, expressed between the two great wars, marked by effective experiments in the typology of public buildings. These have highlighted the value of the so-called "Italian rationalism".

These are architectures that are distinguished by the fact that they are built with national stone materials, in particular Roman travertine, but also Trani and Carrara stone, with the development of a new repertoire of forms and spatiality that reconcile it with the Mediterranean characteristics of the places. Wherever it develops, it proposes the new image of "an architecture suspended between innovative tensions and rarefied atmospheres of tradition; the second affects, more specifically, the conception of space".

Tell it Atiya documents some case studies present in Jordan. They are the architectures of contemporary designers such as Jafar Toukan, Wadah Al-Abdi and Ammar Khammash that highlight how stone has been employed to achieve structural integrity and artistic expression. It also demonstrates that in this architecture tectonic principles often intertwine with plastic aesthetics, particularly in cases where stone is used as the primary material. The fusion of the elements highlights the beauty and resistance of the material, allowing the project to achieve complex and expressive results.

Walid Fouad Omar analyze the stone house built by Hassan Fathy on the northern coast For preserve that architectural heritage and support restoration initiatives. The well-known Egyptian designer is in tune with traditional construction methods. He uses thick walls that insulate and give stability to the house. He analyzes various aspects such as the ventilation system, the planning assumptions that are influenced by Islamic and Egyptian cultural values, the sequence of paths, materials, light and shadow that contribute to creating the atmosphere of the space. Fathy has also sought to create low-cost housing for tourist accommodation models, promoting the adoption of his design principles by the Egyptian government.

Suhaib too Abuhazeem deals with the stone architectures created by Jafar Toukan and traces the architectural evolution of Amman and the innovative approaches of the designer who uses this material in his numerous projects. The results obtained show a deep connection with the heritage of the city. Zaid Sbeitan instead explores the evolution of stone cladding systems in Jordan and Palestine transformed from load-bearing material to thin cladding. Introduced since the mid-twentieth century, there is a need to rethink the fixing systems, materials, and details.

Alis Sameh Okasha reflects on the destruction of Palestinian stone by the Zionist occupation in this territory that is not only committing the genocide of this people but also aims to destroy the memory of its stones. They constitute the indigenous building material of Palestine, and they want to destroy it to destroy the collective memory thus preventing the return of Palestinian refugees to their places of origin. The author highlights the failure of international and humanitarian law to prevent the serious violations committed by the Israeli occupation in Gaza, Jerusalem, and the West Bank. There has been no protection of cultural heritage in the conflict zones and the occupiers have used a series of techniques to hit, destroy, rename, replace and erase the indigenous Palestinian stones.

As can be seen, the range of interventions shows a wide range of issues of great relevance and attests that the Mediterranean is, as Claudio Magris writes in the introduction to Pedrag ‘s volume Matvejevic ‘, "the original amnios of humanity and the cradle of civilization, the Greek form that is born perfect from the sea like Aphrodite, the great test of the soul that Musil speaks of, the encounter with the symbol of the eternal and of persuasion, that is, of life that shines in its pure incorruptible present, in its fullness of meaning". The stone bathed by this sea cannot but be in tune with everything that is present in the volume.

Mario Pisani

The book of «The Stone in Mediterranean Architecture» is the second publication issued by the Forum of Mediterranean Architects, in collaboration with the University of Jordan, Amman and the University of Brescia, Italy.

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This new book followed the previous successful one: «The Courtyard in Mediterranean Architecture.» Both books brought together contributers of architects from Arab and European Mediterranean countries. These books are important references for research and academic study. It significantly enriches the discourse on Mediterranean architecture.

The book titled «The Stone in Mediterranean Architecture» is written in English. It contains over 28 research papers authored by architects and scholars from Jordan, Palestine, Syria, Lebanon, Egypt, Iraq, Italy, Greece, and Germany.

The significance of this book lies in its comprehensive documentation and analysis of stone as a fundamental element in Mediterranean architecture. It explores the varied types of stone, their applications, and architectural diversity. This enables providing valuable insights into both historical and contemporary practices across the region.

Ali Abu ghanimeh

The Stone in Mediterranean Architecture represents a fundamental element of the culture and history of this geographical area. Since ancient times, the civilizations that developed along its coasts have found in stone not only a building material but also a symbol of durability and resilience, reflecting the craftsmanship of the artisans from these lands.

The various types of stone and construction techniques illustrated in this volume have given rise to unique architectures, creating exceptional urban and natural landscapes.

Stone plays an important role in local traditions and retains the power to tell the story of a place, reflecting the cultural identity and resilience of the peoples who have inhabited it and who continue, in the most successful cases, to enhance the qualities of this precious heritage.

Olivia Longo

RUBBLE, STONE, ARCHITECTURE: PLACES OF REBIRTH. THE CASES OF COLLETTA AND POSTIGNANO (ITALY)

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Abstract

The restoration of historic places affected by collapse and depopulation is explored by focusing on two rebirth of Italian villages: Colletta (Castelbianco, SV, Liguria) and Postignano (Sellano, PG, Umbria), both characterized by centuries of history and stone architecture. These settlements could become a positive example for the many ghost towns emptied as a result of significant natural phenomena. They were in fact initially abandoned and have subsequently undergone major restoration efforts that have brought them back to life. The analysis of the material and immaterial regeneration aspects of the places emphasizes the importance of those actions that can trigger virtuous processes in the territory in order to save an important heritage, otherwise destined to end up in the oblivion of time.

Keywords: *abandonment, rebirth, vulnerability, damage, earthquake*

Introduction

Marginalization due to scarcity of infrastructure, services and absence of jobs offers are often the causes of depopulation of small settlements. And, if a natural disaster occurs, the abandonment is complete. The opportunity to be reborn in a virtuous process of regeneration brings benefits on a large scale. Italy, as well as other Mediterranean countries, is dotted with historic villages, which could play an important role in the territorial systems. The repopulation and regeneration of such places would make it possible not to disperse an enormous cultural heritage, to restore the right balance between metropolis and inland areas, and to renew the deal between citizens and nature, taking care of the territory. In this particular historical moment, the complex Italian scenario consists of a lot of valorization initiatives concerning hamlets.
This study deals with two emblematic cases: Colletta di Castelbianco (Liguria Region) and Postignano (Umbria Region). Both present high landscape value, traditional stone architecture, and have been completely abandoned after earthquakes and/or landslides. At last the two hamlets were breathed into a new life.

Colletta, Castelbianco (Liguria Region, Province of Savona)

Colletta is one of the four hamlets of the municipality of Castelbianco and it was founded in the 13th century in the Ligurian hinterland. Forty years ago, it became a pile of ruins in complete abandonment after the 1887 earthquake that destroyed Diano Marina and caused the abandonment of Bussana Vecchia, which was rebuilt further south in 1894. The surviving inhabitants of Colletta emigrated mainly to Marseille, and the village became a ghost town.

Figure 1. Overall view of Colletta

Colletta and its destruction: the 1887 Liguria earthquake

On February 23, 1887 three strong earthquakes affected the western Liguria Region with an estimated magnitude between 6.4 and 7.0. The main shock was felt all over northern Italy, southern and central France, Switzerland, and the Tyrol. The area between Sanremo and Alassio was seriously hitten (CFTI4 Med), as well as the current province of Savona, including Colletta, so heavily damaged to be abandoned. Local structures could not adequately cope with the 631 casualties and about the 20,000 evacuees (Eva et al., 2000).
Many of the faithful were gathered in churches for the celebration of the Ashes, and it contributed to the high number of victims. (Guidoboni et al, 2018).
On the same day, the three main events were followed by 9 aftershocks. The seismic crisis continued until October 1887, and there were about 80 aftershocks. Following the first shocks, a tsunami of intensity 3 on the Sieberg-Ambraseys scale occurred. The horizontal retreat of water on the foreshore was up to 10 m. On the coasts of Imperia many fish died from long exposure to the air. The run-up was about 2 m on the French coast and 1 m in Genoa (Rovida et al., 2011 and 2016, Larroque et al. 2012).
Historical sources include the technical reports written on behalf of Minister Grimaldi by Torquato Taramelli and Giuseppe Mercalli. The two prominent seismologists spent many days at the disaster sites meticulously gathering valuable information, also describing the effects of the earthquake on the environment (liquefaction, disappearance or appearance of water sources, faults and landslides; Taramelli and Mercalli, 1888).
Mercalli reported “the exaggerated height of the houses… especially due to the addition of new floors to already old and unsafe buildings… the lack of keys and iron chains… the bad materials, the poor reparations from previous earthquakes...”. The area was more vulnerable after the earthquakes in 1818, 1819, 1831 and 1854, especially after the more violent ones of 1818 and 1831 (Guidoboni et al., 2019).
Post-earthquake reconstruction was long-lasting and difficult. Liguria became touristic, revaluing ruins to build hotels with repercussions on the road system as well (Turino, 2009).

Colletta and its rebirth between slow tourism and new technologies

In the first half of the 1990s, a group of entrepreneurs from Alessandria, through Sivim - Società Imprenditoriale Sviluppo Iniziative Immobiliari, purchased Colletta with the aim of transforming it into a telematic village. The architect in charge was Giancarlo De Carlo. The hamlet, located outside the main tourist flows, was conceived as a refuge for people defined as ‘white eagles’, i.e.

who preferred to stay in isolated places, but used technology to be connected to the outside world. The construction technique was not sophisticated, but executed with precision, complying with the distinctive characteristic to be entirely built with local stone. The rooms interpenetrated each other, they were rectangular in shape with vaulted ceilings and sides no longer than 4 m. The roofs were flat, favouring the dry materials from agricultural production, such as grapes and olives. The village presented a continuity between open and built spaces, with streets and buildings harmoniously integrated (De Carlo, 2004; Camarda, 2021). The architect identified a 'code' of place and respected it. The solid and empty elements of masonry facades and the white plaster cornices-maintained harmony with the pre-existing system, respecting rhythm and proportion. New volumes were surgically integrated between the existing buildings, while services such as car parks and a swimming pool were designed as topographical architectures, following the orography of the terrain (Berizzi, 2019) (Cavallo, 2022). Colletta is well-known for its advanced IT connectivity, thanks to the fibre optic cabling of all the sixty residential units (Russo, et al., 2020). The cybervillage, whose slogan was 'From Stone to Bits; Architecture and Telecommunications' (Borghini, et al., 2013), is mainly frequented by writers and researchers. The fact that the original intention of creating a telematic community has been replaced by the prevalent tourist use, let Colletta di Castelbianco a visionary project, in which a balance between historicity and contemporary needs was sought (Scafuro, 2023).

Figure 2. Side access of Colletta

Figure 3. Landscape, matter and colours of Colletta

Figure 4. Glimpse of an alleyway in Colletta, with access stairs to residential units

Postignano, Sellano (Umbria Region, Province of Perugia)

Postignano (also called "Postignano Castle") is a fortified mediaeval village built between the 9th and 13th centuries in Valnerina, part of the municipality of Sellano. It looks like a dense and compact settlement with triangular placement. The typical "tower houses" are enclosed within the perimeter walls connected to a watchtower with a hexagonal base. The village then was gradually depopulated due to emigration to the cities, until it was completely abandoned in 1966, due to a landslide that made the houses uninhabitable (Capilleri et al.; 2004).

On 19 September 1979, the area was hit by an earthquake, with intensity of VI-VII degree of Mercalli scale in Postignano (Tarabusi et al., 2020; Bertolaso and Boschi, 2007). In the same year, the American architect and photographer Norman Carver Junior chose Postignano as the cover image for his book 'Italian Hilltowns' and defining it the archetype of Italian hilltowns (Proietti, 2013; Bianconi, et al., 2018; Matacena, 2022).

For about thirty years, the dwellings remained empty, further aggravating the state of decay and finally, in 1992, two passionate architects, Gennaro Matacena and Matteo Scaramella, rediscovered the small Apennine ghost town, purchasing it to give it new life.

The restoration began in June 1997 with a grant from the Umbria Region, but the 1997 earthquake further damaged buildings already decaying by years of neglect, causing new collapses (Nigro and Fazzio, 2007; Fazzio end Bondesan, 2007).

Figure 5. Overall view of Postignano

The 1997 Umbria-Marche earthquake

On Sept. 26, 1997, two seismic events (Mw 5.7 and 6.0 respectively) heavily hit the Colfiorito area (on the Umbria-Marche boundary) with epicentre in Cesi (Province of Macerata) and only 9 hours late with epicentre in Annifo (Hernandez et al., 2004). The earthquake had a maximum intensity of IX degree of Mercalli scale (Amato et al., 1998). On Oct. 14, 1997 an earthquake of magnitude 5.6 with epicentre between Sellano (about 3 km far from Postignano) and Preci, worsened the already vulnerable houses. After a period of continuous minor shocks, on March 26, 1998, a magnitude 5.4 earthquake (epicentre in Gualdo Tadino) was felt in many Italian cities due to the great depth of the hypocenter (45 km). The highest intensity earthquakes ended between April 3 and 5, with 5.1 and 4.7 magnitude (Miller et al., 2004). The municipalities most affected by the 1997 earthquake were Foligno, Nocera Umbra, Preci, Sellano, Assisi and Spello in Umbria, and Fabriano, Serravalle di Chienti and Camerino in Marche. The night shock on Sept. 26 severely damaged the Apennine towns. Some buildings, or parts of them already damaged by previous shocks, collapsed, others were declared uninhabitable, and there was road disruption. Significant damage also occurred in Visso, Fabriano, Matelica, Pioraco and Fiuminata.
Overall, the Umbria-Marche earthquake caused, directly or indirectly, the deaths of 11 people, 100 people injured and at least 80,000 evacuees, plus extensive damage to monuments.

Postignano: rescued historic hamlet comes back to life

In 2004 the village was included in the list of monuments of historical and artistic interest, coming under the control of the Superintendence for Cultural and Landscape Heritage. Restoration works were carried out between 2007 and 2013, maintaining the original appearance of the village and confirming the original division into sixty different residential units.
The few buildings that had collapsed were reconstructed using the fallen stones, guaranteeing complete respect for the original appearance of the hamlet, through an exemplary restoration project. Some of the dwellings were converted into spaces for permanent or temporary exhibitions, a cafeteria, a reception, a restaurant, a shop selling local products and a wine shop. Approximately fifty housing units were used for residential purposes: some were purchased and others converted into widespread accommodation (Fressoia, 2018). The methodology applied in the restoration works followed a sober and rigorous approach, aiming at the philological restitution of the existing building and the secular structures' safety, following the anti-seismic and landscape regulations in force. The testimonies of the former owners became useful complementary elements to the architectural survey, and during the interventions it was possible to restore the finishes buried under the patina of time. Inside the church of S. Lorenzo located in the village, a cycle of frescoes dating

back to the 17th century, discovered following the 1997 earthquake, was also restored (Berizzi et al., 2019). As evidence of the quality of the structural work, it is highlighted that no appreciable damage was found in Postignano following the 2016 Central Italy earthquake (D'Avino, 2019).
Today Postignano is a place to buy your own home or stay as a tourist, but it is also a place to enjoy cultural experiences thanks to activities open to all, such as concerts, book presentations, conferences and various events in public spaces.

Figure 6. Side access of Postignano

Figure 7. Landscape, matter and colours of Postignano

Figure 8. The 15th-century Crucifixion and the 16th-century fresco from the circle of De Magistris, known as Il Caldarola, stand out in the background.
The 1997 earthquake caused the collapse of the back wall, revealing behind it a fresco depicting the Crucifixion with the Sorrows and another one of the Archangel St Michael

Conclusions

Colletta and Postignano are examples of celebration of the harmony between nature and architecture, in which materials, proportions, and shape are balanced with the territorial context. Buildings have the same colours of the surrounding landscape, following the common practice of using stone quarried from the nearest areas.
The recovery of rural settlements is the key to passing an invaluable cultural heritage, increasing Italian resilience. Hamlets are significant sites not only from an environmental, social and economic point of view, but also as key places for sustainable land use in defence of both populous and inland areas.
The process of depopulation of inland villages in the past decades is linked to socioeconomic phenomena, but it is also often worsened by natural phenomena, as the two cases discussed testify. These are symbolic cases of recovery heritage through interesting strategies; moreover, they also offer insights to analyze the evolutionary process of Italian seismology. Both boroughs are located in seismic areas connected to two major Italian earthquakes, which occurred 110 years apart (1887 and 1997) and marked the scientific development of the discipline. Indeed, during the 1887 earthquake Mercalli understood that the damage scales used at that time were insufficient to describe the wide range of damage scenarios observed during his surveying. Therefore, he developed the more comprehensive macroseismic intensity scale is well-known as the Mercalli scale, which he published in the early 1900s.
Dealing with the 1997 event, for the first time in Italy the Mobile Seismic Network of the ING (currently INGV) was installed. High-quality data by ground-based monitoring networks and satellites were thus collected to study the geology behind earthquakes. Subsequent earthquakes in L'Aquila (2009) and Amatrice (2016-2017) confirmed and improved the fault studies related to the 1997 earthquakes. Furthermore, www.terremoto.org, the world's first internet site of a national civil defence emergency to communicate data in real time, overcame the FAX technology, applying the internet new-technology in emergency management (Basili et al., 1998; Cinti et al., 1999; Stramondo et al., 1999; Capuano et al., 2000; Cocco et al., 2000; Chiaraluce et al., 2003; Cultrera et al., 2003).
The present study is part of a wide debate, particularly relevant and current both in the Italian context and in the broader framework of Mediterranean countries.

All photos are by Alessio Proietti.

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THE STONE-OCIDE OF PALESTINE

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Abstract

This paper delves into the memory of Palestinian stone; to assist the argument that the Israeli occupation committed the act of genocide not only against the Palestinian people but also against the stone, the indigenous building material of historic Palestine. The paper presents samples of the occupation techniques to destroy the stone's collective memory. The conclusion highlights the occupation intent to obliterate the spatial content of itself, thus preventing the return of Palestinian refugees.

Keywords

Stone, Collective memory, Genocide, Israeli Occupation, Palestine.

Introduction

Genocide the "crime of all crimes", was coined in 1944, by the Polish lawyer Raphäel Lemkin. According to the international law, genocide means the killing of a group of people (UN, 2024). The continuous attacks, wars, and massacres of the Israeli occupation against not only Palestinian people but also their landscape, olive trees, architecture, and stones; prompts us to argue that the occupier focuses his aggression on everything that represents a memory and bears witness to the Palestinian history on ground. This happened before, in 1948's Nakba, when more than three-quarters of historic Palestine was occupied, 531 Palestinian towns and villages were destroyed and 85% of the Palestinian population was banished and displaced, 71 of these displaced villages were transformed later into tourist sites, and more than half of this number was covered with forests and intensive afforestation campaigns(Abu-Sitta, 2000 & 2016), in an attempt to change their features and erase their memory, history and evident rights.

This technique is still ongoing in West Bank, and its new version is extensively occurring in Gaza. The occupier seeks to destroy housing units, valuable and historic buildings, hospitals, worship places, educational institutes, archaeological sites, and all the infrastructure; intending to change the place's features and spatial content.

Colin Priest (2011) sees violence as a state that goes beyond the physical, including the psychological and intangible memory of an act of conflict, and he claims that conflict is a process of transformation that causes crucial social problems and collective impacts (Piquard & Swenarton, 2011).

The aggression of the occupation forces goes beyond the destruction of the past spatial spaces 'spacocide' (Hafani, 2006), by seizing the land and building a new enforced architecture with a new identity of the occupier. Many researcher discussed the architecture of conflict and the genocide of the collective memory (Pappe, 2006), (Weizman, 2007), (Piquard & Swenarton, 2011) & (Bevan, 2006). Here, the focus here is on the threat to the most indigenous architectural elements, the stone of Palestine. The paper seeks to remember and exhume the architectural memory of stone; to prove that the occupation erases the Palestinians' collective memory, thus preventing the return of Palestinian refugees.

Contextual bonds of stones and trees

The combination bond of stone, trees, green plants, and people within the architecture of historic Palestine is an authentic feature of most villages and cities in historic Palestine. The mountains and highlands appear green from a distance, where green olive trees emerge from the rocks and stones

of the land. The sight of the olive tree branches piercing the stone of an old house or ruins, like an intertwined braid, is a familiar scene, as they both rooted to the same land. Citrus, fig, and olive trees are grown in the heart of traditional Palestinian homes and planted next to and around their homes. Stones and trees are not only aesthetically pleasing, ecological, and functional, but they also carry significant cultural messages with connotations and assign symbolic meanings of belonging (Jim, 2017) & (Shareef and Sani, 2021).

Palestinian Stone

Most of Palestine's buildings and dwellings are built of natural stone. The stone meets the standards of nobility mentioned by John Ruskin, as they are a ground material of a strong mass, with an apparent structural reality of matter, and its thick blocks ensure thermal efficiency. There are various types of stone in the highlands of Palestine, the most famous of which is limestone, whose color varies and ranges from white, yellow, and beige to pink. Each place has its stone characteristics; for example, Jerusalem is known for its Royal reddish-pink limestone. However, there are rare Palestinian districts where Sandstone, Dolomite, and Bazalt lava stone are found (Pappe, 2006).
A stone matches the experience and craftsmanship of the builders, who have passed down the know-how of building and carving with various types of thick stone blocks through the generations. The produced textures of stone vary from natural hand-cut, bush hammered, sandblasted, honed, and polished finish. 'George Anastas', a stonemason who inherited the profession from his family, states that: *"The stone industry and craft attracted large numbers of villagers who worked in agriculture on a seasonal basis"* (Al-Eissa, 2017). Stone also lies in abundance under their feet. It is the cheapest, most authentic, environmental, contextual matching, and harmonious material. It recalls the architect Hassan Fathy's description of clay/mud brick, the earthy building material used since ancient Egyptian peasants. By utilizing indigenous local stone materials, people guarantee the reduction of resource-intensive manufacturing processes as well as transportation costs, thus making it a sustainable resource for architecture. Even the decorations engraved on stone are derived from the surrounding Palestinian nature and cultural heritage. The craftsmanship celebrates the sculptor's freedom of expression. Thus, the connection to the collective cultural memory of the Palestinian people increases the value of stone houses that are as old as the architecture practice in historic Palestine, and the destruction of buildings or their traditions has been a means of erasing altogether the memories of a community and its presence from a specific location.

The Occupation Stone

The occupation does not hesitate to rewrite the stone's history and change its features. Starting with imposing their symbolic engraves; like the Star of David among the Jerusalem Damascus gates decorations, or covering the Palestinian original features with plants and trees in direct intended actions.
Although the advisory architectural Jerusalem committee, in the late 60s, supported the use of stone in the Jerusalem Jew quarter and its environs, to claim 'historical Biblical authenticity' on ground. However, later the stone building technique as a thick material block, transformed into a thinner cladding layer over cement facades (Weizman, 2007, P.70- 82).
'Azmi Bishara' described the Jerusalem Stone as part of the process of falsifying history, "only in Jerusalem the natural stone that was quarried from these very rocks could look as a foreign element within these same mountains " (Weizman, 2007, P.75).
In the 60s and 70s, a copied and distorted cladding stone was widespread as a feature of postmodern architecture on the occupied land (Weizman, 2007). Yet, a careful observer of the corners and the arches can distinguish the thinner cladding stone, compared to the Palestinian thicker stone construction, which is also evident in Palestinian photos, artists' depictions of historic Palestine architecture, as well as in the ruins of destroyed villages.

1. Jerusalem stone and trees. Source: https://shorturl.at/kzMQX

2. Greens and Stone ruins of the depopulated village of Al-Kunayyisa, Al-Ramla . Source: https://www.palestineremembered.com/al-Ramla/al-Kunayyisa/ar/Picture121585.html

3. The village of Abud is located 30km northwest of Jerusalem, Source: Palestine Ministry of Tourism and Antiquities

4. Ein Hod Cafe was a home at Eid Hawd. Source: Tripadvisor https://shorturl.at/cwEHM

Concrete instead of bearing stone also has been a significant marker of architectural modernity in the occupied land, and its manifestation in the city of 'Tel Aviv' and every new settler-colonialist project, that keeps trying to connect the new state with the Western modern civilization, by adopting the Modern international style and prefabricated units that are speedily built outposts by the settlers, imposing a fait accompli over stolen Palestinian lands. Seizing the land and building a new architecture with a new identity imposed by the occupier are the main characteristics of Zionism. (Weizman, 2007).

Beyond the destruction of the past:

The Israeli occupation reaches its extent by renaming hundreds of places, and stones named after them, such as the Turquoise natural stones of "Om-ElRashash", that are changed to Eilat Stone or King Solomon Stone (GeologyScience, 2023), to impose Biblical Connection. Historical references and places of collective memory are also renamed, reinterpreted, or suppressed after killing or displacing the original inhabitants; for example, one of the reorganized Arab villages is 'Ein Hawd' which was renamed 'Ein Hod' after displacing its people, and converted to an artists colony by the Jewish Dadism founder Marcel Janco, who was fond of its stones and rural heritage, without reference to its Arab past (Peppe, 2006) & (Abu-Sitta, 2000).

The occupation laws do not encourage the conservation of natural stone construction, nor do they easily restore the older stone buildings, taking into consideration the high cost of building with

stone, and the poverty and unemployment of the Palestinians; that's why they do not usually maintain this construction technique, and their buildings look poor, especially in the refugee camps, that they consider a temporary place (Weizman, 2007).

'Samih Thawabteh' states that the occupation controls more than 80 Palestinian quarries in Area C, which constitutes more than 60% of the West Bank. Since 1993, the Palestinians have rarely granted permits to extract stone, and factory owners complain of export obstacles due to the occupation's control over border crossings, in addition to the control over the water sector, which is vital for the stone industry (Mossa, 2020).

5. Turquoise natural stones of Om-ElRashash Source: https://www.jpost.com/israel-news/timna-park-opens-doors-for-to-public-excavations-during-hanukkah-573420

6. Gazan worker recycle rubble as Israel upholds ban on construction goods . Source: Al Jazeera, 17 Jun 2021

Preserving the stone of historic Palestine

Each stone building in historic Palestine is valuable, as it presents the cultural identity of Palestinian architecture. Such buildings are the symbol of ancient civilization and cultural heritage. They are integral parts of the Palestinian people, as they are essential to their economic and social life. Thus, the occupation policies negatively affect their lives. The laws forbid and restrict the construction and the stone restoration process in many of the occupied cities. In turn, these obstacles leave no choice for the Palestinians but to build illegally, from the occupation point of view, facing the threat of demolishing their house. One attempt after another of repeated displacement and systematic ethnic cleansing, seeking to erase the entire Palestinian history, heritage, identity, and existence, that 'Eyal Weizman' (2007) describes as a 'laboratory of the extreme'.

Stone Resistance:

One can trace how Palestinian stones is a resistance symbol. Although many of the villages were destroyed in 1948, and the occupiers graved them beneath the new resorts and pine woods to hide them and prohibit the Palestinian refugees from returning to their original homeland, the stone remains to incubate the memories in its ruins. (Peppe, 2006).

The imprinted memory of the stones of demolished houses in the hands of the Palestinian children during the 1987 Intifada/Uprise, facing the occupation tanks, turned the stones into a resistance weapon and a symbol of belonging.

Gazan people, with the scarcity of building materials, during the seventeenth years of siege and continuous aggression, built new places by breaking, grinding, and reusing the stones of demolished houses, as if they were confirming the legend of the Palestinian phoenix, which revives itself from ashes and ruins every time it dies. This reminds us of 'Al-Araqeeb' the Palestinian Bedouin village in Naqab, that struggles with the occupation over land ownership and is rebuild every time they are demolished, for more than two hundredth time, till now (Amara, 2013)&(Middle East Monitor , 2023).

Conclusion

Despite the failure of international and humanitarian law to prevent severe violations by the Israeli occupation in Gaza, Jerusalem, and the West Bank; the protection of cultural property in conflict zones is valued. The discussion pushes the focus from people and their properties to add a new layer of the collective memory embodied in stone as a symbol of belonging. It outlines techniques used by the Israeli occupation to target, destroy, rename, replace, and erase indigenous Palestinian stones, asserting that these actions constitute war crimes, ethnic cleansing, and genocide. and concludes by labeling these violations as “stone-ocide”, and emphasizing the urgent need to address them as war crimes.

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THE CONTINUITY OF THE STONE CULTURES

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Abstract

Mediterranean architecture, characterized by the presence of stone, emerges from the intersection of a heritage of technical knowledge and construction experiences. The contemporary work of an architect who incorporates stone into their projects is juxtaposed with this past. From the use of massive stone to cladding with thin slabs, to the exploration of new and unique expressive qualities capable of reflecting the ethical and aesthetic standards of responsible contemporary architecture.

Keywords

Lavic stone, Juxtaposed, Slabs, Continuity, Technical.

Introduction

The stone is found everywhere. Its usage varies from place to place. In certain countries, the environment shaped by humans is so characterized by its presence that we can speak of stone cultures. Particularly, this is the case in the Mediterranean world. In the past, Sicily had a plural reality, which had produced a solid construction tradition and an extraordinary variety of types and languages in architecture and landscape. It is indeed from the encounter between the heritage of technical knowledge and construction experiences that the mosaic of languages defining Mediterranean architecture as “stone architecture” arises.

The Sicilian landscape, especially the Etna area, due to the presence of lava stone, is characterized by terracing with dry stone walls to such an extent that UNESCO has inscribed “The Art of Dry Stone Walling” on the list of intangible elements declared World Heritage. It’s a landscape born from a perfect interpenetration between human work and that of nature. At least, until a century ago, before the use of reinforced concrete and other modern construction techniques spread with an imperious invasion, determining the processes of contemporary building.

Throughout Sicilian architecture, the bicolor combination of black lava stone and white Siracusa stone has been traditionally utilized. This characteristic was further developed in many buildings of Sicilian Baroque architecture. Especially in Catania and in eastern Sicily, a baroque of colors has been constructed with contrasting chromatic decorative effects, featuring the alternating use of black lava and light Siracusa stone, resulting in an immensely elegant and beautiful outcome.
Today, with the scarcity of skilled craftsmen and the modernization of the construction process, some skills are being lost, making it increasingly difficult to use stone blocks, leading to the use of slabs and therefore to the technology of ventilated walls.

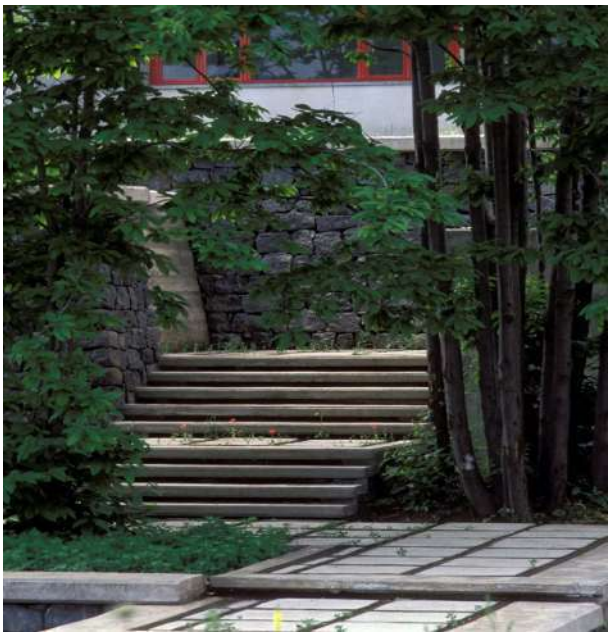
Fortunately, at the beginning of my career, I had the opportunity to collaborate with master stone masons and sculptors, who passed down to me the ancient artisanal wisdom of stone craftsmanship. They were the surviving representatives of a homologous relationship between designer and executor. The codified grammar of stone usage they taught was comprised of elements of the local construction tradition that incorporated segments of technical knowledge. From this relationship and my love for the material, my first works were born. Subsequently, many of my works have been characterized by the use of stone. I have utilized Etna lava stone, Siracusa stone, and many others in their various possible processes and finishes, both in pavements and constructions.

I appreciate the qualities of stone, its durability, and the sense of permanence that I seek in my works to establish an organic connection with the place and time. However, I have always wondered how much of the millennia-old relationship between humans and stone still holds validity for contemporary architecture.

Initially, I tackled buildings with walls made of stone blocks, as well as dry stone walls, a particular type of retaining wall constructed with stones arranged and assembled without the use of any binders or mortars. The rough stones are placed in such a way as to align their contours as closely as possible, correcting their profiles if necessary, and inserting smaller stones to fill the gaps between them. The precision of this composition, akin to a mosaic or puzzle, determines the durability and solidity of the wall itself. I still employ this technique to build garden walls, recognizing the potential of stone connected to expressive and sustainable economic and environmental values. The use of natural stone is motivated not only by the need to integrate with the landscape or express local identity but also by the possibility of creating durable technical elements with contained construction costs and times. In my early works, I used massive stone.

Casa D'Urso - The design opportunity was the most attractive for a young designer: a single-family home situated in a plot of great landscapes. with the levels of the existing terraces. The composition of the building is such as to be set in the ground, aiming for maximum integration with the levels of the existing terraces. The intention of merging the new work into its natural surroundings guided the choice of the lava rock as the only material used for the building creating a camouflage effect with the mountain. The hard and coarse aspect of the stone is softened by the presence of wood used for the large blind shutters of the window frames.

Centro diurno per anziani -The project of the day center for the elderly takes shape from the conditions of the site; the difference in height is overcome by creating the floriculture laboratories almost like a stone retaining wall, placed to contain the terrace on which the main building is set. Vertical partitions dressed in lava stone interrupt the continuity of the eaves, highlights geometrically the regularity of the composition.



Casa DMP - The composition of the planimetrical profile is articulated with the intersection of two main blocks. All the areas flow into each other seamlessly, enhancing the relationship between the internal and external spaces.
The building is partly constructed with exposed reinforced concrete, while some external walls have been skillfully executed by installing ashlars in lava stone and white stone blocks placed to form alternating bands of different sizes, thus reinterpreting, in a modern key, a characteristic element of Catania's Baroque architecture.

MG House- The house unfolds almost entirely at the ground floor of volumes forming an open space that functions as a partially paved entry court. The rooms are a mix of pitched and flat constructions, the latter used as terraces. The observer notes a play of colours in the juxtaposition of plaster walls against the rough spontaneity of lava stone cladding the garage and used to build the retaining walls lining the internal paths. Everything is contrasted by a tall corner tower, finished in bright red.

The choice to finish the external surface of the building in stone, its may entail slightly higher costs during construction, but it minimizes or entirely eliminates maintenance work: indeed, stone does not deteriorate easily and if properly installed, will remain unchanged over time, making the definition of the building's final image much more flexible and rich. With the widespread use of concrete and steel, the central role of stone in architectural design has diminished, and it is now mainly used in thin cladding elements. Today, the external appearance of a stone-clad architectural work conceals a very different reality. In fact, when we encounter a modern building with a stone façade, we can only speculate about what lies behind the cladding. Generally, these are solutions that depart from solid masonry, focusing on intelligent multi-layered vertical wall systems. Thanks to technological advancements in the stone industry and the introduction of innovative anchoring systems, it has been possible to minimize the thickness of stone slabs, which in contemporary cladding techniques is generally around 3 - 4 cm. Expressively, the values of solidity and massiveness historically associated with the material are denied, privileging the value of lightness combined with simplicity of assembly. Various anchoring systems for stone materials have been used in the selected works below.

LRG house - LRG house is located in the town of Giarre, at the base of Mount Etna. This two-staorey single-family home offers a contemporary take on the ancient typology of the Sicilian courtyard. External finishes in white stone and lava stone emphasise the diverse expressions recomposed in the different choices intent on creating a clearly contemporary and complex home.

Chiesa dei Santi Cosma e Damiano- The geometric matrix of the system converges and takes shape in the church building. The building takes shape from the intersection of two square-based elements rotated on each other, from this base, two main lines branch off and the bell tower rises. visual and spiritual reference point of the community. The church is conceived as a unitary and

gathering space both for its plan shape and for the suggestions obtained from a strategic use of natural light and materials with transparent openings. The main volume covered with slabs of lava stone is concluded by a single-pitched inclined roof which follows its plan rising towards the altar. At the heart of the project are the cloisters, a sacred quadrangle paved in stone.

Municipio di Zafferana Etnea - In the Town Hall in Zafferana Etnea, constructed at the turn of the century. Newly designed volumes were rendered congruent with existing ones to obtain a functionally and visually unified whole. This is also aided by the openings in the new volume whose form, generated by doubling the floorlevels, establishes a relationship with the existing building. Siracusa stone was used to emphasise the continully and emotional coherence between old and new: a connection and dialogue – physical and symbolic – between past and present. Architecture demonstrates its contemporaneity when it enganges pre-existing buildings.

Fondazione del Carnevale di Acireale - The conversion of an ancient courtyard building, a former Jesuit College, the dialogue between old and new offered a chance to reinterpret the existing structures. The ancient coutyard was reconfigured and updating the design of the lava stone paving. A new multipurpose hall was createdby combining two rooms. Independent and accessible from the ground floor court, the hall features a characteristic ventilated wall in lava stone, and a new paired rhythym of openings. The wall speaks its own language. By unifying the different volumes it establishes a dialogue with the pre-existing elements and reconstructs the spatial qualities of the court, introducing a diverse and contemporary architectural connotation.

With changes in processing methods and usage, stone has lost thickness and weight. However, despite the majority of processing being done by machines, the finishing work of stone is still carried out by artisans and stonemasons. Today, there is a search for new and unique expressive qualities capable of fully reflecting the new ethical and aesthetic standards of a more responsible contemporary architecture. In my work, I have always sought to experiment with traditional materials by introducing elements of novelty. Working with stone, in an attempt to dematerialize it, has led me to integrate it with other materials such as terracotta or stainless steel, or to vary its dimensions and thicknesses, or subject it to particular processes, seeking in the manual labor of finishing the ability of certain craftsmen to express their ancient knowledge in the artifact.

Complesso Redentore - The building follows the line of the road and the edges of the plot, creating an inner courtyard. A long horizontal block communicates on one side with the original building while on the other there is an energetic vertical structure. Solids and voids are interrupted by vertical lines searching for the best possible conditions of natural light and shade for the new living areas, contrasting with contextual features of classical building styles without denying the language of the modernity. The tradition of external walls in lava stone and brick which characterises the history of building technology in Catania is evoked in the walls of the new. The lava stone and brickwork are used in the facing of the base of the building, marked by strong horizontal masonry joints and the corners of the building, giving the appearance of columns.

MF House - The project was driven by the idea of creating flexible interior spaces projected out in the beauty of nature to redesign the appearance of the existing house. Comprised of pure volumes that dialogue with the surroundings, the new composition is dematerialised by large full-height windows providing stunning panoramic views. Curving walls finished in stone evoke the fluting of classical or the pleating of Greek statuary and curved piers of differing widths and thicknesses create reliefs that vibrate under changing light. Variegated patterns exalt effects of chiaroscuro and reinforce the verticality of the wall. A dissonant harmony creates elevations with new architectural quality whose elegance distances the new design from the uncertain proportions of the existing building.

Villa H2 - A villa on the hill of Aci Castello, between Catania and Taormina. The design of the building is inseparably linked to the arrangement of all the external areas. Indeed, the construction communicates with its surroundings, becoming an integral part of it. Large stone slabs form the flooring of the outdoor spaces, located in the immediate vicinity of the residence, integrating with the lawn parts of the overall arrangement. The stone cladding of the facades is made of light stone slabs with refined groove work. The ventilated facade technique hides an in-depth technical study of details and details behind an apparent simplicity. Vertical cuts and varied large glass openings allow panoramic views.

Conclusion

Specific knowledge of production processes is an indispensable additional task required of the designer who aims to keep pace with their era.
The advancement of processing techniques has expanded creative possibilities, allowing architects to explore new frontiers in the use of stone. The renewal of architectural language is linked to the recognition of the potential of stone connected to expressive and sustainable economic and environmental values: the use of natural stone is motivated not only by the need to integrate with the landscape or express local identity but also by the possibility of creating durable technical elements with contained construction costs and times, equipped with high thermal inertia, easily recyclable. Even though in most cases today stone constitutes only a superficial layer of the building, stone walls still speak to the heart and evoke emotions.

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Stone as an eye to the history: tracing the story of Cordoba through its stones

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Stone has eyes; its stiffness and durability turned it into a time portal. The history of any city can be read through its stones. Cordoba is one of the richest historical cities in the Mediterranean, it witnessed a clash of cultures starting with the Romanian culture who were the first known cultures that lived and developed the city of Cordoba. Stones of Cordoba documented and stored the stories of this city. Political and religious events were documented through its stones. This chapter will tell the cultural story of this city through representing two of its most important stone landmarks; the Cordoba bridge, and the mosque of Cordoba.
Keywords: Cordoba, tracing history, Cordoba bridge, the mosque of Cordoba, stone documentaries

1. Introduction

Stone durability and strength made it part of any cultural history due to its ability to resist the different conditions. The Mediterranean climate is known as hot and dry in summer, mild and wet in winter, therefore, using stone was part of the architectural compositions of the Mediterranean countries[1] . Cordoba is known of its rich history; it was declared as a World heritage site by UNESCO in 1984 [2] . The city was known for its beauty during the Umayyad regime, it was known as the world most beautiful city [3] . Throughout history, stones have been the most durable and time-passing way to preserve and document the cultural integration of this city. The stones of the city reflect the interesting integration of cultures that passed and ruled Cordoba. Even though many of its buildings were demolished due to political wars and conflicts, the cultural integration is preserved by its layered architecture including two important layers pre-Islam and Islam. The research will tell a story of two architectural symbols of Cordoba; The bridge of Cordoba, and the Mosque of Cordoba.

2. The bridge of Cordoba

The stone bridge was renovated as a replacement of an older wooden bridge in the 1st century during the Roman regime. The city at that time held a special political place as the capital of the Roman province. This led to a notable development, roads were paved and high-level schools were built. This due to the declaration of Cordoba as the capital of the province [4] . This development increases its population which created a need for a durable stone bridge to facilitate the river

(1) Martínez-Martínez, J., Benavente, D., Gutiérrez, S. J., García-del-Cura, M. A., & Ordóñez, S. (2017). Stone weathering under Mediterranean semiarid climate in the fortress of Nueva Tabarca island (Spain). *Building and environment, 121, 262276-*.

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crossing. During that time the bridge was characterized by 17 stone arches supported by semi-cylindrical buttresses distributed in a pattern to preserve proportion and balance, most of these characters were destroyed through wars. However, the Islamic Umayyads rebuilt the current bridge on the ruins of the Roman one, the 14th and 15th arches of the bridge are originally from the Roman regime . Stones of this bridge present a timeless witness of the great history of this city, and it offer an interesting instrument for archeologists and architects to trace the city development. The bridge documents the great expansion that Cordoba witnessed as it was the center of the Roman and Muslims during their regimes, which requires the erection of this bridge to facilitate the movement between the central city of Cordoba and the suburbs around it

Graph 1. The current Cordoba bridge (source: Midjourney AI)

3. The Mosque of Cordoba

The mosque of Cordoba is one of the most important landmarks of Cordoba, the mosque was built during the Umayyad regime in the 8th century [7,8] . The mosque held a political announcement of the Islamic presence in Cordoba. Therefore, the mosque architecture reflects the economic strength and development of Umayyad's regime. Consequently, the mosque scale is massive, and its architecture was unlikely very rich in features[9].

Besides the significant historical era this mosque symbolize, stones of this mosque are integrated with the older layer of Cordoba as it was mainly built above ruins of and older great Roman Basilica[10,11] . At first, the Islamic Mosque was built and retained the Basilica within its walls. As a result, Christians and Muslims could pray at the same place during that era[12] . Afterwards, the basilica was destroyed and the mosque was extended through a vast arcade and gardens[13] . By the end of the Islamic domination, the site was turned into a church again, then a gothic church was built at the center of the wide arcaded garden[14,15].

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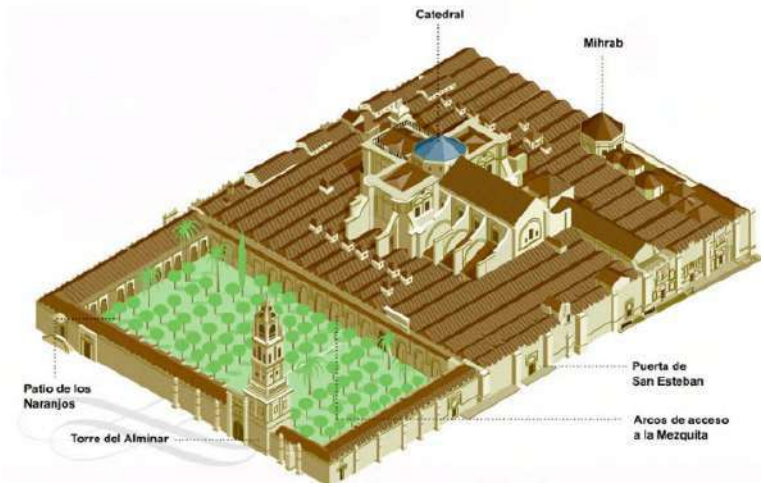
In conclusion, the political clashes in return for different religious affiliations were documented through the stones of this landmark. Once it was a church, it became a mosque once, then it turned into a church again. Nowadays, this massive building is a museum that holds significant leftovers of the great cultures that ruled the land of Cordoba and made a difference in its history, most of this museum is underground[16,17]

Graph 2. The current Cordoba mosque[18]



4. Conclusion:

Stones durability and stiffness make it one of the special materials through history. It creates a timeless gate to the history of cultures, as it helps us to be able to trace the development of historical cities. Cordoba was one of the most critical cities in history, the city witnessed a set of wars due to its strategic location in the Mediterranean. The wars and conflicts that had taken part on the land of Cordoba and destroyed parts of its amazing buildings, though it is still presenting a unique architecture.

Stones of Cordoba are still standing to tell the story of this beautiful city. The stone bridge of Cordoba proved that the efficiency of stone in Inheritance stories throughout history. Its stiffness and resilience kept the bridge as a witness of Cordoba's great history until our days. Meanwhile, the stones of the grand mosque of Cordoba assisted in telling a story of a great religious clash that took place in the land of this city. The twists it witnessed being a mosque or a church through history are documented and can easily be read through the formation of this landmark. At last, stones made us able to widely open our eyes to what brings us to who are we today, stones eyes made us able to read, imagine, and write the great history of this land.

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STONE THROUGH THE CENTURIES

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Keywords

architecture,antiquity,durability,lithoid,sustainability

Abstract

My contribution to this book aims to provide a brief historical excursus on the use of stone, since antiquity, as the primary natural building material: from the Acropolis of Athens to the 20th century, stone, together with wood, has in fact characterised the world of construction. As an architect/planner, I thought I would illustrate, also with the help of photographs, one of my works: the church of St Paul the Apostle in Frosinone, on the outskirts of Rome, in which the use of stone, both inside and outside, is fundamental.

In the mid-15th century, Antonio Di Pietro Averulino, known as Filarete, in his 'Treatise on Architecture' reworked the myth of the primitive hut in the light of the Christian tradition " ... and for this reason it is to be believed that having made a roof for his hands, considering the need for his life, he thought and made himself some habitation to defend himself from the rain and also from the heat of the sun."

And if, from the hut of branches begins the long and fascinating history of architecture, over the centuries stone has certainly become the priority element for human constructions From the Greek city with its fantastic monuments, from the Acropolis in Athens and the imposing Parthenon, the first known work of prefabrication, to the theatre of Epidaurus in the Peloponnese and that of Dodoni, stone in the petrous land of Epirus; up to the equally majestic works of Roman civilisation: the Colosseum and the entire area of the Roman Forum, but also those road infrastructures, the so-called consular, which made Rome Caput Mundi. The Roman road system, of which ample traces remain, was the most efficient and long-lasting road system of the ancient world, bringing Roman civilisation to the furthest reaches of the empire, and all this was possible thanks to skilful construction techniques, but also to the use, in the form of paving stones, of a material indestructible over time, such as stone. And so, throughout the centuries up to the present day, especially the regions of Mediterranean Europe, are characterised by a tradition linked to a lithic type of construction technique and technology, including in that word the whole of all commercial species such as: travertine marble granite porphyry and all stone in the strict sense.

How then can we fail to remember all those works built in Italy, in the first half of the 20th century, during the fascist period? Monuments, schools, public buildings were largely built in stone: from the Eur district, on the outskirts of Rome, where the so-called Square Coliseum stands out, to the Foro Italico with valuable floor mosaics and marble statues embellishing the athletics tracks. Or in Bolzano, the Victory Monument, a splendid marble complex celebrating the Italian victory in the First World War over Austria-Hungary. Designed by architect Marcello Piacentini with magnificent sculptural groups inside by great artists. But that is not all. As early as 1927, Benito Mussolini began to think more and more decisively that in order to solve the problems of post-unification Italy and to bring it to the attention of the other great world powers, the way forward was to return to agricultural life. Hence a plan of land reclamation, the most important of which was that of the Pontine Marshes and that of the Terralba Plain, a desert and marshy area on the Gulf of Oristano in Sardinia.

But for the purposes of the theme we are addressing in this book, I want to take a closer look at a small village that was founded in the Apulia, in the province of Foggia: Segezia. Here, too, the season of reclamation and populating the countryside is marked by the regime's policies to support the creation of small and medium agricultural property. Segezia was built between 1939 and 1942, about 12 km from the city of Foggia and lies along the road to Benevento. The planimetric layout is in the form of a Greek cross and is developed on a north-south and east-west axis, converging on the central square. The latter, designed on the type of the medieval square, contains all the functions of political administrative and religious representation. On the minor streets are small residences with a garden and vegetable garden at the back. The Town Hall incorporates the loggia style, on three floors, and is made of brown brick to emphasise the austerity of the civic function. The Casa del Fascio (House of the Fascist) is characterised by the massive and tectonic Tower, as in other villages and founding towns, and by sculptural and decorative works in marble, testifying to the grandeur of Fascism. The most original and valuable architectural work is certainly the church with its high bell tower. The latter, characterised by nine rows of architraved loggias resting on a solid stone base, stands out in the flat rural landscape thanks to its belfry decorated with beautiful blue majolica tiles. The single-nave church is made of local Apricena stone. The front is clad with slabs of Trani stone, a splendid white local stone, set with precious multicoloured tiles of majolica from Vietri in the province of Salerno. An elegant and refined monumental complex in which local stone, combined with another typical Mediterranean material such as hand-painted majolica, becomes the original and characterising element of this small southern Italian village.

Both in Italy and overseas, in Greece as in Libya, in Ethiopia as in Eritrea, Fascism relied on stone to celebrate the myth of ancient Rome. In addition to public buildings, there were many monuments, fountains and statues made of stone, from the Arch of the Silenes, with its colossi on the pediment, to celebrate the construction of the Libyan coastal road, designed by the architect Florestano di Fausto, who had already imprinted his modern imprint in a Mediterranean style on Rhodes, to Plinio Marconi's plans for Addis Ababa, with the graceful municipal palace, in which the stone tower soars above the two short wings. Or from Saint Barbara, patron saint of miners, a high relief by Ugo Carrà, located on the side of the church in Raša , on the southern coast of Istria, almost halfway between Rijeka and Pula, to the Metaphysical Tower of the Sabaudia Town Hall, by architects Piccinato, Cancellotti, Montuori and Scalpelli . The same architects who designed the city's Urban Plan on the classic scheme of the cardo and decumanus, as well as most of the public buildings. These include the church, which for strictly ideological reasons does not interfere with political power, but is built in another square, adjacent to the main one. The parish complex formed by the liturgical hall, with a high bell tower and a baptistery, detached from the hall, is treated with a striking travertine decoration with brick recourses. The same ornamental discourse is applied to another church of that period, in another founding city on the outskirts of Rome: Guidonia. Here, architect CalzaBini realised the church of Santa Maria di Loreto, using stone cladding with horizontal recourses of different colours, both for the liturgical hall and for the two bell towers that flank it.

Moving on to the post-war period, how can we fail to recall the work of architects such as Mario Ridolfi, with his works clearly identifiable by the skilful use of sponga stone, a material typical of his area, Umbria, and Paolo Portoghesi? Of the latter, who recently passed away, I am thinking of the Baldi house, designed and built in the late 1950s in central Italy. Although small in scale, it represented an innovative architectural manifesto during the post-war economic recovery. A 'new' architecture attentive to the territory and history, also made of sponge stone and brick.

Of particular interest at the end of the 20th century was the construction of the church dedicated to Saint Pio in Pietrelcina, Apulia, designed by Renzo Piano. Here the great Genoese architect used local Apricena stone to make all the structural elements such as arches and colonnades, as well as the imposing cross in the churchyard and all the flooring. Inside too, the great artists who worked

on the sacred furnishings used stone materials. In the same years, Mario Botta tried his hand at designing a synagogue on the university campus in Tel Aviv, Israel, which was already full of works by other famous architects, such as Louis Khan. In order to follow the client's wishes, architect Botta designed two identical buildings: two cubes that transform into a truncated cone, connected by a common entrance. One cube serves Orthodox Jews, the other liberal Jews. The striking effect, in addition to the shapes, is created by the exterior cladding in red dolomite, while the interior is made of golden stone from Tuscany. It is precisely the dialogue between these two materials that conveys the building's archaic message. '... Contemporary culture offers an architecture of consumption and noise, but I think it is important to think that there is also an architecture of silence, where it is possible to evoke other conditions, other feelings, other loves... Contemporary architecture is strongly tied to technical facts, to functional elements: this is a great limitation. Architecture as language, as physical presence, is able to communicate beyond the contingent; architecture is a 'permanence' that dialogues with the passing of the seasons, with the solar cycle, with the notion of time: architecture requires long periods of time.' (Mario Botta).

And coming to more recent times, i would like to recall the Sancaklar Mosque, in the Buyukcekmece district, on the outskirts of Istanbul, in which Emre Arolat Architects, while focusing on the concept of prayer, resolves the architectural theme in an original way, strongly characterising the volumes and the external arrangement with the use of stone. In a continuous interplay between nature and artifice, the architects have designed a high stone wall separating the chaotic traffic of the Turkish capital from the space inside the mosque. Here, a natural stone and lawn walkway, which rests on the slope of the ground, leads to the worship building, which is semi-basement, placed under a long roof and also made entirely of stone. The interior of the prayer hall, reminiscent of the primordial space of a cave, is a place of meditation and silence, thanks also to the rarefied distribution of light, which arrives from the skylight and from the skilful openings arranged along the Qibla, the wall facing Mecca.

I would also like to illustrate one of my works, realised in 2010, the Saint Paul the Apostle Parish complex in Frosinone, on the outskirts of Rome, where the use of stone starts from the powerful basement in sponga stone to all the sacred furnishings made of Roman travertine.

The disappearance of set rules, standards and prudent evaluations which gave the *plantatio ecclesiae* a precise role in urban design, capable of conditioning the surroundings, is now evident. Areas destined for new churches are often marginal, small and sometimes morphologically problematic. Rarely can the architect create works of collective meaning while mantaining the symbolic significance of new religious architecture – a place of prayer and contemplation – in a context of chaotic, haphazard, and often unauthorized urban growth. Also with the construction of the Church of St. Paul the Apostle in Frosinone there was this type of anonymous peripheral sprawl, worsened by the presence of a highway, the Monte Lepini, which touches the allocated plot of land.

So with the parish complex, comprising the church, parsonage, rooms for pastoral ministries, and auditorium, a central area was created, with a square courtyard in the centre of the project; an attempt was also made to restore, among other things, a local tradition, namely that of the cloister typical of the medieval abbey communities and a characteristic feature of much of the land of Ciociaria, effectively, defining the area of Christian aggregation.

For the spatial configuration, the iconography is strong, not only for its size, but especially for the peremptory nature of the geometric image; the sacred is thus represented using pure and flawless volumes: cylinder, cube and parallelepiped. The skyline and chromatic range of the entire complex emphasize an easily readable formal hierarchy and content, so that the white of the cylinder is set off against the gold of the cube, lower down, and the dark blue of the parallelepiped, lower still.

The cylinder is the church: in its simplicity, it is created by the evolution of the circle – the perfect form of infinity, which begins and ends in itself. In this case it starts from a base of solid rock, the earthly

roughness of which rises, is refined and dematerialises into a smooth, clean white, which represents the dimension towards which it reaches. The sky is enclosed inside a room that eliminates all boundaries.

An echo of columns and the reinterpreted rosette evoke the grandeur and tradition of ancient sacred architecture.

Those who enter the church purify themselves before gaininig access to the liturgy, which explains the penitentiary at the entrance. The assembly room has no preferential aisles, and everything sorrounds the altar, the celebrant, and the Eucharist, creating physical communion between the faithful and the presbytery, despite the distinction of ministerial roles. Instead what emerges is the axis between the portal (an architectural icon of Christ and the altar), symbol of the essence of Christ: victim and priest. the same square shape of the small altar, commissioned by the Commission of Sacred Art of the Italian Episcopal Conference (CEI), tones down every line of demarcation. Of the presbytery, raised in relation to the floor of the church, the sacred vessels are raised, modelled in elementary forms using the same stone of the floor.

These sculptures in travertine come from a close collaboration with Fernando Rea, an artist whom I have measured myself against all these years, believing that if it is true that all the works of architecture should have an iconographic design, established among other things by law, then a church of architectural design alone would be incomplete.

The light of the Holy Spirit comes in from the rose window above, Paul's sudden intuition acting as a backdrop, while a rhythmic succession of light and shade creates geometric effects on the circular wall. On the ceiling, two steel beams mark the path from the entrance to the apse; the intersecting glulam beams are broken by spires that show the clear sky.

It is therefore an area designed in a simple and straightforward manner, such as to allow the faithful, at a glance, to easily and actively participate in liturgical celebrations while feeling at ease. Even the baptistery, with its function of initial purification, is circular and is set apart to underline the symbolism. Its configuration creates a route: one descends into the severity of the stone to be bathed and to re-emerge purified towards the blue. The olive tree, glimpsed through the windows set in stone, provides a sense of peace and meditation.

The bell tower with its cross, demanded by all to show the sacredness of the place, although physically denoting the corruptibility of matter with the oxidized steel, conceptually expresses the tension of the soul moving upwards, towering like a beacon in the night.

The churchyard, as mentioned, defines the space of aggregation. It acts as a filter between the road, the world with his troubles, and the place of prayer and reassurance.

Specifically, it will become a focal point for the neighbourhood, the 'square' where people mingle outside the church even in the shelter of the porch on rainy days, in addition to acting as a venue for activities that will provide a vital impulse to the town.

On the square stand the rotated cubes that serve as an auditorium. The cube, in Christian tradition. represents the terrestrial world. The building has a glazed foyer which is grafted into the rigid solidity of the room.

All this excursus to highlight that stone, together with wood, is the natural material par excellence in the field of architecture. What remains to us from antiquity, the so-called ruins, are nothing more than tombstone constructions worn away by atmospheric agents and natural disasters. The rest of the building materials, the artificial ones, go to landfill and unfortunately they are very difficult to dispose of.

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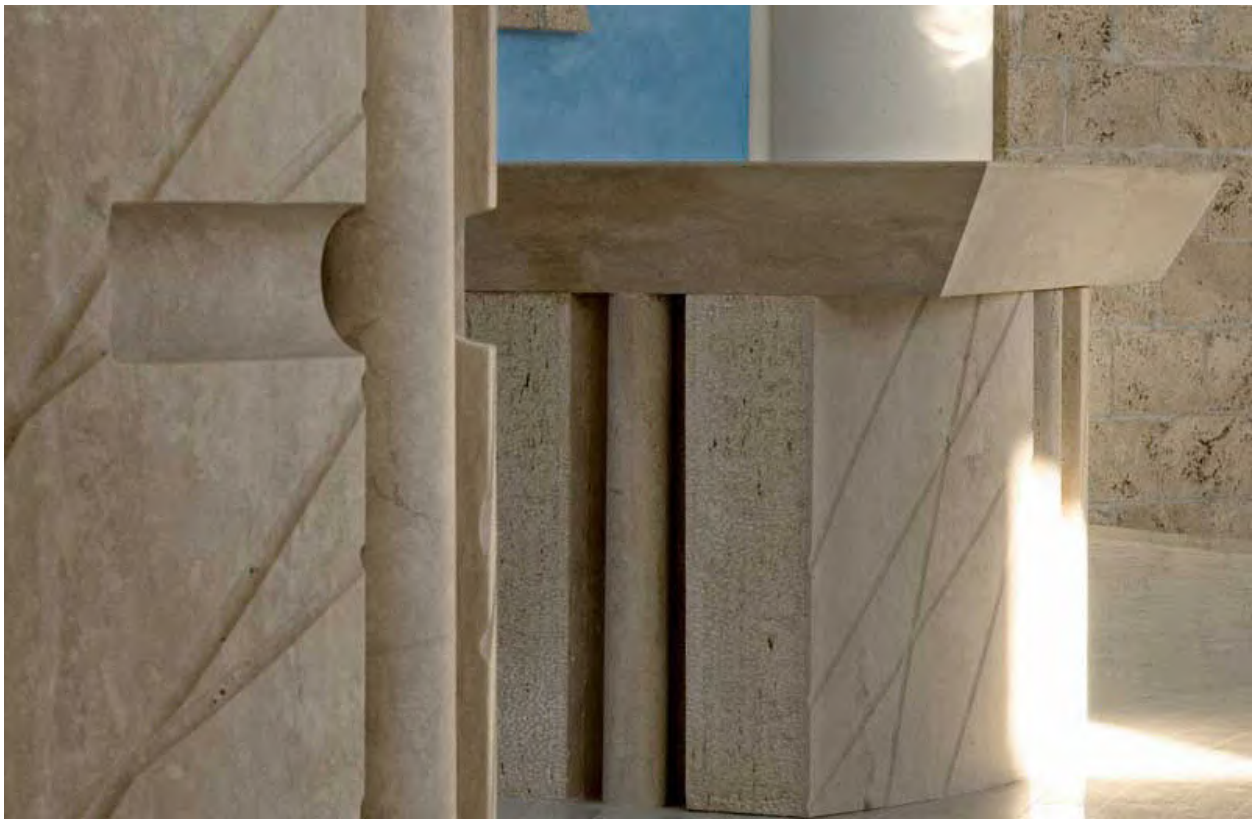
5) *Details of the stone base*



6) *Details of the altar and ambo in travertine*

Theory and catalogue cards for the conservation of stones in Cultural Heritage

Davide Sigurtà

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Abstract

The enhancement of stone architectures is achieved through two actions: the proper recognition of its value in the history of construction techniques and local culture, and the material safeguarding to be implemented through correct restoration operations.

This paper aims to provide a brief overview of modern restoration theories in Italy, focusing then on the operational methods to be adopted in restoration sites and the main implementation techniques.

Keywords

catalogue cards, conservation, Cultural Heritage, processes, operation,

Introduction

A restoration intervention is generally carried out on what we call an artwork: to understand what restoration is we must first understand what an artwork is.

The concept of artwork has changed throughout history, adapting to the cultural and philosophical context of art history at the time.

Likewise, restoration operations have changed over the years precisely because they are linked to the changing meaning of the artwork; these operating methods have adapted to artistic theories because the restoration operation cannot be disconnected from the value given to the artwork.

For the history of the different theories over the centuries on the topic of the artistic nature of an artwork, and the consequent way in which restoration interventions were carried out, refer to more specific texts[1] and now we focus on the most recent theories.

Currently, for the recognisability of an artwork, it is important to understand its link with its historical path, where history is not only linked to the great events carried out by great historical figures of the ruling classes of the various eras.

At the end of the 60s, Braudel (who theorized this new type of historiography) began a process of reevaluation of detailed historiography of the need to study that "material civilization... the silent and almost forgotten stories of men … whose weight was immense and the noise barely perceptible"[2].

From this postulate comes the need to study a historiography of sectors and artistic objects previously considered minor, which have not necessarily changed the world, but which have certainly given a turning point, in a given historical and cultural moment to the perception that the common population had of that fact; this does not invalidate the concept of artwork, which has developed over time, but broadens its meaning.

In this cultural context, the concept of artisticity of artwork broadens to include elements that, until recently, were considered "background".

(1) In italian language:
C. BRANDI (1997), Teoria del restauro, Ed. Torino, Piccola Biblioteca Einaudi
S. CASIELLO (a cura di:), Verso una storia del restauro. Dall'età classica al primo ottocento, Firenze, Alinea editrice
M. DEZZI BARDESCHI (2009), Restauro punto e da capo. Frammenti per una (impossibile) teoria, Milano, Ed. Francoangeli
In English language:
A. CONTI, H. GLANVILLE (2007), HISTORY OF THE RESTORATION AND CONSERVATION OF WORKS OF ART, Ed. Routledge 2007

(2) text translated from the Italian language - F. BRAUDEL (1977), Capitalismo e civiltà materiale (secoli XV-XVIII), Torino, Ed. Eiunaudi, p. 21

If artwork is any object that was produced by a given cultural instance, in a given historical moment, the material aspect must also enter into the conservation and restoration processes as part of that complexity that the concepts analyzed previously have brought out. In this context the restoration must always be carried on the material aspect of the artwork and must be guided by the awareness that the aesthetic aspect must be safeguarded in its artistic and historical duplicity.
Due to the importance given to every intrinsic aspect in the definition of artwork, restoration must realized with the aim of preserving the object as it appears at the moment in which the intervention be done; clearly this complexity must not be altered with new additions that could generate a new complexity, different from the original, creating a false history immagine that erases the passage of time (examination of historical patinas)[3].
with the aim of translating these theories into working practices, over the last few decades, a series of basic concepts have been defined which now have been considered essential in an intervention on a heritage artefact.

Minimal intervention

Artwork lives over time and undergoes a different theoretical interpretation based on the historical-philosophical demands of a given era: an object considered precious in one era may be considered "ugly" or insignificant in another historical period.
From this perspective it is not surprising that the value of the decorative elements of a monument could be appreciated with more or less consideration over the centuries: in some periods they could be considered as responding to the aesthetics that characterized the "prevailing" style and therefore worthy of protection, in other eras these could appear to be memories of an unhappy era and therefore they could also be demolished.
In the current state of historical-critical and restoration theories, it has now become certain that every historical-monumental asset has value because it must be transmitted to future generations in all its complexity, meaning every aspect of its compositional, material and technical stratification.
For this reason, our interventions on stone materials must be implemented by modifying their peculiar characteristics as little as possible, including in this also the subsequent interventions carried out on the building as demolitions, additions, renovations and compositions - material changes.
Every minimal intervention must, therefore, be limited to conserving what is there: we intervene to guarantee the "transmissibility" of the existing historical and material image by following these principles:

- parts are not removed if they are not harmful to the static conservation of the property;
- action is taken only until the problem that puts the survival of the object at risk is eliminated and limited to the affected area;
- both the aspects relating to the formal image and the materials are always preserved.

Recognizability

Making a final treatment or a structural modification made during the life of artwork produces a new image of it, provoking a different vision in the consciousness - knowledge that the population had of that Monument.
These changes cause non-homogeneous, partial or incomplete aesthetic images, which however, once made, are also accepted by the general public.
In this sense, restoration work on the stones cannot lead to flat, unitary and homogeneous surfaces as a memory of a unity that the passage of time has erased; on the contrary, a non-homogeneous curtain wall gives us a feeling of closeness to the events that brought the artwork to the present day, creating a kind of "empathy" which may be the only way to safeguard the object itself.
Given the above, the intervention must always be identifiable as a modern insertion so as not to

(3) In the Italian theoretical discussion: C. BRANDI (1997), Teoria del restauro, Torino, Piccola Biblioteca Einaudi, pp. 89-97

create a historical forgery that could mislead as to the real consistency of the property in question by respecting the following principles:
- no “stylish” additions, but restore, conserving and reporting the materials;
- use technical choices to make a new material integration evident: undercut, chromatic differentiation, etc.;
- use non-invasive materials so as not to modify the historicized image.

Reversibility

The problem of reversibility is now to be considered a “false problem” since it is now well established that every restoration intervention irremediably produces changes whose final effect is often difficult to understand.
Even the simple pictorial integration with watercolors is actually something that in a possible future removal could lead to conservation problems of the original material; for this reason, reversibility must be understood in a dialectical relationship with the other principles exposed here.
Reversibility, therefore, must be understood as an ideal principle to strive for to the maximum of current capabilities with the awareness that every restoration intervention leads to the loss of something; starting from this awareness and with this objective we understand that the way to minimize the effects of restoration is linked to knowledge of the object we are working on.
Restoring, therefore, means knowing an object very well in order to operate with minimally invasive processes and choosing those that have greater reversibility, with equal effectiveness.
For these reasons we must work on an artwork respecting the following objectives as much as possible:
- use materials compatible, by composition, with existing materials;
- absolute prohibition on using cement-based materials or with insufficiently tested organic components;
- do not use interventions “in subtraction” from the original material unless strictly necessary.

Compatibility

The need for conservation of a stone artwork must be studied so that any restoration interventions do not cause further future damage, for this reason, among the many precautions to be taken there is always the need to opt for technical solutions that use materials compatible with the specific type of stone.
Their survival, therefore, is not only linked to the resolution of the current conservation problem, for which we are working, but must also concern the possible effects that the use of certain techniques and certain materials may cause in the future.
For this purpose, it is always necessary to know in depth the nature of the stone material because certain materials used in the restoration can be dangerous for some types of stone.
If we want to guarantee future generations the possibility of studying a given material moment in human history with new eyes, we must try to transmit it in its completeness, using materials that do not lead to further degradation phenomena because they are not compatible with the material on which we are working; in this we must also pay attention to the use that will be made of the object which must also be studied so that it guarantees future conservation.
To achieve these goals, the interventions must be carried out in a manner compatible with the history, material and use of the property in question, ensuring compliance with the following concepts:
- importance of “compatible” reuse, in order not to distort the historicized totality of the asset;
- use of new interventions “in addition”, with the function of superstructures and not replacement of functions;
- to investigate the real causes of degradation in order to use the truly essential techniques and materials.

The techniques of stone preservation

Cleaning

Cleaning with low pressure deionised water

The technique is done with pressure washer machines with operating pressures in the order of 4-6 atm.
Due to the energetic mechanical action of the impact of the water jet with the surface, it can only be used for particularly resistant stones with a good degree of conservation; for the same reason, the method can be used to remove fairly adherent crusts or dirt deposits.
The pressure jet can damage delicate parts or neighbouring materials of a different nature and therefore particular attention must be used in protecting the parts not subject to the intervention.
For stone slabs joined with mortar joints or with other materials it will be necessary to calibrate the cleaning action on the latter which present less resistance to the mechanical action of the jet. If the dirt is very adherent, heated water can be used.

1 Cleaning with demineralized water system

Cleaning with nebulized water spray

This technique is particularly suitable when you need to remove dust and deposits that are soluble in water or not too cohesive to the substrate; especially suitable for removing thin superficial deposits bound with gypsum or secondary calcite, on carbonate and slightly porous stone materials.
This method is based on the solvent capacity of water, which can remove not only dirt, but also soluble salts: therefore this technique is particularly valid for encrustations made up of partially water-soluble compounds.
This process must not be used in the presence of black crusts of considerable thickness (1-3 mm) and containing high percentages of gypsum (between 20% and 30%) since application times that are too long could cause damage to the material. With this technique the stone is cleaned by spraying the material with nebulized water which also produces a mild mechanical action by contact, but above all capable of generating a chemical action. For this reason it can be used on delicate materials or with decorations, but not with serious detachment, lifting and/or decohesion phenomena.

2 Manual cleaning with cotton buds and demineralized water

Manual mechanical cleaning of light deposits

The mechanical cleaning of stone surfaces is an operation to remove surface deposits which can take on heterogeneous methods and degrees of effectiveness. It is possible to clean surfaces affected by deposits of loosely adhered atmospheric particulates until particularly resistant black crusts have subsided so as to prepare for further cleaning operations. Generally, this type of mechanical cleaning is limited to loosely adhered atmospheric particulates or loose deposits (guano, soil, etc.). Depending on the operation required, the conditions of the dirt and material to be removed must be appropriately assessed so as to choose the most appropriate tool and degree of depth.

Cleaning by water-based absorbent compresses

The operation allows the removal, from stone surfaces, of homogeneous layers of water-soluble or slightly soluble compounds (such as thin black crusts, around 1 mm).
The advantage of their use lies in the possibility of avoiding applying cleaning substances directly to the surface. The type of compress will depend on the degree of persistence and solvency of the dirt to be removed, although it must be kept in mind that the compresses will not be particularly suitable for removing thick crusts. In the case of porous and/or poorly cohesive materials, in order not to make the operation traumatic, it will be advisable to place Japanese paper or Kleenex on the surface.

3 Cleaning with cellulose-based compress

Laser cleaning

This method exploits physical principles and not chemical or mechanical actions, in fact, the laser equipment is a high precision instrument, capable of producing energy in the form of a light wave following a stimulated emission of radiation, which allows cleaning selective, removing crusts and deposits.
The use of this system, precisely because of its notable selectivity, can sometimes make it possible not to carry out pre-consolidation of particularly degraded surfaces; however, it should not be forgotten that in some cases the removal of the crust can lead to the crumbling of the underlying stone substrate, if it is in a state of advanced decohesion. The system guarantees minimal invasiveness, not requiring the use of chemicals or contact with abrasive materials and guarantees a high degree of control since each impulse affects layers of a few millimetres and therefore cleaning occurs progressively.
The interaction with stone materials of different nature is limited to the type of radiation emission and therefore makes cleaning selective for a single type of stone, resulting in no harm to other materials, since the source must be differentiated to ensure that the laser can work on different surfaces, such as stone, wood, metals, etc.

4 Stone cleaning with laser

Repairs

Filling of superficial cracks

The aim of the intervention will be to fill the gaps and discontinuities (partial lack of mortar joints, fracturing of the stone or ashlar, etc.) present on the surface of the stone (whatever its origin) so as to “unify” the surface and offer adequate resistance to degradation agents (chemical and biological air pollutants, water infiltrations, etc.).

5 Grouting surface cracks with lime mortar

Edge protection grouting

The intervention is used to create a small filling on the edges of the fractured stone or on the edges near a gap. The intent of the operation is to resolve an abrupt interruption of the planar layer of the material which risks undermining the stability of the remaining part. In fact, the edges of a gap or a break are more exposed to atmospheric or physical agents which find an easy point of deposition in the discontinuity of the material, with a consequent increase in the degradation process linked to their peculiarities.

Creation of a finishing layer (plaster)

The intervention is used to create a layer of plaster lime finishing with the dual objective of creating a layer of protection for the surface and restoring visual continuity without, however, any intention of reconstructing the lost image.
The finishing plaster will be realized with natural aerial or hydraulic lime; the mixture will consist of lime putty (alternatively, mortar mixed with natural hydraulic lime NHL 2 in a lime-hydraulic ratio of 5:1) and inert material whose particle size will depend on the desired final effect (smooth or rustic); the binder-inert ratio may vary from 1:2 (if a hybrid mortar is used) to 1:1, and the thickness should not exceed 3 mm. The plaster will be applied using a steel American trowel in one or more layers, according to the desired level of finish and in accordance with the project specifications. The outcome of the operation will largely depend on the application of the inert material; therefore, it is preferable to carry out the application when the plaster substrate is still sufficiently fresh so that the inert material can adhere well. The application temperature may range from +10°C to +30°C.

Consolidations

Adhesive consolidation of raised and/or detached elements

The intervention is used to make parts of detached or lifted material present on site solid again using suitable adhesives based on aerial or hydraulic binder (lime if is structurally possible). This procedure is used when flakes or larger portions of material must be re-adhered and voids or pockets must be filled due to the detachment of layers parallel to the surface. By doing so, it will be possible to “unify” the surface and offer adequate resistance to degradation agents. The re-adhesion operations can be made structurally resistant (to its own weight or to accidental loads) by inserting pins or stainless steel structures).
The choice of material and methodology will be made based on the type of material and damage (fractures, voids and discontinuities) caused by it, as well as its extent and severity.

Reaggregation of the surface

The treatment is necessary for restoring cohesion to materials made brittle or porous by degradation agents, protecting them and making them more resistant to subsequent attacks. The method is based on the physical principle of capillarity, i.e. the ability of fluids to naturally penetrate the space between the two very close surfaces of a cavity.
In particular, we mean the impregnation of the material with a product which, penetrating deeply, improves the cohesion of the altered material and the adhesion between it and the healthy substrate. Inorganic products are used due to their greater affinity with the stone.
The best conditions for applying the treatment occur in a confined environment and in a laboratory with the techniques of immersion, in case of prolonged contact between the consolidating material and the rest of the object. For large building surfaces, such as masonry walls, other methods are applied, such as application by brush until waste, spray and tablets.

Adhesive pre-consolidation of raised and/or detached elements:

The intervention is objective at offering an element of protection to the stability of the stone portions that present lifting or detachments. Cleaning operations, in fact, would risk further damaging the degraded part, also causing its loss. For this reason, before proceeding with any operation on the part, it is necessary to create a mild re-adhesion between the lifted and/or detached element and its sub-layer. The operation is temporary and must remain in place only for the work prior to the actual re-adhesion where the degradation will be definitively repaired. For this reason, the materials used must be slightly adhesive and easily identifiable so that they can be easily removed once the safeguarding operations have been completed.

Removals

Removal of inconsistent paint films, without bleach, using absorbent compresses

Cleaning using absorbent compresses will be advantageous not only for the removal of soluble salts but also for the removal of homogeneous layers of water-soluble or poorly soluble compounds (such as thin black crusts, around 1 mm), stains originating from organic substances, layers biological agents (bacteria, lichens and algae) will also be able to reduce copper or iron oxide stains.
The advantage of their use lies in the possibility of avoiding applying cleaning substances directly to the surface. The type of compress will depend on the degree of persistence and solvency of the dirt to be removed and in the case of porous and/or poorly cohesive materials it will be advisable, in order not to make the removal operation traumatic, to place Japanese paper or Kleenex.
In the case of particularly resistant pathogenic substances, tablets with limited doses of chemical substances are used. Detergents are able to reduce the surface tension of water, increasing the cleaning action, and allow to dissolve organic substances, to keep in suspension the particles of inorganic deposits which have not been solubilised or broken down and to carry out a bactericidal action.

Removal of deteriorated mortar joints

The operation allows to remove the deteriorated mortar joints damaged by chemical or mechanical aggression. You must pay attention to removing only those parts that present a deteriorated condition so as to make minimal the loss of structural capacity and chromatic and/or physical layers deterioration. It is also important to pay attention to the total removal of the inconsistent joint (generally cement-based) to prevent even small traces remaining from altering the behaviour of the substrate and/ or new plaster. Since removing the mortar joint undermines its structural stability, special care must be taken when carrying out the operation, proceeding to small sectors that will be immediately subject to consolidation before moving on to the next one.

Final operations

Biocidal treatment of higher plants

The objective of the intervention will be to prevent the regrowth of higher plants permanently and without damaging the substrate. The operation will take place following slow mechanical extirpation and subsequent washing of the affected part with deionized water to remove the biocide. The development of higher vegetation on the surface causes a dual action of degradation: the root system pushing into the discontinuities present in the facing can cause mechanical damage and, in many cases, to the fall of material, in addiction the plants facilitates the access of water inside the masonry. The presence of acidic organic substances, normally released by plants through their roots, involves a chemical action on the wall surface contributing to the solubilization of the mineral components of the materials.

Biocidal treatment of mosses and lichens

The objective of the intervention will be to permanently prevent the regrowth of mosses and lichens, an operation to be carried out without damaging the substrate. This type of vegetation preferably takes root in highly humid and shaded areas, especially if fed by the presence of rainwater or dispersed water, condensation or rising humidity. The development of mosses and lichens on the wall surface creates various degradation phenomena on the surface. In particular, bryophytes (i.e., mosses) have a primary covering action, but also carry out mechanical disintegration actions, penetrating inside the materials and construction elements. Lichens act, however, by creating phenomena of covering, decohesion, fracturing and corrosion of the surface.

Conclusions

This work represents a minimal contribution to the development of good practice in the conservation of stone surfaces. The following catalogue cards are a necessary synthesis to give a preliminary idea of the importance of a correct protection of the stones artefacts, whose survival depends on the same safeguard of the material with which they are made.
The necessary simplicity of the processes reported is also due to the indispensable consideration that it is impossible to fully predict the details of the works on materials that have undergone many variations over the centuries; changes caused by the passage of time or by the action of man and, therefore, difficult to evaluate.
For this reason, I stopped to generic considerations rather than to bring back the working cards in their completeness; cards produced in the course of my decennial activity of designer and director works on Cultural Heritage in Italy[4].
The necessary generality of the catalogue cards also derives from the awareness that it is not possible to produce a detailed manual of generic operations because the complexity of such operations on such complex materials requires the attention to proceed to the step by step, adapting the techniques to the infinite complexity of the object: it is the artefact that drive the design and conservation work and not the other way around.

(4) For information on the cards produced and for advice on issues relating to the storage of stone materials you can contact me at: disvelartesigurta@gmail.com

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THE TIMELESS ELEGANCE OF STONE: ARCHITECTURAL TECTONICS IN JORDAN

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Abstract

This paper explores the concept of tectonic architecture in Jordan, with a focus on the use of stone as the primary building material. The study begins by defining and distinguishing the concept of tectonic architecture, providing a theoretical foundation for the analysis.

The paper examines various case studies in Jordan. These include the works of contemporary Jordanian architects such as Jafar Tokan and Wadah Al-Abdi and Ammar Khammash. Through these examples, the research highlights how stone has been employed to achieve both structural integrity and artistic expression.

The analysis reveals that in Jordanian architecture, tectonic principles often intertwine with sculptural aesthetics when stone is used as the primary material. This fusion showcases the material's natural beauty and strength while also allowing for intricate, expressive designs. The study concludes that the timeless elegance of stone in Jordanian architecture exemplifies a harmonious blend of functional and artistic values, making it a unique and enduring element of the regional architecture.

Keywords: Tectonic Architecture, Sculptural Architecture, Stone Construction.

1. Introduction

Jordan architecture is a testament to the enduring elegance of stone as a basic building material. By examining the innovative works of contemporary architects such as Jafar Tokan and Wadah Al-Abdi and Ammar Khammash, this study aims to illustrate the unique blend of structural integrity and aesthetic beauty in Jordanian stone architecture.

2. Tectonic Architecture

Tectonics in architecture is defined as "the science or art of construction, both in relation to use and artistic design." It refers not just to the "activity of making the materially requisite construction that answers certain needs, but rather to the activity that raises this construction to an art form." It is concerned with the modelling of material to bring the material into presence. (Maulden, 2013)
The concept of tectonics can be defined as the unity of architectural character with structural aspects, as structural systems are considered the first pillar for achieving high-level aesthetic results in architecture. The essence of tectonics is concerned with the quality of visual interconnection of design elements, which includes the aesthetic expression of materials, structure, and building architectural form. So that the structure of the building is the same as the shape of the building. (Thinking about material first, then space) with an emphasis on space enclosure (construction is an indication of spatial design). Figure (1)

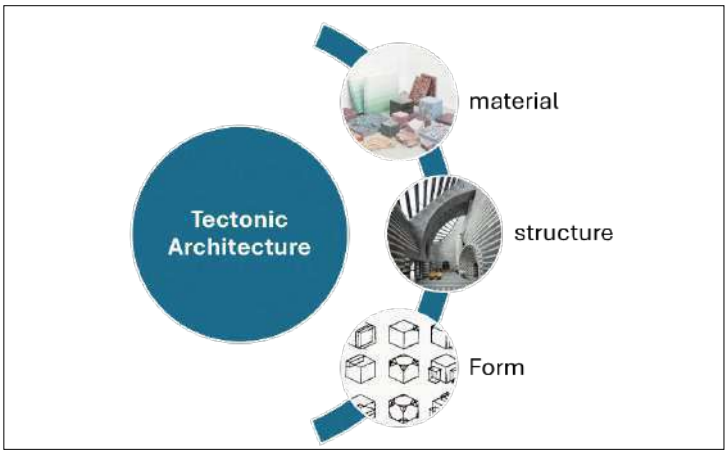

Figure (1), Tectonics in Architecture.

Tectonic also is integrative; it examines "the interwoven relationship between space, function, structure, context, symbolism, representation, and construction. No single definition exists that conveys the full meaning of the term tectonic, primarily because it has evolved over time.
Material is a matter of fact of tectonic architecture. It is the means of execution, a major force of resistance, and means of expression (Borden, 2010), the tectonic activity can be conceived in two groups: the group of the pure built work, or the architectonic; and that of the smaller forms, of the tectonic of useful objects. Both are based upon the same principles of formal constitution. (Schwartz, 2016)

2.1. Stone architectural tectonics

Stone tectonic architecture emphasizes the expressive potential and construction techniques of stone as a primary building material. This architectural approach combines the structural integrity and aesthetic beauty of stone, creating buildings that are both functional and artistically significant. (Acocella, 2007) that could be explained by the following points:

- Material Honesty: In stone tectonic architecture, the natural properties and textures of stone are showcased without unnecessary embellishments. This approach highlights the material's inherent qualities and celebrates its natural beauty.

- Expressive Structure: Structural elements such as columns, beams, and load-bearing walls are often left exposed, making the construction technique a central feature of the design. This transparency in the building process emphasizes the integrity and strength of the stone.

- Integration with Environment: Stone tectonic architecture often harmonizes with its surroundings, using local stone materials that blend naturally with the landscape. This approach not only enhances the building's aesthetic appeal but also promotes sustainability by reducing the need for imported materials.

- Craftsmanship: The skill and artistry involved in working with stone are paramount in stone tectonic architecture. The detailed work of masonry and the precise fitting of stone elements are crucial for both the structural stability and the visual impact of the building.

Stone architectural tectonics emphasizes the interplay of material, structure, and form, leveraging the unique qualities of stone to create buildings that are both robust and aesthetically appealing. As a material, stone offers unparalleled durability, strength, and a timeless aesthetic, characterized by its natural textures and color. Its inherent compressive strength makes it ideal for load-bearing

structures, allowing architects to design robust elements such as walls, columns, and arches that can withstand significant weight and environmental stresses. (Abu Ghneimah, and Gousha , 2002) Structurally, stone's mass and stability contribute to the creation of buildings that are not only sturdy but also sustainable, reducing the need for frequent repairs and maintenance (Macleod & Walker, 2015). Stone's ability to be finely cut or left in a more natural state provides versatility in design, supporting both intricate details and monumental forms. This structural integrity, combined with the skillful craftsmanship of stonemasonry, enables the construction of enduring edifices that embody both functional and artistic values

3. Case studies from Jordan

3.1. Jubilee School by Jafar Tukan

The Jubilee School, designed by Jafar Tukan, is an exemplary case of stone tectonic architecture in Jordan. This educational complex utilizes local stone to create a robust and sustainable structure. The material's natural properties are showcased through exposed stone walls that blend seamlessly with the surrounding landscape. Structurally, the school employs traditional masonry techniques combined with modern construction methods, resulting in a stable and resilient building. The form of the school is both functional and aesthetically pleasing, featuring clean lines and thoughtful integration of indoor and outdoor spaces, emphasizing the harmony between built and natural environments. Figure (2)

Figure (2), Jubilee School by Jafar Tukan.

3.2. Al-Naji Villa by Wadah Al-Abdi

Wadah Al-Abdi's Al-Naji Villa exemplifies the fusion of tectonic and sculptural principles using stone. The villa's design emphasizes the natural beauty of stone, incorporating it into both the structural framework and the decorative elements. The structure of the villa is designed to withstand the local climate, with thick stone walls providing thermal mass and insulation. The form of the villa features a blend of traditional Jordanian architectural elements and contemporary design, creating a home that is both modern and rooted in its cultural context. Al-Abdi's careful attention to detail and craftsmanship results in a residence that is both functional and artistically expressive. Figure (3).

Figure (3), Al-Naji Villa by Wadah Al-Abdi.

3.3. Rangers Academy by Ammar Khammash

Ammar Khammash's Rangers Academy is a striking example of how stone tectonic architecture can be applied to modern buildings. Located in a natural setting, the academy utilizes local stone to create buildings that harmonize with the surrounding landscape. The structural design incorporates stone as a primary load-bearing material, ensuring durability and stability. The form of the academy reflects Khammash's commitment to sustainable and context-sensitive design, with buildings that feature natural ventilation, daylighting, and integration with the environment. The use of stone not only enhances the aesthetic appeal but also reinforces the academy's connection to its natural and cultural- nature heritage. Figure (4).

Figure (4), Rangers Academy by Ammar Khammash.

4. Conclusion

Stone tectonic architecture in Jordan seamlessly blends structural integrity with aesthetic expression. The natural properties of stone, including its durability, strength, and visual appeal, make it an ideal material for creating buildings that are both functional and beautiful. The case studies highlight how stone is utilized not only for its structural benefits but also to enhance the cultural and environmental context of the architecture.

The Jubilee School by Jafar Tukan demonstrates how local stone can be used to create educational spaces that are sustainable and harmonize with the landscape. Wadah Al-Abdi›s Al-Naji Villa showcases the fusion of traditional and contemporary design, utilizing stone to create a home that is both modern and rooted in cultural heritage. Ammar Khammash›s Rangers Academy illustrates the potential for stone to be used in environmentally sensitive and contextually aware designs.

Overall, this research concludes that the use of stone in Jordanian architecture exemplifies a timeless elegance, bridging historical techniques with modern design principles. The integration of tectonic and sculptural elements in stone architecture not only honors the material›s natural beauty but also contributes to the creation of enduring and meaningful structures. The study underscores the importance of stone as a versatile and enduring material, capable of connecting the past, present, and future of architectural design in Jordan

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STONE'S IMPACT ON THE FORMATION OF AMMAN RESIDENTIAL ARCHITECTURE
Case study: Villa Qattan.

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Abstract

This research discusses the use of stone within the residential architecture of Amman, indicating its significance as both a traditional and contemporary building material. The study refers to the historical roots of stone construction in the region, demonstrating how local geology, climate, and cultural heritage have influenced its widespread application in residential structures, by highlighting various architectural studies. The research emphasize the aesthetic, functional, and environmental benefits of stone, through a contemporary case study from Amman. The findings confirm the enduring relevance of stone in Amman's residential architecture, affirming its continued use in modern architectural practices to preserve the city's distinctive character while meeting contemporary needs.

Keywords

Amman, Architecture, Contemporary, Residential, Stone.

Introduction

The use of elements derived from traditional architecture to demonstrate cultural identity is evident, as an attempt to relate contemporary architecture to the roots of place. (Al Nassar et al.,2020)
The use of stone goes back to a long time ago, then developed until it became part of Amman's architectural identity, which distinguished it. (Atiyat, 2015) Furthermore, it was developed in a contemporary style that is compatible with contemporary architecture. Stone's role in Amman architecture emerged when the tendency was towards architecture with a significant character. (Abu Ghanemeh, 2002)

1- Architecture in Amman.

The characteristics of the built environment in Amman have been changing rapidly affected by the urban developments. (Musa, 2017) Moreover, Zalloom (2023), demonstrated that the urbanization fast rise which had been fueled by accelerated technical advancements since the 19th century, facilitated the transformation of spatial and social boundaries. The effects had fundamentally altered the current urban structure which affected the cityscape. (Zalloom, 2023) Factors including the historical legacy of the site on which the city is built and the diversity of the city's population formed by various waves of displacement and refugee movements have shaped the city's identity, in addition to the return of many professionally educated architects coupled with the change in lifestyle in view of the changing socio-economic conditions, where a new era of modernist influence had begun in Amman, which merged with local building tradition of masonry and stone. (Dahabreh, 2020) Architects, such as Jafar Tuqan, Bilal Hammad, Farouk Yaghmour, Ayman Zuaiter, Ammar Khammash, Khalid Nahhas, and many others had an important impact on the architecture in Jordan and a major role in developing the local architecture in Amman city. (Abu Ghanimeh, 2011)

2- The Use of Stone in Amman Contemporary Residences.

Atiyat (2015), indicated that Stone is considered the oldest material used by Man in construction and building starting from ancient civilizations up to the architecture of the traditional houses in Amman where the availability of limestone quarries and the extensive tradition of building with stone had made it the most commonly used and valued material, which therefore made Amman famous for the extensive use of stone. (Figure 1)

Considering this material's contribution to sustainability and thermal regulation, including its ability to resist natural factors over thousands of years. Whereas, stone has numerous properties which allow the formation of a microclimate that's suitable for human life and varies depending on the seasons. It retains heat in winter and keeps the rooms cool in summer. (Abu Ghanimeh, 2011)

1- Contemporary residential buildings in Amman. (Researcher)

3- Jafar Tuqan's Impact on Amman's Architecture.

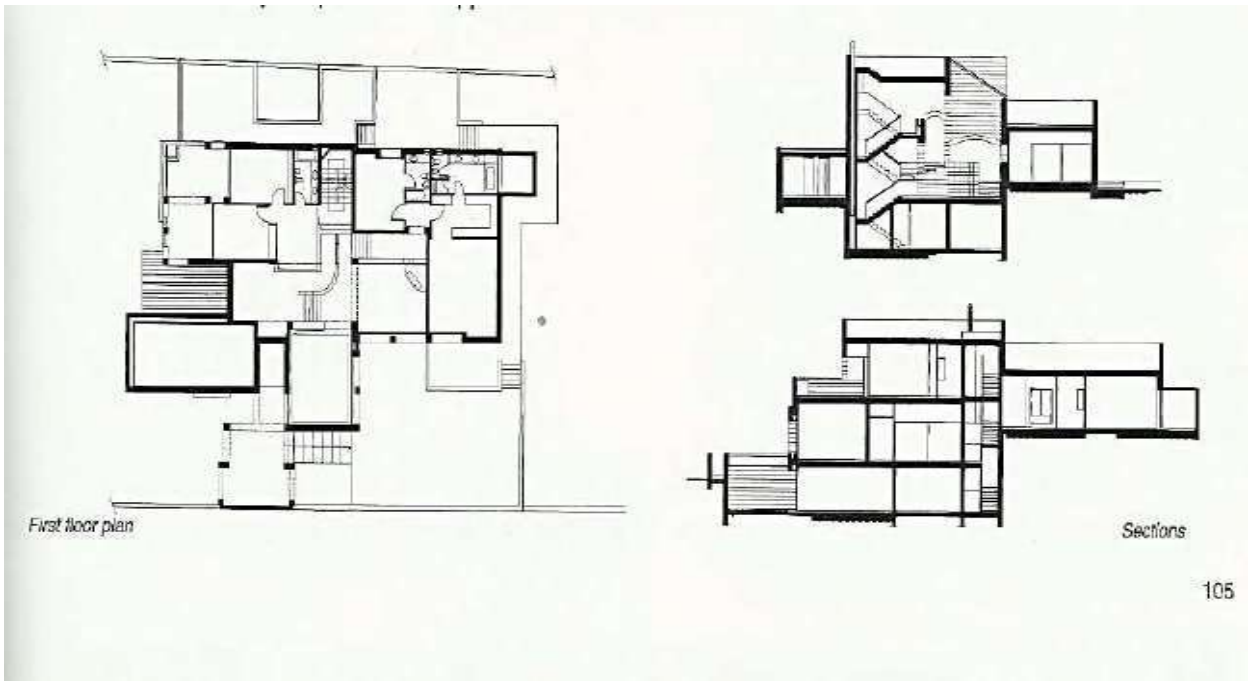
As stated by Pisani, et al. (2001), Jafar Tuqan is one of the substantial architects who had a primary role in shaping the character of Amman architecture. He contributed to the architectural renewal of Amman while the impact of his work spread over Amman. Furthermore, the architect has participated in major projects in multiple countries, as demonstrated by Abu Ghanimeh (2011), he is considered one of the most significant modernist architects in the Arab world and is a recipient of various awards along with the Aga Khan Award for Architecture. (https://www.archnet.org/authorities/489) Tuqan established a connection with the notion of space, which originated a unique color in his designs, that reflects the natural stone representing the uniqueness and simplicity of Amman city, along with his influence that revised and defined the general form of the contemporary residence in Amman. (Pisani, et al., 2001) Tuqan's significant projects in Jordan included the SOS Children's Village in Aqaba, Jubilee High School and Amman City Hall in collaboration with Jordanian architect Rasem Badran. As well as his residential constructions in Amman such as Villa Rizek, Villa Salfeti, Villa Shalabi, villa Abu Rahmeh, and Villa Qattan. (Abu Ghanimeh, 2011)

4- Villa Qattan as a Case Study.

Along with the architect's notable residential projects, Villa Qattan (Figure 2), which is located in Abdoun, a modern district in Amman, is a representation of Tuqan's unique architectural characteristics. The villa, which was constructed in 1998, combines both modernity and originality. (Abu Ghanimeh, 2011)

2- Villa Qattan, Amman. (Unknown)

It consists of four levels separated according to their function. (Figure 3) The first level includes the kitchen and dining room, and the following level includes the living room and outdoor area. The third level includes two bedrooms, and the other two bedrooms in addition to a living room are on the fourth level. (Pisani, et al., 2001)



3- Villa Qattan first floor plan and section. Pisani, M., Abu Ghanimeh, A. (2001). Jafar Tukan Architecture. (https://arab-architecture.org/db/building/villa-qattan.)

The substantial use of stone in Villa Qattan whether over the exterior facades or the interior space, refers to the continuity between ancient and modernity. (Figure 4) The inner courtyard of the building is an extension of the exterior, the walls and topped arches are covered and paved with local stone.

4- Villa Qattan, Amman. PISANI, M., ABU GHANIMEH, A. (2001). Jafar Tukan Architecture.

Conclusion

To sum up everything that had been noted so far, the application of stone in residential architecture in Amman reflects a deep connection to the city's cultural heritage and environmental context. The prevalent use of natural stone has not only enhanced the aesthetic appeal of residences but also contributed to the sustainability and durability of the structures. As a defining element of Amman's architectural identity, the stone continues to play a crucial role in maintaining the city's unique character while adapting to the contemporary design movements. This research highlighted the significance of preserving and innovating upon traditional materials to ensure the harmonious development of local residential architecture, particularly in Amman.

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https://arab-architecture.org/db/building/villa-qattan

City between the cities
The "architectural" mosaic of the church of Santo Stefano in Umm er-Rasas (Jordan)

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Abstract

This research work analyzes the cities represented in the mosaic of the Church of Saint Stephen in Umm er Rasas in Jordan. These cities are evidence of the presence of topographies - cities, places, captions -, which highlight the architectural features of some cities of Palestine and ancient Jordan, immersed in a timeless Mediterranean. The aim is to digitally redesign the urban characters of each city represented in the mosaic and create a digital and analog model of the single stone scene.

Keyword

Mosaic, Stone, Architectural Element, De-construction, Representation.

Introduction

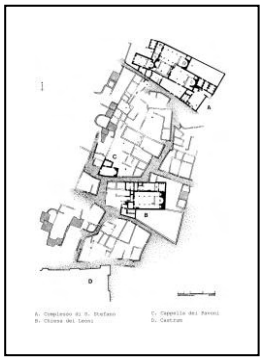
This paper aims to communicate an exploratory method for the transition from a design as a simple two-dimensional representative technique to an analog and digital model, able to express precise contents and to construct and represent them symbolically through sequences of logical operations, which make, through concepts of graphic formalization, intelligible the symbolic use of a given object/figure […][1].

G.G., F. S., L. P.

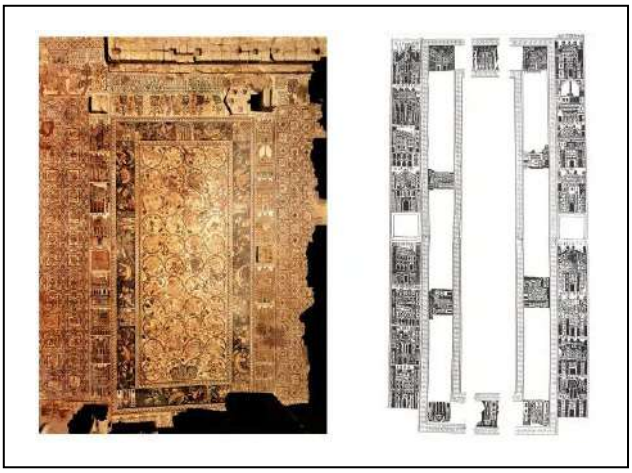
The aim is therefore to give back graphically a new architectural and formal vision of the mosaic floor as evidence of the intense building activity of the area that then included the Jordanian borders. The graphic operation consists in translating the two-dimensional information of the image into a homologous three-dimensional that contains the morphological characters of the urban forms represented in the flat mosaic scene. The work, as already proposed on other occasions of study and research, focuses on the relationship between analog and digital representation, providing *a tool deemed necessary for the coding of a computerised analytical system, aimed at investigating those aspects of particular interest to the disciplines of representation.* A deconstructive analysis of the mosaic carpet with particular reference to the lateral strips of the mosaic. An attempt to understand and communicate the models of cities with the intention of "revealing" the urban morphologies, which are shown in their architectural contents through a careful, *rigorous graphic operation of analysis, criticism, redesign, in a new form oriented to a new clarity useful because transmissible.*

(1) Reference is made to the essay by Ginex G., Stilo F., Pizzonia L. Analysis and representation for digital humanities: la Mappa mosaico di Madaba. Digitalizzazione, analisi, decostruzione riportato in bibliografia in cui si è messa in atto una metodologia simile a quella proposta nel presente lavoro

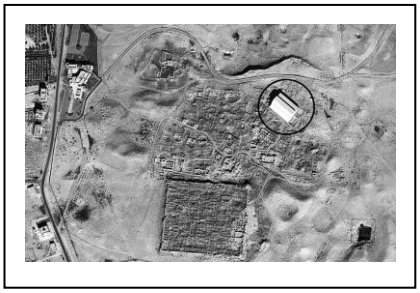
Umm er Rasas, is an ancient Christian-Roman settlement of Jordan whose main group of ruins consists of the Church of Saint Stephen where inside you can admire many floor mosaics. Umm er-Rasās, also called Castrum Mefa'a, is a Roman-Byzantine archaeological site characterized by a military camp where the remains of the church complex of Saint Stephen, the church of Leoni and the chapel of Pavoni dominate. (Fig. 1).



Almost all the architectural remains have mosaic floors, but of high value is the mosaic of the church of Santo Stefano (21 x 10.50 mt), (fig. 2),



in which are represented with essential elements, the cities that once were in this region. Umm er-Rasas is located 30 km southeast of Madaba, between the Road of the Kings and the desert road. A fortified field surrounds the ruins in an enclosed area with walls and *high buttresses* (Fig. 3). In addition to the fortified enclosure the camp has only one access door



on the north side of which are distinguished inside the ruins of the camp from where several arches still standing and emerge also several architraves and columns bearing special crosses. (Photo 1/5).

The ruins of the residential district located outside the walls are presented with a disordered morphology, and «It is *recognized as a basic type in the fabric of Umm er-Rasas the court house (domus) whose dimensions of the elementary cell vary from 5x5 meters to 7x7 meters (..) based on the fence, is characterized by a rectangular perimeter wall (..) with one of the short sides on the road with access".*[2] (M. Piccirillo 1989) The archaeological investigation has shown a large number of religious buildings, still legible in plan and in what remains of the elevation.

Although only the ruins are left of the Roman settlement, what makes it significant is that the Church of Santo Stefano, with its mosaic floor depicting sixteen ancient cities, is still visible outside of the walls. Mentioned in the Old and New Testaments, fortified by the Romans and still by Christians, it represents for the whole geographical area of Jordan a city of considerable importance at the time of the Christian occupation of the Holy Land. The mosaic of the church of Santo Stefano 718 A.D. depicts sixteen large cities on both sides of the Jordan.

(2) Reference is made to the essay by Mangiameli S.: *Kastron Mefàa, city among the cities in the mosaic of the church of Santo Stefano in Umm el-Rasas* published in: In: Mediterranean Spaces and Cultures 4 Construction of an Atlas of the Mediterranean Cultural Heritage. vol. 4, p. 329- 337, Naples: La Scuola di Pitagora editrice, ISBN: 978-88-6542-408-7

The first external excavation was carried out in 1986 by the Studium Biblicum Franciscanum and in particular by the scientific work of the Franciscan friar and archaeologist Michele Piccirillo.

The stone cities represented in the mosaic are *"comparable only to the discovery of the Charter of Madaba in 1897"*. The *mosaicist* in reproducing the stone cities *has inserted a double series of cities of the region.*

To the north 8 cities of Palestine divided into two groups of four: The Holy City (of Jerusalem), Neapolis, Sebastis, Kesaria, Diospolis, Eleutheropolis, Askalon, Gaza. To the south seven cities of Jordan, for a double space given to the first of the series, Kastron Mefaa, followed by Philadelphia, Midaba, Esbounta, Belemounta, Areopolis and Charachmoda. [3]

A representation whose content goes beyond the classic design that highlights with few signs morphological characters, architectural details and distinctive and essential themes of the ancient Mediterranean cities. A sequence of cities that constitute a topographical and architectural ensemble that clearly highlights the type of buildings present in those territories. In the mosaic are also represented in the central part ten Egyptian cities or localities probably immersed in the waters of the Nile, and the sixteen representations of cities placed in the external register of the mosaic. The sixteen cities develop into two groups. The first placed in the left part of the mosaic consists of eight Palestinian cities: *Jerusalem or Aghia Pòlis, Neapolis, Sebastis, Kesaria, diospolis, Eleitheropolis, Ascalon and Gaza.* The second in the right side with other Jordanian cities: Kastron Mefaa, which occupies two squares, Philadelphia, Madaba, Esbounta, Belemounia, Areopolis, Charach Mouba. (Fig. 5)

(3) Mangiameli S. op. cit.

The pictorial realism of urban representations refers to models of mosaic cities also present in the transept of the Byzantine basilica of the church of St. George in Madaba, also known as the Charter of Madaba which has already been analyzed in a previous essay[4] that presents images of cities sometimes realistically connoted as the case of the city of Jerusalem and sometimes in a generic way giving space only to the symbolic nature of them.

In particular, the city of Jerusalem is represented in the mosaic of Madama with a dense sequence of architectural details that connote a clear and evident intention to represent the importance of the site and its strategic function in the Mediterranean area. (Fig. 5, Photo 6)

The representations of mosaic cities denote a refinement of the architectural lexicon and urban spaces. It is a *forma urbis in its overall design* that develops on a unique geometric plan that declares as a whole an idea of *"elected city"* but at the same time real city through its most representative buildings. *An architectural language oriented to represent the iconic weight of the models,* a microcosm that contains a figurative thought in a unified cosmographic vision. Cities are immersed in an abstract space that has no precise cartographic and landscape connotation of reference.

The focus will be on how to represent the *"figures"* in volumetric form.

The elements present in the representations can be summarized in: facades of a temple, in the case of the city of Neapolis or by the presence of a simple column inserted in a courtyard as in the quadrant of Kastron Mefaa. *They are almost all polygonal cities surrounded by turreted walls as in the Hellenistic- Roman cartographic tradition […]*[5] The plan of the buildings is almost always central or basilical and the roofs are mostly domed or sloping. The presence of walls with varying heights persists. Doors and porches play a decisive role. There are also isolated images of buildings with some variations. Towers and colonnades are present in almost all representations.

All elements that allow a first reworking of the elementary data.

Particular emphasis was placed on modelling.

The procedures adopted can be summarised as follows:

- identification of the morphological nature of the Urban Form represented in the card/figure;
- morphological analysis of the hierarchy of the elements existing in the floor mosaic;
- Identification of the "Form", and de-construction of the same as a basic operation to be carried out through a series of consequential phases of work;
- Digital representation of cities;
- Construction of concrete models of individual urban units.

the purpose of the work was to bring to the surface the images *"hidden"* or *"latent"* in the iconographic tiles of the model.

Reflections and objectives of the work:

Unveil the grid, the forms, the architectural structures (formal) through a narrative that reveals its particular narrative charm of the archetypal urban form.

(4) Ginex G. and others op. cit.

(5) Piccirillo M. *Madaba le chiese e i mosaici,* Ed. Paoline, Milan 1989 pp. 293/294

In practice:

We have created models and images that connote how the representation of architecture requires a look that does not stop only at the objective data of the image. the image penetrates through the folds of the material and inside the hidden invisible of the mosaic image, mimicking the geometry, aesthetics and history as n archive that can be used to draw conclusions based on stylistic, symbolic, or functional criteria. All the models analyzed satisfy a repertoire of forms philologically related to the past. The aesthetic perenniality of each model, on the one hand, satisfies a theoretical position towards the method and, on the other hand, represents concretely existing works in which the architectural elements convey the sense of the *founding* formal values of those architectures. the model analyzed in this case assumes the role of *stone artwork* both in the single particular site represented, and in its complex articulated.

Below are the tables of some elaborations with the aim of clarifying the working method in which the original *text* is only a principle of memory of the city represented which subsequently constitutes a unit of measurement of the entire mosaic.

A concrete tectonic and spatial structure is constructed in relation to the specific places depicted in a typological series of urban events to which each scene belongs. The whole stands as a *"source"* and as architectures that confront each other, through their own identity. The dimensional pattern is always the same. The graphic process amplifies the architectural phenomena present in each *"scene"* projecting them into an ideal universe that history and representation will care to bring back to their *"true"* reality.

The narration of the original thus assumes its real completeness, in which the concreteness of the design also takes a problematic form presented only as a theoretical elaboration of an *"idea"*. It is thus a *"second world"* of images to which a new objective existence is attributed. A level shift in which architecture intentionally becomes stone through a continuous increase in complexity. A tangible representation of factors and elements that take on new, more realistic and concrete measurement parameters from mosaic tiles and scenes.

A new representation that is presented in an evolutionary way as a logical architectural structure based on the exercise of drawing that operates in this case as *"unveiler"* of a high combinatorial possibility of the elements of architecture.

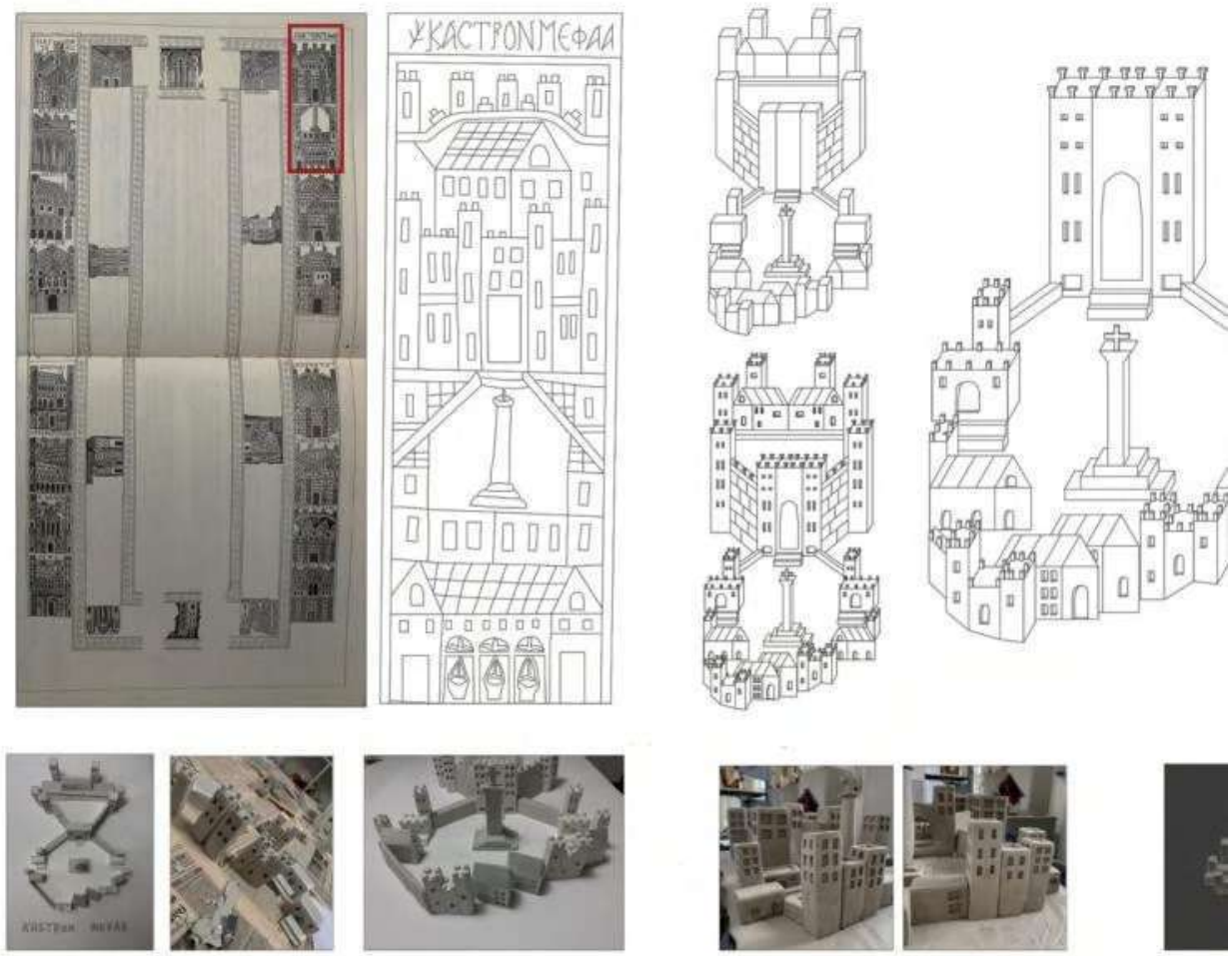
Conclusion

The cities and the elements analyzed are characterized by the inseparable relationship that has been created over time between the territory and the *"shape"* imprinted in the soil that represents it. The analyzed urban plants are legible only in a phenomenological key and can be interpreted as archetypes of the Mediterranean city. Each settlement analyzed in the individual scenes becomes *"morphological synthesis"* as a result of a process of recognition of theoretical places that from a lost integrity have allowed to rebuild a new, such as to make an assembly of fragments intelligible as a unitary urban system distributed in the ground. In this way a correct interpretation of the *"founding"* urban moments detected through an analog device has been found that returns to the mosaic cities an urban dimension lost and recognizable only in its *"genetic principle"*.

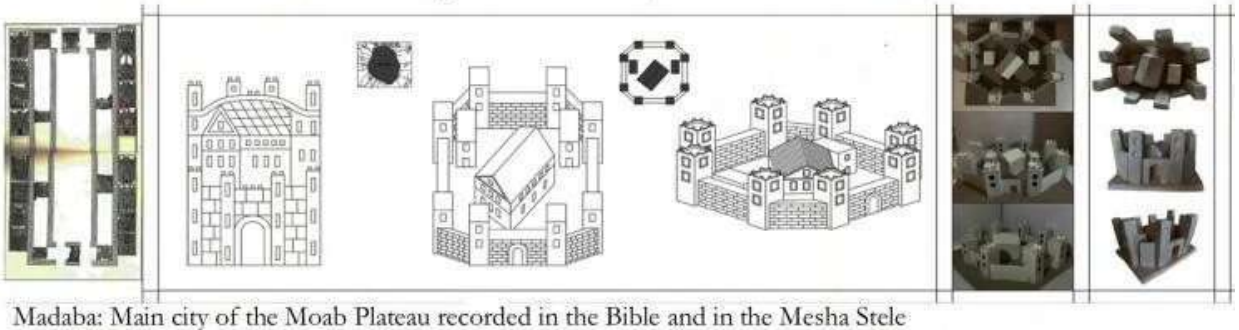
Traces as a synthesis and memory of an urban structure that leaves only its writing on the ground and at the same time leaves a glimpse of a past of urban and architectural forms now swallowed and scattered in the earth[6].

(The tables below illustrate the work that has been done.) From imm. 1 to imm. 5

(6) Refers to the essay: Ginex G. Formal structures and compositional alphabets. Roman urban plants in the desert regions of the Mediterranean, in: Spaces and cultures of the Mediterranean 3 ed. Centro Stampa d'Ateneo, Reggio Calabria 2011. Pp. 301-320

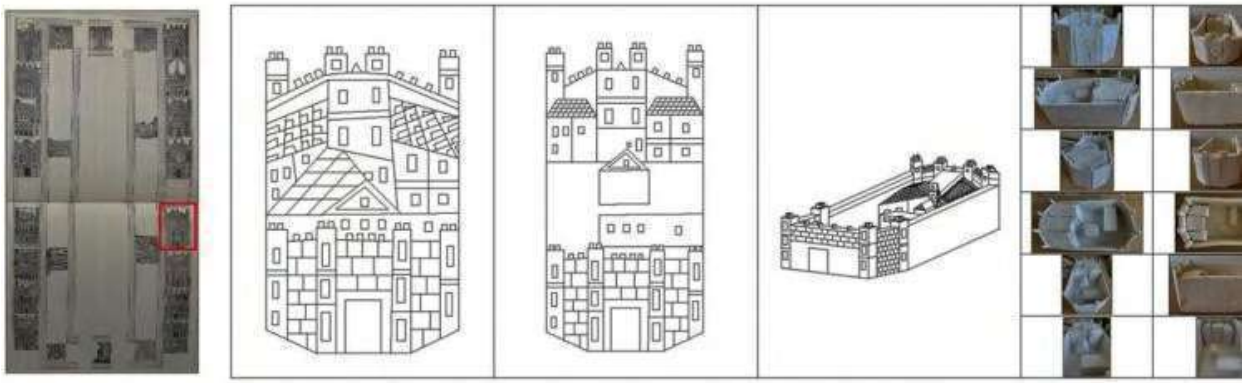


Kastron Mefaa: Ancient name of the city of Umm er Rasas, seat of a Roman detachment

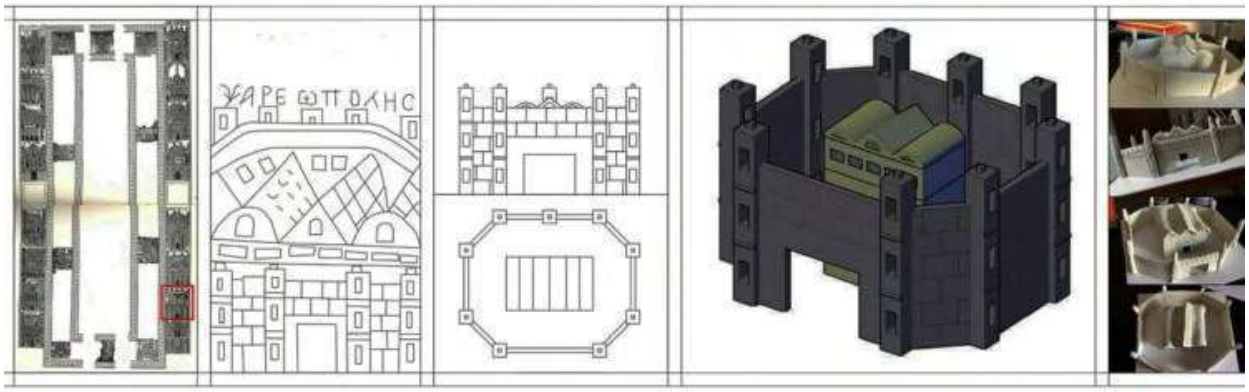


Madaba: Main city of the Moab Plateau recorded in the Bible and in the Mesha Stele

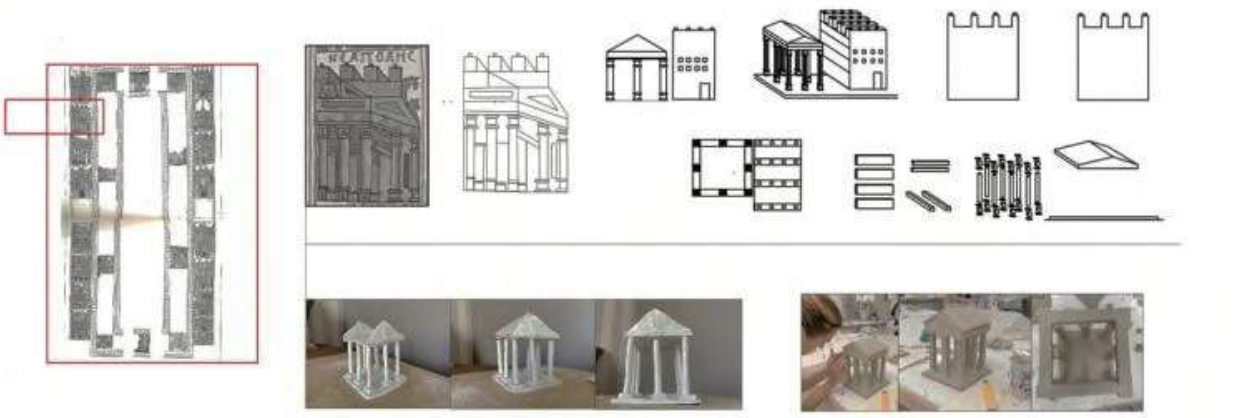
Diaspolis: It was an episcopal city of Palestine



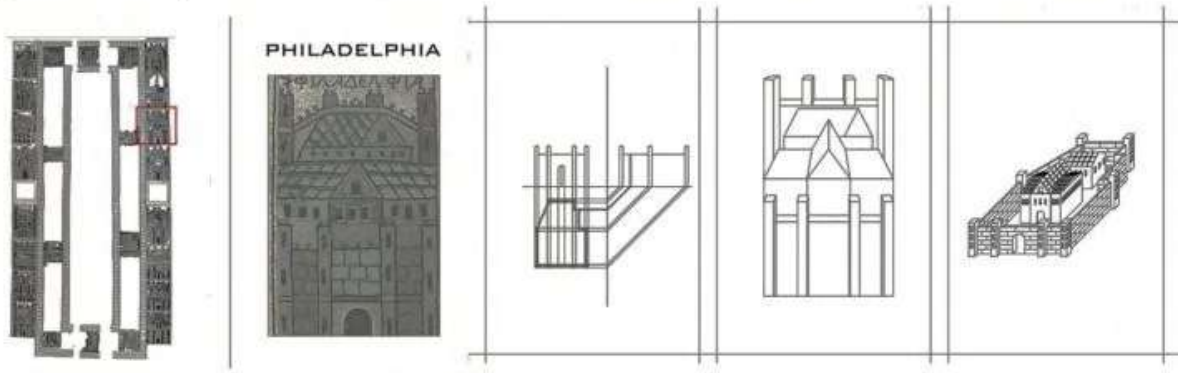
Esbounta: : City of the Arabia Province and episcopal seat in the Byzantine era



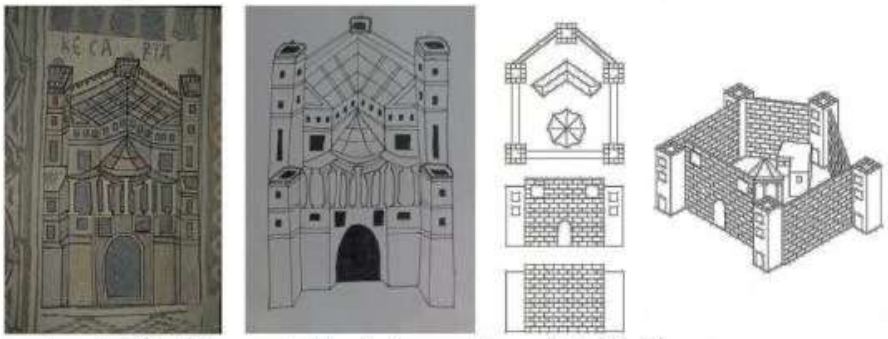
Aeropolis: : Remembered in the Bible as 'Ar Moab. It was a city in Palestine and an episcopal seat in the Byzantir



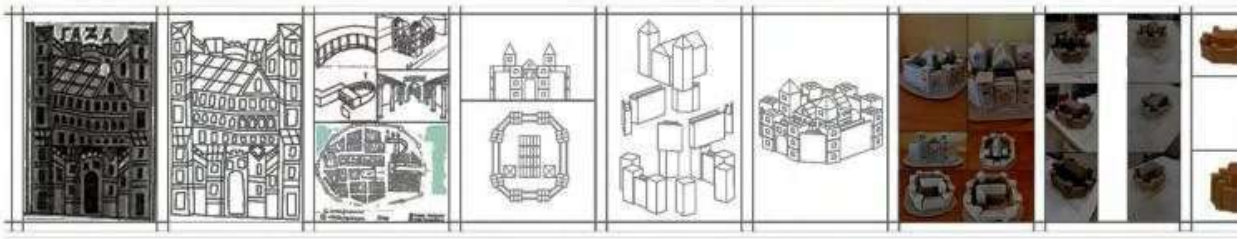
Neapolis: Current Naplous administrative center of Samaria



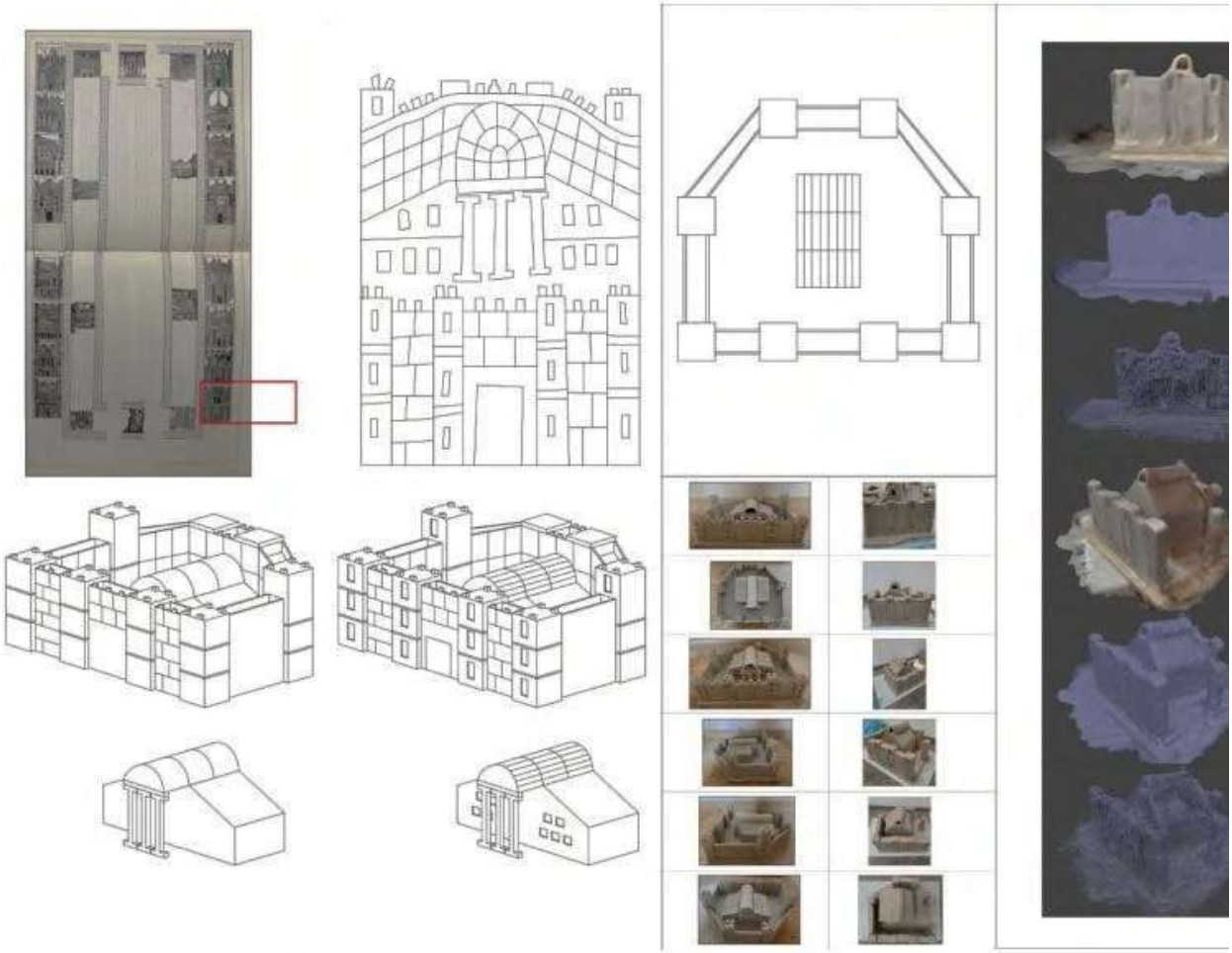
Philadelphia: Ancient Rabbat Ammon, capital of the Ammonites



Cesarea: Ancient Phoenician port on the Palestinian coast. The city became the capital of the Roman province of Judea

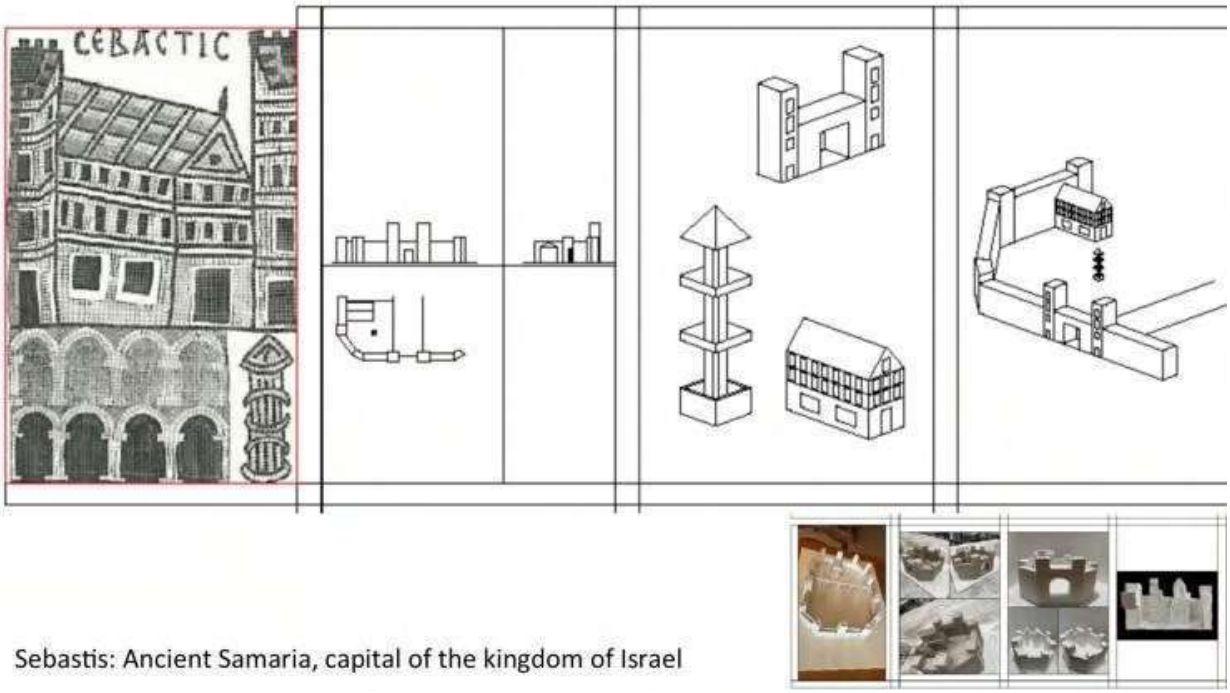


Gaza: Port city on the Palestinian coast on the border with Egypt



Charach Mouba: City of Palestine and episcopal seat in the Byzantine era

Belmounta: Highland village remembered in the Bible with the name of Bet Ba'al Ma'on.



Sebastis: Ancient Samaria, capital of the kingdom of Israel

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The drawings were made by the students of the course.

The graphic material has been reworked for the publication of this paper.

STONE AS ELEMENT OF CONTINUITY

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University of Campania, Luigi Vanvitelli

Abstract

The proposed contribution aims to be a survey of the use of stone in Italian architecture of the 20th century and in particular starting from the 1930s with the arrival of Italian Rationalism. The stone is that of Roman travertine, a material quarried in Tivoli, a few kilometers east of Rome and already widely used in ancient Rome with the construction of famous monuments such as the Colosseum, the Pantheon or Hadrian's Villa itself in Tivoli.

Keywords

Stereotomy, matter, italian rationalism, strictness, history.

Introduction

The last great season of Italian Architecture took place between the two great wars. A season characterized by great experiments, especially on public buildings, which culminates in the so-called "Italian rationalism". These works are almost entirely characterized by buildings constructed with national lithic materials, in particular Roman travertine, but also Trani and Carrara stone, available in different and specific forms. Modern Italian architecture, which also draws heavily from the new repertoire of European forms and spatialities, is characterized by specificities that reconcile it with the Mediterranean characteristics of the places in which they develop.

In the most emblematic buildings, two dominant characteristics seem to emerge, despite the specificity and singularity of the works. The first concerns the aesthetics of surfaces and volumes, the very image of architecture suspended between innovative tensions and rarefied atmospheres of tradition; the second affects, more specifically, the conception of space.

Objectives and results

The wide and widespread use of stone coverings constitutes the most peculiar and original contribution of the research of Italian rationalism, compared to the use of industrial materials or plaster surfaces recurring in the works of the European avant-gardes. The areas of the new architectural language mainly concern the reinterpretation of the traditional elements of stereotomic stone construction such as the base, the wall mass, the architraves and the corner chains. In this action, much of the creative tensions and experimental energy of modern Italian architecture are consumed. The surfaces are rethought and redefined for each individual element. The simplicity is only apparent and the unity of these homogeneous volumes is achieved, in the most complex works, through solutions of refined precision. The connections that are established between the load-bearing framework and the cladding, between continuous walls and openings, between thin slabs and special solid wood elements, between the vertical plane and the ground become the founding themes of the new design logic.

The result is essential and dry architecture, devoid of any rhetorical reference to tradition and yet bearers of an implicit historical continuity, of a refined and modern evolution of the classical conception. Along this direction, the works of Giuseppe Terragni, Adalberto Libera, Luigi Moretti come to life, just to mention the best known and most emblematic names of this historical period. They present themselves in the season of renewal of modern European architecture with creations that are true masterpieces, still capable of speaking to contemporary research today. If the architecture of the European Modern Movement is defined from a constructive point of view

mainly through structural frameworks with pillars, beams, partitions in reinforced concrete and steel which take on an autonomous value, which can be included within spatial organisms, Italian design culture does not eliminate completely the characteristics connected to the wall construction, while engaging in the evolution of the load-bearing wall on the perimeter closing surface. The works proposed below, with private commissions or linked to design competitions, even if with specific peculiarities and inevitably identifying aspects, arise as a line of research and experimentation in continuity with those linked to Italian rationalism.

1 – L. Moretti, Fencing academy, 1934-1936, Rome, Italy

2 – A. Libera, Congress Palace, 1938-1954, Rome, Italy

3 – G. Guerrini, E. Lapadula e M. Romano, Palace Of Italian Civilization, 1939-1953, Rome, Italy

This house is a sculptural object that lives in its relationship with light and the materials of which it is made. Perfect, calibrated, plastic interactions between mass and light generate a direction of dense, defined, safe shadows. A succession of spaces crossed by natural light, stone and exposed concrete: this is an architecture designed by working with light, but also with its shadow typical of Mediterranean environments and architecture. Radiant light has no structure; natural light has structure and here generates space. The project summarizes its strength in a few calibrated gestures; masses that emerge from the subsoil, break through the plate as if a telluric energy were at work here to reveal a space capable of giving its imprint to the whole.

Roman travertine and Trani stone are the materials that strongly characterize the architectural object in its spatial representation and in its relationship with the context.

4 – Double House, San Marcellino, Italy

5 – Double House, San Marcellino, Italy

The five residential units are characterized by a strong material presence which gives the entire organism great rigor and elegance. The materials used, Roman travertine and Trani stone, compose large wall masses, recalling volumes carved into the stone, an architecture with a stereotomic character.
The surrounding wall, on the outside, is covered in travertine slabs.
The flooring on the ground floor is entirely made of trani. There is no distinction of material between inside and outside, but a single mono-material plane.
The volumes on the first floor are covered on the outside with trani slabs.
Even if used as a covering, stone does not lose its material strength and character.

6 – Terraced Houses, San Marcellino, Italy

7 – Terraced Houses, San Marcellino, Italy

The intervention used in the rural area of the province of Benevento at the foot of Mount Taburno is defined by the generating force of the natural and anthropized landscape. The project summarizes its strength in a few calibrated gestures, seeks a possible relationship with the place, looks and lets itself be seduced by the geometry of the mountains, by the telluric force of the rocky material. The elevated parts, strictly made of wood, are founded on stone bases, boulders that emerge irrevocably from the subsoil, almost as if telluric energy were at work, a clear reference to the concept of settlement archaeology. The choice of finishing materials was made with an approach based on the combination of tradition - technology - eco sustainability, in order to propose a product not only of architectural value but which shows high performance for all building components, respect for the materials and materials to be building local tradition, sustainable production, recyclability and boosting the local indigenous economy.

8 – Pascarella's farm, Frasso Telesino, Italy

9 – Pascarella's farm, Frasso Telesino, Italy

Conclusions

This review, made up of works from the 1930s by some of the most important Italian architects of the time and recent works designed and created by the Iodicearchitetti studio of which I am the responsible designer, has served to understand how in reality there is a conductor that binds them, a very precise strategy. Using the tools of modern and contemporary research to return to dealing with the legacy of the past, but ultimately keeping alive a solid concept of architecture, pacified in volumes, resistant to the shocks of time, to the fluctuations of taste and fashion.

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The Conservative Restoration and new life of the historical farmhouses in gray tuff from Campania -Italy

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Abstract

The value of rural farmhouses in the building tradition of the Mediterranean areas, the value of stone, in this case gray tuff, and of lime and pozzolana, the value of the structural system of the farmhouse built to meet the needs of families and their expansion, the area of Italian interest in northern Campania: all this was the work carried out by the Pontinpietra Academy and the engineer Gianfranca Mastroianni in the renovation and conservative restoration of the farmhouse surrounded by greenery, which gave new life to the building and local environment.

Keyword

Conservative restoration, traditional techniques, territories, gray tuff, school construction sites

Introduction

In a geographical context such as that of Campania, in Italy, in rural areas there are many farmhouses that served as homes for families and parents which allowed families and children to live with new families and grandchildren. The house became a family and peasant micro community. In the rural houses of the upper Caserta area the construction scheme was usually the following: living area with room used as a fireplace and kitchen and cellar and material storage and stables, and shelters for animals such as chickens and pigs, often taking advantage of the openings under the vaults. The vaults had the function of carrying the stairs in order to create galleries to access the rooms on the first floor dedicated to the sleeping area: in each room a family slept, husband, wife and children. The construction materials of these types of buildings are gray tuff, lime and pozzolana-based mortar, the roofs are made up of wooden beams and the roofing is made with tiles, the floor, if it exists, is also in terracotta. given by the fact that the soil is rich in clay with the presence in the area of ovens for cooking clay products.
In this article we refer to a specific example of conservative restoration of an abandoned farmhouse, renovated by applying traditional construction techniques and we will talk about the sense of care that such fragile buildings require so that they can find new life and new functions while maintaining their original character, their historical memory. This is the work carried out by the engineer Gianfranca Matroianni and his work group and by the expert knowledge of the local master builders.

The conservative restoration – the historical countryhouse “Le Coste”

The historic farmhouse undergoing conservative restoration is built in gray Campanian tuff and the first group of houses dates back to the end of the 1700s and the subsequent phases of expansion of the building can be seen in the layout of the structure. The structure is on two levels for a total of approximately 400m2 in an L-shaped plan made up of two buildings facing south - and south west - The renovation involved a wing of the L and part of the surrounding annexes. The renovation operations, given the strong level of deterioration of the masonry and the wall system, took place through the care of every single part of the building, with an approach from a building of historical importance and with the desire to recover as much as possible through interventions of sewing and unstitching, removal of the wall texture, cleaning of the tuff stones manually, reconstruction of the

wall texture with lime binder and pozzolana. This attitude to renovation is the intrinsic value of the work carried out, that is, recognizing the construction in its essence and nature and respecting it in the renovation actions, being very careful in adding elements of contemporary buildings and retracing the elements of value of the structure

1 – photo of the existing building before the renovation following the removal of the brambles - north, south, facades.

2 – photo of the existing building before the renovation following the removal of the brambles - east, west facades.

Traditional construction techniques

The wall structure subject to conservative renovation had the main typological elements on which the recovery activities were concentrated:

- Walls in gray tuff
- Masonry arch on the main façade facing south
- Main vault on south-facing façade
- Secondary arches and vaults under secondary stairs on the north-facing façade

Therefore, depending on the characteristics of the masonry and the main construction elements, it was chosen to operate in terms of traditional techniques for the reconstruction of the arches, vaults and wall structure.

The main technique was the dismantling of the stones no longer attached and the reconstruction with new mortar. The recovery of the main vault saw the need to build a wall to support the discharge in height at the corresponding positions at the kidneys of the corresponding arch.

The search for materials most similar to the original construction and the use of disassembly and reassembly processes of the built structure are the two main macro aspects applied to the renovation, without the need to demolish the structure as a whole, but by applying a partial reconstructions for to be able to advance in the reconstruction of the whole, applying traditional construction techniques to temporary intermediate steps and to punctual block construction actions to be able to advance in the whole of the building until complete conservative restoration

3 – steps of the works from how it was to how it was renovated - main facade on the south side.

4 – steps of the works from how it was to how it was renovated - main facade on the south side.

Construction materials - lime plasters - construction techniques

The building materials used for all phases of the renovation were:

- local gray tuff - recovering existing tuff blocks and reshaping them with manual equipment
- construction mortar composed of hydrated lime, pozzolan and sand
- lime and pozzolana plasters
- newly supplied Neapolitan yellow tuff blocks
- wood for roof beams and attic and planking
- clay tiles for covering
- baked clay for flooring
- iron and wood and glass for fixtures, gates and doors
- where necessary – reinforced concrete micropiles. for perimeter sub-foundations

5 – type of existing and used materials: wooden beams, lime plaster, gray tuff from Campania.

Below are the photos of the reconstruction phases of the gray tuff arch, an important element of the main south facade, which due to its condition of having the ashlars no longer attached and its protrusion from the plane of the facade with a notable inclination, it is was removed and restored by repositioning the existing ashlars taking care to make them geometrically congruent for the construction of the arch itself. A work of care, technique and construction skill entrusted to the local master builder Mr. Enzo Di Meo, master for us group of engineers for the construction of the arches and the recovery of the masonry vaults.

6 – the gray tuff arch in its construction phases - south facade.

Conclusions

The approach followed for this conservative consolidation intervention is the very value of the work carried out, the resulting methodology is hoped to become a modus operandi for the various similar farmhouses present in the surrounding areas and in general for the degraded masonry buildings present in the area national and international. .
The applicable methodology can be summarized through the following phases and essential value points for the success of the work:

- Care and respect for the property to be renovated

(first element that must characterize a restoration and restructuring technique)

- The ability to “feel the masonry”, recognize its valuable parts, read its history and the construction phases of the building
- Knowledge of local building traditions
- Supervision of local master builder technicians who have ancient knowledge of local constructions
- The support of modern and contemporary qualified technicians with a systemic approach to the management of renovation works - resolution of complex processes

- The supervision of knowledgeable technicians in the choice of solutions, materials and construction phases
- The sense of care and knowing how to insert as little as possible compared to the existing and only decorations and not ornaments.

Thanks to all this and a lot of will, the “Le Coste Mastroianni” farmhouse has been reborn.

7 – post-renovation south facade.

8 – post-renovation north facade.

Sitography

www.pontinpietra.eu

www.unina.it

THE "STAR VAULTS"

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Abstract

In Puglia, particularly in the provinces of Brindisi and Lecce, there exists a construction system that is largely unknown compared to traditional vaulted roofs, mainly because its use is almost exclusively regional.

The vaults that make up this construction system do not even have a specific name: they are often called "star vaults," a term that directly refers to the morphological appearance of the structures, but it does not adequately describe the extensive range of variations that make the classification and description of this structural type so intricate and complex.

Keywords

Puglia, tuff stone, stars, spigolo vault, squadro vault.

INTRODUCTION

Puglia is a region in southern Italy where many dominations have succeeded each other over the centuries. Over time, Roman, Arab, Norman, and Spanish influences have made significant contributions to defining a structural model that has skillfully blended the experiences of very different cultures and traditions.
The material that made the development of the star vault construction possible is tuff, a sand-lime-conglomerate from the Pliocene and Pleistocene, widely spread throughout the region in various qualities that differ in color, compactness, porosity, and mechanical characteristics. Thanks to these features, tuff is perfectly suitable for solving all architectural and structural problems.
The complex articulation of the *star vault* construction system is evidenced by the existence of two different models: the *spigolo* vault and the *squadro* vault, each with its own morphological and structural characteristics, both deriving from a single and ingenious, yet simple, construction technique. The uniqueness and originality of these constructions, virtually unknown compared to traditional classifications of vaulted structures, result from the skillful aggregation of established models, such as the barrel vault, the groin vault, the pavilion vault, and the sail vault.
The environments covered by these vaults encapsulate the culture and traditions of yesteryear; while the ability of the construction system to respond with remarkable flexibility to a wide range of needs, including climate-related ones, has ensured its development over time.
Since the construction system is confined to a limited geographical area, the nomenclature of the elements that compose it use a local dialect, where many terms are neither translatable into Italian nor English. Thus, the technical terms are faithfully retained in their original language, in homage to a centuries-old tradition.

THE FORMAL GENESIS

The model develops as an organic and flexible solution to the most complex structural problems, representing an admirable synthesis between the Roman coffered vault and the ribbed Gothic vault. From a static perspective, the star vault model lacks the characteristic Gothic ribs that support brick panels, and yet, just like in the Gothic structural model, the resulting static stresses, typical of thrusting structures, are localized at the corners of the environment and not on the load-bearing walls, as happens in Roman and medieval coffered vaults.

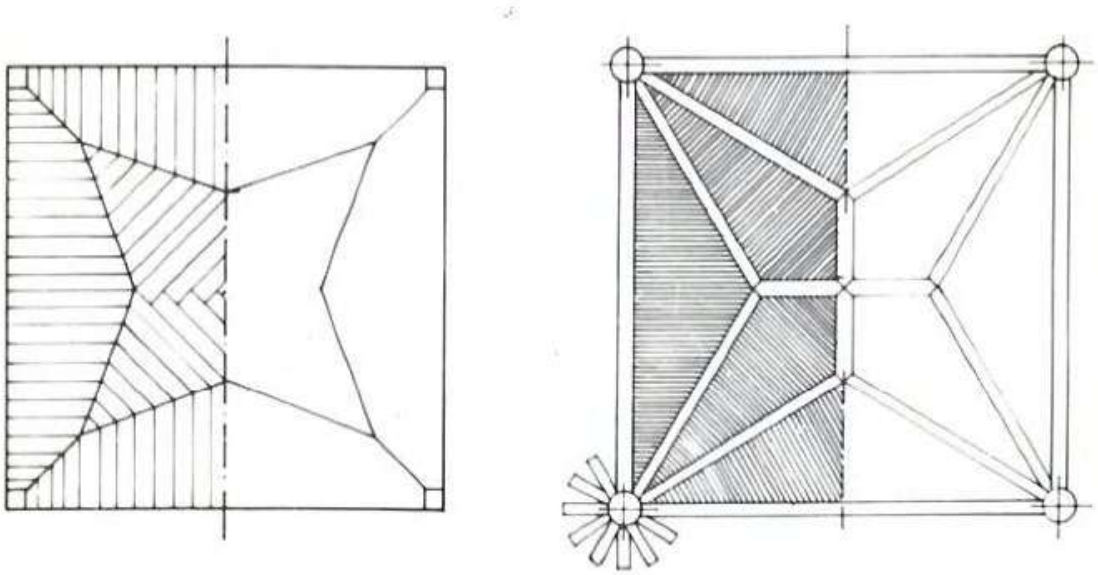


Image 1. Analogies between tuff vault (on the left) and Gothic ribbed vault.

Image 1 highlights the morphological-structural analogies of the tuff vault with the Anglo-French Gothic model. Despite being a coffered vault, the tuff vault shows clear formal similarities with the Gothic vault; although tuff is unsuitable for creating robust ribs, the influences of the Norman vault are evident both in the central panel (called *vela*) and in the points of the star, while in the groin intersections, the traditional French arrangement is respected.
In the following paragraph, we will examine in detail the two structural types of the *spigolo* vault and the *squadro* vault.

THE SPIGOLO VAULT

Within the system of tuff vault constructions, the *spigolo* vault represents the simplest type, both in terms of form and structure. It is a vault designed to cover large spaces by creating point-based structures, meaning with load points on isolated pillars. Due to its characteristics of great formal and structural flexibility, this type of vault was therefore used not only in residential contexts but also in larger structures like factories and religious complexes.
Regarding the calculation of wall thickness at the points of static stress load, a simple formula was used: S = D/4, where the wall thickness "S" was equal to ¼ of the larger chord diameter. However, since the system was designed with an eye toward economizing construction materials, builders employed some refined techniques to significantly reduce the larger chord diameter, thereby reducing the wall thickness; in addition, the presence of adjacent vaults further contributed to reducing the thickness of the wall covering.
From a morphological perspective, the *spigolo* vault is characterized by a four-pointed star, with the points facing the corners where the static stress results are concentrated. Image 2 highlights the morphological characteristics of this structural model.

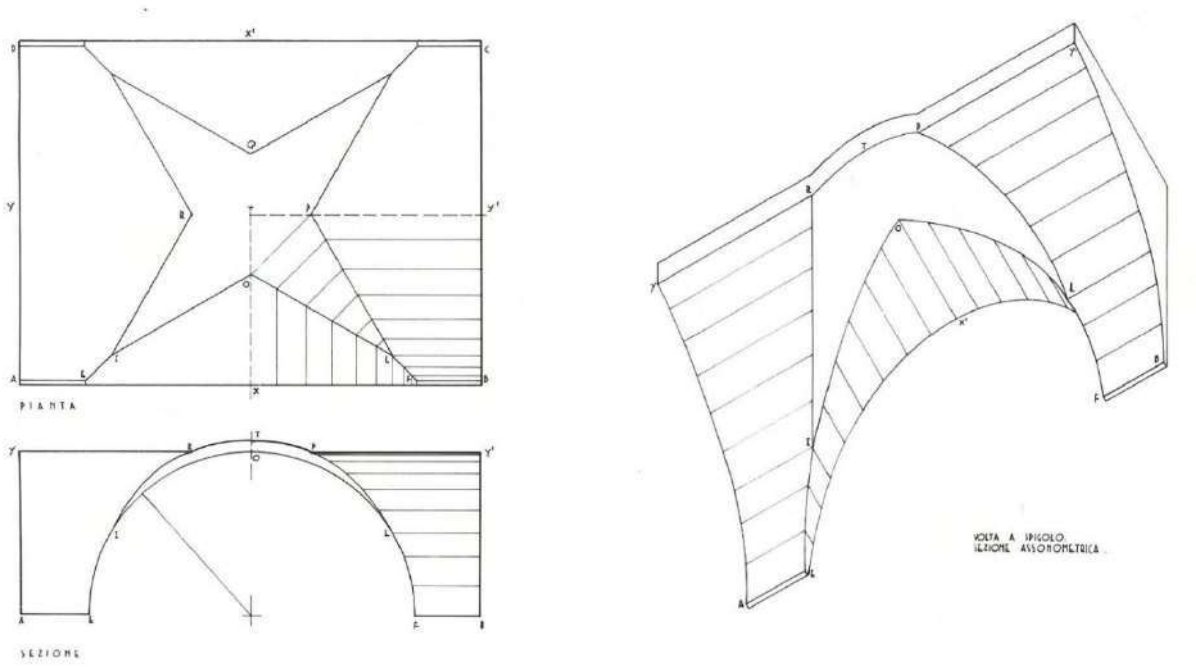


Image 2. Plan, section, and axonometry of a *spigolo* vault.

In the floor plan projection, Image 2 further highlights the arrangement of the tuff blocks. As you can see, the points of the star do not reach the ends of the groin connections that connect to the perimeter wall; the actual vault consists of the central panel, which is a portion of a sail vault and creates the characteristic star, and the groin connections, while the corners connecting to the wall are known as *appese*. The *appesa* is not part of the vault and consists of a number of courses of blocks, depending on the size of the area to be covered: the larger the area, the greater the number of courses making up the *appesa*. To cover a space up to 4 meters wide, for example, there may be *appesa* consisting of 3 or 4 courses of blocks, and each course is called *mano*. Below, in Image 3, is the construction detail of an *appesa*.

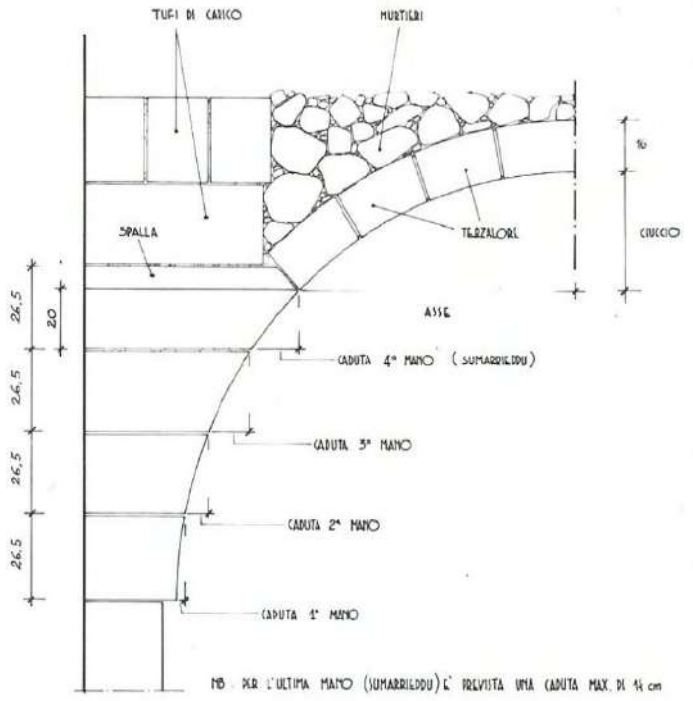


Image 3. Detail of the *appesa* of a *spigolo* vault.

The number of courses required to form the *appesa* is determined by the perpendicular projection of each course. The projection of the last course of blocks, where the shoulder to receive the blocks forming the vault is built, could never exceed 14 cm. The master mason, to this end, would first draw on the wall the required larger diameter and, with that, establish the projection of each course of blocks necessary to build the hanging piece and its number. The projection of each course is defined as a *caduta* (drop). The shoulder block, the one with the greatest projection, is known as the *sumarrieddu*, or little donkey, due to its shoulder-like shape.

THE *SQUADRO* VAULT

The *squadro* vault represents the most complex and evolved model of the construction system. Its morphological genesis represents the refined fusion of three distinct structural models: the groin vault, the pavilion vault, and the sail vault, as highlighted in Image 4. From the diagram, you can see how the final model is a summary of the three different types whose morphological characteristics are easily identifiable in the individual parts that make up the *squadro* vault. In the detail on the right, parts A represents the groin connections, corners B, known as *cappucci*, represent the pavilion vault section, while the central panel C clearly identifies the sail vault section.

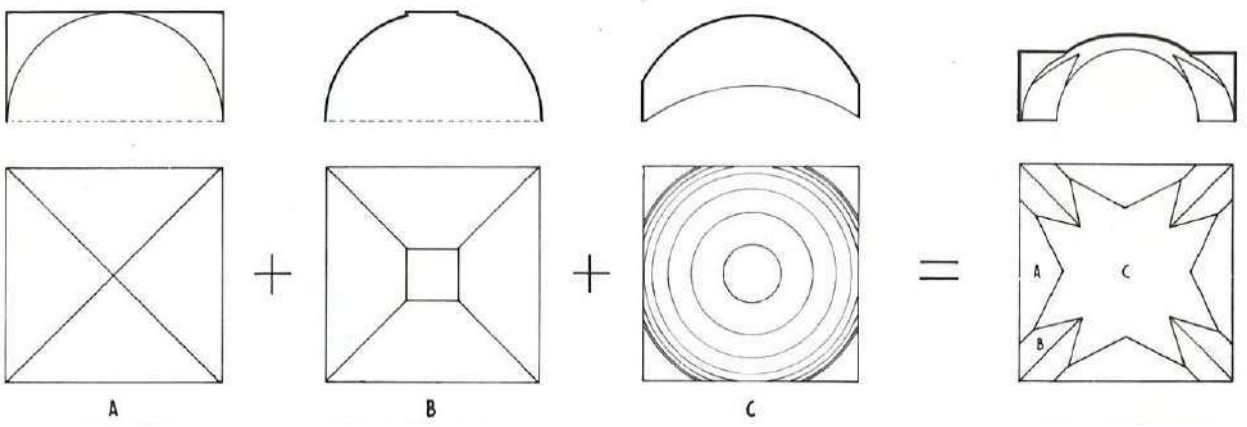


Image 4. Diagram of the formal derivation of the *squadro* vault model.

The *squadro* vault differs from the *spigolo* vault in that, in its floor plan projection, it forms an eight-pointed star instead of four. The high elegance and complexity of the artifact made this type highly sought after; in relation to the quantity of construction material required to create a vaulted space, this structural type required thinner piers compared to the *spigolo* vault, but this advantage was offset by the need for large-sized blocks to create the much more complex *appese*. For these reasons, the construction of *squadro* vaults was primarily intended for more prestigious or representative domestic spaces, or for upper floors where the lower weight provided a significant advantage to the building's structural stability.
Below, in Image 5, the obvious differences between the *appese* of the *spigolo* vault and the *squadro* vault are shown. The axonometry of the *squadro* vaults' *appese*, instead, highlights the integration with the load-bearing wall, of which the *appese* are considered an integral part.

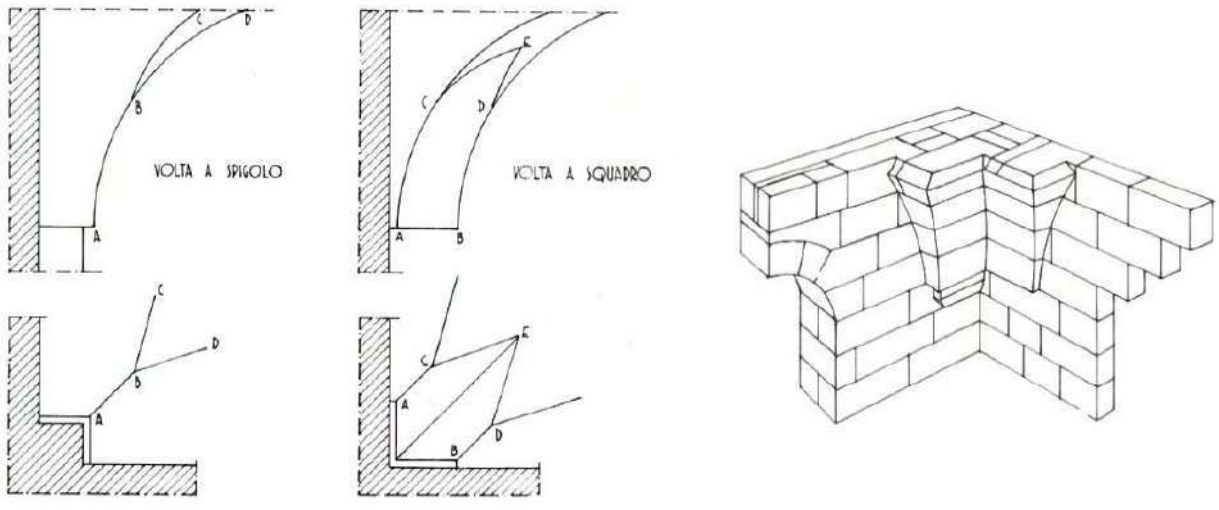


Image 5. Comparison between the *appese* of the *spigolo* vault and the *squadro* vault. On the right, axonometry of the *appese* of the *squadro* vault.

THE CONSTRUCTION STAGES

Below are illustrated some essential stages in the construction of a *spigolo* vault. After determining the diameter of the larger chord arches and, thus, the number of courses required to construct the *appese*, a specialized worker (called *mannara*) proceeds with the creation of the *appese* blocks (Photo 1).

Photo 1: the specialized worker cuts the blocks for the *appese*.

Photo 2: the blocks of the *appese* are positioned in the corners of the wall.

After positioning the *appese*, the shape of the vault's arch is drawn on the wall. Photo 3 shows the use of a very simple centering device, known as *forma*. If the space to be covered has identical dimensions on all four sides, the *forma* can be moved to each side, allowing the vault to close concentrically; in this case, the centering device is called *forma volante* (flying form), as it is moved from one side to the adjacent side until the vault is completed. If the space has rectangular dimensions, there will be two different centering devices: the *forma madre* (mother form), which is larger and draws a semicircular arch, and the *forma figlia* (daughter form), which has the same radius as the *forma madre* but creates a pointed arch and, therefore, a portion of the vault with an ogival shape. Using the same radius ensures that the *appese* always have a 45° angle with respect to the sides of the space.

Photo 3: the worker positions the *forma volante* on the wall to trace the arch of the vault.

Photo 4: once the design is traced, a recess is made so that the blocks of the vault rest firmly on the wall.

After completing the preliminary operations described above, the actual construction of the vault can begin. The blocks that make up the vault are thinner than standard-sized tuff blocks and are known as *terzalore*.

Photos 5 and 6 illustrate the progress of the construction, which is done by moving the *forma madre* from one side to the other, proceeding concentrically toward the closing of the vault.

Photo 5: the *forma* is progressively moved forward as the groin section progresses. At the same time, the side walls are loaded.

Photo 6: the four groin sections are almost complete, and now the sail vault portion will be constructed.

Photo 7: Groin sections completed. Final stage of the vault construction.

Photo 8: the closing stage of the vault, called toppa (keystone).

Vault closing stage.
As you can see, the system takes advantage of the typical coffered system, as the construction achieves complete stability even without the key blocks (known as *toppa*).
This is a significant advantage over the ribbed Gothic vault, where the diagonal arches must be complete to ensure the structural stability of the system.

Photo 9: example of a building covered with large spigolo vaults, without the keystone closure.

Below are images of several *squadro* vaults, where the harmony and evocative effect that light creates on this elaborate structural type are evident.

Photo 10: a squadro vault in a rectangular space.

As can be seen from Photo 10, the *squadro* vault has an eight-pointed star, not four. Additionally, note that the arch along the shorter side of the space is a pointed arch. In the *squadro* vault, the same rule applies, where the *forma figlia*, or the smaller centering, has the same radius as the *forma madre*. As a result, the corners of the *appese* are always oriented at a 45-degree angle to the sides of the space, just like in the *spigolo* vaults.

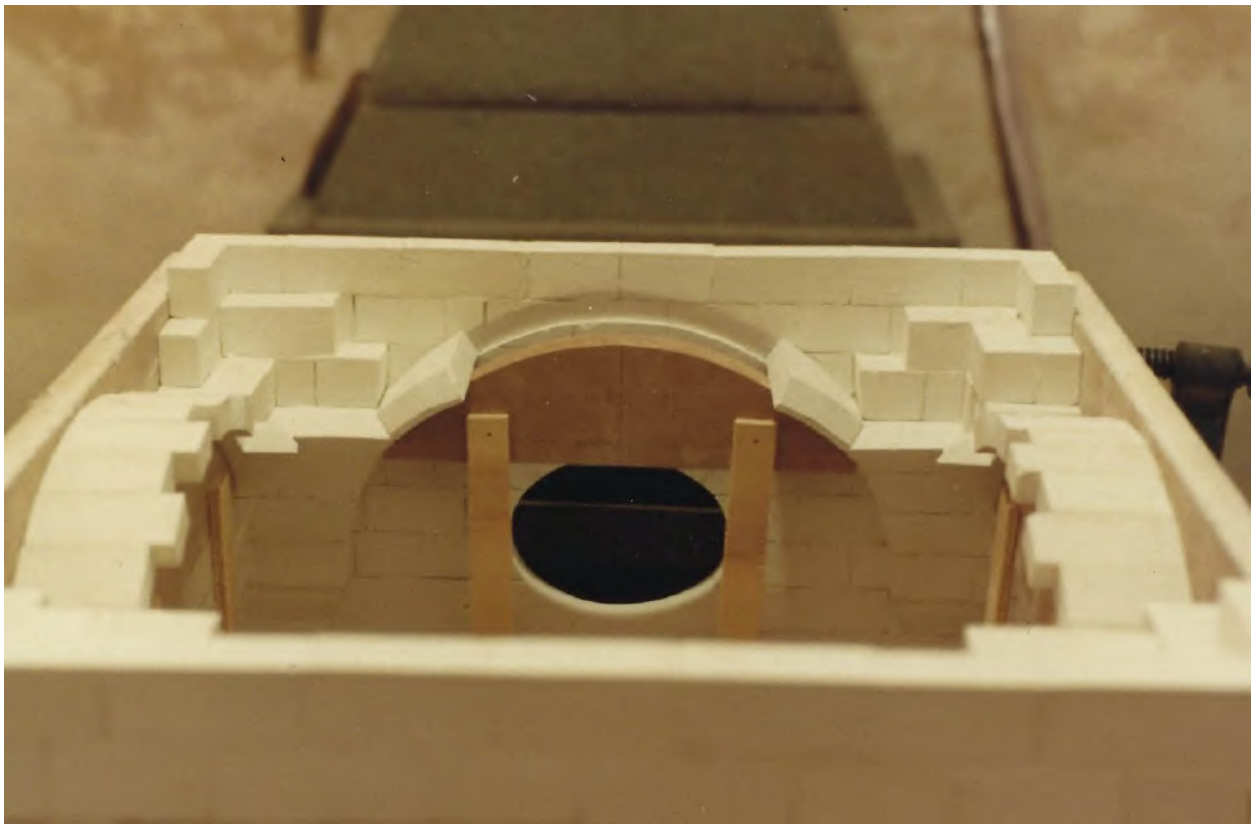


Photo 11: plaster model of a squadro vault.

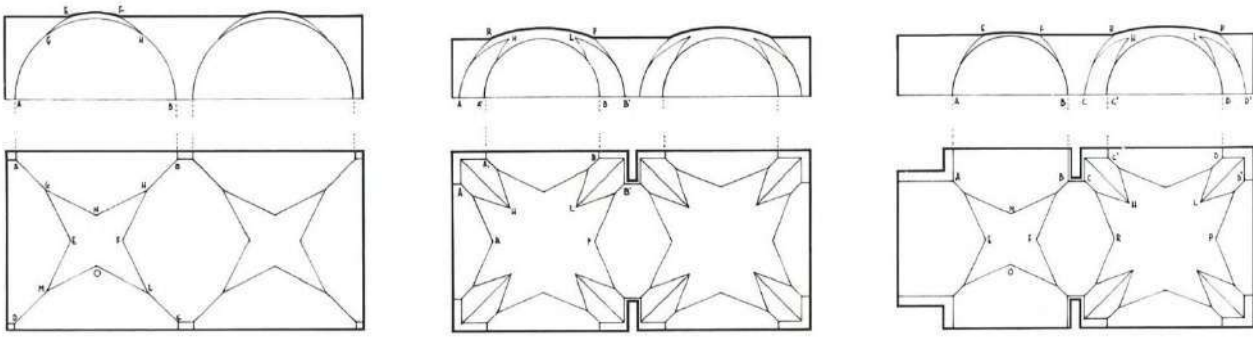
In Photos 11 and 12, showing the construction of a scaled model of a *squadro* vault, you can see the techniques used in its creation, identical to those employed for *spigolo* vaults, except for the additional complications due to the construction of the *appese*, here shaped as pavilion vault corners. The environment depicted in the model is square-based, hence the centering is the *forma volante* (flying form) type.

Photo 12: Model of a squadro vault. Interior detail.

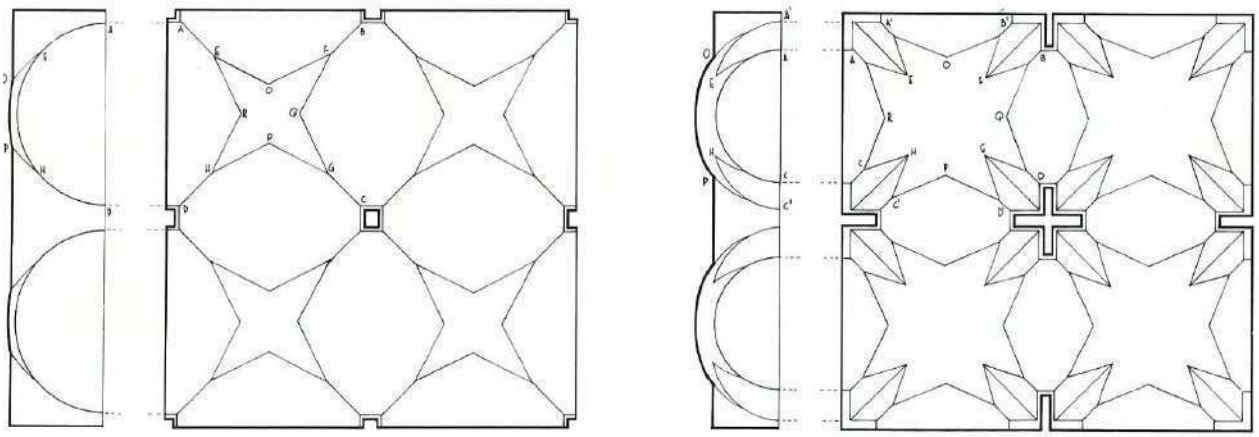
Photo 12 shows the arrangement of the tuff blocks in the *appese* and in the *cappucci*, as well as the placement of the groin sections. Note also how the "squaring" provided by the portion of the pavilion vault, which constitutes the *appese*, significantly reduces the larger arch radius, allowing for a substantial reduction in the thickness of the load-bearing walls.

AGGREGATION EXAMPLES

Below are some examples of the aggregation of the two types.



Drawing 6. Example of aggregation on an elongated plan.



Drawing 7. Example of aggregation on a square plan.

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The Poetics of Stone Architecture in the Mediterranean Realm

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Abstract

Stone has been widely used by the different civilizations that flourished in the Mediterranean Region. Stone has been the primary construction material used especially for institutional buildings such as amphitheatres and temples, and for defining public spaces such as the agora. The old and new wonders of the world in the region including the grand pyramids of Egypt and Petra of Jordan, have been erected using stone. While the latter was not literally built, it was rather carved in sandstone mountains.

Keywords

Resilience, Village architecture, Stone texture, Pattern, Harmony

Introduction

Stone has profoundly influenced the landscape of Mediterranean architecture throughout history. Builders have long capitalized on its distinctive qualities to erect grand structures that endure as tributes to human achievement across the ages. Several characteristics rendered stone as the best choice for buildings throughout history, this is why the Mediterranean civilizations have extensively used stone; the Pharos, the Greeks, the Romans and the Ottomans. It also symbolizes the intricate accord between creativity and the environment. It has been used for construction without the need for transformation or additions. It's carefully extracted and crafted, respecting the delicate equilibrium between conservation and utilization. This fusion results in enduring edifices that encapsulate the essence of bygone and contemporary societies.

Since the early settlement in the Eastern Mediterranean and until the early 20th century, the typical farmer house was built maintaining the standard typology of a single story volume made of heavy stonewalls with a flat earth-covered roof[1]. Stone barrel vault construction was used for large span structures including temples and palaces during the first millennia. Examples are found in Jordan such as Qusayr Amra. Cross vault structure has been the most commonly used type to create symmetrical large spaces that may carry a central dome. While the cupola was less frequently used with central dome erected on flat roof of linear corbel stones. The dome covering the bath space in Qusayr Amra is an example.

Figure 1 Beitiddine, Lebanon. Photo credit: Imad Kayyali

(1) Stone and Architecture

Figure 2 Qusayr Amra, Jordan. Photo credit: Parehen Komok

Figure 3 City walls, Al Quds. Photo credit: Imad Kayyali

Stone in the Eastern Mediterranean is uniquely featured in the local cultures. Where Islam avoids symbolism and spiritual identities to materials, only the Black Stone of Kaaba in Mecca maintained its significance throughout history for its connection to Prophet Mohammed's teachings (PBUH) and beliefs about its origin. Additionally, Muslims desire to visit the Dome of the Rock in Al Quds, featuring a raised rock that the Prophet stepped on to ascend to heavens during the Mi'raj as Muslims believe.

Visual Characteristics of Stone in Architecture

Whether you are meandering in a Jordanian village or a Tuscany mountainous town, you would be taken by the sunny blue sky and scattered dwellings of white facades, with red and green bougainvillea twigs hanging over richly textured stone walls. It is an experience that portraits the mountainous village architecture in many Mediterranean countries where nature beauty and human creativity blend.

Stone encompasses a unique richness of variety that feature different accents and shades due to their mineral ingredients. The aesthetic charm of using stone in architecture is unmatched. The inherent beauty of stone, displaying various natural colors, patterns, and textures, contributes an essence of sophistication and durability to structures. Various stone varieties like marble, granite, limestone, and sandstone each have unique visual features, providing architects the option to choose a color, texture and pattern that fits their design intent and widen the horizon for more creativity.

Figure 4 Beitiddine, Lebanon. Photo credit: Imad Kayyali

Figure 5 Ashrafiya Mosque, Amman Photo credit Rani Sammour

Combinations of stone colors have been used to create variety and to accentuate the facades and flooring patterns, such as the mix of white and pink or grey stone in vernacular architecture in the Levant Region, locally called “Ablaq”. Inside the Great Mosque of Cordoba, poly-lobed and horseshoe interlacing arches were introduced. The alternating stone and red brick interior of this mosque is one of the most picturesque spaces of the Andalusian Architecture in Spain.

Figure 6 Grand Mosque of Cordoba, Spain. Photo Credit: Dr. Rasem Keilani

The different types of stone are naturally formed material that develop over extensive periods due to geological processes, the most common types are: Lime stone, Sand Stone, Marble, Granite, Volcanic stone (of black and grey shades), Rockstone, Basalt stone, Flint stone, Solid stone, Gypsum stone, Porphyry stone, Quartzite, Slate, Travertine, Onyx and Alabaster.

Visual attributes: stone's aesthetic attraction and inherent charm in architecture stem from its distinct colors combined with accent colors, patterns, and textures. Architects leverage these features to craft visually mesmerizing spaces of a timeless elegance, while taking advantage from the enduring durability of these materials. The different stone varieties like marble, granite, slate, basalt, limestone, sandstone and others undergo geological processes spanning hundreds of thousands or millions of years, culminating in their unique shades of colors, shaped by factors like mineral components, sedimentation, and metamorphism.

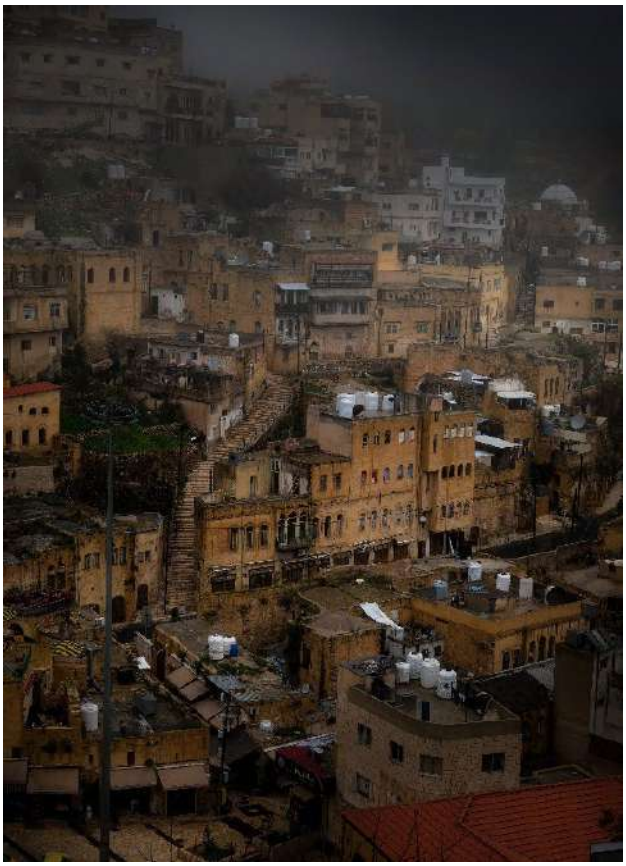

Figure 7 yellow stone architecture, Salt City, Jordan. Photo credit Sami Al-Nator

Stone facades are primarily made of limestone or sandstone. The main hues of them are: beige, cream, grey, light pink, yellow and green shades, with varieties of veining patterns that enrich the stone planes with soft pitch of colors. Designers also experiment using combination of stone and stucco facades to create interesting forms, contrast, and variety. The use of stone and white stucco combination was inspired by traditional architecture, where one material stands for one layer against the other material. In other cases the heavy stone forms the lower part of the wall that carries the lighter stucco parts above.

Figure 8 Amman, City of Limestone. Photo credit: Imad Kayyali

Figure 9 hotel in Petra, a combination of stone and stucco finish façade. Design: SBA, photo credit: Imad Kayyali

Stone façade styles of variable textures and colors have been industrialized to mimic the natural stone. Stucco antique techniques have been widely used in contemporary custom homes in Southern California.

Texture: stone texture has been developed throughout ages using different tools and techniques. The rocky texture has been widely used in the Levant area as stone was quarried from exposed rocks where the surface layer was targeted for its rich and natural look (rocky). When large stone quarries became technically and commercially viable using advanced technologies to extract large slabs, machine cut stone became the standard building material that was produced in standard sizes for the regularly used stone courses' heights. As an outcome, smooth surface stone dominated the last quarter of the 20th century buildings as a raw material, which conveyed mass production, modernity and machine age spirit. The smooth surface has been subject to several techniques to add some texture to re-vitalize the surface using different hammers and chisels of variable sizes and shapes, to create diverse coarse and fine patterns that encompass the shadow-light interaction on the surface. Other techniques have been used to split rocks manually into two parts, to obtain natural-like surfaces.

Marble and Granite: The vibrant hues and patterns found in some forms of stone including marble, granite and slate create visually striking surfaces that ornaments the ambience. Surfaces get different treatments to achieve the desired result, smooth, matt or even rough for a rustic feel. Slate has to have a protection layer to avoid erosion due to friction and maintain a saturated color hue. Marble has the grain element featuring veining patterns where large rocks can offer mirrored patterns when carefully split into two sides, to book-matched marble.

Colors spectrum: Spanning from dark shades of charcoal, dark grey and black to pure whites and creamy colors, in addition to green, red, brown, blue and many others. The color variety is caused by diverse minerals and impurities that form the stone rock. Designers test varieties of types to craft dynamic interplays of color schemes, from cohesive to contrast, evoking particular emotions and styles within a design. Over time, designers have carefully chosen marble hues to cultivate harmonious architecture and interiors, incorporating accent colors in motifs, floor borders, and wainscoting to produce contrasting effects.

Figure 10 Slate and sandstone. Architect: Imad Kayyali

Figure 11 Flooring pattern- different marble types

Harmony with Nature

Stone architecture can seamlessly blend with the surroundings nature in villages especially respecting geology, topography and ecology. It may start with using locally sourced stone for buildings while maintaining the original topography. When it comes to architecture, we can express lighter structural interference, carefully scale masses that blend with the surrounding rock formation in terms of color, stains and pattern. Larger structures can still blend with nature if carefully, sensibly and responsibly designed and erected. Several smaller components can offer flexibility to achieving harmony by coping with the natural contours and stone layers. Small masses can then be composed to achieve the desired size when integrated together. Native plant materials use is essential for landscape design, which would naturally tolerate climate conditions.

Figure 12 Wadi Moussa, Jordan. Photo credit: Imad Kayyali

Cultural Symbolism

Stone has been attached to building traditions in several Mediterranean societies. By time, it became culturally attached to heritage and traditional architecture and values for its endurance associated with stability. This trait of stone encouraged architects to continue using different types of stone to emulate traditional architecture and emphasize its spirit.

Stone walls can be integrated in the interior spaces in addition to the interaction with the protected outdoor spaces including courtyards. The courtyard is culturally an outdoor space that the house and its occupants breathe enjoying outdoor activities in privacy. Stone elements in the courtyard enrich the ambience whether these elements were walls, balconies, fountains or a private covered corner for whispering such as the Iwan.

Figure 13 Stone facades in a private courtyard, Photo credit: A. Laham

In Italy, a village's identity used to be conferred by the architecture typologies and the colors of stone and other materials, however it became easier to ship stone materials from outside using modern transportation recently.

Physical Characteristics of Stone

Durability: Several types of stone used for construction including limestone exhibit intrinsic durability and toughness, enabling stone-built structures to endure over time and present a phenomenal performance in resisting various environmental adversities including weathering. This robustness has solidified stone as a preferred option for creating ever-lasting buildings and monuments, and was used to erect the prominent historical places.

Resilience and adaptability: Stone's resilience is an additional factor that enhances its utility in architectural designs. This characteristic has attracted designers and builders to prefer stone to shape their creative designs. With the ability to be formulated into various sizes, shapes, and patterns, architects can craft a wide range of distinctive and innovative designs from rectilinear to curvaceous.

Figure 14 Contemporary use of stone and glass in facades, Amman. Photo credit Imad Kayyali

Stones lend themselves to intricate detailing, making it possible to create elaborate facades, decorative accents, and sculptural highlights. Furthermore, stone can be seamlessly integrated with other materials such as glass, metal, or wood, providing chances for creative and visually captivating architectural designs.

Thermal traits: Before 100 years ago, load-bearing stone walls were typically present in the stone architecture of the Levant Region as wellas other Mediterranean areas such as the Adriatic region. The construction characteristics of these old stone houses maintained the thermal insulation characteristics of stone, including its performance as a passive energy conservation element. Modern stone architecture use thin layers of stone for cladding backed with industrial insulation materials, lacks these advantages due to the fact that stone high thermal performance assumes a massive thicknesses.

Conclusions

Stone visual richness and superior physical characteristics including its timelessly resistant to aging put it as the common material that has been preferred by the different civilizations that flourished in the Mediterranean Region till today. Stone as a construction material offers tremendous potentials of creative designs for architects, interior designers and landscape architects. Moreover, stone can be used to visually blend architecture with nature, in addition to its thermal insulation and passive energy characteristics that can be revisited to integrate this natural material in our endeavour to create eco-friendly built environment.

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Egyptian Alabaster, Craft of Shaping Mountains from Past to Present

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Abstract

Stone was the most important material used through the long history of Egypt, since Ancient Egypt until Graeco-Roman and Islamic Egypt. Egypt was known as one of the main sources of alabaster in antiquity, Egyptian alabaster is not only recognized for its aesthetic appeal, but it also reflects the multilayered and rich cultural, religious, and technological features of Egypt's history. Moving from the ancient use of Egyptian alabaster in Ancient Egypt, reaching the Grand Egyptian Museum. The following chapter will explore the position of alabaster in Egyptian construction, architecture and identity.

Keywords

Alabaster; Travertine, Ancient Egypt, Mosque, museum.

Introduction

Alabaster is a beautiful translucent stone, widely used to create artistic objects and decorative elements and even in construction, even though using it as building material is limited, that is due its softness, translucency, and luminosity. Alabaster was known in Egypt since ancient times, until today it is used as local material to reflect the Egyptian identity, linking Egypt's glorious past to the desired future.

Alabaster properties:

Alabaster has a solid texture, it comes in different colours, yet it is a creamy white stone in general, usually with grey, yellow, pink or brown veins. Its hardness is low, while the most attractive feature of alabaster is its translucency, its ability to let light pass through it, this varies depending on its thickness and purity, as alabaster can transmit up to 80% of light. This quality gives it a luminous appearance, so it gives alabaster a soft glow when it is carved into decorative objects, or architectural elements. This unique quality has made it a popular choice for creating unique artworks throughout history, and making it ideal for creating lighting elements, such elements that generate warm and diffuse light. The most prized and commonly used type of alabaster is the white variety, known for its purity and ability to transmit light effectively.

Natural alabaster – Modern alabaster lamps

As a material, Alabaster is a relatively soft and fragile compared to other stones commonly used similarly, like marble or granite, this means it is highly workable, but proper care and handling are necessary to preserve its integrity and prevent damage. Alabaster is a lightweight material, so it easier to transport, handle, and incorporate into architectural designs compared to heavier stones. It also exhibits good sound-absorbing properties, which make it useful in applications where acoustic control is desired. It is inherently fire-resistant. Alabaster is generally stable under normal conditions. But it can be susceptible to environmental factors such as high humidity, temperature fluctuations, and exposure to chemicals, which may impact its long-term stability and integrity.
"Alabaster" name is derived from the Ancient Egyptian word *alabaste*, which refers to vessels of the Egyptian goddess Bast. Greek word "ala*bastros*" it used to refer to a vessel which used to hold perfumes, the word "*lapis/ alabastrites* "was the ancient Roman name for the stone, the ancient *"alabastrites"* (after the alabastron jars) is the origin of the petrologically name of "alabaster". Today, the word "alabaster" which is defined by geologists, refers to a variety of gypsum rock.

Ancient civilizations used alabaster, Such as Mesopotamia, Ancient Egypt, and Ancient Greece and Rome. The historical significance of alabaster lies not only in its aesthetic appeal but also in its cultural, religious, and symbolic associations. It also reflects the technological advancements of civilizations over time.

Historical alabaster works, "Saint Holding an Open Book" 16th century(the Louvre Museum in Paris), 1499 - The Cardinal Mazarin staircase 1660, Spain

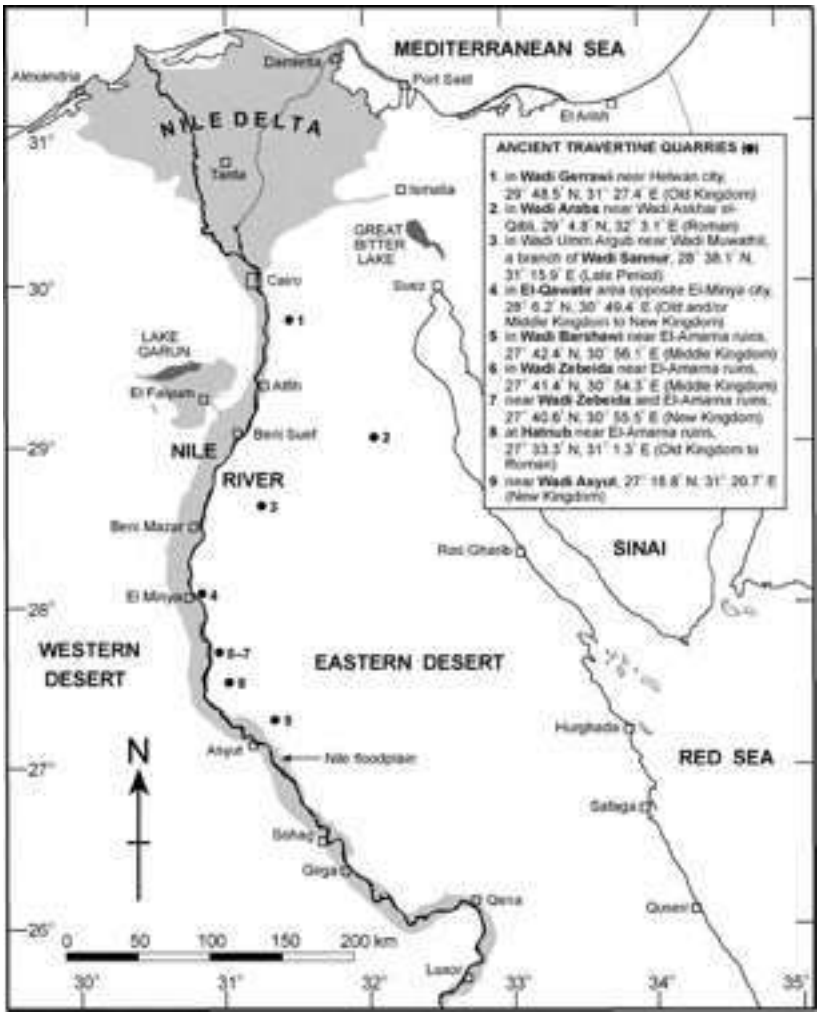
Today, Alabaster is found in various parts of the world, but the main deposits are in Spain, Italy, Egypt, Mexico and the United States. It is still valued by artists, sculptors, and craftsmen for its unique properties, and is still used in various forms, including blocks, slabs, and powder, and can be carved, sculpted, or turned on a lathe to create a wide range of artistic and decorative objects. Also, alabaster finds its place in architectural applications, particularly for its ability to transmit

light. It can be used as wall panels, lighting fixtures, and translucent windows, where its ability to diffuse and transmit light adds a touch of elegance and beauty to interior spaces.
It is essential to ensure the ethical sourcing and sustainable use of alabaster to protect the environment and support responsible mining practices.

Using Alabaster in modern interior design

Egyptian Alabaster (Travertine)

In general, alabaster is a form of calcium sulphate or Gypsum. Beside Egyptian rock gypsum, most of Egyptian alabaster is mineral calcite and not gypsum, so what is commonly called “alabaster” would be usually the travertine, a translucent shelly calcite rock, resembling real alabaster, but free of gypsum. The Roman occupants linked it to the gypsum rock from the vicinity of Volterra, Tuscany. While international petrography alabaster stands for the gypsum ferous variety and ‘‘travertine’’ for the Egyptian rock type. Egyptologists defend the lithological term Egyptian Alabaster or even calcite-alabaster.
The genealogical primacy rests in the Egyptian calcite rock, the general nature of travertine leads to a different appearance from the Egyptian rock as it is not translucent and was never used in ancient Egypt. Thus, the Egyptian travertine is commonly referred to as alabaster in the Egyptological literature, Egyptian alabaster, or Oriental alabaster, “calcite- alabaster” or simply “calcite”. It is massive fine-grained amber brown. Since ancient times, Egypt has a rich history of alabaster production. Egyptian alabaster is renowned for its purity and translucent qualities.



Locations of ancient quarries

The Egyptian alabaster was quarried by the Ancient Egyptians at numerous locations, most of its quarries are in the Eastern Desert, are within 25 km of the Nile Valley. Egyptian alabaster occurs as secondary veins and pods in the limestones of the Mokattam, Samalut, and Minia formations (check the map). The most famous alabaster quarries in Egypt are located at Hatnub, although smaller sources between Helwan and Asyut were exploited in ancient times.

Alabaster in Ancient Egypt:

Due to its beauty and translucent character the Egyptian alabaster had an irresistible attraction Since Ancient Egypt and until Graeco-Roman times, alabaster was employed in artistic and architectural elements. In ancient Egypt, alabaster was considered a precious stone, The ancient Egyptian name for travertine is Ss *(shes)* and, in the Old Kingdom, bit (bit). Alabaster was a prestigious material employed by the ancient Egyptian artisans. The natural variations in the stone's appearance were utilised to enhance the finished products.

Tablet for 7 oils from the Old Kingdom – Ancient Egyptian jar from the New Kingdom Museum of Fine Arts, Boston

Alabaster was used to make a variety of decorative items, they created ritual objects, and for different funerary purposes, vessels and the famous alabaster canopic jars or which were used to store the internal organs of the deceased during the mummification process vases, bowls, sarcophagi.

Hundreds alabaster vessels were found in the labyrinthine galleries below Djoser's Step Pyramid at Saqqara, and. Most of them were undecorated but had elegant carved forms ranging from tall cylinders to wide plates. These were made using hand powered drills with copper blades that cut and carved out the interiors, museums around the world are now filled with good examples.

A group of stone vessels from a tomb at Haraga (MET museum) – An ancient jar (Risd Museum)

In architecture, it was one of the stone most employed in subsidiary building, lining passages and rooms altars, temple pavements, column, pilasters, socles, portals, and even colossal statues out of alabaster. It was used to create colossal statues, one of the main statuses symbols as presents of the kings to the gods.

Alabaster was also employed in the construction of temples, such as the Temple of Luxor, where it was used for pillars, wall reliefs, and statues. One of the used examples in temple pavements, in the funeral chambers beneath Djoser's pyramid, in Sakkara. Constructed by King Khafre (ca. 2545 b.c.) The valley temple which connected the Nile River to the king's pyramid complex, the walls of the temple were lined with polished red granite while the floor is paved with gleaming alabaster, the red and white contrast would have made for a striking entrance to the sacred space.

A restored colossus of Mykerinos' mortuary temple at Giza (2m35 in height), Old Kingdom – The valley temple of King Khafre (ca. 2545 b.c.),

The alabaster from ancient quarries (Wadi Gerrawi, Wadi Araba and El- Qawatir) were used in the sphinx of an unknown Eighteenth or Nineteenth Dynasty (New Kingdom) king at Memphis, and the two alabaster barque shrines for the Eighteenth Dynasty Kings Amenhotep I/ Thutmose I and Thutmose IV in the Open-Air Museum at Luxor Karnak Temple.

Islamic Art:

Alabaster holds a prominent place in Islamic art and architecture. It was used in the construction of mosques, palaces, and tombs, where it was carved into intricate geometric patterns and decorative screens like the *mashrabiya.* It was also employed for the creation of lanterns, which were usually adorned with calligraphy.
In Egypt, after the end of the pharaonic period, there was not a lot of mention to the Egyptian alabaster. Yet it was still known and used in Mamluk architecture. In general, in Islamic Egypt, it was used in small objects particularly for small vessels. This changed with Mohamed Ali Basha, who adorned his mosque at the Citadel of Salah El Din.

The Alabaster Mosque

As the mosque is an institution as old as Islam itself, it did not only play a role in shaping Muslims' experiences but delivering political messages as well. Mohamed Ali Basha used to make his statement of modernity and nationalism at the beginning of the 19th century, through a building acting as a historical narrative. The nineteenth century was a significant time of change in the modern Egyptian history, after France's departure from Egypt in 1801 and Sultan Selim III's reluctant recognition of Muhammad 'Ali as the governor *(wali)* of Egypt in 1805.

Muhammad Ali built his mosque atop of the Citadel of Cairo, the mosque stands proudly above the city, visible from all directions, it was made to be an architectural representative of his power over Egypt.


The Alabaster Mosque (1830 -1848)

Mohamed Ali originally commissioned a French expert, Pascal-Xavier Coste to design the mosque, but Coste's design was Mamluk in style and coordinated with the existing architectural landscape of Egypt. Yet, Mohamed Ali rejected it, he wanted the design as an act of rebellion." Al-Asad argues that by building a mosque in the imperial Ottoman style, Muhammad 'Ali "*expressed his equality with his overlord in an unambiguous way*". It is an imperial mosque, where Mohamed Ali was buried, with it, he challenged Istanbul much in the same way that he did militarily.
The existing mosque architect was Yusuf Bushnak , his design model was the Sultan Ahmed Mosque (the Blue Mosque) in Istanbul. This style empowered by the minarets and multiple half-domes surrounding the central dome, it was to serve the authority of the Ottoman Sultan, a declaration of de facto Egyptian independence.
This mosque was a radical break from Cairo Mamluk architecture. Now it is the most visible of Islamic monuments in Cairo, Muhammad Ali›s Mosque became a symbol of the city, even if it is the least Egyptian of these monuments. The architecture is entirely Ottoman, the decoration of the building is alien to Cairene traditions, there are no stalactites, geometric shapes or arabesques. But there is Egyptian alabaster. Alabaster was used to panel both the lower interior and exterior walls of the mosque. The main material is limestone, but Alabaster was extensively used in the mosque, especially the forecourt, as the Lower story and forecourt are tiled with Egyptian alabaster panels up to 11,3 m. Alabaster was brought from *Wadi Sannur* site, y it lies at 70 km south-east of Beni Suef. It has approximately 13 quarries of alabaster. This stone typically consists of thin bands of milky to creamy white, opaque calcite alternating with thicker bands of brownish. The mosque is now known as the Alabaster Mosque.


The Alabaster Mosque (1830 -1848)

Why was Egyptian Alabaster chosen?
Alabaster has a long and deep history in Egypt. It was widely used in the Egyptian architecture, employing Egyptian suggests that alabaster rooted Muhammad 'Ali's Mosque in Egypt, it was how the land of Egypt impressed itself upon the mosque. Formally, Muhammad Ali's Mosque may have appeared alien, but the material carried deep Egyptian resonances.

Alabaster Walls (Interior -Exterior)

Alabaster in Contemporary Egypt

Some argue that contemporary industry is probably different from that in ancient times, after a decline of about 2,000 years, with the alabaster production reviving in the early 19th century. But some would argue back that this trade did not vanish, it had passed on from one generation to the other. As the case in *Gourna,* in Luxor, next to the Mortuary temple of Hatshepsut, where the whole town would work all day manually with *El-Manad,* before they started using the machines in cutting the stone in the 70s. Today workshops exist even in the heart of Cairo where alabaster is brought by trucks from Assiut, Suez, Arish and Minya, then it is cut into squares and work on it.

Worker using small pieces of sandstone to give a final smoothing to a vessel in 1972- Alabaster tourist trade today.

Historically, the Egyptians had not mined more than about some hundred thousand tons of the Egyptian alabaster. Recently, new occurrences appeared, 10 km west of Qurna has been opened, delivering the raw material. It is mainly used for tourist attractions such as small figurines and vases, and sometimes artificially altered to give the impression of the Egyptian antiquities.

The Grand Egyptian Museum (GEM)

This museum is an archaeological museum - under construction- in Giza plateau, about 2 kilometres from the Giza pyramid complex. It will be the home of artifacts spanning Egypt's storied past, hosting over 100,000 artifacts from ancient Egyptian civilization, including the complete Tutankhamun collection, and many pieces will be displayed for the first time. With it a new image of developing Giza plateau is rising.
The design of the building was chosen through an architectural in 2002, the organizers received 1557 entries from 82 countries, making this coemption the second-largest architectural competition in history.
The monumental project in Cairo, the Grand Egyptian Museum is, designed by the Irish firm Heneghan Peng Architects, the design echoes the timeless grandeur of Egypt's iconic pyramids.

The Grand Egyptian Museum

The design of the museum utilizes the level difference to construct a new "Edge" to the plateau, a surface defined by a veil of translucent stone that magically transforms from day to tonight.

The focus of the Grand Egyptian Museum (GEM) façade is to express Egyptian civilization using all its elements. the museum's stone façade integrates into the surrounding landscape.
The façade includes seven pyramids, a number that has held significant meaning throughout Egyptian history. The use of illumination to link the earth to the sky through light, a fourth dimension was introduced.

The eastern façade of GEM is divided into three parts, two of which contains three pyramids. A seventh transparent pyramid is located on the façade facing north toward the Giza Plateau. The main entrance featuring a triangular opening made of locally sourced alabaster, as one of the main features of the museum is the translucent stone wall, made of pure alabaster, making up the front facade of the building. The striking façade changes from day to night, reminiscent of the sands in the surrounding context.

The Grand Egyptian Museum

Egyptian local materials such as Alabaster are used in the cladding, employing eternal symbols to characterise our ancient civilization, this pyramid represents the continuity of Egypt's pioneering influence from antiquity to the modern day.

The Grand Egyptian Museum

The Grand Egyptian Museum

Conclusion

Egyptian Alabaster is relatively well rooted in Egyptian identity. Moving from its sacred use in Ancient Egypt to our present, it is the one of the perfect elements to use to deliver nationalism, uniqueness, and modernity.

As a craft, It may disappear as a craft or at least be mechanized, but alabaster carving will remain a thriving art in Egypt, produced mostly for the tourist trade, providing a taste of Egypt magical heritage.

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Echoes of Stone: Stone as a Storyteller in Jordanian Architecture. Introducing villa concept designed by Majida Naser Shwayat.

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Abstract

The architectural landscape of Jordan is an intricate mosaic of geological diversity of the region and the historical layers of its civilizations. This paper explores the integration of locally sourced stone by introducing a case study of this concept through the construction of a unique villa by Architect Majida Naser Shwayat, highlighting how these materials reflect both Jordan's natural heritage and its cultural identity. Through an examination of the villa's design, which merges traditional stonework with modern architectural elements, we analyze the psychological and environmental impacts of using stone, thereby underscoring its role in sustainable architectural practices.

Keywords

Jordan, Stonework, Mediterranean Architecture, Sustainable Design, Cultural Heritage.

Introduction

Jordan, situated at the crossroads of the Mediterranean and Middle East, serves as a profound testament to the historical civilizations that have flourished on this land. Its rich geological diversity—from deserts and mountains to plains—provides a unique backdrop for examining the architectural interplay of notable civilizations such as the Nabateans, Greeks, Romans, and Islamic caliphates. Stone, a plentiful natural resource in the region, has been integral to Jordanian architecture, reflecting both the utilitarian needs and aesthetic preferences of these societies. This paper explores the historical significance of stone architecture in Jordan, highlighting how each era's technological and cultural advancements have left an enduring architectural legacy. Additionally, it introduces a modern architectural endeavor that embodies the essence of these historical influences, showcasing the adaptive strategies of Jordan's people to their environment through time.

The Geological and Historical Context of Jordanian Architecture: A Stone-Centric Perspective

Jordan's diverse geological landscape has not only provided a rich palette of stones pivotal to its architectural heritage but also served as a canvas for the historical interplay of civilizations that shaped the region. This section explores the architectural identity sculpted by different types of stone over millennia, highlighting how each period utilized specific stone types and distinctive designs, thus laying a foundation for understanding the evolution of stone use in Jordanian architecture from ancient to modern times.

Sandstone Era: The Nabatean Legacy (312 BC - 106 AD)

The Nabateans, renowned for their hydraulic engineering and architectural finesse, prominently used the vibrant red sandstone available in southern Jordan to carve the city of Petra. This iconic site exemplifies the Nabatean mastery of stone carving, serving both religious and residential purposes while integrating seamlessly with the harsh desert environment. The intricate facades and expansive tombs, featuring classical motifs and detailed columnar carvings, underscore their sophisticated stone carving techniques, epitomizing Nabatean engineering and artistic prowess. (Taylor, 2001)

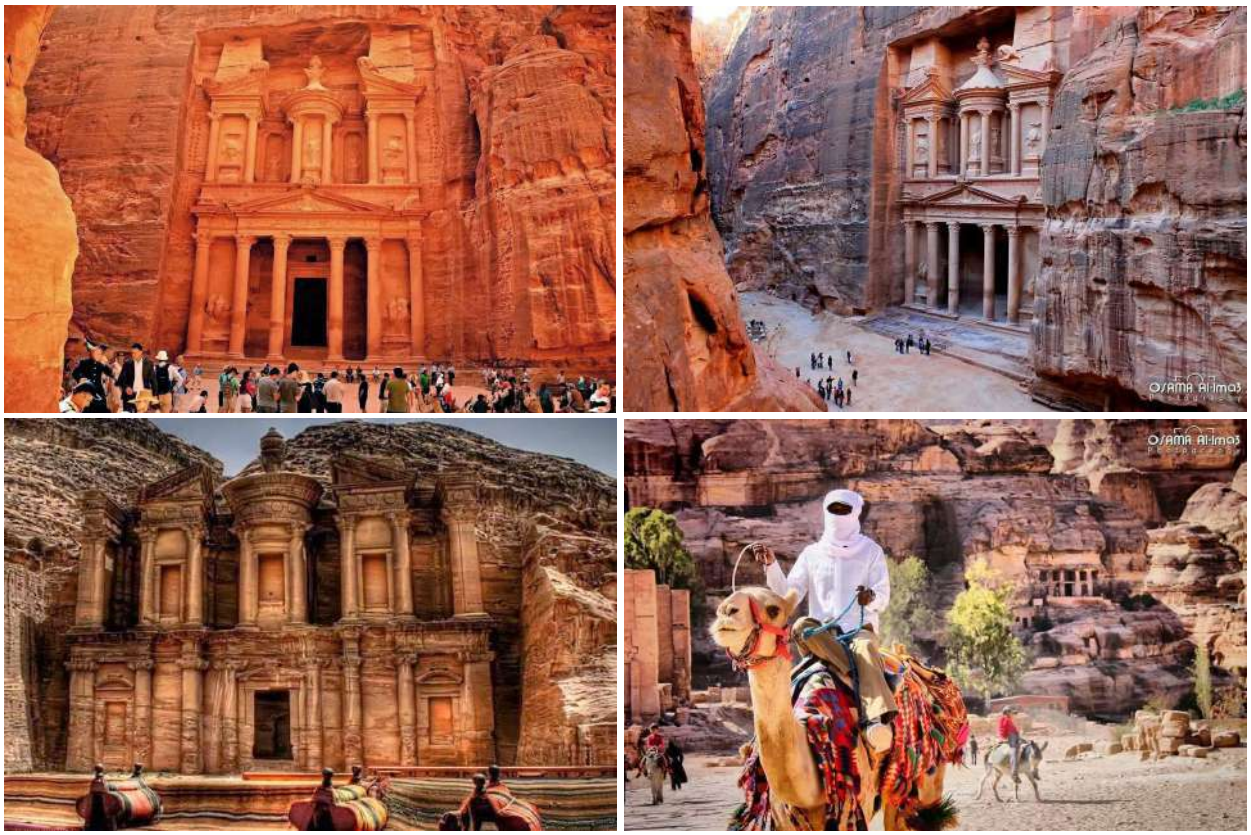

Figure 1 Nabatean Petra Architecture. Petra-Jordan.

Limestone Period: Greco-Roman Influences (63 BC - 4th century AD)

Following the Nabateans, the Greeks and then the Romans made significant architectural contributions to Jordan, prominently using locally quarried limestone. The ancient city of Jerash (Gerasa) stands as a testament to this era, where colonnaded streets, grand temples, and theaters showcase the classical Greco-Roman architectural styles that emphasized symmetry, harmony, and grandeur. Architectural elements such as Doric, Ionic, and Corinthian columns, along with detailed capitals and entablatures, illustrate their appreciation and adaptation of Jordan's limestone to their monumental architectural styles.

Mosaic and Structural Stone Age: Byzantine and Early Islamic Periods (4th century - 10th century AD)

The Byzantine period was marked by the extensive use of stone for constructing churches and monasteries, characterized by detailed mosaics and domed structures. As the region transitioned into the Islamic period, the architectural use of stone evolved to include the construction of mosques and madrasas, emphasizing durability and the aesthetic qualities of stone. Notable structures from this era, such as Qasr Amra, highlight the use of both structural stones for robustness and artistic stones for intricate decorative work, including muqarnas and arabesque panels. (Michell, 1995)

Military and Defensive Stonework: Crusader to Ottoman Periods (11th century - early 20th century)

From the Crusader through the Ottoman periods, the architectural focus shifted towards military and defensive structures such as fortresses and castles, utilizing massive stone blocks for their construction. Kerak Castle and other similar structures from the Crusader, Ayyubid, and Mamluk periods illustrate the strategic use of stone for defense, featuring thick walls, fortifications, and intricate Islamic decorative styles. The Ottoman period continued this tradition but also reintroduced larger civic buildings that incorporated intricate tile work and large domes, adapting the local stone to the ornate Ottoman architectural style.

Architectural Design and Concept

The focus of this study is a villa designed by Architect Majida Shwayat, who utilized stones sourced from various Jordanian regions to create a building that is both a homage to and a reinvention of traditional stone architecture. The design incorporates elements of the deconstruction movement and Islamic architectural features like arches and latticework, blending them into a structure that harmonizes with the natural wind patterns for environmental efficiency.

Majida Naser Shwayat is a distinguished Jordanian architect and engineer, has made significant strides in her field since graduating from the Jordan University of Science and Technology in 1996. Known for her meticulous approach to architectural engineering, Shwayat's designs often reflect a deep commitment to both aesthetic appeal and functional utility. Her career is marked by a dedication to enhancing environmental sustainability and urban development, which is evident in her leadership roles within various environmental and cultural organizations. As a visionary in the Jordanian architectural community, Shwayat's work on the featured building in this case study exemplifies her innovative design principles that harmoniously blend modern engineering techniques with environmentally conscious practices. This building not only stands as a testament to her engineering prowess but also showcases her broader commitment to creating spaces that are sustainable, user-friendly, and culturally significant. This villa was built in 2004 as Dr Adel Safadi's villa, located in Irbid, Jordan.

Types of Stone Used:

Three main types of stone were used in the construction of the villa. These multiple stone types were strategically used throughout the villa's façade, interior elements like fireplaces, and structural components such as stairs and floors.

Ruwaished Limestone: This type of stone is sourced from the eastern regions of Jordan, characterized by its pristine white color which gives it a striking appearance suitable for both interior and exterior architectural applications. Ruwaished limestone has been increasingly valued for its aesthetic qualities and durability. In contemporary Jordanian architecture, it is prominently used in new constructions and restoration projects, where its bright and clean look aligns with modern architectural styles while maintaining a connection to traditional Middle Eastern designs. Its softer nature compared to harder stones like granite makes it particularly suitable for detailed facade cladding, interior decorations, and sculptural elements.

Figure 2 Exterior Facade of Villa Showing three types of stone utilized. Safadi Villa- Irbid, Jordan.

Travertine Stone: Primarily found in the northern regions of Jordan, particularly around Ajloun and Jerash, exhibits a range of colors from golden-yellow to orange, adding a warm and inviting tone to the structures it adorns. Historically significant during the Roman era, travertine was extensively used in Jordan for constructing

columns, flooring, and decorative details in various public buildings and monuments, evident in the archaeological sites that still stand today. Its relative durability, coupled with its aesthetic appeal, makes travertine a popular choice for less trafficked areas in modern construction, ideal for flooring, wall cladding, and outdoor paving, thanks to its beautiful coloring and unique textural qualities. (What Is Travertine Tile? | The Tile Shop, 2024.)

Black Basalt: This is a volcanic stone typically found in Jordan's desert regions, known for its robust black color and exceptional durability. It has been significantly utilized since the Roman and Byzantine periods, where its strength made it an ideal material for building fortifications, roadways, and other structures requiring durability and resistance to wear. The historical use of black basalt in northern Jordan is notable in the construction of military and defensive architectures, where its hardness and weather-resistant qualities were crucial. In contemporary settings, black basalt continues to be favored for its abrasion resistance, used in applications such as paving roads, constructing durable building foundations, and crafting kitchen countertops and floor tiles that withstand high traffic.

Details of Design and Concept:

Figure 3 Entrance Stone Arch Inspired from Jordanian Historical Architecture and Stone Applications. Safadi Villa- Irbid, Jordan.

Figure 4 Entrance of Villa illustrating Stone Construction. Safadi Villa- Irbid, Jordan.

Figure 5 Showing Mixed Use of Different Types of Stone Especially Black Basalt Stone. Safadi Villa- Irbid, Jordan.

Figure 6 Villa Facade Constructed Using Travertine Stone. Safadi Villa- Irbid, Jordan.

Figure 7 Side Facades. Safadi Villa- Irbid, Jordan.

Figure 8 Window Arches and Frames Made from Three Different Stone Types. Safadi Villa- Irbid, Jordan.

Figure 9 Exterior Lighting. Safadi Villa- Irbid, Jordan.

Figure 10 Villa Entrance Showing Design Details. Safadi Villa- Irbid, Jordan.

Figure 11 Window Design with Three Different Stone Types. Safadi Villa- Irbid, Jordan.

Figure 12 Side Facade with Stone Window Framing. Safadi Villa- Irbid, Jordan.

Sustainability and Environmental Considerations

The villa not only showcases the aesthetic versatility of Jordanian stone but also emphasizes sustainability. Features such as a water collection system, solar panels, and the use of glass bricks—manufactured from desert sands—enhance the building's environmental efficiency. In addition, the thermal properties of stone contribute to the villa's energy conservation measures by being an efficient insulator and protector from outdoor weather along with changing seasons reflecting a commitment to sustainable building practices.(Jordan Green Building Council, 2017)

Stone has long been valued for its durability and strength, attributes that are crucial in ensuring the longevity and resilience of buildings. Its natural properties offer excellent compressive strength, allowing structures to withstand significant weight and endure environmental pressures across all four seasons in Jordan. Furthermore, stone's resistance to weathering, corrosion, and fire helps maintain both structural integrity and aesthetic appeal over time. This inspired the concept of the villa and guided Shwayat's design. Historic constructions in Jordan, such as the city of Petra, carved from rose-red sandstone, and the limestone ruins of Jerash, exemplify this durability. Despite the varied climate throughout the year, these sites have endured centuries and remain standing today, showcasing the enduring power of stone in architecture.

The Psychological Benefits of Stone in Architecture

The use of stone in architecture significantly influences psychological well-being by instilling a sense of peace and calm both inside and outside the building. The material's stability and permanence convey a deep connection to nature, which can evoke feelings of safety and tranquility. The distinct textures and varied colors of stone also enhance this effect, aesthetically aligning with

the surrounding environment and adding to the overall beauty of the structure. This visual appeal not only impacts those residing within the building but also those who view it from the outside, promoting a general sense of wellbeing. Additionally, the acoustic properties of stone buildings contribute to this tranquil atmosphere by insulating interior spaces from external noise, creating a serene environment that supports mental health and relaxation. Together, these qualities make stone an invaluable material in spaces designed for healing, reflection, and spiritual engagement.

Figure 13 Details Around the Villa Utilizing Stone Element – Stone Bird Feeder. Safadi Villa- Irbid, Jordan.

The Cultural and Spiritual Significance of Stone in Architecture

Stone serves as a cornerstone in architecture, not only reinforcing the structural integrity of buildings but also enriching the cultural and spiritual identity of the areas they occupy. Utilizing native materials and resources, stone construction affirms the identity of a building and connects deeply with the local history and heritage. Its application across ages encapsulates the socio-economic symbolism accumulated through various civilizations, often reflecting aristocracy, wealth, and the upper class.

Moreover, the use of stone in constructing sacred structures such as temples and mosques highlights its spiritual significance. This material contributes to creating spaces that resonate with the spiritual practices and beliefs of a community, facilitating a profound connection between the physical environment and the metaphysical realm. In this manner, stone not only supports the physical manifestations of cultural identity but also embodies spiritual and communal ethos, making it a pivotal medium for expressing both communal identity and individual piety.

Stone's enduring nature and ability to withstand the test of time also mean that it plays a crucial role in preserving cultural heritage. As older stone structures are maintained, restored, or repurposed,

they provide continuity in a rapidly changing world, allowing new generations to connect with their cultural history and identity. Through its aesthetic and functional versatility, stone shapes the architectural landscape, maintaining the cultural memory and enhancing communal ties by embedding local traditions and historical narratives into the very structures inhabited by the community. Thus, stone is much more than a building material; it is a symbol of tradition, stability, and continuity, holding the stories and values of the people who work and live around it.

Integrating Indigenous Flora in Landscape Design for Aesthetic and Ecological Harmony

In this design, the landscape concept carefully integrates a curated selection of indigenous flora to achieve aesthetic harmony and ecological sustainability. The chosen assortment includes fruit-bearing trees such as citrus, lemon, fig, pomegranate, olive, and grapevines, which provide both visual appeal and practical benefits from their seasonal produce. Additionally, the landscape features flowering trees like wisteria and jacaranda, celebrated for their striking violet blooms, alongside species with vibrant orange flowers, enhancing the color palette of the villa's outdoor spaces. This deliberate integration of native plant species not only enriches the sensory landscape but also promotes biodiversity and environmental sustainability. Architect Shwayat's design concept reflects a thoughtful engagement with local botanical resources, aligning aesthetic objectives with ecological considerations within the villa's landscape architecture.

Figure 14 Green Element Touch in Design. Safadi Villa- Irbid, Jordan.

Incorporating Inclusive Design Features for Enhanced Accessibility

The design of the building prominently incorporates features to enhance accessibility for individuals with disabilities, ensuring that the environment is inclusive and welcoming for all visitors and occupants. Special attention has been paid to providing comprehensive handicap accessibility, which includes wide doorways, ramps instead of stairs where necessary, appropriately placed handrails, and accessible restroom facilities. These features are integrated seamlessly into the overall design, maintaining aesthetic harmony while ensuring functionality and ease of use. This approach not only complies with legal standards for accessibility but also reflects a commitment to social inclusivity, allowing people of all abilities to access and enjoy the facilities without impediment, thereby fostering a sense of belonging and respect within the community.

Flow and Connectivity Through Strategic Design of Movement and Vision Axes

The architectural design of the house places a strong emphasis on the axis of vision and movement, creating a thoughtful interplay between semi-open, semi-closed, and fully enclosed spaces. This strategic layout ensures that from any seated position within the house, occupants have clear sightlines to other areas, enhancing both the sense of space and connectivity. The versatility of the closed spaces is particularly noteworthy; these areas are designed to be adaptable and inclusive, accommodating various activities and gatherings without feeling restrictive. The careful consideration of visual axes not only improves navigational flow but also fosters a feeling of openness and transparency throughout the home. This approach allows for a seamless integration of different areas within the house, promoting a unified and cohesive living environment.

By strategically aligning the axis of vision with the paths of movement, the design ensures a fluid transition between different areas, guiding occupants through a series of interconnected spaces. This thoughtful placement of doorways, hallways, and sightlines facilitates intuitive and effortless navigation throughout the home, promoting a natural flow that aligns with daily activities and interactions.

Figure 15 Vision Axis. Safadi Villa- Irbid, Jordan.

Figure 16 Mix Use of Stone. Safadi Villa- Irbid, Jordan.

Figure 17 Interior Use of Stone- Finishing: Stone Fireplace and Stone Stairs. Safadi Villa- Irbid, Jordan.

Figure 18 Interior- Exterior Finishing. Safadi Villa- Irbid, Jordan.

Conclusion

The villa stands as a testament to the enduring legacy of stone in Jordanian architecture, bridging the gap between ancient techniques and modern sustainability needs. This building not only serves as a residence but as a statement of cultural identity, showcasing the potential of traditional materials to meet contemporary demands without sacrificing style or substance.

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GEOLOGY AND ARCHITECTURE BETWEEN CAMPANIA AND PUGLIA

Name Surname Author

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Abstract

An architect and a geologist from Luigi Vanvitelli University in Naples, supported by a young architecture graduate of theirs and a natural science student from La Sapienza University in Rome, describe some works of architecture born from the confrontation/encounter with the context that hosts them and their "stones." The eight works, not all of which have come to fruition, are signed by the architect himself and arise in places volcanic tuff, which, excavated to the point of forming huge underground cavities (see Naples), represents here the known for load-bearing framework of all constructions until the advent of reinforced concrete with Le Corbusier›s domino frame and its ever-changing sequel.

Keywords

Geological history, Southern Italy, Architecture and Works, Stone, Worksheet ReviewTufo

Introduction

The contribution offered with this article to the subject of study moves from my condition as an Italian/Campano, native of a territorial area that concludes its extensive flat shape northward by soaring into Mount Tifata, sacred to the people of Capua Antica, and southward into the welcoming Tyrrhenian geology of the Gulf of Naples to which the coastal winglets are the Vesuvius and the Miglio d'Oro to the north and the flat craters of the Campi Flegrei and the Domiziana plain to the south. And immediately thereafter as an architect who, enjoying the privileged observatory represented by the University, daily reads the world of forms around him and then, in addition to the new and infinite building materials offered by modernity exploded in the last century and in continuous and convulsive becoming, the immense beauty and ductility of the excavated stone material, extracted from the places where it still abounds before taking the form of buttresses, walls, paving stones, and roofing. Not being an historian nor a technologist, but rather a compositionist, this narrative draws for practicality in the small pool of personal experiences concluded with built works and in an archive of projects never executed, all of which became, for the writer, reflections and suggestions on how to preserve and re-propose a relationship with the "raw building materials" in places characterized by their constant presence for millennia.

The short circuit then is certainly determined in the scientific fellowship and sharing at the moment when the contribution of colleague Daniela Ruberti is essentially configured in these pages. Her in-depth academic knowledge of the geological peculiarities of the places where she has been carrying out her studies for years (Department of Engineering of the Unicampania-Vanvitelli University of Caserta) interfaces with the works then commented on, increasing the interest of this work otherwise destined to be basically descriptive. Thanks to the conversations we frequently had about the "geologies" of our territory as well as the affinities and points of contact of our respective sciences and research, it was easy to arrive, by systematically passing the baton to each other, at the sharing of this experience to the point of shedding light on the goodness of the typological and formal choices made upstream, perhaps as a peculiar contribution given by this paper.
Of the eight works presented, by affinity of themes addressed, we distinguish the first five (three realized, one drawn, one submitted for competition) from the other three as more specific reflections on "tuff stone" in its various connotations; they all fall within the extensive territory of the Province

of Caserta: The first in Sant›Angelo d›Alife, a location on the western edge of the Matese massif; the second in Ruviano, the last municipality of Caserta before entering the Province of Benevento; and the third in the very city that was the Capua of Hannibal›s Ozi, today Santa Maria Capua Vetere, in terms of refinement of manners and wealth in direct competition with Rome before being razed several times by the barbarians at the beginning of the first millennium; continuing in order is then described a designed but unbuilt work still concerning the former Capua and a place on the Appia Antica that is peculiar as it is included in the curtain built at the edge of the square that introduces the Amphitheater Campano, second in the world only to the Colosseum in Rome. Last of the five is an exercise whose contest design singularities fall within the municipal territory of the city of Teano and Calvi (Silicinum).

The other three works narrated (two made, one submitted for competition), two of which are in Campania territory and one in Apulia territory, represent reflections on the sometimes more appropriate use of very consistent and clear stones from other geological regions, the first two of which were made in Capua and Santa Maria Capua Vetere, respectively, and the third, a competition, in the City of ”Sassi” (stones): Matera.

Objectives

The main purpose of this contribution was to understand the extent to which stone building materials - in my case predominantly tuff but it can be said stone in general in its various modes and techniques of construction, more or less traditional, both for cultural reasons but mostly for geographical reasons - have been present in our architecture over the last 40 years, both as structural framework and as a mere external skin for formal or protective finishing. This stems from an interesting retrospective reinterpretation of what has been produced over the course of a long personal experience in the field and from a listing of significant samples of how much space “stone” has found in terms of form and content, despite the secular nature of gestures and experiments always different from each other in deference to a modernist creed of clear Neapolitan school.

The journey into geological history

The geological background of these cities can be read not only in famous historical buildings erected from characteristic stones but also from the sites of stone extraction, often located within the cities or in the subsoil. In this sense, the approach used for the designs that will be illustrated below takes into strong consideration the local geological resources and traces a geological history of the Italian peninsula that is millions of years old.

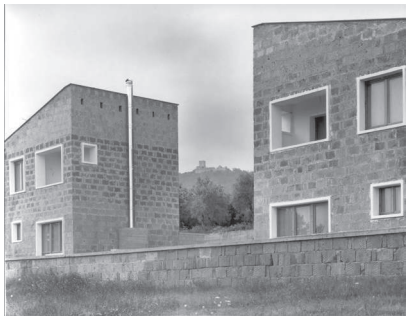
The first area of interest corresponds to the northern and northeastern part of the Campania Plain. The geological evolution of the plain was mainly conditioned, in the last 2-3 million of years, by fluvial and marine processes and the volcanic activity of the Campi Flegrei, Somma-Vesuvius and Roccamonfina volcanoes. In particular, the geological subsoil composition in this area is formed by a succession of different units composed of volcanoclastic deposits, related to the Campania Grey Tuff (CGT; 39 ky B.P) and Neapolitan Yellow Tuff (NYT; 15 ky B.P.) pyroclastic eruptions from the Campi Flegrei volcanic district. The CGT deposits, in particular, were spread over the whole Campania Plain, giving rise to a thick (up to 40 m thick), laterally continuous volcanoclastic unit characterized by different lithofacies, mostly derived from the different mineralogic compositions: yellow zeolitized tuff, grey tuff, piperno (Ruberti et al., 2020). The good mechanical characteristics of the tuff lithofacies justify the presence of numerous quarries and cavities, according to the availability of adequate thicknesses of coherent lithofacies (Vigliotti et al., 2023).

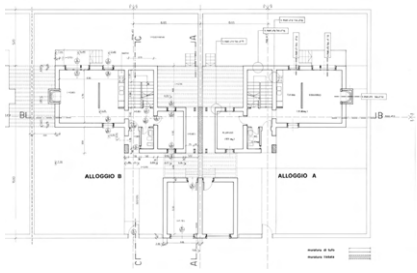
We definitely move back in geological time when we talk about Pietra di Trani and Calcareniti di Gravina. The first represents the shallow sea environments that characterized the Mediterranean area in the Cretaceous time, before the structuring of the Apennine chain began. It is a microfossiliferous and sometimes dolomitized limestone rock. We then embrace the first phases of the structuring of the chain with the Quaternary calcarenites of Gravina which host the Sassi di Matera and are characterized by lithified calcareous sand (Tropeano et al., 2018).

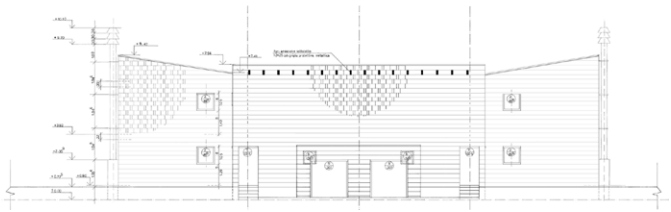
Sant'Angelo d'Alife

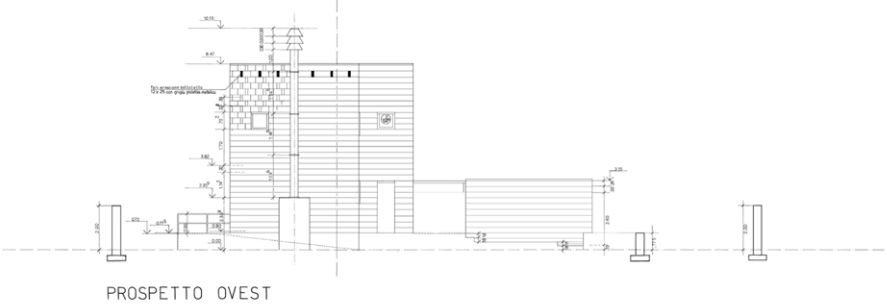
Social Housing for Farmers - Built

The defining feature of the construction made for farming families is the volcanic tuff of the load-bearing walls and its combination with the built parts where Mediterranean white plaster appears, with pergolas that connect the volumes by blending them, and with the essentiality of the framed openings. The goal was to let the strength of the solid masonry and the green backdrop of the native vegetation prevail. Due to the limited financial resources typically provided by the Caserta Public Housing Authority, the work was completed through successive simplifications, always striving to turn needs into virtue. A clear and highly significant example of the language used is the collage of tuff stones deliberately sourced from different quarries. The color tones, ranging from the more contemporary dark yellow to the ancient gray, freely blend into unique compositions entrusted to the craftsmanship during the construction of the works.





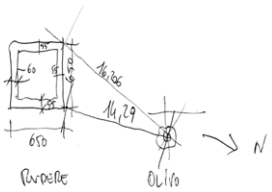


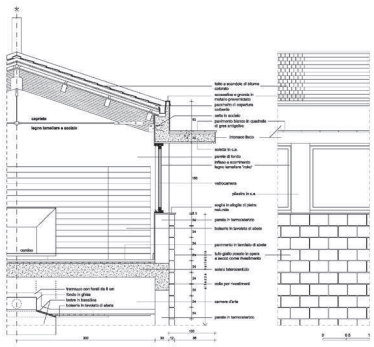


Ruviano

Private Courtyard House - Built

In the center of the glade, at a more sloping point, stood a square-based tuff ruin of about 36 square meters, once used as a shelter for shepherds during transhumance. The panoramic nature of the land overlooking the valley and the bends of the Volturno River, as well as the pre-existing small ruined building, provided the inspiration for the symbiotic plan between old and new, which became the work's main strength. The structure is centered around a 15x15 meter courtyard, bordered to the southeast and southwest by the three building sections that form the complex. The ruin was demolished and rebuilt on its original site using its same recovered and roughly hewn gray tuff stones as the base until they were exhausted, then completed with new plastered tuff. It is the most advanced and turreted element towards the valley landscape and the most significant part of the composition. The other base parts are immediately distinguishable by the difference in color and size of the new tuff blocks used.





Santa Maria Capua Vetere

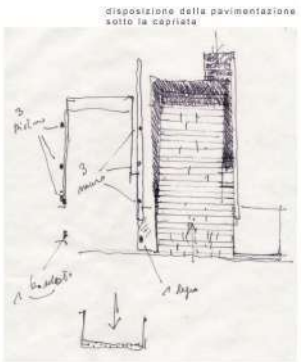
Martucci Foundation Garden - Built

The sequence of entryway, courtyard, and garden, and its parallel alignment with the main street (in line with the centuriae traced by ancient surveyors), are the main reference points of the project. A wall, as tall as a person, separates the paved area from the green carpet. This wall is distinguished by the regular cut of the thin yellow tuff blocks that cover it, which are elevated from the ground and stand out from the evident load-bearing nature of the pre-existing gray walls, highlighted by the precise geometries of the cleaning performed. A characteristic gray paving stone, reconstructed with large stones recovered from some ancient municipality in the countryside, permeates the repeated spatial system. This paving stone weaves various patterns, now in the entryway and courtyard, now under the truss, now along the paths that, immersing into the garden, create thin basalt slab mats to evoke the cardo and decumanus of the unique centuriation of Ancient Capua.









Santa Maria Capua Vetere

Hostel at the Amphitheater - Unbuilt

This proposal involves the restoration of a tuff stone building, originally an agricultural consortium, situated within the built perimeter overlooking the large green area in front of the amphitheater of Ancient Capua, known as Spartacus' amphitheater. Given the intended use, this project aimed at the complete restoration of the old structure by removing all the accretions accumulated over the years. Alongside modern and clearly distinct functional integrations within the courtyard's living spaces, the strength of the tuff walls facing the exterior was to be emphasized. Various enhancements were introduced to the interesting pattern of openings on the two exterior facades, following a path of revealing the ancient structural arch pattern hidden by plaster, thus creating a virtuous dialogue between old and new. Unfortunately, the demolition and construction of a historical replica is the regrettable conclusion to this brief architectural endeavor.

Teano

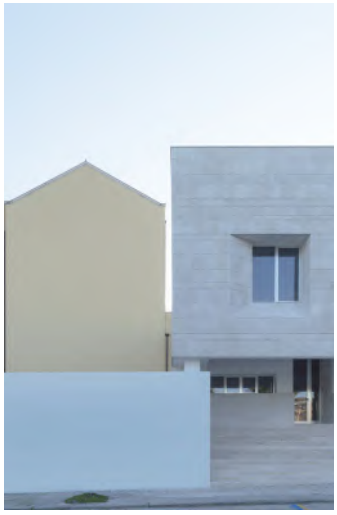
Church Outside the Walls - Competition

The parish complex draws inspiration from the concept of simplicity that characterizes the Pope Francis pontificate, thus emphasizing hospitality and coexistence. Inside, a structure made of ancient recycled gray tuff stones dominates; the rest is entirely made of new quarry tuff and light plaster. Teano, a town at the foot of the volcanic massif of Roccamonfina, has one of the largest dioceses in Italy. Outside the urban perimeter, the steep site possesses an evident sense of “sacred place.” Hence the idea of a walled citadel layout with a large enclosed square, from which the liturgical body of the church rises exclusively in gray load-bearing tuff stones, donated by the faithful or sourced from abandoned farmhouses, stables, ruins, remnants of ancient constructions. There is a four-meter elevation difference between the valley entrance and the support level of the citadel. The large gray liturgical hall, made of earth and emerging from the earth, is pierced by dovecotes that allow a cascade of light beams to enter. The bells are prominently displayed in a large opening already visible from the valley. Open porticos, even on multiple levels, connect the volumes in which the complex is coherently articulated.

Capua

Building for Parish Classrooms - Built

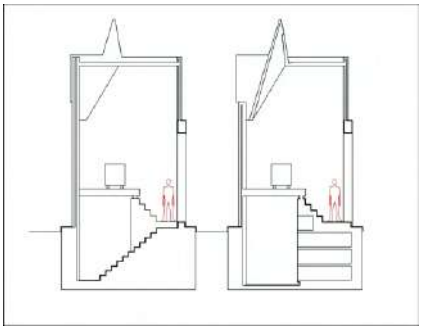
The site of the parish classrooms in medieval Capua is a natural extension of the wing of the post-war sacristy of the semi-destroyed Cathedral Basilica of the bishopric of the city of Capua. The work, entirely clad in roughly hewn slabs of Trani stone arranged in a pattern of horizontal striations that emphasize the multiplicity of perforations and their various flares, attempts a dialogue with the significant building history of what was once the capital of Lombardia Minore, as well as the city of Ettore Fieramosca and Pier delle Vigne, reinterpreting in a modern key the deep cuts in the masonry and the morphological freedoms of the eccentric Capuan Middle Ages. The complex, protruding from the Riviera Casilina and closely observing the flow of the Volturno River, after successfully challenging the countless constraints that silence architecture, may perhaps also win the challenge against time, thanks to the use of ancient Apulian stone that protects it.



Santa Maria Capua Vetere

Hypogeum Chapel - Completed Work

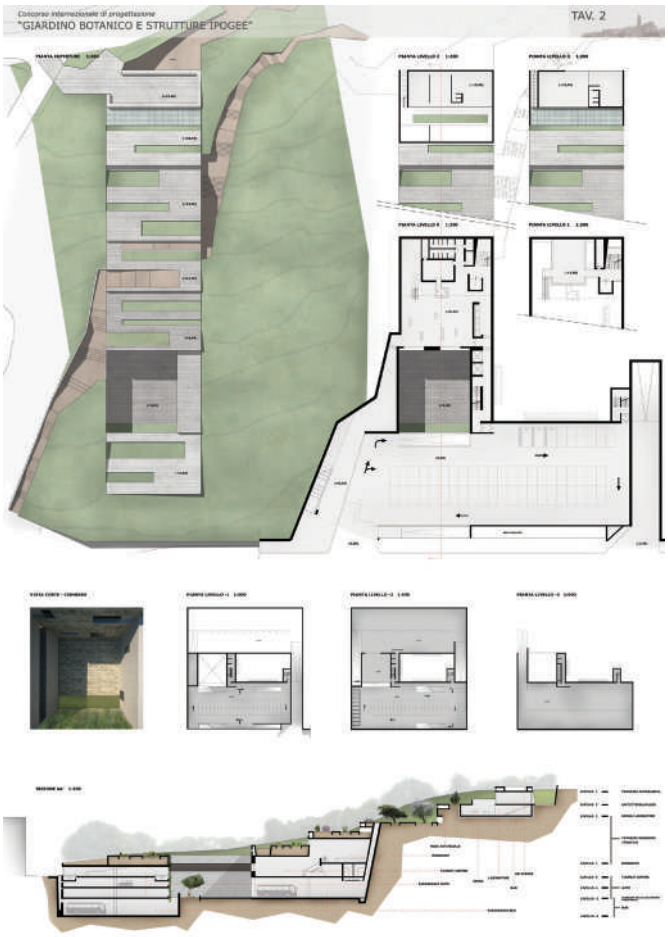
The chapel combines the typological theme of the Mausoleum with that of the Hypogeum. At the heart of the composition lies the monolithic tomb made of rough-hewn blocks of Trani stone of the family patriarch, establishing a dialectical relationship with the smooth stone cladding of the repeated pillars in the corner insert and the blind walls finished with small ancient Capuan bricks. The synthesis process begins with an understanding of the site and the relationship between the plot and its immediate surroundings, with only two facades open to the greenery of the avenues and the public space. The compositional scheme of void and solid is challenged only by the skylight in concrete and glass, opened at the top between a blind side and the roof slab. It is positioned on the axis of the main burial, reflecting its off-center position.



Matera

Mountain Parking - Competition

From parking to tourist hospitality, from catering to specialized research, the sought-after image is that of the maximum concentration of functions in hypogea and sloping terraces made of Apulian limestone, replacing an immense rectangular plot carved out, from mountain to valley, on the hillside. The experience begins with the complexity of the forms of the city renewed in 1663 to become the capital of the Province of Basilicata. Then come the explosive hypogeal singularities of the Sasso Caveoso, the precipice of the Gravina, the caves of the troglodyte city on the barren side of the Forra, and then the cistern houses or caves untouched since the evacuations of the 1950s. The complexity of these places seems to merge with the project themes. The reference to the “stones” and the cascading overlap of houses whose roofs are both roofs and terraces, gardens, pergolas, and squares in a long sequence of interminglings, leads to the precise definition of the scope of the botanical garden with regular terraces planned in a scattered form on the promontory, masking the large public parking lot for Matera, the capital of culture.



Conclusions

From the intersection of the predominant disciplines in this study, geology and architecture, and from the diachronic reading of a reduced and highly personalized sample of built buildings and others that remained only on paper, with the care to verify that all had somehow used a well-known, widespread, and local raw material which then, when worked, became stones, walls, slabs, etc., a virtuous mix of suggestions has emerged. This mix unequivocally demonstrates how the future of places, even in the most indifferent and cynical post-digital contemporaneity, depends on their own resources and how future societies and history will know how to protect them.

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THE STONE of THE COLOSSEUM, ROMAN TRAVERTINE and SAN PIETRINI.

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Abstract

The colosseum is the largest Roman Amphitheatre ever created in the world, It could hold up to 87,000 people, was built during the reign of the Flavian, between C.E. 70 and 72 under the emperor Vespasian, located in the centre of the city of Rome, Italy. It was built using more than one hundred thousand cubic meters of roman travertine for the external wall alone. These days it has become ***UNESCO World Heritage Site****, and in 2007 it was included among the new 7 wonders of the modern world.*

Keywords

Colosseum, travertine, San Pietrini, historical, UNESCO, Heritage.

Introduction

Regarding the fact that the Colosseum was to be constructed on top of a lake, the construction process should utilize materials more resilient to water. Its large structure consisted of four stories of 76 arches.
The ideal material to be used from aesthetic and functional aspects was the Roman Travertine from neighbouring Tivoli.
The main pillars, ground floor, external wall, slabs; to sustain the Colosseum, and the seats were designed using Travertine. In addition to using mixture of concrete for constructing the remaining areas, as an invention in that era. The outer wall required over 100,000 cubic meters of travertine stones, with 300 tons of iron clamps. Making the structure resistant to damage during extreme weather conditions; earthquakes.

The Roman Sanpietrini; named cobblestones make the pavement of the streets and alleys of the centre of Rome unique. Anyone who visits Rome for tourism or work will find themselves walking on this pavement which is difficult to walk on wearing high heels.

The Roman Sanpietrini

In order to understand better what are the Sanpietrini, and how they resist until our current days, let's try to discover more about them.

What are the cobblestones of Rome?
The sanpietrini is a small block of leucitite, a rock of volcanic origin extracted from the quarries located at the foot of the Alban Hills and the Viterbo area. Today the name is also used for blocks of similar workmanship made of porphyry.

When we talk about cobblestones, also called flints, we therefore mean the paving of the central areas of the capital, made up of blocks cut to the same size in a truncated pyramid shape, positioned next to each other.

The typical size is 12x12x8 centimetres. They are laid dry on a bed of sand or pozzolana.

With this ancient methodology, entire surfaces have been paved in the centre of Rome, even in irregular sections, because the block solution allows to cover the ground, adapting to every imperfection, and then proving resistant over time and even to adverse weather conditions. For example, it is capable of draining rainwater very well.

History of the origins of the sampietrini of Rome
The first cobblestones dates back to the sixteenth century right in St. Peter's Square to allow carriages to slide better on the ground. Hence the name Sanpietrini.

Pope Sixtus V used them for the first time in 1585, then Clement XII Corsini in 1736 who decided to use them widely also in the streets of the 14 districts and on Via del Corso, where they were

covered with a crushed sand and tuff to prevent people and animals from tripping during the Carnival.

In the period (18th – 19th) the use of this paving method spread almost everywhere in the city and for example Piazza Navona and Piazza del Quirinale were also paved with flints.

Until 1927 the cobblestone production industry needed lots of efforts to be done manually. Rome is almost completely paved in Sampietrini. This block took on an important historical and identity role for the Romans. [See Table 1].

Why the sanpietrini called by this name?
The cobblestones in the streets of Rome are called sampietrini because it was used for the first time by Pope Sixtus V, known as the urban planner pope, to pave St. Peter's Square.

In addition to the fact that they were mistakenly called 'flints' from the name flint, a sedimentary rock. But the cobblestones are composed of leucitite, a stone of volcanic origin.

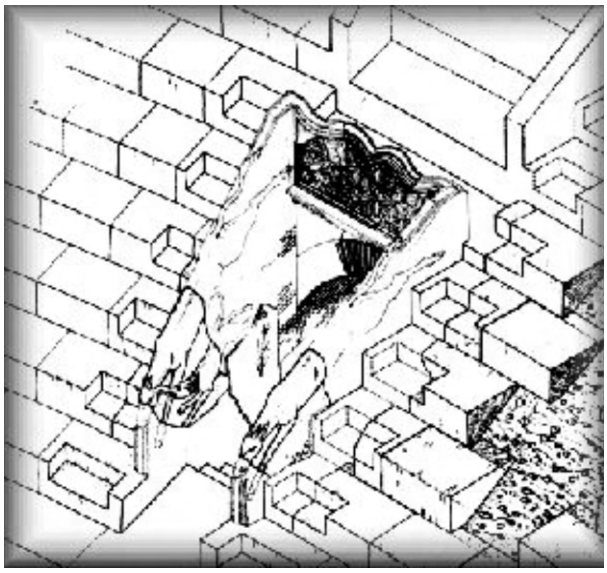
The heart-shaped cobblestone
Also called "Er core de Nerone", it is a block that over time has taken on the shape of a heart and over the years has become a real tourist attraction. The "heart-shaped cobblestone" is in the Libeccio della Rosa dei Venti in Piazza San Pietro.

Table 1. Sanpietrini within the time

Years	Friars	Status
1585	Pope Sixtus V	First time using the sanpietrini
1736	Clement XII Corsini	using the sanpietrini widely also in the streets of the 14 districts and on Via del Corso
In the period (18th – 19th)		The use of sanpietrini spread in all the city arriving to Piazza Navona
1927		Lots of efforts needed to done the production of the sanpietrini manually

Later, the materials and the stones of the Colosseum were plundered and re-used in many buildings of the city. In the amphitheatre the marble elements were:

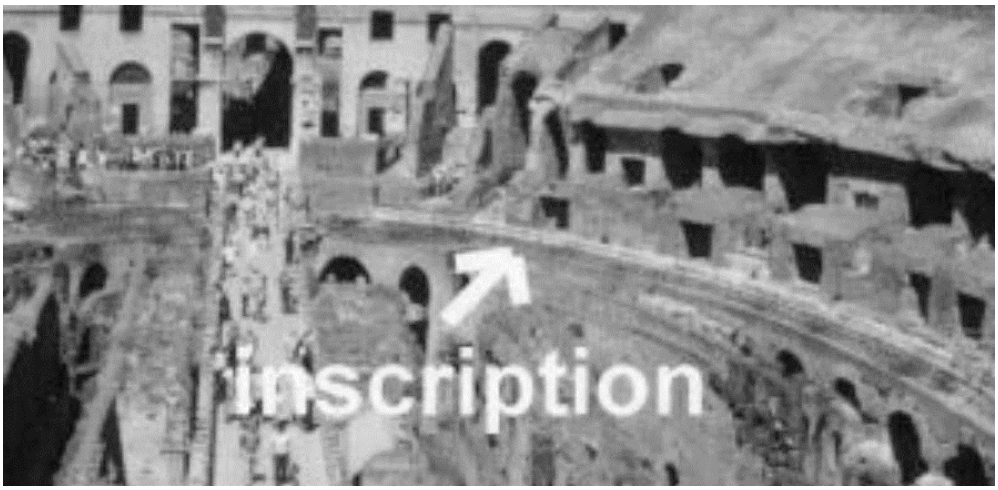
– The first two or three rows seats reserved for the Senatros
– The portico columns in summa Cavea
– The decorations along the corridors, around the arena and the Cavea.
– The entrances' barriers in the Cavea
– The Niches' decorations



A reconstruction of one entrance to the cavea

Archaeologists have found:
– 65 Columns' capitals;
– 9 Columns' bases;
– Pieces of cornices, trabeations, tympana, and consoles;
– Barriers' fragments.

The monumental inscription, (443-444 AD) were recently recomposed using more than 100 fragments of marble, achieving the restoration of the arena and the podium, which was damaged by a flood, by the Prefect Flavius Paulus. The inscription was designed on the podium with two and a half circles around it. This inscription replaced a former one; (411 AD), then the blocks had been restored in the 3rd century, by Honorius or Theodosius II.

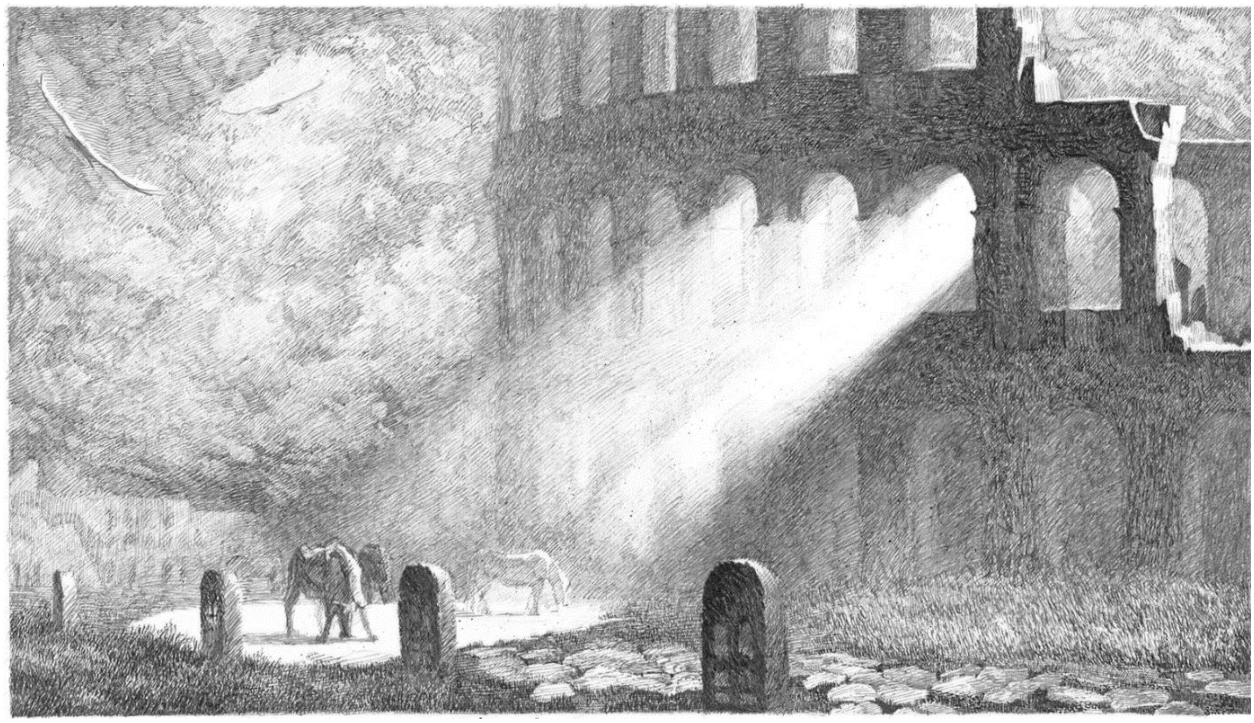


The inscription

The recycling materials process appeared in the Colosseum from the III century. Many different capitals of columns have been found dates back to that period or to the II century. Lots of proofs assure that the Colosseum suffered This should prove that the Colosseum suffered such massive damages, affected that no marble artifacts of the upper portico survived the II century. The ages of the elements prove that two main restorations of the Colosseum were carried out in the III century, the first probably started at the time of Macrinus, after a fire, and ended later with the Antonines. The second was probably carried out at the time of Gordianus III or Decius. More capitals are dated at the second quarter of the V century, after the earthquake of 429 or that of 443-444.

A capital of the most common type

Most of the information above was found in the essay by P. Pensabene – Elementi architettonici in marmo. In AA.VV.- Anfiteatro Flavio – Immagine Testimonianze Spettacoli – Quasar, 1988



Abandoning the stones" – Pen and ink by Sergey Krivonogov, a Russian artist

The materials taken away from the amphitheatre were reused in Popes' palaces, and for churches all around the city.

Il Palazzo di Venezia

Il palazzo di Venezia was established in 1467, by Pope Paulus II. In 1564 it became the powerful Republic of Venice, where the Venetian ambassadors lived. Nowadays it's a Museum of artworks: paintings, sculptures, ancient weapons, tapestries, clothes, gold and ivory artefacts.

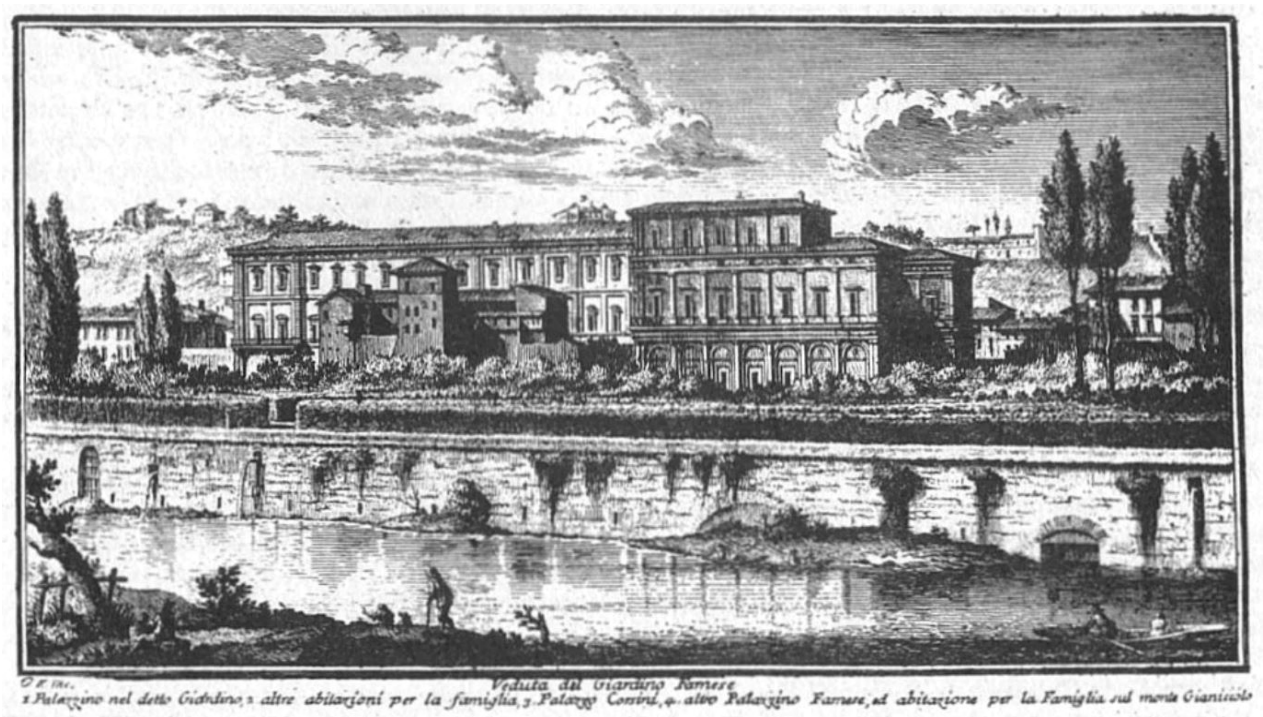
San Marco

The Basilica of St. Mark dates back to 336, many restorations happened during the time. The current basilica dates back to (1455-71), by Cardinal Barbo; Pope Paulus III, for the venetians in Rome. In the XVIII century lots of baroque decoration have been added in the inside. The façade with the fascinating three arches was the masterpiece of Renaissance Architecture, by Giulio da Maiano, or Leon Battista Alberti.

La Scala Santa

La Scala Santa was established in front of the Palace of Lateran (1585-1590), by Domenico Fontana for Pope Sixtus V, preserving the old private chapel of the Popes.

Drawn by Giuseppe Vasi, shows the rest of the square, with the obelisk, the baptistery and the hospital on the right



The back of the Farnese palace, the famous Giardino Farnese, as it appeared in the 18th century, before the banks of the river were built. This print is by Giuseppe Vasi

Il Porto di Ripetta

Conclusion

The stone in the ancient architecture plays a very important role until our current days, regarding the fact that it was the first and the essential building material to represent the beauty of the facades and the architecture of arches, furthermore it was used for places and spaces and plazas, letting us reviewing all the history of the place within the time.

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STONE ACROSS TIME: BRIDGING HERITAGE AND INNOVATION IN JORDANIAN ARCHITECTURE

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Abstract

This study examines stone's evolution in Jordanian architecture, highlighting its role in preserving cultural identity. Through historical, theoretical, and contemporary lenses, it examines how modern architects reinterpret traditional stonework using innovative design principles. This research underscores stone's enduring significance, contributing to the discourse on material authenticity and cultural continuity in architecture.

Keywords

Stone, Cultural Identity, Jordanian Architecture, Material Innovation, Stonework Evolution

Introduction

For millennia, stone has served as a fundamental component of Jordanian architecture, profoundly shaping the country's built environment, from the intricate carvings of Petra to the contemporary buildings of Amman. This research critically examines the evolution of stonework in Jordanian architecture, with a particular emphasis on its role in perpetuating cultural identity and fostering a profound sense of belonging. By employing a multifaceted approach that integrates historical, theoretical, and contemporary perspectives, this study aims to illuminate the innovative design strategies employed by modern architects to reinterpret traditional stonework, celebrating the inherent authenticity of stone. This analysis ultimately underscores the enduring significance of stone, highlighting its continued relevance across historical and contemporary contexts. Furthermore, it emphasizes the pivotal role stone plays in defining the unique architectural heritage of Jordan.

Background

Stone is significant in Jordanian architecture due to the country's geological wealth and profound cultural legacy. This section provides a historical overview to trace the evolution of stone. It also examines various theoretical perspectives on materiality to highlight the importance of stone in shaping architectural practices and cultural identity in Jordan.

Historical Context of Stone Use in Jordanian Architecture

Jordan's rich geological resources, mainly limestone, sandstone, and basalt, have profoundly influenced its architectural heritage. Stone has been a fundamental element in the country's built environment, reflecting Jordan's rich geological resources and the enduring appeal of stone's aesthetic and tactile qualities, deeply intertwined with its historical and cultural narratives. The use of stone has evolved through technological advancements and cultural influences, from Petra's intricately carved facades to Amman's contemporary buildings.

The Nabataeans, an Arab tribe flourishing from the 4th century BCE to the 1st century C.E., left an indelible mark on Jordan's architectural landscape (Rjoub, 2016). Their capital, Petra, is a

testament to their unparalleled stoneworking mastery, with magnificent structures carved into sandstone cliffs. Iconic facades such as the Treasury (al-Khazneh) and the Monastery are not just structures but living proof of their skill and the deep cultural significance of stone, symbolizing wealth and power. With the advent of Islam in the 7th century C.E., successive Islamic dynasties, including the Umayyads, Abbasids, and Mamluks, governed Jordan. Stone persisted as the primary construction material throughout these periods and was prominently featured in mosques, palaces, and fortifications. The Umayyad desert castles, such as Qusayr Amra and Qasr Hraneh, are notable for their sophisticated stone carvings and mosaics (Melnik, 2019; Rjoub, 2016).

1 - Jordan's architectural heritage: Nabataean Petra, Qasr Kharana, Qusayr Amra, Qasr Al-Hallabat, and Qasr Al-Azraq

The Ottoman conquest in the 16th century introduced new stonework techniques and styles, while the early 20th century saw the adoption of Western architectural styles and construction methods under British colonial rule. Stone, a material that has withstood the test of time, continued to be a key component, often used alongside modern materials like concrete and steel. Following Jordan's independence in 1946, there was an increased interest in traditional stone architecture, driven by a desire to assert national identity (Rjoub, 2016). This period marked a revival of stone use, symbolizing cultural heritage and continuity between traditional and contemporary structures.

The contemporary architectural scene in Jordan, with Amman as a leading example, reflects a complex interplay of various styles and trends, mirroring broader socio-economic and cultural transformations. Since the 1960s, the architecture in Amman has oscillated between modernist influences and efforts to reclaim a distinctive local identity through traditional materials like stone (Jarrar, 2013). This era transitioned from international architectural styles to regionalized modernism, integrating local cultural elements within contemporary frameworks (Daher, 2008). This dynamic interplay ensures that stone remains a symbol of Jordan's rich architectural legacy while adapting to the demands of modernity.

Theoretical Perspectives on Materiality in Architectural Discourse

In architectural discourse, stone's significance in shaping Jordan's built environment transcends mere functional considerations. A constellation of theoretical perspectives illuminates the profound influence of this material on preserving cultural identity, fostering a sense of belonging, and enriching the phenomenological experience of space.

Aristotle's philosophical framework posits a symbiotic relationship between form and materiality, where the intrinsic properties of a material fundamentally shape its manifestation and the qualities

it imparts (Hendrix, 2013). This notion resonates with Juhani Pallasmaa's concept of agency, which underscores the active role of materials in shaping human experiences through their tactile and sensory attributes (Pallasmaa, 2005, 2012). In Jordan, the materiality of stone—its texture, weight, and durability—engages the senses uniquely, enabling architects to create functional and emotionally resonant environments.

Kenneth Frampton's Critical Regionalism and John Habraken's emphasis on cultural continuity (Habraken, 2008) converge in advocating for an architecture deeply rooted in local contexts and cultural traditions. Integrating stone into contemporary Jordanian architecture is vital to the region's rich heritage, preserving cultural memory and fostering social stability. This practice exemplifies Homi Bhabha's theory of cultural hybridity, where traditional stone applications harmoniously fuse with modern design styles, reflecting a dynamic cultural identity that respects the past while embracing innovation (Bhabha, 1994).

Furthermore, Edward Relph's Place Attachment Theory elucidates the emotional bonds forged between individuals and their built environments (Relph, 1976). The familiarity and cultural resonance of stone in Jordan's urban fabric contribute to a distinctive sense of place, anchoring the local population in a shared narrative of permanence and belonging.

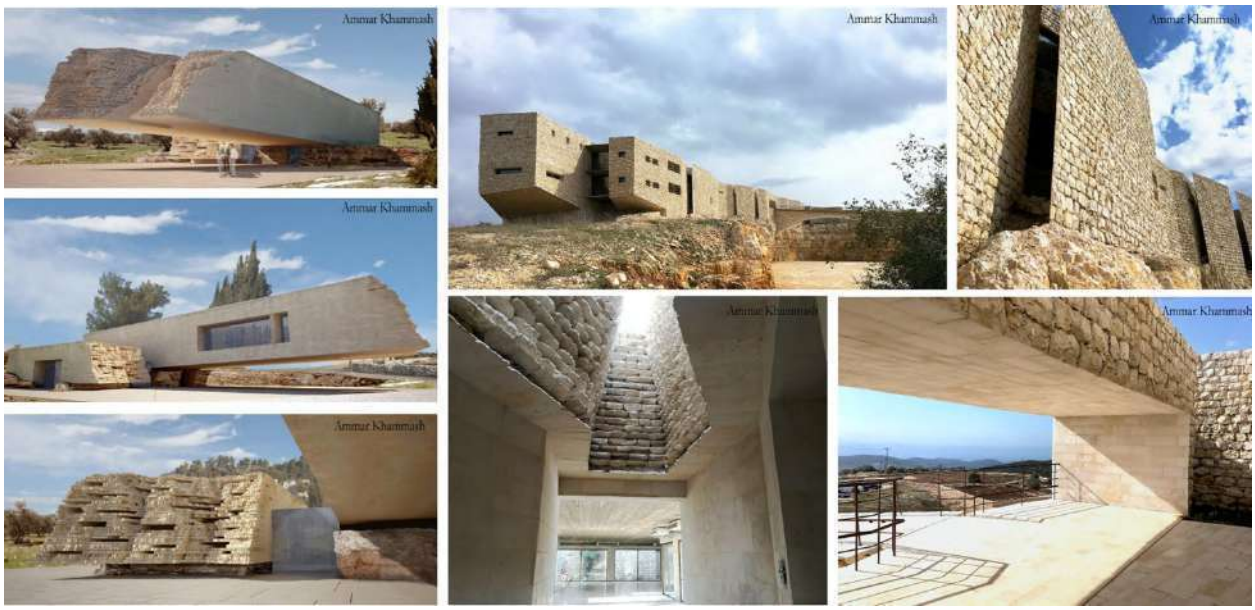
Collectively, these diverse theoretical perspectives create a comprehensive understanding of how the materiality of stone transcends mere function in Jordan's architecture. It serves as a catalyst for preserving cultural memory, asserting regional identity, and shaping architectural encounters' sensory and phenomenological dimensions. The interplay between stone's intrinsic qualities (Pallasmaa, 2005, 2012), its ability to evoke meaningful spatial experiences, and its capacity to anchor structures within local contexts and traditions (Frampton, 1983; Habraken, 2008; Bhabha, 1994; Relph, 1976) converge, making this material an invaluable medium for preserving Jordan's architectural identity while embracing modernity.

Contemporary Approaches to Stonework in Jordan

Jordanian architecture continues to utilize stone, reflecting a desire to honor the country's cultural heritage while incorporating modern design principles. This section explores the innovative use of stone in Jordan's built environment, highlighting emerging trends, advancements, and cultural significance.

Material Expression and Authenticity

A discernible shift can be observed towards celebrating stone's unrefined, organic attributes. Designers increasingly embrace the innate allure of stone through minimal alteration and delicate finishes that maintain distinct textures, patterns, and color diversities. This genuine material expression fosters a link between the built environment and Jordan's geological essence while attaining a sophisticated yet natural aesthetic.



2 - Material Expression: Embracing stone's natural beauty and unrefined texture

Hybridization

Contemporary architects transcend conventional stone use by seamlessly integrating glass, metal, and concrete. This hybridization engenders dynamic façades that deftly negotiate opacity, transparency, solidity, and lightness. These synthetic materialities catalyze novel spatial perceptions and evolving cultural symbolisms that challenge architectural conventions.

3 - Hybridization: Integrate stone with glass, metal, and concrete

Dematerialized Stone

Stone is reimagined as intricate, perforated surfaces that dissolve material boundaries. This innovative approach challenges conventions, fostering synergistic interplays between architecture and the natural environment through dynamically modulated light, shadow, and ventilation. A sophisticated, phenomenological engagement with stone develops, broadening its architectural applications.

4 - Dematerialized Stone: perforated surfaces

Earthed Authenticity

Modern Jordanian architecture seamlessly integrates stone into the landscape. Stone facilitates smooth transitions between indoor and outdoor spaces, contributing to a consistent visual and textural experience and highlighting the interdependence of built and natural environments.

5 - Earthed Authenticity: connect the building to its ground

Monolithic Minimalism

Monolithic minimalist designs feature unified stone cuts, creating large, cohesive surfaces. These buildings emphasize pure geometric forms and minimal ornamentation, showcasing the stone's natural texture and color. They convey solidity and permanence with precise alignment and sharp edges, making bold architectural statements of durability and timelessness.

Plastic Architecture

Architects explore the potential of stone by articulating the dynamic interplay of masses and planes through various textures. Combining smooth, polished surfaces with rough, natural finishes adds depth and complexity to geometric compositions, emphasizing horizontal and vertical planes.

6 - Monolithic Minimalism

7 - Plastic Architecture: the dynamism of masses and planes

Material Narratives

Contemporary Jordanian architects create intricate material narratives by combining different stone expressions. Layering various types, textures, and techniques results in visually rich wall systems. This layered approach produces rich visual effects and reinterprets traditional stonework, seamlessly merging Jordan's heritage with modern innovation.

8 - Material Narratives

Dimensional Sculpting

Emerging digital design and fabrication advancements are transforming traditional stonework, moving it beyond two-dimensional constraints. Stereotomics—complex stone cutting and fitting (Marzo & Neves, 2020)—is now used to create three-dimensional forms with volumetric depth. Further exploration of this approach holds promise for crafting visually and experientially immersive spaces.

9 - Dimensional Sculpting and Stereotomics.

Conclusions

This study addresses the enduring and multifaceted significance of stone in Jordanian architecture. Far from a mere structural and aesthetic material, stone is a cornerstone of cultural identity, fostering a profound sense of belonging. Stone embodies Jordan's rich geological and cultural heritage, evident in both Petra's ancient Nabataean carvings and Amman's modern buildings. This study investigates how architects reinterpret traditional stonework through innovative design principles by examining modern approaches like material hybridization, dematerialization, and dimensional sculpting. These contemporary practices celebrate the inherent authenticity of stone,

ensuring its continued relevance in Jordan's architectural heritage. Moreover, this study underscores stone's multifaceted role, transcending mere functionality to act as a catalyst for cultural expression, placemaking, and a captivating sensory experience. Stone's ability to shape not only functional but also meaningful and enduring built environments underscores its role in effectively bridging heritage and innovation in Jordan. By synthesizing historical, theoretical, and contemporary perspectives, this research enriches the discourse on architectural materiality, illuminating the tradition-modernity nexus and informing future practices within Jordan and beyond.

Acknowledgments

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ARAR CULTURAL HOUSE / BEIT ARAR(1988-) THE POET OF JORDAN

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Abstract

This research aims at creating knowledge on the architectural heritage of courtyard houses in northern Jordan in terms of their historical formation factors, significance, continuity, and architectural typology. It lead to understanding the tangible and intangible values of this heritage and its significance contribution to today's society and Jordan's national identity. The research concludes that this living heritage should be preserved, protected, and passed on to future generations. This research has a significant addition to the architectural conservation field and social science studies.

Keywords

Architectural heritage, Arar Cultural House, Courtyard house, Housh, Jordan

Introduction

Arar's House/Museum was donated by his family to honour one of the Arab world's greatest poets and the Kingdom's first celebrities Mustafa Wahbi Tal (1899–1949) known by his neck name Arar. The house hosts occasional cultural events all-round the year. It is situated on the oldest hill in Irbid dated back to the 2000 BC (Figure 1).

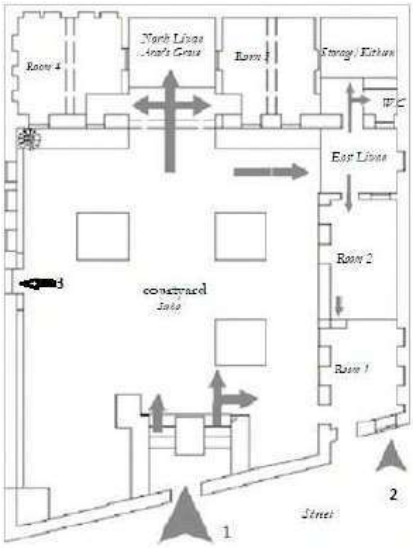
1– Arar's house location in Irbid city marked in the yellow spot

Arar was born in Irbid in the Ottoman Empire. He completed his elementary education in his hometown, later leaving to complete his high school education in Damascus. His rebellious and stubborn temperament would appear as early as his high school years in Damascus, when he would be exiled several times by the Ottoman authorities for participating in school strikes against their policies in the region. In his adulthood, he would be imprisoned and exiled several times for democratic activism or for insulting high-ranking officials by the governments of the Arab Kingdom of Syria, and, after its downfall, by the government of the Emirate of Transjordan. He venerating the lands of Jordan, and at other times vehemently criticizing its government's policies. He also wrote poems dedicated to criticizing British policies which supported Zionism in Palestine along with British colonial officers in Transjordan, His eldest son Wasfi Tal was Jordan's Prime Minister for several tenures during the late 1960s and early 1970s until his assassination in 1971.

Typological characteristics

Arar's House (*Beit Arar*) was built in Irbid and owned by the poets father the lawyer Salah Mustafah Tal in 1890s. It represents a fascinating demonstration of the elite urban settler life. The house particularly reflects the economic status of the Arar's father and his family role in the socio-political life of the area. The construction of the house was influenced by different typologies, which make the complex a composite-typological house. The courtyard house (*Housh*) contained the houses of one patrilineal extended family sharing the courtyard services.

The layout of the house and components is an excellent old Damascene-style house with a blend of various Arab and Islamic architectural influences on Tel Irbid. The single floor house is consists of seven rooms set around a courtyard paved with volcanic black stones. The total area of the house and the court is 497 sq. meters . The built up area is 202 sq. meters and the rest 293 sq. meters was left for the planted court yard. The exterior walls of the house is built of local lime and black basalt stone courses situated around a large courtyard. The interior walls of the home were made of mud brick and straw. The centre piece of the building is a berry tree in the courtyard that has stood for over a century (Figure 2). The complexity of the courtyard in the house reflects the economic and social situation of its owner and even depends on it, the courtyards of large and influential families with additional requirements for places of hospitality, storage, and others become more complex and larger than the courtyard of ordinary families that are characterized by their simplicity.



2- Arar's house floor plan

Chronology of the house

Due the functionality of the house layout and its relative size, the house was used by different functions through its historical timeline. The home was rented for a time to a British physician of Indian origin, who used the building as a hospital and a clinic for the greater Irbid area. Arar and his family briefly inhabited the home in the 1930s. Between 1944 and 1950, the house was transformed into an elementary school by Mohammad Subhi Abu Ghaneema before it again housed a member of the Tal family. The house was abandoned for a number of years which expose it to structural, architectural, and plantation detrition. In 1988, Ara's family decided to transfer this house into a cultural hub to honour the poet. Arch. Raed Al Tal, then the professor of architectural history was in charge to take the responsibility of the documentation, assessment, renovation, supervising and project manager of the renovation,, along an extensive consultation with arch. Ali Abu Ghaniemeh and then professor of architectural history. The implementation of the project from the documentation stage up to the grand opening of the cultural house took 10 months (1988-1989) (Figure 3) .

3- Arar's house before and after restoration

Currently, the Arar Cultural House is managed by the Jordanian Ministry of Culture. It continuous maintenance is a sharing effort between the ministry and Al Tal family.

Analysis of Architectural Typology

Analysis of the architectural typology covered the material and building technique, the chronology of the house, in addition to the house's typological characteristics that were influenced by the regional characteristics and the patron's lifestyle. Therefore, this will help in assessing the importance of the house in its context.

Courtyard (Housh)

The house is an inward-looking unit that forms an independent, isolated entity. The most part of the openings are towards the inside court (*Housh*), and openings toward the outside are limited to the entrances of the house and small windows. There is a separation between and private domains, that reciprocates the privacy of all the Arab houses as there is a direct entrance to the guest room from the adjacent street (Figure). The single-space rooms around the courtyard, considered the private spaces for the domestic household.

The house had more than one entrance, in which each one serves a different function. The main entrance to the house (gate 1), which is located on the main street from the southern facade; the guest enters without exploiting the house's privacy and two secondary entrances to the residences, the first from the secondary street from the northern side (gate 2), and the other from the western side, and a fourth entrance connecting the house yard and the west part houses of the owner (gate 3) (Figure 2).

The courtyard (*Housh*) was the main constituent of the compound with the various single-space houses gathered around. This was the focus of all female domestic activities and the centre of their being. Cleaning dishes, washing clothes, cooking, cleaning grain, drying produce and also sitting and talking, were all activities that took place in this semi-private domain. The courtyard was also the most common location for rainwater cisterns (Figure 4).

4- The courtyard (el Housh) Arar's house

The Liwan represents a distinctive architectural element in Arar's House. The house had two Liwan, it is an internal space surrounded by walls on three sides and it is open from the fourth one to integrate with the courtyard. It is usually used for family gatherings. Currently the northern and main Liwan houses the tomb of Arar's body (Figure 5& 6).

5- The main north Liwan in Arar's house opened to the courtyard (Housh)

6- The Liwan Arar's house

Material and Building Technique

Walls

The exterior walls of the building of the complex have been constructed by two faces filled with rubble-mortar between them, with a thickness of almost 1 meter. Constructed with Isodomic regular masonry laid in 26 courses (around 24 cm in height and various sizes in width) with minimal use of mortar. The stones were imported from several locations: Shallala-Ramtha and from Sakhrah and Shatana, which were carried on camels backs (two stones per camel). The interior walls are made of horizontally laid courses of semi dressed ashlars of different shapes and sizes with smaller flakes mixed with mortar in the joints. Some rooms are widely plastered with the traditional lime earth plaster mixed with hay (*tibn)* (Figure 7).

7- The white washed interior walls of Arar's house

Fences

The side fences had traces of pillars on either side. It is a building technique to build the fences as masonry under compression. The interior fence that separates between two buildings had a different stone masonry from two sides, as for the western side made of horizontally laid courses of semi dressed ashlars of different shapes and sizes with smaller flakes mixed with mortar in the joints (Figure 8).

8- The side fences that separate Arar's house from the his fathers other houses. The remains of (Gate 3) indicated in the floor plan.

Ceilings

Wood is employed as a structural material; rather, all horizontal spans are made of masonry under compression. Two rooms were built by using arching support construction system, which represents the building techniques of the 19th century to the 20th century (Room 3 & 4, Figure 2). There is one room built by using a barrel-arch system. The interior walls and ceiling were plastered with modern mortar and painted white (Figure 9).

9- The wooden trunk and reeds roofing system using arching support construction in Arar's house

Openings

There is an aesthetic language among the architectural units that summarizes the harmonious formatting of architectural façade. The arrangements of the openings for the house consist of a sideways doors, and on its left are two windows with one small high window - which were practical for ventilation- for each room. The arches in general played a significant role in highlighting the importance of the house façade thus specifying the entrance and centrality in relation to the rest of the building. In Arar's house, door and window openings were executed by semi-circular arches, the segmental arches were in most of the windows, and pointed arches were used only in the main entrance (Figure 10&11)

The doorways and some windows have semi-circular arches with usual keystones. The segmental arches have unusual keystones, for instead of being in the usual shape of a wedge, they have a more complicated interlocking shape that, at least visually, appears more stable. This type of keystone was found also in the Ottoman buildings in Irbid, where it is also part of a segmental arch very similar in size and shape and nicely ornamented with an eight-point star typical of the late Ottoman period. The door and window frames of the house are made of carefully dressed white limestone blocks. Wood was used in both doors and windows as the shutter materials, and glass was used to let light into buildings. Nowadays these windows are changed using metal ones (Figure 10).

10- Wood was used in both doors and windows

10- Nowadays these windows are changed using metal ones

11- Pointed arch is used only in Arar's house main entrance

Conclusion

Documenting and understanding Arar's house and its history made it possible to create a perception of the nature of the courtyard houses and the values associated with them. This resulted in a comprehensive assessment of their tangible and intangible values, which produced their significance. the government should strictly enforce the laws, guidelines and regulations for the protection of heritage buildings and follow the national cooperative statements adopted by the responsible entities.

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Images

Images 6 are credit for Osama Al Natour

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Stones: Natural Mineral Intelligence and Architectural Composition in the Contemporary

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Abstract

The use of stone in architecture opens up foundational questions concerning the time of architecture, the relationship between architecture and mineral nature, the scale of architectural design, its measurement, and its geometric generative diagrams. The question the architect must ask himself is: at what scale do I conceive of stone? There is in fact a scale of the mineral nature defined here of the Ground Line, territorial, and there is an architectural scale of the "piece of stone." The contemporary has given some design answers that redefine the moves of architectural composition.

Keywords

Time of Architecture, Architecture-Nature: Mineral, Ground Line, Trans-naturality, Architectural Composition.

Introduction

This paper starts from the principle that there is a relationship between architecture and nature and that investigating it leads primarily to the clarification of the principles that nurture architectural design. In a broader sense, it is about observing the origin of things, the natural archetype, the root, the fundamentals from a contemporary perspective. Where, with Giorgio Agamben[1], contemporary means the urgency of a style appropriate to one's destiny rather than to one's era. This touches the sphere of an architect's autobiographical necessity and more specifically of architectural composition.

Time

If the architect, of the contemporary, creates a relationship with stone it does not simply mean that he intends to give an aesthetic or technical connotation to his work but can mean much more. In general we can say that using stone in a contemporary building or a piece of a city means going to the archè of architecture, that is, to its primary, original condition. Stone acts as a dialogue between the time of origin and the time of the present. Transcending it. A piece of stone among the materials of architecture is the one that transcends time, supersedes it and, in a sense, governs it. Stone has the scent of eternity, it has the aura of geological era, of history of the Earth instead of historical era, the history of man. To use stone is to go beyond the long waves of history to the waves of geology, of time far away where historical time is time near, very near, the child of the philology. Contemporary architecture is made of steel, glass, brick and concrete or, in the latter case, a toxic material with very high CO2 emissions. Finding a piece of natural stone in a building gives us hope for a progressive rethinking toward a new responsibility of the architect. Toward a new time.

(1) GIORGIO AGAMBEN (2008). *Che cos è il contemporaneo?*, I Sassi Nottetempo, Rome: "He truly belongs to his time, he is truly contemporary he who does not coincide perfectly with it nor conform to its claims and is therefore, in this sense inactual but precisely because of this, precisely through this gap and this anachronism he is capable more than others of predicting and grasping his time." (pg. 8).

Architecture-Nature

Using stone in architectural composition can also mean creating a relationship between architecture and nature, where by "nature" I mean: natus, origin[2]. With the use of stone the relationship between architecture and nature is enshrined. Stone is the material element that belongs to the mineral world. But it is useful to make a distinction. At what design scale is stone understood?

Scaling

There are two different scales: the contextual scale of the land, the Earth Line[3], and the architectural scale, that of the "piece of stone" obtained from the quarry. To understand the potential of the two points of view, it is necessary on the one hand to analyze when there is the relationship of architecture to the earthy, plastic, mineral forms of its territorial context and on the other hand to analyze that of the architect who uses pieces of stone, slabs obtained from quarries. These are quarry-cut pieces where the stone can be bushhammered, flamed, honed, brushed, satin-finished, rolled, blunted.

Ground Line

Relating a building to the Earth to the Ground Line means designing how a building is rooted in the natural, mineral, geological surface that is the earth's crust. Of this they are interested in its conformation, its moving forms. Incessant. Frei Otto makes the Earth's crust belong to the great family of "inanimate nature 'which he defines as follows: 'Rocky materials: a galaxy, a planet, a mountainous relief, a volcano, a crystal, a columnar basalt fragment. "[4]The architect who establishes in his design a relationship with the Earth Line is confronted with the marvelous forms of geological nature, the surface morpho-sculpture, which is often ground but sometimes also rock, sedimentary, magmatic, metamorphic stone. Establishing a relationship with the earth's crust means grafting the 'building into it and creating a volumetric, spatial confrontation with the Earth Line that becomes a compositional opportunity. Architecture and earthy nature with their two different scales enter into a virtuous compositional relationship, which sanctions environmental respect and emphasizes the opportunity of the compositional relationship between architecture and nature.

Piece of Stone

Different, on the other hand, is when architecture uses the piece of stone, the element derived from the earth's coast, that is, the module, the measured slab that comes from the quarry cut. Often it is the facing of the building or, in the cases of the noblest archaic Mediterranean architecture, it is the foundation and corner stones of the dry-stone walls that are found in the architecture of the Spanish coasts, central southern Italy, Arab or Greek vernacular architecture.
In both cases, however, it is clear that working with stone means working with the "permanent," bringing architecture to the conditions of its original nature. The changeable of man, has a constant need to confront long time, and stone is the noblest opportunity that architecture has to evoke the "permanent." The use of stone is not only for technical matters, which are, moreover, very efficient, but also for philosophical, poetic, linguistic matters. Each architect finds inspiration, foundation and often hyperbole from it toward the long time of architectural composition.

(2) The word nature comes from the Latin *natus*, which we can translate as "origin." According to the Treccani Italian Encyclopedia, natura in Italian and nature in English come from the Latin feminine noun natūra, a derivative of natus, past participle of nasci "to be born."
(3) The concept of "Earth Line" lies in Raffaella Laezza's PhD Thesis in Architectural Composition obtained at the IUAV University of Venice XIII cycle, later published in the volume RAFFAELLA LAEZZA (2000). *L'architettura della Linea Terra,* Edizioni Osiride, Rovereto
(4) FREI OTTO (1982). *The Architecture of Nature* Il Saggiatore, Milano

Peter Eisenman: "Classic and Experimentation in Mineral Nature"

In the case of Peter Eisenman's Galicia City of Culture project in Santiago de Compostela (fig. 1,2) the two project scales are present. The mineral natural world is a design element both at the scale of the Earth Line, defined by him as "ground" and at the scale of the piece of stone. The project grew out of an International Competition in 1999 and was completed in 2005. In this work, Eisenman cuts the ridge of Mount Gaias, deforms the natural geological ground and grafts the new Cultural Center onto it by reconstructing its skyline, that is, the ridge of the mountain through the volume of eight buildings. At the same time he covers all eight buildings with stones. Let's stop the gaze: look at the millions of pieces of quartzite he uses. Shades of gray, white, gold, sometimes a hybrid pink-yellow color are created. Quartzite stones belong to the building tradition of the Galicia Region. What is most interesting is that these stones, at two different scales, give a measure to the project. Indeed, he covers with stone the roof, some parts of the elevations, several floorings with minimum modules measuring 30cmX30cm. He also marks in the roof, through stone, a grid of maximum modules measuring 16mX20m. The building, as a whole, internally captures the geometry of the great lines of geology, of the mineral landscape and because of this and belongs to an archaic classicism that is to the "classic" [5] that goes beyond time. A strange silence is felt when visiting the building. The project is still, motionless and is an example of the use of stone at the two scales. One senses that contemporary architectural research was waiting for this singular and unique work where the relationship with the natural mineral is tradition and at the same opportunity toward a new point in architecture. Peter Eisenman draws the modules of the stones according to Cartesian grids at the two scales, precisely, 30cmx30cm and 16mx20m: this stems from his compositional habit using the rationalist constructive geometric grid. It is the diagrammatic, mathematical-geometric part of his way of composing and it is the way of holding history and experimentation together. History because the grid is Andrea Palladio's planimetric diagram filtered through Peter Eisenman's readings and studies of the writings of Rudolph Wittkower [6]. Experimentation because the final forms are certainly not those of history but those of Eisenmanian time. This project seems to us to be the fruit of a true state of knowledge other, singular, and for that very reason it touches the strings of the spirit.

Cecil Balmond: Generative Geometries from the Mineral to Trans-naturality

It is interesting to analyze another way of conceiving stone, the mineral of the Earth, as a generative tool of a project. This is the case with the beautiful sketch-drawings where Cecil Balmond superimposes on his photographs of mountains the generative lines of their forms. The result is a geometric grammar that we find published in his illuminating book "Element"[7] (fig. 3, 4, 5). Cecil Balmond has seen beyond the material condition of many mountains and brought back to us geometric diagrams: these narrate the continuous movements and metamorphosis of nature and are thus conceived as, themselves, diagrams of movement. It is the architect who through the process of trans-naturality can translate these generative lines into other architectural designs. The operation of trans-naturality is a compositional operation and is precisely that of transforming the constituent principles of the construction and figuration of nature into geometric and constructive principles of

(5) The term "classical" is an ever-changing term. Working with natural patterns entails a statement: the compositional process is not classical. Moreover, the process of creating architectural forms is not linear: it is different from the classical pattern, and it is radical. It is based on the "architectural diagram". Which is plundering of diagrams, patterns, found in nature. Architecture becomes an active meditation on geometry. Toward building. Not classical is the relationship with history since it traces geology, the a priori formation of nature in an incomplete time. Not classical is the view of history since it is thought, within a continuous line for disjunctions, ruptures. And in continuity with this, even the present is brought to a disjunctive happening, open to its own metamorphosis never interrupted. But it is classical what passes and goes beyond the long waves of history.

(6) In the 20th century, some authors have restored the sense of a precise method of reading architectural history by outlining the-relationship: architectural history/geometry of design/architectural composition. For the architectures of Andrea Palladio see RUDOLF WITTKOWER (1947). *The Mathematics of the Ideal Villa* in Architectural Review

(7) CECIL BALMOND (2007a). *Element*, Prestel Editions, 2007

the forms of architecture. Inside the forms of geological nature Cecil Balmond has looked with an eye similar to that of Johann Wolfgang Goethe[8] who taught us to see with an inner eye to nature with its metamorphic processes and not dwelling on the apparent and static outer forms. Balmond equally borrowed the natural "patterns" of mountains, of their geological movements, the graphic traces of their transformations: here he found endless diagrams for architecture. It is a non-pictorial, non-landscape reading of the large-scale natural mineral context where pattern is the possible genetic code for the architectural composition of other buildings. If architecture is based on geometric principles, a geometric diagram defining the conformation of a portion of the earth's crust can become the geometric diagram of a contemporary architecture. It is the architect who chooses to do this operation, according to his or her own style. Balmond's diagrammatic principle reinforces the idea that in order to explain complex phenomena or forms, a simplification can be made: if nature has its geometric principles then inanimate nature, the Earth line, has those of "vector" geometry or a geometry of motion assonant with the geological transformation principles of "nature Earth." The generative and experimental use of complex geometries with nonlinear design systems are the basis of his research. We can say that this thinking belongs to what Balmond calls, "new humanism." Thus in an interview, "The new humanism is to recognize in nature the power of the pattern, multilayered, catalytic of which we ourselves are a part. Pattern is strongly hidden within our consciousness in many ways: from the simple aggregation of molecular structures within a spatial spiral to the landscape of nature. When we design, we break a resonance with the deep, hidden archetypes of forms."[9]

Conclusions: Stone against Brilliant

Time, the relationship of architecture to nature, are two of the cognitive categories that inspire the use of stone in architecture. The dimension of responsibility to architecture, in an age of ecological transition where great leaps of the classical paradigms of thought are taking place, prompts us to conceive of natural elements, such as stone, not as surface objects, merely useful for covering the facade of an architectural volume. Instead, it is a tool for analyzing the natural mineral context; a tool for understanding the scale and measure of the project; a tool for understanding the metamorphic processes of nature; and a tool for responsibly safeguarding the surrounding environment. In short, it is a fundamental tool of the project. A stone, it might even shine, leaving us awestruck by its beauty: think of a beautiful piece of crystalline marble, an almost totally pure material that shines naturally due to the presence of tiny crystals. But if its use does not bring us back to the principles of architectural composition, to the thought of architecture what role does it play? Architecture, its principles do not change just like a piece of stone: both go beyond time to give foundation to human thought.

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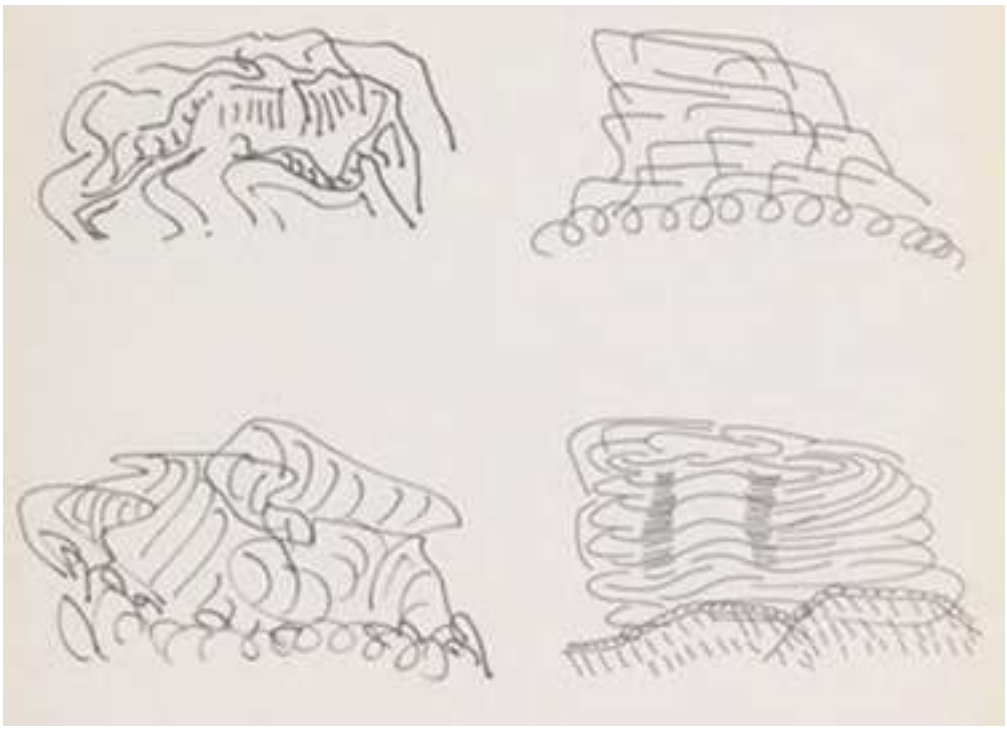
Figures

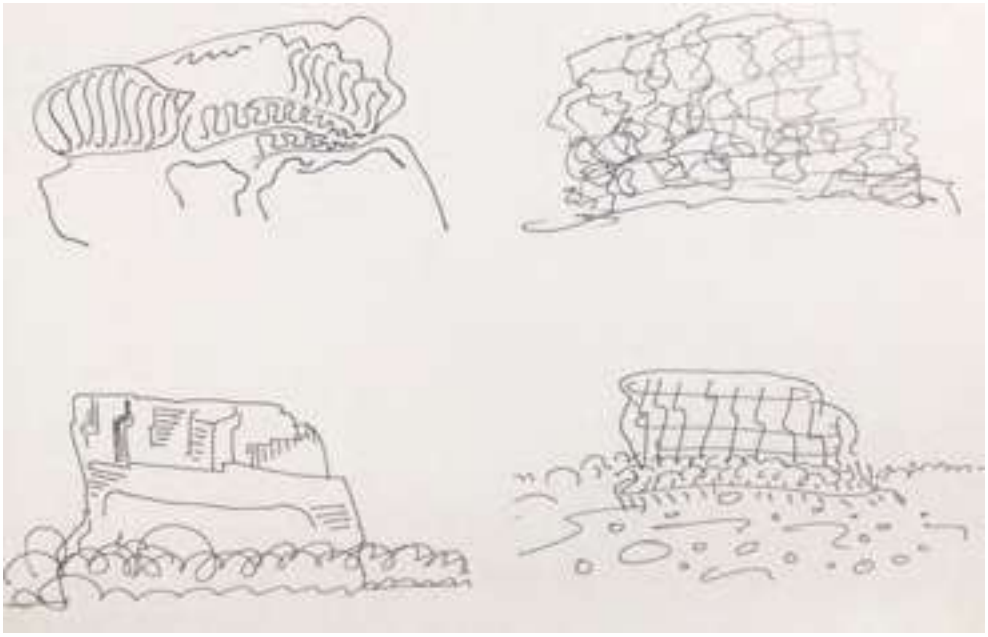
1 PETER EISENMAN, GALITIA CENTER OF CULTURE, SANTIAGO DE COMPOSTELA, FROM RAFFAELLA LAEZZA (2005). PETER EISENMAN GALITIA CENTER OF CULTURE, SANTIAGO DE COMPOSTELA, UNICOPLI EDITIONS. PHOTO BY ANITA SEMERANI

2 PETER EISENMAN, GALITIA CENTER OF CULTURE, SANTIAGO DE COMPOSTELA, FROM RAFFAELLA LAEZZA (2005). PETER EISENMAN GALITIA CENTER OF CULTURE, SANTIAGO DE COMPOSTELA, UNICOPLI EDITIONS. PHOTO BY ANITA SEMERANI

3 CECIL BALMOND, STONE DIAGRAMS, FROM "ELEMENT".



4 CECIL BALMOND, STONE DIAGRAMS, FROM "ELEMENT".



5 CECIL BALMOND, STONE DIAGRAMS, FROM "ELEMENT".

THE USING STONE IN AMMAN'S BUILDINGS: CASE STUDY JAAFAR TUQAN'S BUILDINGS

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Abstract

Stone is a basic building material in Jordan in general and in the city of Amman in particular, and it is available locally, which gives the spirit, rootedness, and adaptation to the environment to the locality. Despite the development and emergence of modern building materials such as glass in modern buildings, the paper discusses a group of architectural works. Jaafar Tuqan, whether public or residential buildings, with an emphasis on the use of stone in most of his buildings, using different methods and techniques for stone and with various patterns of stone on the facades of buildings such as Al-Mesamsam, Al-Tabzah and Al-Mafjar. He was famous for using more than one type with the same block formation of the building in order to improve the local architecture and keep up with it. Contemporary urban development, such as the use of other building materials such as concrete, glass, steel, and wood.

Keywords

Jaafar Tuqan, Stone, Amman city, Faced, Architectural Techniques.

Introduction

In Jordan, stone is considered one of the main materials used in construction and cladding of the building's outer shell. This is for social, artistic, cultural and technical reasons, and because it is suitable in terms of cost and the ability to be within reach, and it has benefits that have proven its worth in terms of aesthetics. Construction and protection.

Due to the different natural topography in Jordan, this led to the presence of different environments in Jordan and the multiplicity of quarries depending on the source and the environment surrounding the quarries. Therefore, different types of stones were produced in different sizes, colors, and shapes, including Ma'an Stone, Ajloun Stone, Hayyan Stone (Mafraq), and Qatranah Stone. (Abu Ghanima, Ghosheh, 2000)

The colours of stones vary in quarries, as there are many colours such as yellow, bright white, white, green, black, and pink, but the common colour in Jordan is white in the facades, and we use the rest of the colours in decoration, interior decoration, fireplaces, and entrances. It was noted that In some facades, the colours of the stone differ, especially in one facade (2000 ,غوشة ,أبو غنيمة), Stone was used in the exterior and interior facades, both in public and private buildings such as housing, so it can be considered an element of continuity between the old and the modern (Abu ghanimeh, 2015.).

With the technical and technological development in architecture, construction methods and building materials have evolved with the emergence of new types.

1. Jaafar Tuqan's

He is one of the architects who have great importance through The influence on the architecture of the local city of Amman and an architectural imprint characterized by the link between modern thought, history and originality. He is considered one of the distinguished Jordanian architects in international projects, whether inside or outside Jordan, and he has a group of projects that have won many awards, the most important of which is the Aga Khan Award. Of his projects, such as S.O.S Children's Village in Aqaba (1991), Bank of Jordan, Jubilee Secondary School in Amman

(1999), Amman City Hall (in collaboration with Rasem Badran), Dunes Club Amman, Marriott Dead Sea Resort and spa, Jordanian National Museum. In addition, For its residential buildings such as Villa Rizk, Villa Salti, Villa Celebi, Villa Abu Rahmi and Villa Al-Qattan in Amman (Figure 1) (ابو غنيمة، 2002).

Figura 1:Some of Jaafar Tuqan's projects using stone, Source (Researcher)

1.1. Jaafar Tuqan's style in design

Jaafar Tuqan is called the architect, the poet of stone architecture and his style was distinguished by a rare boldness and his approach to a modern plastic eloquence, especially through the use of stone in most of his buildings as a finishing material and window openings distributed regularly on the surface of the facade.

The stone is as if engraved, adding features of stability, strength and solidity to his buildings that architecture lost, compared to the recent period when glass panels were used in the facades, which are characterized by lightness and simplicity.

In this regard, Toukan says: "Although, during my long practice in the field of architecture, I have experienced many styles Architecture does not use stone, especially in the other half of this century. Stone remains in my conscience and sentiment The material that is most adherent and consistent with the concept of shelter, and is the purest, simplest, and ablest to adapt to forces

Nature, because he is from nature and grows old in it with pride." (Tuqan, 2007).

1.2. An overview of Jaafar Tuqan's excellence in using stone

Stone was used in the exterior and interior facades, both in public and private buildings such as housing, so it can be considered an element of continuity between the old and the modern.

The stone has many properties that allow you to create a microclimate Suitable for human life, which varies according to the seasons. It retains heat in the winter and keeps rooms cool in the summer.

Regarding his excellence in using stone material in his projects, local architect Hassan Ghoneim, who began his career with Jaafar in the year1986 AD, commented that Jaafar's original signature can be recognized in his projects around Amman. He was innovative in all aspects of design and knowledgeable: Saying, "In the way he experimented with stone," he adds, he was credited with shedding light on a new method of applying stone cladding above windows. When he came to Amman, everyone was placing stone vertically above the windows. Jaafar's method was based on placing the stone as horizontal curtains hidden within the wall. Since then, this has become the standard installation today (Tuqan, 2007).

2. Jaafar Tuqan's Projets

2.1. Bank of Jordan

One of the most important architectural buildings that had an impact on local architecture in Amman It imposed itself strongly on the urban fabric of the entire surrounding area Which reflected Jaafar Tuqan's approach in his application of techniques in the uses of stone In an innovative and new way to Amman architecture It is characterized by symmetry, which enhances its role in the visual design scene The building is clad in stone, marble and glass(Figure 2) (AbuHazeem, 2021).

Figura 2: Bank of Jordan, Source (Researcher)

2.2. The Museum of Jordan

It reflects the history and heritage of Jordan, and summarizes the progress and development over time as it contains a collection of treasures from Jordan's history.

The building's exterior represents the continuation of time. The building's stone cladding is divided into layers and the base layer consists of raw stone that turns into "white stone bound in the upper layer.". The main idea is that it symbolizes the civilizations that passed through Jordan. The white stone represents the present and the glass indicates the future (AbuHazeem, 2021).

Figura 3: The Museum of Jordan, Source (Researcher)

2.3. The Children's Village SOS in Aqaba (1991)

The Children's Village is located in the residential suburbs of the city of Aqaba on the Red Sea. One of the international prerequisites for children's villages is that they must: To be built in an existing social environment, so that it is not isolated from the urban context of the city. This was the second village of its kind built in Jordan; The first was in the capital, Amman, and the third was in Irbid. This project was completed in 2000. It has been designed The Three Villages by the late architect Jaafar Touqan.

The overall goal of the program was to create an environment within an urban community Existing, where orphaned children can enjoy living conditions that are close to them as much as possible from normal family life (AbuHazeem, 2021).

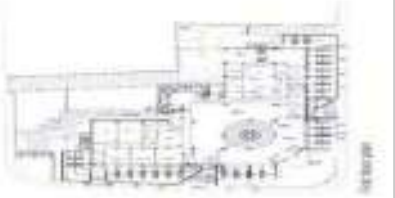
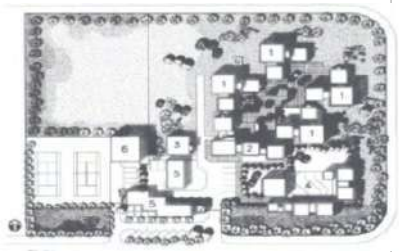
Figura 4: The Children's Village SOS in Aqaba (1991), Source (Researcher)

2.4. Kattan Villa

Site features have been used to their fullest extent to produce a design that incorporates a protected outdoor space, in While the interior is a multi-level game of spaces overlooking the middle of a space lit. It features an internal courtyard, extending outwards, clad in golden stone. The segmental arches automatically intersect the straight line, emphasizing the light variations at different times of the day (AbuHazeem, 2021).

Figura 5: Kattan Villa), Source (AbuHazeem, 2021)

Table 1:The name, location and style of Jaafar Touqan in some public and residential buildings designed by Jaafar Touqan, Source (AbuHazeem, 2021)

No.	Building Name	Jaafar Tuqan›s style	Plans
1	Bank of Jordan Amman-shmisani/1997	1- In his approach, he adopted what is called “excavation” of architectural blocks, which he began by His Indian works. Louis Kahn - (1975 - 1901) Kahn Louisola 2- Use of stone in large sizes and application Local sesame stone on the G.F facades & polished local stone Upper floors 3- Using mechanical stone suspension technology:	
2	The Jordan Museum Amman /2013	1-A huge entrance and a gradual progression of clustering. 2- The facades are made of rough and smooth stones, and the glass represents the future 3- No frills. 4- The building is a mixture of traditional elements and contemporary forms.	
3	The Children’s Village SOS in Aqaba (1991)	1- Its adoption in the design and construction of building walls on rocks and stones. 2- Falling from granite mountains in a simple and traditional way, but in a modern way, and replacing Wooden columns with precast concrete. - Using some traditional elements of environmental treatments for the project, such as Mashrabiyas, air shelters, and a wooden pergola.	
4	Kattan Villa Amman /1998	1- Use of stone in the interior walls of the building Working to restore heritage elements, especially in the entrance area and living spaces. 2- The regular gradation of the building blocks and the wide openings with their lines Straight 3- Unifying the pattern, size and colour of the stone Building parts.	

Conclusions

1- The relationship between architecture and building materials was simple until the advent of the industrial revolution in the nineteenth century. They invented machines, factories, and steel structures. With the development of science, geometrically calculated building materials were used.
2- The materials were chosen from the surrounding environment, such as stones, while preserving their external appearance or durability, which is the material for building walls, foundations, and columns.
3- The role of basic building materials is to express the function of the building, and add aesthetic values to the internal coordination and external appearance of the building.
4- The most important elements that affect the process of architectural formation of the building are the structural systems, the building materials used, the implementation methods and the techniques used.
5- The development of building materials that the architect relies on to embody and shape his buildings has had an important impact on architecture in Jordan, especially the development of the local architecture of the city of Amman and its integration into society.
6- Jordanian stone has many advantages and characteristics in terms of its strength and beauty, which qualifies it to compete and enter the global architecture markets strongly.
7- Amman suffers from a complete alienation between the population and the city.

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THE LANGUAGE OF STONE AS MATERIAL, PHENOMENON, AND VALUE FOR A NEW PERCEPTION OF ARCHITECTURAL SPACE.

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Abstract

Contemporary architecture balances innovation with tradition, epitomizing responsible design. Stone's enduring significance in architecture lies in its symbolism, craftsmanship, and adaptability. Material, phenomenon, and value define architecture's essence, bridging the past with the present. Through thoughtful integration, stone continues to shape architectural narratives worldwide.

Keywords

Space, stone, material, phenomenon, value.

Introduction

Architecture is an art that combines form and function, aesthetics and utility, in a dynamic equilibrium reflected in the technical choices and construction details adopted during the design process. The design approach leads to choosing between the functional needs of space and the aesthetic expression of form. Technical choices, such as the selection of materials and the arrangement of structural elements, prove to be fundamental in translating the architectural concept into a built reality and also into an architectural language. This type of language, when referring to the use of stone both as a construction material and as a cladding material, has long been a universal language in architecture. In addition to being a durable and resilient building material, stone also holds rich symbolic and expressive significance that has shaped the history of architecture worldwide, especially in the Mediterranean context. The earliest forms of masonry constructions date back to prehistoric times, when humans began stacking stones or bricks to create shelters. These early constructions were often rudimentary but represented a significant step in the evolution of architecture, offering protection and security to early communities. In ancient Mesopotamian, Egyptian, Greek, and Roman civilizations, masonry constructions reached unprecedented levels of sophistication and complexity. From the pyramids of Ancient Egypt to Greek temples and Roman monuments, masonry became an expression of political, religious, and cultural power, testifying to the technical and artistic skill of builders of the time. During the Middle Ages and the Renaissance, masonry construction techniques continued to evolve, with the introduction of new materials, processing techniques, and architectural styles. Gothic cathedrals and Renaissance palaces testify to the skill of artisans in shaping stone and bricks to create architectural works of extraordinary beauty and complexity. With the advent of the industrial era, masonry constructions underwent significant transformations, with the introduction of new materials such as reinforced concrete and steel, which are cage structural processes, and for the first time in history masonry constructions are put in the background. However, interest in traditional masonry has remained alive, with movements such as neogothic and neoclassicism revisiting and reinterpreting architectural styles of the past. Therefore, stone as a construction material, except in small realities and for building restoration, seems to be a victim of this change but, from the beginning, it demonstrates an adaptability through the use of the material as cladding. Illustrious architects such as Otto Wagner, who constructed his subway stations with steel structure clad in stone, Adolf Loos, who analyzed how the concept of cladding, like that of dressing, are instinctive actions of man, up to Ludwig

Mies van der Rohe, who assigned a primary role to stone in many of his works, leading to the Italian Rationalism movement.

The use of stone in Italian Rationalism had various effects both aesthetically and technically. Aesthetically, stone imparted a sense of solidity to buildings, emphasizing the idea of stability and rational order inherent in the movement. Technically, stone represented a reliable and durable construction choice, in line with the functional and pragmatic principles of Italian Rationalism.

Finally, the third millennium, in which society is in deep crisis but also undergoing significant transformation with the explosion of the digital revolution and growing environmental issues. The digital revolution has introduced a range of tools and technologies that are radically transforming the design and construction process. In the stone processing sector, digital modeling, 3D laser scanning, and computer-aided manufacturing allow for precision and customization never seen before. These technologies enable architects to fully exploit the aesthetic and structural potential of stone, creating complex and detailed forms with greater efficiency and precision.

Alongside the digital revolution, there is a growing awareness of the environmental impact of the construction industry. The extraction, transportation, and processing of stone can have a significant impact on the environment, including soil erosion, air pollution, and excessive use of water and energy resources. Consequently, there are increasing efforts to reduce the environmental impact of stone usage in architecture through sustainable practices such as the use of local stones, optimization of production processes, and recyclability of materials.

Stone, with its solidity, strength, and variety of shapes and colors, has always fascinated humanity. However, its importance goes beyond its physical qualities; stone has been shaped and interpreted through the lens of aesthetics, becoming a medium through which to express ideas, emotions, and symbolic forms linked to cultural aspects.

The aesthetics of stone is a complex and multifaceted phenomenon that encompasses multiple artistic and cultural disciplines. Through its transformation from inert matter to object of aesthetic contemplation and cultural symbolism, stone has profoundly influenced visual arts, architecture, and urban landscapes through its materiality, its phenomenon, or through its value. Its impact endures over time, continuing to inspire artists, architects, and urban planners worldwide.

For convenience of further study, we will discuss some built examples of architecture useful for understanding what has been discussed previously through key terms. The identification of these terms is arbitrary but instrumental to the discussion.

Material

The use of stone, or any other material, in architecture is not merely abstract choices but concrete decisions that must be established throughout the design process. The material has a precise form and its own processing method. In the project, it has its position and orientation that modifies its conformation. There are forms that can determine a space, a way of building, a structure, which with their measurements or proportions emerge as one style rather than another. We could say that every material possesses its own architecture. The choice and arrangement of building materials significantly influence the perception of spaces, creating sensations of warmth, comfort, and physical well-being. Additionally, the materiality of buildings can contribute to the creation of distinctive atmospheres and the expression of aesthetic and cultural values.

Fig. 1 – The use of split stone contrasting with the purity of plastered forms, *Ara Pacis Museum*, Richard Meier, 2006, Roma. Source: photo by S. Rugino.

Fig. 2 – The use of split stone juxtaposed with the purity of plastered forms and the white marble or the Ara Pacis, *Ara Pacis Museum*, Richard Meier, 2006, Roma. Source: photo by S. Rugino.

The use of stone in the Ara Pacis Museum in Rome showcases its physical substance, which takes on different forms in space, potentially even becoming a tactile, sensory experience. The finish of the stone explicitly reveals the processing carried out, through splitting, yet still manages to exalt the pure forms of the design. Meier chose to use travertine, a local limestone, to clad some parts of the Ara Pacis Museum. Travertine was employed for both external cladding and some internal elements, imparting a uniform and homogeneous appearance to the monument. Stone processing techniques were carefully selected to ensure the monument's durability and resistance over time while maintaining the integrity of its original forms and details. The smooth and uniform surfaces of travertine create a fascinating contrast with the clean and geometric lines of contemporary architecture. Furthermore, the choice to use stone as the predominant material allowed for maintaining a visual and symbolic connection with the ancient monument while adding a new aesthetic and conceptual interpretation. The aesthetic materiality of stone enhances its visual, tactile, and symbolic qualities, and the way it has been utilized creates an exaltation of form.

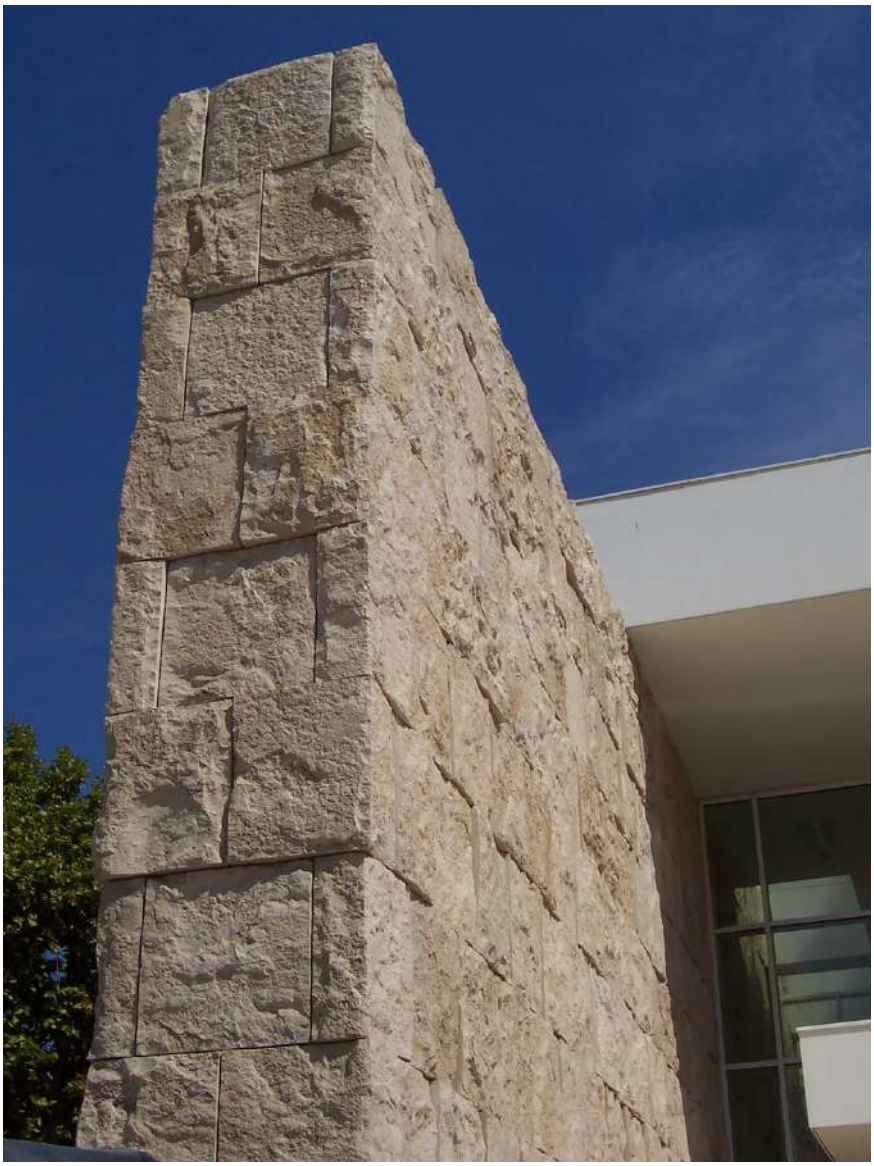

Fig. 3 – Detail of the wall constructed with split stone, *Ara Pacis Museum*, Richard Meier, 2006, Roma. Source: photo by S. Rugino.

Phenomenon

The term “phenomenon” derives from the ancient Greek “phainomenon”, which means “that which appears” or more precisely “that which is visible”. In a general sense, a phenomenon can be defined as an observable event or manifestation that occurs in the natural world or in other domains.

Fig. 4 – The use of open-patterned stone decorating the space, *Barcelona Pavillon*, Mies van der Rohe, 1929, Barcelona. Source: photo by S. Rugino.

In philosophy, the concept of phenomenon is closely linked to ideas of perception and reality, with phenomena representing the sensory manifestations of human experience. Sensory manifestations play a fundamental role in the experience of architectural spaces, influencing the perception of space, form, color, and light.

Mies van der Rohe’s approach to the use of stone as a phenomenon is characterized by a search for essentiality through formal purity.

In the panorama of twentieth-century modernist architecture, Ludwig Mies van der Rohe’s Barcelona Pavilion emerges as a timeless icon of simplicity, elegance, and conceptual clarity. Situated in the context of the 1929 Barcelona International Exhibition, this architectural masterpiece continues to evoke admiration and interest for its unique combination of essential geometric forms, refined materials, and fluid spatiality.

The Pavilion stands out for its clear adherence to the fundamental principles of architectural modernism, including formal simplicity, structural rationality, and innovative use of materials, and is characterized by a harmonious intersection of horizontal and vertical planes in stone, defining open and fluid spaces. The glass walls engage the observer in a constant dialogue with the surrounding landscape, creating a sense of continuity between interior and exterior.

The skillful use of marble, steel, and travertine imbues the pavilion with a quality of timeless elegance and refinement.

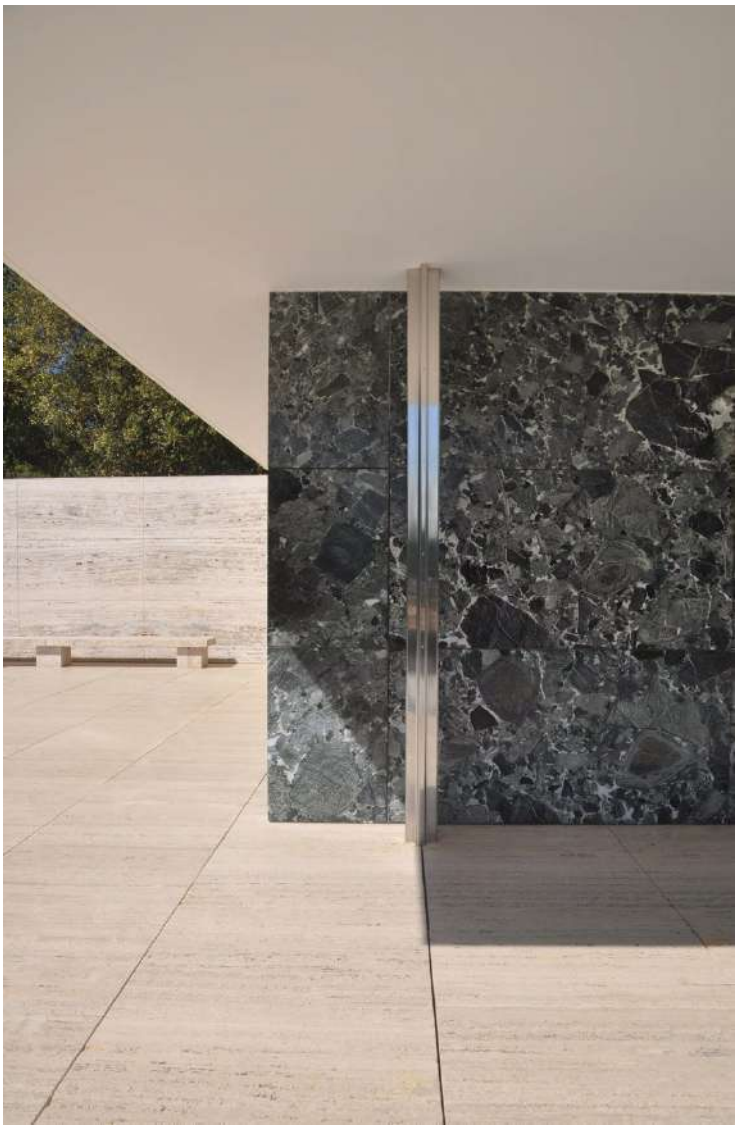

Fig. 5 – The use of open-patterned stone contrasting with new materials such as steel, *Barcelona Pavillon*, Mies van der Rohe, 1929, Barcelona. Source: photo by S. Rugino.

While it can be described as an example of architectural simplicity, it is important to emphasize that this simplicity is not the result of a banal reduction or lack of complexity. On the contrary, Mies van der Rohe's quest for simplicity emerges from his ability to synthesize and harmonize a wide range of architectural elements into a coherent and harmonious composition. In this sense, the simplicity of the Barcelona Pavilion is the result of a refined process, in which each architectural element is reduced to its essential form. In fact, Mies states that the simplicity of architecture lies in the clarity of architectural means and the purity of materials.

The finish of the marble surfaces of the pavilion, in "open stain" technique, cutting the marble block into thin slabs where the veins compose designs similar to the entire block, renders the language of stone a "phenomenon" rather than "material". This means that Mies emphasizes the chromatic values of the stone rather than the materiality of the marble block.

Value

The concept of value in architecture is inherently linked to our perception of built spaces, encompassing aesthetic, functional, cultural, and emotional aspects. It can also be defined in terms of utility, beauty, symbolic meaning, sustainability, and adaptability. The value of a building can vary depending on the cultural, social, and economic context in which it is situated and can be influenced by factors such as history, location, and urban context.

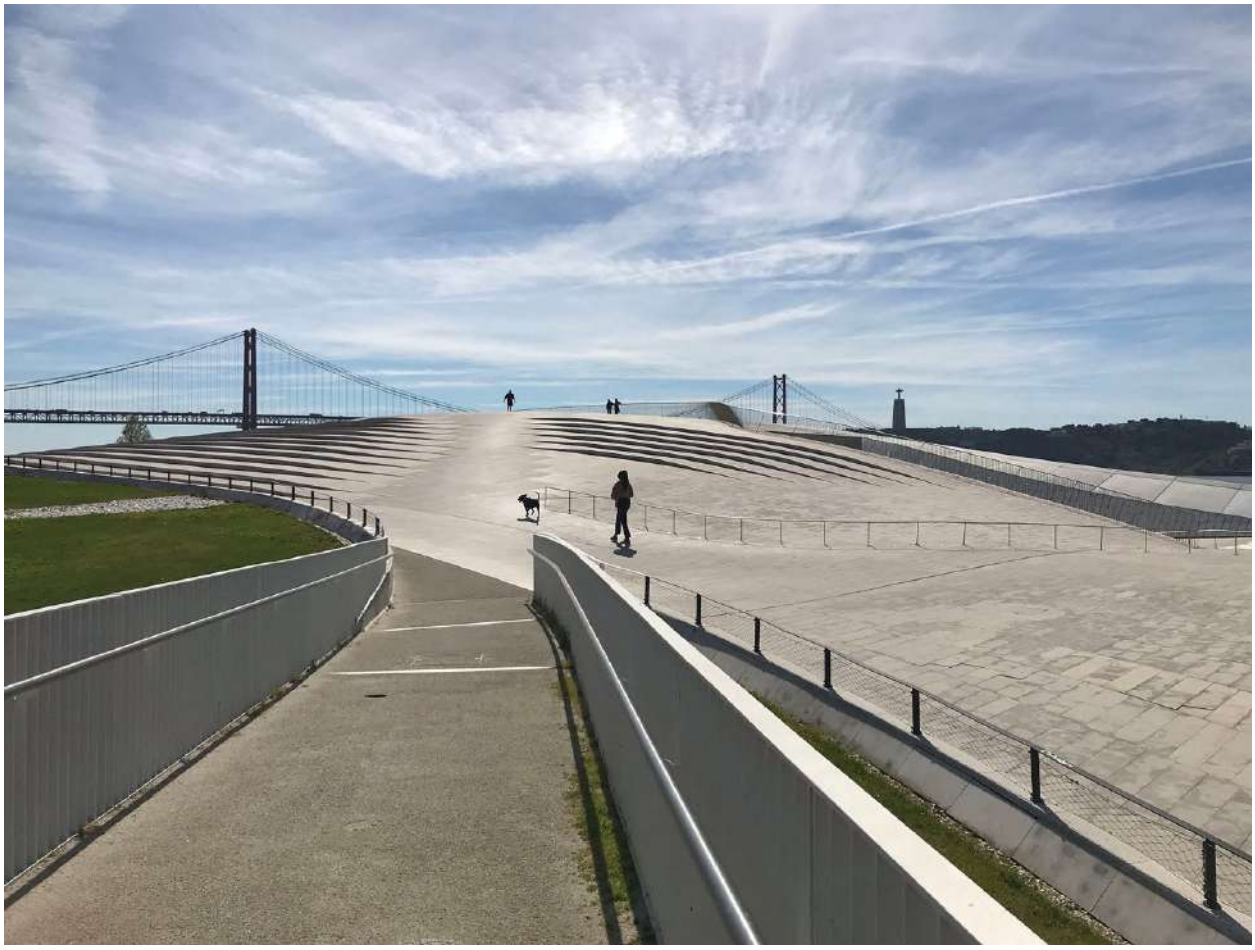

Fig. 6 – The use of local stone that becomes landscape, *MAAT*, Amanda Levante, 2016, Lisbon. Source: photo by S. Rugino.

The value of an urban context can derive from various factors, including the preservation of historical and cultural heritage, the promotion of diversity, and the creation of attractive and accessible public spaces. The historical tradition of a place contributes significantly to its identity and value. Architectural elements, structures, materials, and decorative details that reflect the history and culture of a place imbue architectural spaces with depth and a unique character. These elements can be witnesses to past epochs, significant events, or local traditions and can contribute to creating a sense of continuity and belonging.

Fig. 7 – The use local stone and typical tiles of the area, *MAAT*, Amanda Levante, 2016, Lisbon. Source: photo by S. Rugino.

Fig. 8 – The use local stone and typical tiles of the area, *MAAT*, Amanda Levante, 2016, Lisbon. Source: photo by S. Rugino.

This is the case with two architectures built in Portugal: Rem Koolhaas' Casa da Música in Porto and Amanda Levete's MAAT (Museum of Art, Architecture, and Technology) in Lisbon.
The Casa da Música, located in the Boavista district of Porto, stands out for its bold modernity in an urban context characterized by a mix of historical and contemporary architecture. Its strategic location in the center of a public square makes it a focal point of the city's cultural life. The design of the Casa da Música is characterized by bold lines, dynamic geometric forms, and innovative use of materials. The main facade is clad in panels of white concrete, while the interior features an explosion of color and light, given also by the cladding of the walls with typical "azulejos" tiles, large windows, and reflective surfaces.

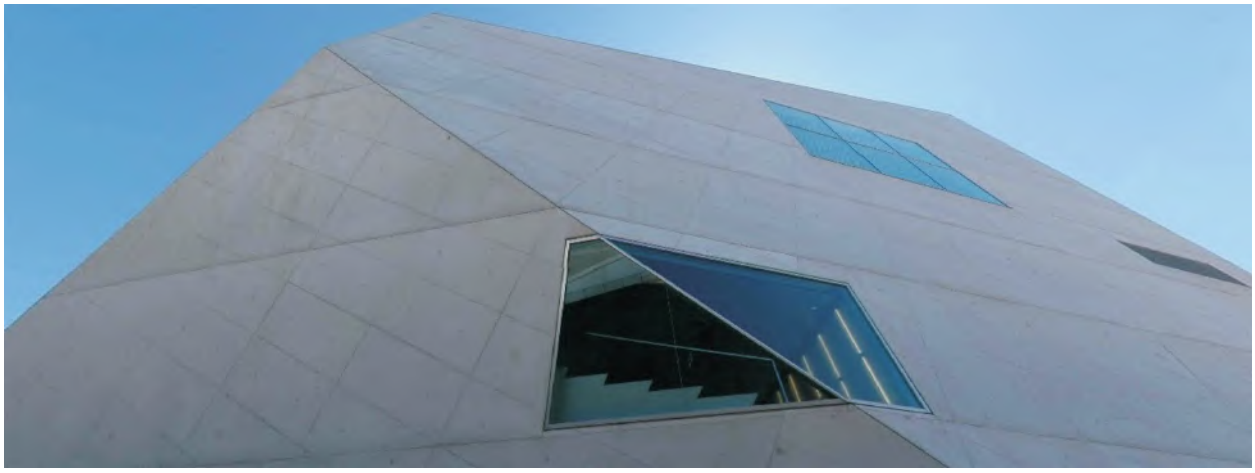

Fig. 9 – The exterior cladding white cement panels, *Casa da Musica*, Rem Koolhaas, 2005, Porto. Source: photo by S. Rugino.

Fig. 10 – The interior cladding with tiles featuring geometric patterns, *Casa da Musica*, Rem Koolhaas, 2005, Porto. Source: photo by S. Rugino.

Fig. 11 – The interior cladding with traditional tiles "azulejos", *Casa da Musica*, Rem Koolhaas, 2005, Porto. Source: photo by S. Rugino.

The tiles play a crucial role in the architecture of the Casa da Música, contributing to value and defining the style and atmosphere of the interiors. Used in various areas of the structure, from walls to decorative elements, the tiles harmoniously integrate with the bold and contemporary design of the Casa da Música. Their presence lends a sense of visual coherence and continuity to the spaces while adding texture and color to the environments. From traditional ceramic tiles to glass or metal ones, the structure features a wide range of materials and finishes.

The MAAT is located on the riverside of Lisbon, in an area rich in history and culture. The design of the MAAT is characterized by fluid lines, organic forms, and above all, the creative composition of historical materials: the tiles that cover the streets of Lisbon and the cladding of almost the entire building with trapezoidal tiles. The structure stretches along the Tagus River, with a series of interconnected volumes that rise like suspended waves above the ground. The main facade is clad in white ceramic, following the rich Portuguese artisanal tradition, which reflects sunlight and creates an iridescent effect that changes with atmospheric conditions.

The use of tiles as cladding represents an excellent example of how a traditional material can be reinterpreted in a contemporary context to create extraordinary visual and functional effects. The tiles significantly contribute to the aesthetics, functionality, and durability of the structure, imparting its spaces with a distinctive and engaging character. Ultimately, the innovative use of tiles in the MAAT highlights the creative and technological potential and value of this material and celebrates its versatility and beauty.

Conclusions

Contemporary architecture often finds itself navigating between technological innovation and construction tradition. While new technologies and materials offer new design possibilities, knowledge of traditional techniques and construction details from the past can inspire original and sustainable solutions. The dialogue between innovation and tradition is essential to ensure a responsible architectural practice that respects human and environmental needs.

Stone in architecture goes beyond its practical function as a building material; it is a vehicle for complex and multifaceted symbolic meanings that reflect the aspirations, beliefs, and experiences of the local culture. Its solidity, craftsmanship, sacredness, and connection to historical memory are just some of the many symbolic dimensions that stone assumes in architecture.

Material, phenomenon, and value represent three key elements that define the essence of architecture. Material constitutes the physical substrate of buildings, phenomenon concerns the sensory and perceptual experiences generated by architectural spaces, while value reflects the cultural, social, historical, and economic importance of the context in the case of the Mediterranean.

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Petra scripture

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Abstract

Stone buildings express a modernity that crosses history and geography because it is the material closest to the earth, so that nature takes longer to recover the order from which artifice has taken it away; furthermore, the shape of the load-bearing buildings coincides with the shape of the space while the stone materials demonstrate the work of those who put them into place, either in the calligraphy of the opus incertum, or in the geometric rigor of arranging blocks and slabs.

Keywords

Composition, construction, constraints, topography, measure

Stone construction has been at the root of my training since the theme of Composition V “Single-family house in Vietri sul Mare” assigned in 1969 by Nicola Pagliara and since then I have preferred stone also adhering to the thought that the writer Marguerite Yourcenar, in the book “ Memorie di Adriano, Einaudi 1963”, makes the emperor Hadrian say: «Building means collaborating with the earth, leaving the mark of man on a landscape that will remain modified forever; also contribute to that slow transforma- tion that is the very life of cities», so stone buildings will be those that can aspire to become “ruins” as opposed to those materials that will become waste.

1

RACHYTE GARDEN IN ISCHIA, 1979 - 1981. The request was the design of a garden in the vast land in Casamicciola, but ignoring the art of gardens and re- fusing to give an answer in terms of beautification, I addressed the problem with the terms which I place at the basis of every project: *what, how, where* along with *con- struction, constraints, topography and measure* and the topography itself, like the excava- tion and filling of road projects, directed the solution in rectifying the slope in two levels, then the cutting of the land which introduced the support structures with vertical arches and buttresses, while the difference in height led to part of the house being buried, a condition similar to the holiday home built by Le Corbusier in La Celle-Saint-Cloud covered with soil and grass.


2


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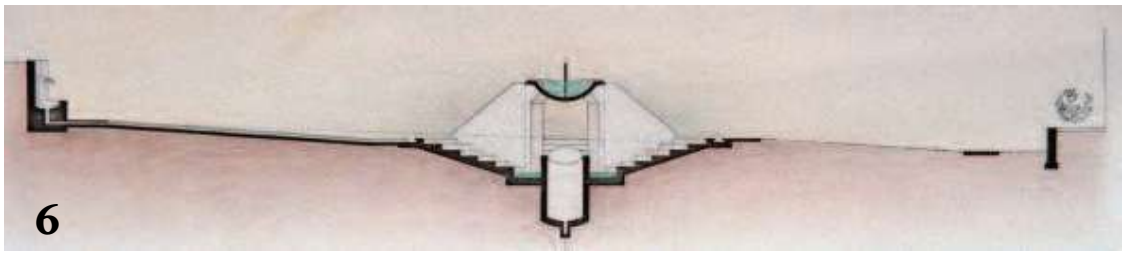
4


5

TONE FOUNTAIN in Rocchetta E Croce (CE), 1983. The project was born from the path of the water and is based on gravity and the void: the gush towards the sky is contrasted by the waterfall which, from the basin supported by the but- tresses, overflows towards the basin below rooted in the concentric steps of the enclosure with the annular canal.



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VERSACE BOUTIQUE in Potenza, 1984. The rooms were on the first floor of a building in via Pretoria, so I designed a gazebo as a showcase located in the courtyard and visible from the door. It was therefore the paving of the entrance hall that suggested making the floor of the boutique in stone which simulates a pre-existing street.

8

9

10

AF HOUSE in the countryside near Calvi Risorta (CE) 1983 - 87. The construc- tion in tuff blocks is the ancient one with the excavation of the foundation, the base and the growth of the walls with the unveiling of the space. On that con- struction site I liked to compare its configurations to those of the archaeological sediments, imagining the forms of the construction coinciding with those of its decay, when time, acting from top to bottom, will restore the earth's natural order and the materials that were taken away from it. . The last element capable of resi- sting nature will be the first to have been built, it will therefore be the foundations that preserve the memory of the building and its conception in the earth. The house was for parents returning from Eritrea and today it is a refuge for weekends

11

12

ORIO HOUSE in Calvi Risorta (CE) 1988. With Maria Rosaria Fiocco and Ulde- rico Marciano. The client traded Apulian oil, so he asked to use blocks of Lecce tuff which is a compact sedimentary rock that is easy to work with. The skeleton is made of reinforced concrete, while all the walls are made of modular blocks in- stalled with glue and the joints made with cables which required extremely rigorous designs. Furthermore, the material led me to use the arch invented by Louis Kahn with concrete tie rods which, like the beams, are covered with “Terranova” plaster. Part of the portico was rebuilt in the Italian Pavilion of the 1996 Venice Biennale, while in 2018 the house was protected by MIBAC, the ministerial body responsible for protecting architectural heritage.

13

14

NDERGROUND HOUSE in Santa Maria al Monte, municipality of Forio d'Ischia, 2015. Using the tuff blocks of a rural house no longer alive, the refuge has the ambition of enhancing the landscape with values greater than those of the l 'building demolished. Reachable only by mules, the semi-underground space has a single elevation and includes the living room, four beds, a warehouse and tanks for rainwater collected from the earth covering, while electricity is supplied by ver- tical wind generators.

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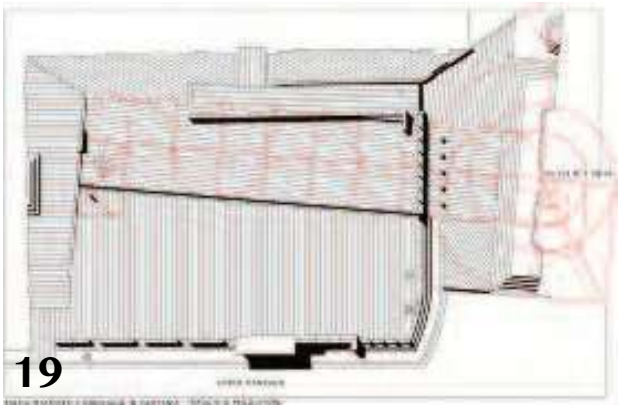
18

REDEVELOPMENT OF THE CAMPANO COURSE IN GIUGLIANO (NA)
1995-97. With R.Guadalupi, L. Maisto, P. Pirozzi, R.Pirozzi.
Corso Campano is an ancient Roman consular road located on the East-West axis, where illustrious buildings and ancient churches overlook the church of San Nicola and the church of the Annunziata. To prevent cars from parking in Piazza Matte- otti, beyond the steps of the difference in height, there are the bus pavilion, benches and bollards made of solid “Biancone di Trani”. The existing paving stones were re-chiseled and installed according to the design; the pavilion was built with four-centimeter slabs serving as formwork for the reinforced concrete castings.

EDEVELOPMENT OF THE UM- BERTO I COURSE IN MODUGNO
(BA), with Maria Rosaria Fiocco, coll. Paola Arcamone, 2005 - 2013.
It is made entirely of “Biancone di Trani” stone.



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From the church of Santa Sofia, attributed to Domenico Fontana, the golden ratios and the five-degree rotation with respect to the East-West axis of Corso Campano were detected, a rotation corresponding to the position of the equinoctial axis on the day in which the remains of the saint of origin cumana were transferred from the sanctuary of Montevergine to Giugliano, so the intervention was based on the same principles with which Domenico Fontana placed the church in relation to the celestial order, the earth, the sun and therefore time.

21

IAZZA CARLO FESTA in Avellino, with Gianluca Di Vito and the Municipality's Urban Redevelopment Office, 2007. The square is bordered by an ancient back- drop, two schools and a private garden. The Trani stone texture marks the axis to- wards the bell tower of Santa Maria Assunta and the directions of the pavilion with bar serving the schools and the neighborhood.

Stone buildings require the tools of the level and plumb line which, in addition to guaranteeing the beauty of order, are an antidote to the current fashion of distorted

22

23

RBAN REQUALIFICATION OF THE GIUGLIANO METRO STATION,

2006 – 2011. With M. R. Fiocco, G. Di Vito, A. Greco, V. Sorrentino. .

Giugliano station is an interchange between road and rail transport with a bus sta- tion, shops, the bridge restaurant and the office tower (not built). The contrast bet- ween the horizon line of the bridge restaurant and the vertical of the offices is reiterated by the slab of the bus station and that of the tower. The metric precision, elevated to an aesthetic factor, is manifested in the travertine module that governs the entire project. The staircase is made of six centimeter thick slabs of the precious Navona travertine, the roof of the bus station is covered in four centimeter slabs of travertine which on the extrados are perfectly horizontal with open joints that collect the rainwater directed into the steel columns.

24

25

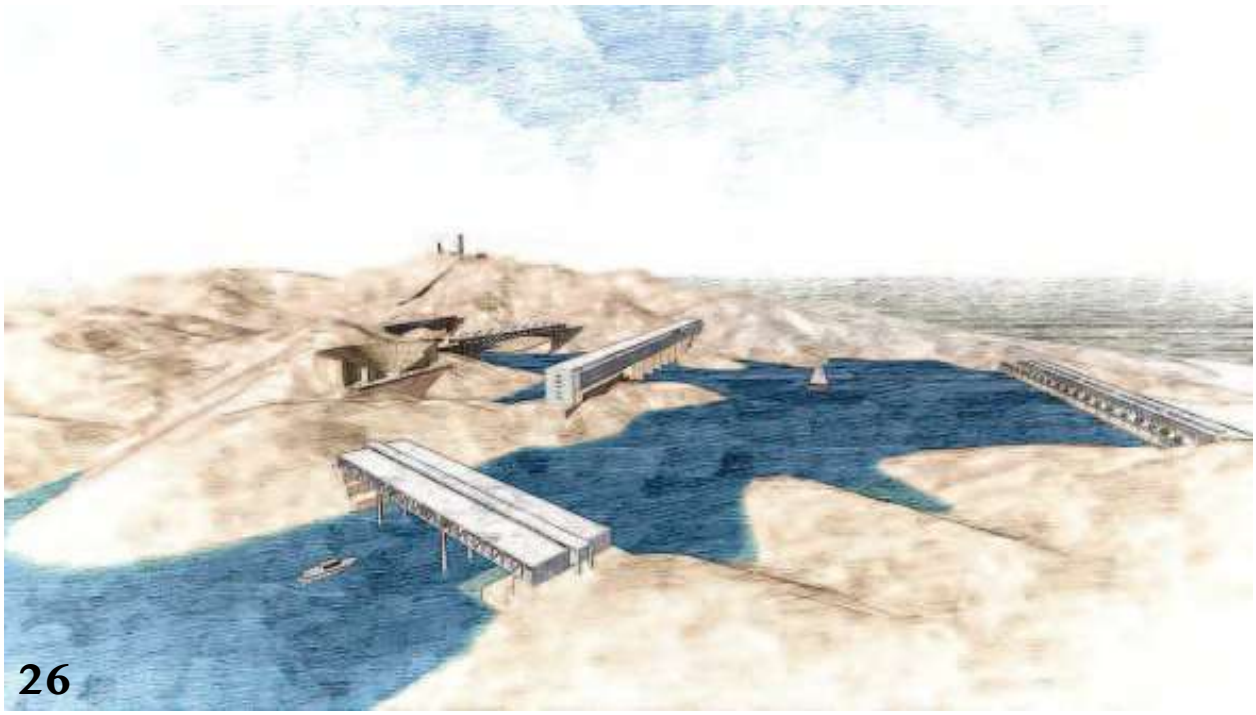
OURIST CITY IN ABHA, ASIR (SAUDI ARABIA), 2013 – 14, Awarded com-

petition (with P. Arcamone, F. Balzano, A. Barbati, P. Cirelli, G. D'Argenio, T. Espo- sito, M. R. Fiocco, M. Giacca, M. Giampaolino, G. Nugnes; historical consultant

A. M. Raffone; structural consultant engineer. A. Formisano).

Near Abha, Prince Faisal Bin Khalid, governor of Asir, established the invitation- only competition of a tourist city for Saudis attracted by the highland climate.

Lacking historical models to design a "tourist city", I used geography both to define the road layouts and to solve the water problem which, with contour lines, we pla- ced four dams on the streams that give rise to four lakes and eighteen villages tourist facilities with houses, centre, restaurant, swimming pool, gym, playgrounds and



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prayer room. The five types of accommodation are built with the local stone tra- dition, while in five “bridge buildings” with current techniques there is the gym, the hotel, the shopping centre, the museum and the auditorium. The “bridge buil- dings” are connected by tram and the mosque by the funicular. While villages sup- port nature, bridge buildings express it. The center of gravity of the center is the open-air theater which satisfies the passion for music and poetry that attracts en- thusiasts from all over Saudi Arabia to Abha. From the two trips to Saudi Arabia, I published the book “Tourist City in Abha, Saudi Arabia” with texts in Arabic, En- glish and Italian, Giannini Editore 2014, a book in which I documented the extra- ordinary architecture of stone, earth and earth and stone of Asir.

27

HE WAY OF CRAFTS in Naples, with Vincenzo Bruno and Maria Rosaria Fiocco, 2021. It is a commission from Maurizio Marinella with the aim of bringing together the artisan workshops of Neapolitan excellence with exhibition and sales spaces. In the 16-hectare lot in the former Feltrinelli area, building in height was ruled out and, due to the alluvial nature of the soil, digging garages and warehouses was ruled out. Except for the tower, the load-bearing structures are gravity walls built in layers according to the Roman technique of casting concrete with aggrega- tes obtained from the demolition of dilapidated buildings. With the archaic con- struction from the bottom up, the project aims to be redress for the land and the city with a step backwards which, quoting the philosopher Henri Bergson «does not consist in a regression of the present into the past but, on the contrary, in a progress of the past in the present».

28

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EW FENCE WITH ENTRANCE AND MUSEUM OF THE ARCHAEOLO-

GICAL PARK OF VELIA, with Vincenzo Bruno and Remo Ricco, 2023. Velia is the city of Parmenide of Elea the philosopher who considered ALETHEIA, the round truth to be sought through thought, in opposition to DOXA, the “non- being”, daughter of the senses which are false and deceptive.

The walls are built in layers according to the Roman technique of concrete castings with aggregates obtained from the demolition of dilapidated buildings; he joints are COR-TEN iron plates every 60 centimetres.

30

31

UBLICATIONS AND EXHIBITIONS

TRACHYTE GARDEN IN ISCHIA. **Books:** “Architettura e Ricerca”, ’84; “Architettura Italiana della Giovane Generazione” di P. Scaglione, ’89; Controspazio n 6, ’91; “Napoli 5 Architetti” a cura di F. Irace, Clean, ‘96. “Resistenze, frammenti di Architettura di pietra, terra, luce e aria di Sandro Raffone” with introduction by Mario Pisani, Clean ’00; “Altre parole nel vuoto” di S. Raffone, Giannini, ’12; “Il tetto come elemento di architettura” di A. Acocella, ed. Brianza Plastica ’99; **Magazines:** Gran Bazaar n 3, ’84; Controspazio n.6 ‘91; L’Architettura n 426, ‘91; Controspazio n. 2, ’98. Exhibitions: “Regole del costruire, regole del comporre”, Clean ‘88; “Na- poli-Porto, due realtà a confronto - Adalberto Dias e Sandro Raffone”, Campobasso ‘98; Ist. Studi Filosofici, Napoli ‘96; “II Salòn de Architettura Cubana”, La Habana ‘99; “Vitalità del moderno” In/Arch, Roma ‘00.

In 1991 the client and the designer obtained an In/Arch Award. STONE FOUNTAIN. Published on “Altre parole nel vuoto”, Clean ‘10. VERSACE BOUTIQUE. Published on Uomo Harper’s Bazaar n.38, ‘86.

RAF HOUSE. **Books**: “Architettura italiana della giovane generazione”, ed. Materiali di Progetto Nuovo a cura di P. Scaglione, ‘89; “Case e ville in campagna”, ed. De Vecchi ’89; “Spazio immagini” di F. Formisani, ed. Thema ‘93; “Tetti in laterizio”, di A. Acocella e M. Pisani, Laterconsult ‘94; “Napoli 5 architetti” a cura di Fulvio Irace, Clean ‘96; “Le case degli archi- tetti” di A. Cornoldi, Marsilio ‘01; “Resistenze, frammenti di Architettura di pietra, terra, luce e aria di Sandro Raffone” con introduzione di M. Pisani, Clean ’00; “Altre parole nel vuoto” di Sandro Raffone, Giannini, ’12. Ma- gazines: “Gran Bazaar” n 8/9, ‘86; “Ottagono” n 82, ‘86; “Domus”, n 692, ‘88; “50x70” n 1, ‘88; “Costruire in laterizio” n 29, ‘92; “Itinerario” n. 6, ‘92 di Renato De Fusco; “Controspazio” n.6, ‘91; “L’industria delle co- struzioni” n 280, ‘95. Exhibitions: “Regole del costruire, regole del com- porre”, Clean ‘88; “Napoli-Porto, due realtà a confronto - Adalberto Dias e Sandro Raffone”, Campobasso ‘98; “Napoli, 5 Architetti”, Istituto Ita- liano per gli Studi Filosofici, Napoli ‘96; “II Salòn de Architettura Cubana”, La Habana ‘99; “Vitalità del moderno” dell’In/Arch, Roma ‘00. In 2018 the house was selected by MIBAC, organization of the Ministry of Cultural Heritage and Activities responsible for the protection of architectural he- ritage.

IORIO HOUSE. **Books:** Napoli 5 Achitetti, ’96; Venice Biennale Catalo- gue, ‘96; Resistenze, Clean ‘00. **Magazines:** Gran Bazaar n 63, ‘88; D’Ar- chitettura n 12+1 ‘95; L’industria delle Costruzioni n 280 ‘95; D’Architettura n 14 ’96. Exibition: a part of the portico was reconstructed for real in the Italian Pavilion of the 1996 Venice Biennale; in 2018 the house was selected by MIBAC for the protection of architectural heritage. REDEVELOPMENT OF THE CAMPANO COURSE IN GIU- GLIANO.. **Books:** “6. Mostra internazionali d’architettura - sensori del futuro, l’architetto come sismografo” ed. Electa e La Biennale di Venezia, ‘96; “Lo spazio pubblico in Italia ‘90-‘99”, Alinea Editrice, ‘99; “Resi- stenze”, Clean ‘00; “Altre parole nel vuoto” di SR Giannini ‘10. Magazi- nes: “Tracce di architettura” n 13 ‘97; “L’Industria delle Costruzioni” n 321/2 ‘98; “Area” n 36 ‘98. Exhibitions: Piazza Matteotti, the only Italian project out of 120 participants, won the second degree of the European Urban and Regional Planning Awards on 27 September ‘97. A few years ago, imitating the Taliban in Afghanistan, the Municipality’s policy destro- yed the entire intervention and replaced it with what can be seen from Google.

PIAZZA FESTA. **Magazines:** “Altre parole nel vuoto” Giannini ‘10; “Ar- chitettura e città del 3° millennio” ‘12.

URBAN REQUALIFICATION OF THE GIUGLIANO METRO STA- TION. **Magazines:** “Metropolis” in “Abitare” dic. ‘06. **Books**: “Napoli dal Novecento al futuro” di B. Gravagnuolo, Electa ‘08; “Altre parole nel vuoto”, Giannini ’12. Exhibitions: Biennale di Venezia, Triennale di Mi- lano, Bruxelles, Napoli, ‘06.

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THE WAY OF CRAFTS. **Books:** “Identità dell’architettura italiana” Fi- renze ‘21

NEW FENCE WITH ENTRANCE AND MUSEUM OF THE AR-CHAEOLOGICAL PARK OF VELIA. **Books:** “Identità dell’architettura italiana” Firenze ‘23

STONE FACADES IN CONTEMPORARY ISLAMIC CENTERS.
CASE STUDY : CULTURAL ISLAMIC CENTER AND IT'S MOSQUE IN ROME.

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Abstract

Despite the abundance of new materials made available by advancements in technology and industry, stone has remained a popular choice for modern architecture. Architects have continued to incorporate stone facades into their designs, combining tradition with innovation. This article delves into the reasons why stone is still a preferred material for contemporary Islamic centers and the unique characteristics that contribute to its enduring appeal.

Keywords:

Stone, contemporary, Islamic Centers, Rome.

Introduction:

One of the primary reasons architects choose stone for modern buildings is its connection to nature. As an organic material, stone helps create a sense of harmony between the built environment and the natural landscape. With the growing emphasis on sustainable design and biophilic architecture, using stone in facades contributes to a greater ecological awareness and a reduced environmental impact.

Stone in cultural Islamic center in Rome-Italy:

Roman bond - Particular technologies were employed for the brickwork of the mosque, that the architects derived from Borromini's models On- of XVIIth century Rome. The project thus required red Roman bond as an indispensable architectural necessity, and it was built using handmade bricks and regular 1mm thick mortar layers.

Beyond the aesthetic and architectural needs, there was also the need to guarantee the stability, of the outer brick layer in case of seismic activity, not to mention the unusual need of covering the continuous concrete walls with an adhering brick layer.

First, a handmade block measuring 12x25.5x6cm was used to obtain the bricks for the construction of masonry walls with (roughly) 1mm thick mortar layers. This allowed the diamond disk slicing of small 5x3x24cm bricks with perfectly levelled faces and smooth surfaces (3 small bricks per block were obtained). Then a special mortar was employed to anchor the brick facing to the hollow tile cladding. The mortar on one hand guaranteed a tear strength of roughly 10kg/m², while on the other it gave the brick layer a good degree of elasticity; the latter allowed the facing to absorb not only structural settlement, but also all possible seismic vibrations.

In case of seismic activity, the anchorage of the brick layer to the hollow tile cladding was guaranteed by the use of one stainless steel anchor per square meter. Furthermore, in case of earth quakes, the minor specific weight of the layer- due to the use of hollow tiles-allowed a consequent reduction of the horizontal uncoupling force, which is proportional to the layer's own weight. Lastly, having used hollow tiles undoubtedly determined an improvement of the internal environmental conditions, both from a thermal and an acoustic standpoint: two factors that for a place of prayer and meditation are not at all negligible.

The travertine The Roman Travertine Society, on the basis of the design plans, elaborated work drawings regarding the parts to be built in stone. The construction was carried out in the following manner: a) selection of the necessary ma blocks directly at the quarries; b) preparation of the ground traces and, consequently, of the mouldings for the making of the travertine elements; c) preparation of the blocks in the Bagni di Tivoli factory using avant-garde machinery and highly specialised workmanship. Particular attention was paid to the anchorage of the single blocks: fasteners and cramps were built in stainless steel b (Aisi 304), along with all the other anchorage accessories. The building of the minaret clearly exemplifies the above mentioned phases of construction. To veneer the reinforced concrete bearing pillars with travertine, a type of anchorage based on a ventilated system was used. On the other hand, an ingot internally reinforced with H -d stainless steel elements was used for the supporting shafts of the two balconies, thus substituting of the reinforced concrete structure. These shafts were completely hand built by the stone cutters in their work-shops. The stepped soffit structure of b the balconies has been built in ingot travertine, successively fastened with steel ties anchored to the reinforced concrete floor, thus avoiding excessive loading of the underlying travertine shafts.

The many designed pavements of the Mosque, the Library and the foyers have all been built with a range of various tonalities of travertine such as white, classical, sovereign and walnut. They all come from the Barco, the Valle Pilellad and the La Fosse quarries[1].

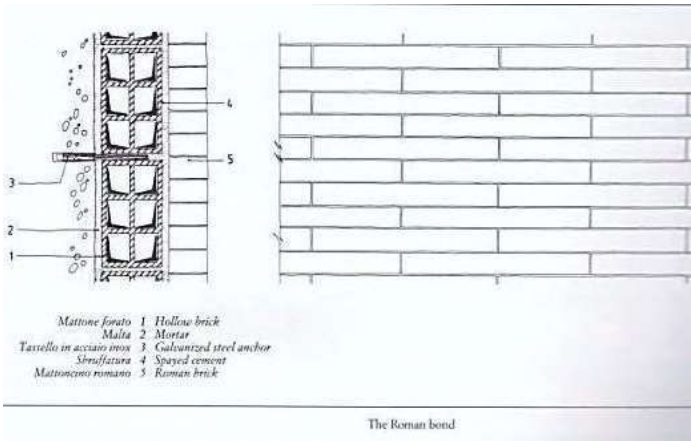

Fig. (1) the roman bond

Fig. (2,3) the roman bond

(1) P.portoghesi-v giglotti- s.mousawi-(1993)- la moschea di roma -alloro editrice,p .63

Mosaics and stuccoes - The many materials, magically moulded by the clever bands of man, speak different tongues and tell different tales, thus allowing the building to come into contact with the architecture of the site. Portoghesi has chosen and used these materials to establish an i intimate relationship with the various situations, thus creating continuity with history and traditions. He turns out to be an attentive mediator capable of both capturing distant echoes and establishing generic links and voluntary repetitions - by working inside a continuity that is quite explicit in the mosque's Prayer Hall decorations. The - presence of mosaics and stuccoes in the latter carry us to faraway places and tell the tale of an ancient culture.

The mosaic decorations dialogue with the Hall's architecture, completing this great space's mystic sense, thus emphasising its architectural - symbolism. They have been realised by the hands of Maghreb craftsmen, according to the most ancient traditions that luckily have been kept alive by specific schools. The mosaics cover completely all the walls and represent the access to an enchanted world in which the craftsmanship and the ability of the hands that forged them have moulded and sculptured the coloured ceramics until reaching the point of turning them into the small multi coloured fragments of the various geometrical combinations. The clay tiles, baked in large square forms of standard dimensions, have been glazed with strong, electric, shiny, dense colours.

Fig.(4) The mosaic decorations

Fig.(5) The mosaic decorations by the hands of Maghreb craftsmen

Conclusion

Stone's inherent durability and low maintenance requirements make it an attractive choice for contemporary buildings. When properly installed and cared for, stone facades can withstand harsh weather conditions, resist wear and tear, and retain their appearance for generations. This longevity reduces the need for frequent replacements, contributing to a building's sustainability and cost-effectiveness over time.

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The earthen stone architecture as a natural heritage, Bassir village. Syria

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Damascus university/Syria.

Abstract

The research highlights the stone architecture in the village of Bassir, southern Syria, as a sustainable natural heritage. Its housing and urban fabric were distinguished by a distinctive architectural and construction vocabulary linked to the local cultural heritage. It formed a distinct architectural product through green spaces and planting in homes.

Stone architecture has played an effective role in terms of its importance as a sustainable environment and an original architectural intellectual product through the experience of the Muhanna brothers in applying the cheap construction method where raw materials are available in the land.

The experience embodied the concept of sustainable and traditional construction in the region, and the project won the Aga Khan Award in 1999.Keywords

Keywords" south Syria, Bassir village, culture heritage. stone structure , Agha khan award.

1. Introduction

The **Hauran** (Arabic: حَوْرَان, Romanized: *Ḥawrān*; also spelled *Hawran* or *Houran*) is a region that spans parts of southern Syria and northern Jordan. It is bound in the north by the Ghouta oasis, eastwards by the al-Safa field, to the south by Jordan's desert steppe and to the west by the Golan Heights. Traditionally, the Hauran consists of three subregions: the Nuqrah and Jaydur plains, the Jabal al-Druze massif, and the Lajat volcanic field. The population of the Hauran is largely Arab, but religiously heterogeneous; most inhabitants of the plains are The region›s largest towns are Daraa, al-Ramtha and al-Suwayda.

From the mid-1st century BC, the region was governed by the Roman Empire›s Herodian and Nabatean client kings until it was formally annexed by the empire in the 2nd century AD. The Hauran prospered under Roman rule (106–395 AD) and its villages functioned as largely self-governing units, some of which developed into imperial cities. The region continued to prosper in the Byzantine era (395–634), during which different Arab tribes ruled the Hauran on Byzantium›s behalf, including the Salihids (5th century) and Ghassanids (6th century) until the Muslim conquest in the mid-630s.

Bassir is a Syrian village located in southern Syria in the Hauran Plain, about 50 km away from the city of Daraa towards the north, and 5 km east of the city of Al-Sanamayn.

The population of Basir currently amounts to about three thousand people, and is inhabited by a large number of families. The population is Syrian Christians who follow the Greek Melkite Catholic sect, as are its neighbors from the surrounding towns such as Khabbab, the village of Tabna, Al-Masmiya, and others.

The population of the village of Basir is about 3,700, according to the 2007 census. It is one of the few villages in Syria where there is no illiterate person. Everyone is proficient in reading and writing, and the level of those with advanced degrees is high. Most of the village's families came from Busra and Jabal al-Arab as-Suwayda, and some of them live in the village. They wandered at first, then moved to the site of Basir to build their village.

The town is famous for its agriculture, including wheat and other grains, in addition to the cultivation of olives and vegetables.

The history of Bassir's residence dates back to the year (9 BC), when Herod made it a military agricultural garrison and built a number of observatories there in order to monitor the thieves who were blocking the caravan route on the Damascus - Masmiya - Al-Lajat - Busra Al-Sham line. Its population reached the year (6). BC) to about two thousand people. In the modern period, it was inhabited by a family from the Al-Zoubi family and then migrated before the arrival of the Muhanna family, the Falouh family, and their relatives. The village witnessed a large migration to Damascus, the capital, and Lebanon in the fifties of the twentieth century. However, after 1972 AD, it began to witness the opposite migration. After the number of houses in the village in 1972 AD was about (150 houses), it reached (300 houses) in 1980 AD. Houses) after services became available, and the first of these services was a drinking water network with a tank and three artesian wells in 1972, the electricity network in 1976, the telephone network in 1985, and other basic services.

Under the Romans, the grain of Batanea and the wine of Auranitis were important for imperial trade, and throughout its history, the Hauran was the major source of the Levant›s grain. The region saw a decline in the 17th century until increased demand for Syrian grain and improved security led to the agricultural revival and re-population of the Hauran in the mid-19th century. The region also historically benefited as a key transit area on the traditional Hajj caravan route to Mecca and later the Hejaz railway. The Hauran remained Syria›s breadbasket until being largely supplanted by northern Syria in the mid-20th century, which coincided with its separation from interdependent areas due to international borders and the Arab–Israeli conflict. Nonetheless, it persisted as an important agricultural and commercial transit area into the 2000s.

The wide availability of basalt in the Hauran led to the development of a distinct vernacular architecture characterized by the exclusive use of basalt as a building material and a fusion of Hellenistic, Nabatean and Roman styles. The durability of basalt is credited for the Hauran's possession of one of the highest concentrations of well-preserved Classical-era monuments in the world. Hauran towns such as Bosra, Qanawat, Shahba, Salkhad, Umm al-Jimal and numerous others contain Roman temples and theaters, Byzantine-era churches and monasteries, and forts, mosques and bathhouses built by successive Muslim dynasties.

It is worth considering that stone architectures can still considerably contribute to the wellbeing of society. First, because of the high cultural significance they express on a wide range of tangible and intangible values of societies; and second, for their ability to address the shared goals of sustainable development, both global and local, and for social, economic, environmental and cultural matters, in a variety of natural and cultural contexts of the world.

– Their adaptation and integration into natural environments with minimal impact, the absence of CO2, contributing to healthy and less polluting environments.

– The preservation of natural resources, which are useful and essential for future.

– The saving of renewable and non-renewable resources (energy, minerals, water).

– The adaptation of stone materials and technologies to the widest variety of climates of the planet.

– The access to decent housing for the greatest number of people, regardless of their origin or social class.

– The establishment of a built heritage that creates a cultural, economic and social wealth.

– A major contribution to the local economic development, on the full stone construction branches, by mobilizing the local workforce on a wide range of professions and jobs.

– The ability to convey the tangible and intangible values of local societies to strengthen their identities, to maintain social cohesion.

– The sustainability of the participatory and solidary approaches in the production of the living environments.

– The 'gift' of knowledge and craft skills, talents and creativity of workers, their dignity, and their pride, for the benefit of individuals and communities.

– The ability to stimulate human creativity in the field of crafts and arts and many other inputs yet, that we will try to better surround.

2. Vernacular Heritage and Earthen stone Architecture: Contributions for Sustainable Development.

Stone is one of the world's oldest building materials, appreciated for its strength and durability. In ancient times it was chosen for its abundance: As a natural material, it was readily available and dependable. But there's a lot more to the material than one might expect, and there's a reason why architects continue to build with it, around it, and in it. The structures on this list demonstrate stone's ability to shape-shift; it can be used in its raw form or polished for a sleeker effect. It's no wonder that it's the chosen material for important monuments and buildings such as places of worship, castles, and palaces, as it will outlast almost any other material.

2.1. Traditional Arts Using Stone

Although it changed in accordance with the prevailing conditions in different periods, decorative stone-working in Turkish art always maintained its high quality.

The best examples of stone-working can be seen in the architecture of the Seljuk and Ottoman periods. Stone is the main component not only of construction but also for internal and external decoration.

The best examples of stone working can be seen in monumental doors, in the walls of cities and palaces, the main doors and courtyards of mosques and medreses, and in column heads, minarets and fountains.

The most common ornamentation used are geometric patterns, plant motifs, animal relieves and palmets.

Walls may also decorated by the use of bricks. Dark and light-colored bricks are used to create geometric designs in order to embellish walls. The external walls of mosques, tombs and castles are the best examples of this. Stone used in the art of stone-working can be classified according to the differing construction techniques:

2.2.Stone-working (In Architecture, and Gravestones)

In traditional architecture, stone-working plays an important role in the construction and decoration of internal and external walls. Another common use is for gravestones.

Various techniques are used in stone-working, such as carving, relief and scraping. Ornamental elements are generally plants, geometric designs and writing. Animal figures are rarely seen and human figures only in the Seljuk period.

2.3.History of stone Applied to architecture: Technologies and devolution.

The history of stone applied to architecture is linked to human beings since the beginning of our times. It was a shelter for the prehistoric man when he lived in caves, assuming from the dawn of our existence its telluric character and understanding it as our connection with the Earth. Our ancestors understood its timelessness and monumentality. They erected ambitious stone dolmens with a super human effort.

Table 1. the stone architecture vernacular in the village



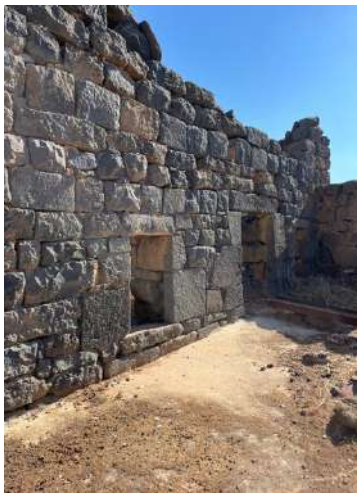
















3. Stone architecture , through the eyes of its people .the integration between stones and landscape.

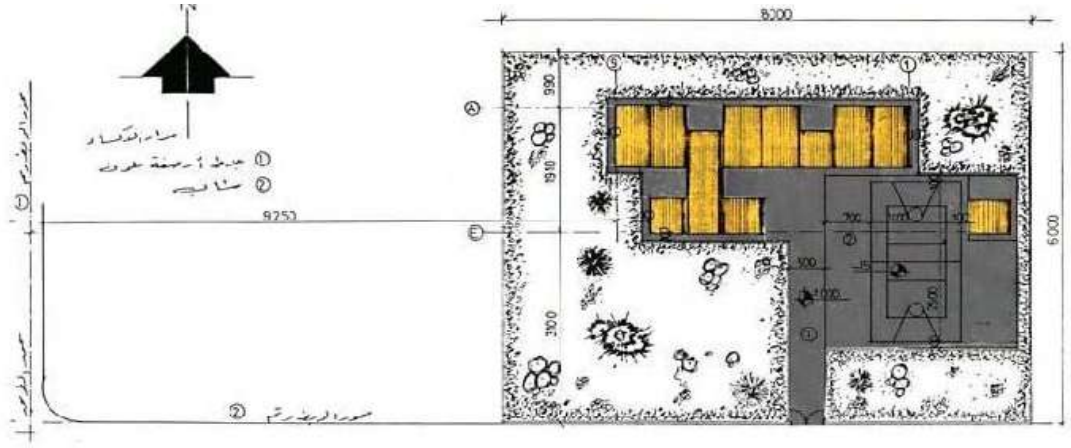
-The trees, the flowers.

Table 2. The green elements in the urban fabric and houses.

4. Toward the contemporary sustainable stone architecture (Muhanna brother).

The stone building system developed by the three Muhanna brothers - two architects and one engineer - offers a new, challenging approach to construction in Syria. Their system is based on the belief that a variety of rural building types, including one- or two-floor level houses and schools, should be made of the regional basalt stone, found in abundance on farm land, rather than of reinforced concrete frame with cement block infill, as is now the custom. Since no imported steel is used in the Muhanna system, and the local basalt stone can be inexpensively gathered and sorted, the cost of construction can be greatly reduced. Four schools designed by the Muthanna's in southern Syria were built for one-third less than the cost of typical contemporary construction. For these schools stone was gathered within a radius of 15 kilometers of the site, separated by size and roughly shaped as necessary by hand tools - the small stones being used for the vaults and the larger for foundations and walls. The vaults, essentially traditional stone arches reinvented with the help of computer technology, were erected by unskilled labour on demountable timber or metal shuttering. Each school is composed of classrooms and corridor segments spanned by five-meter-wide vaults. The jury found the stone building system as applied to the four schools "a strong design, a wise plan, and a rational product which can be applied to all other types of rural construction where stone is available."(Recipient of the Aga Khan Award for Architecture in 1992).

Tables.3. Muhanna brothers project



Site plan for the school.

Archway leading to administration rooms

Archway plaster finish detail

view from the south with administration to the left

General view showing site context from the south

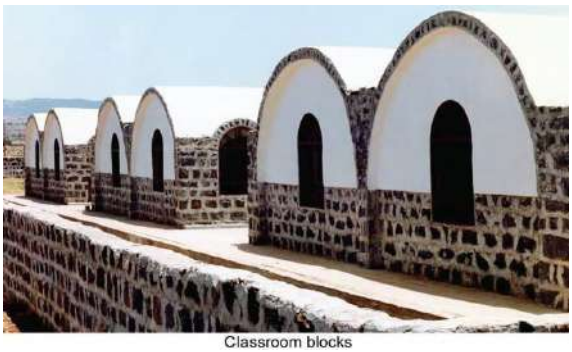
construction details

Outdoor class room

view the stone resource and building

close-up, window detail

Close-up showing exposed stone work on facade view



Classroom blocks

Archway and circulation area

Circulation arcade

Class room block with, archway rear

5. Conclusions”

The stone architecture in the village of Basir formed a sustainable architectural legacy for the urban and architectural fabric, as it reflected the memory of the place and the behavior of the people in the importance of preserving it.

The creative experience of the Al-Muhanna brothers, who were from the village, in building schools and houses was of great importance for enhancing construction with traditional materials as a modern and sustainable architectural feature.

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Thanks and gratitude.

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The Stone, Amman, and Jafar Touqan

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Abstract

This article explores the enduring relationship between Amman's architecture, stone usage, and the influential architect Ja'far Tuqan. It traces Amman's architectural evolution and Tuqan's innovative approaches to incorporating stone into his designs, showcasing his deep ties to the city's heritage. Through case studies of prominent buildings like the Jordan Museum and Arab Insurance Company Building, it demonstrates Tuqan's adept fusion of tradition and modernity. Overall, the article highlights Tuqan's pivotal role in shaping Amman's architectural identity through creative stone utilization.

Keywords

Stone utilization, Jafar Touqan, Architectural evolution, Architectural heritage, Amman.

Introduction

Amman has been a site of human settlements and advanced civilizations since the Stone Age, resulting in the creation of notable sites including the Roman amphitheatre, Amman Citadel, Roman Nymphaeum, and nearby mansions. Throughout the years, Amman has observed the progression of several civilizations while preserving its unique architectural style and masonry. Architects like Jafar Touqan are currently examining and incorporating features from Roman, Greek, Mediterranean, Ottoman, and Arab architecture into their current work. The mountains of Amman have been the site of numerous notable efforts, which serve as a testament to its abundant cultural and historical legacy, particularly demonstrated through the distinctive use of stone. This study investigates the significant correlation between Amman and stone, as well as Jafar Touqan's deep affinity for the city and his inventive utilization of stone.

Purpose of the paper

This study aims to provide insight into the evolution of Amman's architecture in response to contemporary architectural principles, specifically examining the utilization of stone in the modern era. Stone, as the essential and traditional material used in the construction of the city of Amman since ancient times, is the foundation of modern Amman's identity. The study will also investigate the influence of the renowned architect Jafar Touqan on the city of Amman, as he is credited with establishing the modern Jordanian stone detailing school and molding the city's architectural identity, according to numerous accounts. Furthermore, it will examine Touqan's method and application of stone resources, cultivating them in alignment with the Amman environment, and the distinctiveness of its cultural development.

Research Methodology

The study employs a descriptive-analytical approach to accomplish its goals, offering a chronological account of Amman's association with stone from ancient eras to the contemporary era. This relationship has a profound influence on Amman, creating its identity. Moreover, it examines the notable impact of the deceased architect Jafar Touqan and his architectural endeavors, scrutinizing them to underscore his profound association with Amman and its distinct character, particularly in his utilization of stone.

The relationship between Amman and stone

Amman's profound affiliation with stone, derived from its geographical location, has profoundly influenced its identity. The city's stone requirements were originally met by the seven surrounding mountains, which served as a natural source of this material. With the emergence of quarries, the use of stone became crucial in the creation of Amman, playing a defining role in its architectural character. The use of quarries was a notable change, indicating the crucial role of this material in the city's development, with a total of 90 quarries spread around the kingdom. (Atiyat, 2015)

The building materials were obtained from the nearby surroundings, specifically from the abundant stones and trees located in the torrent fringes. Despite the rudimentary technique of masonry and the utilization of indigenous stone, they have successfully achieved a unified architectural aesthetic to a certain degree. (Alfadalat et al., 2023)

In addition to its use in construction, stone represents the cultural continuity of Amman. Quarries provide a narrative of how the city utilizes and adapts to its resources. The ongoing relationship between Amman and its terrain exemplifies the city's ability to adapt and utilize its natural surroundings for long-term and environmentally-friendly growth. Stone serves not just as a construction material, but also as a fundamental and symbolic component in the urban story of Amman. (Atiyat, 2015)

Jaafar Tuqan's relationship with Amman:

Ja'far Tuqan, a prominent Palestinian/Jordanian architect born in Jerusalem in 1938, left a profound impact on Amman's architectural landscape. His deep-rooted connection to the city and his upbringing in a household steeped in creativity and cultural sensitivity influenced his architectural philosophy.

Tuqan's architectural legacy in Amman reflects his commitment to simplicity, rationality, and a deep understanding of the city's environment. Through his pioneering projects, he transformed Amman into a vibrant hub of contemporary Arab architecture and mentored a new generation of architects. (Mufadilah, 2014)

"Amman is a city loved by no one, neither the rich nor the poor." (Ababsa, 2010)

These were perhaps his last words before entering a severe stage of illness in his chapter in the book "Amman: The City of Stone and Peace" by the French-Algerian writer Mariam Al-Ababsa. He criticized the overwhelming feeling of estrangement among the city's residents, created by the depletion of its resources. They never stopped exhausting it, failing to appreciate its beauty and culture. The poor do not love it because it gives them nothing, and the rich do not love it because it is not safe enough to secure their future, as most of them sought foreign citizenship without looking back at the city they lived in or striving to uplift it. He emphasized that the feeling of estrangement resulted from the selfishness of its inhabitants, affirming that living in a city is not enough; rather, we must give and commit to the city we reside in. This was evident in his contributions to Jordan and Amman, specifically through architectural works that received numerous awards, confirming his passion and humility in merging his love for Amman with his vision as a rational architect. He held the belief that architecture embodies a way of life, and our lives and interactions should mirror the logical process of architectural thought. (Sameh, 2009)

Tuqan's dedication to preserving Amman's architectural heritage and his vision for the city as a thriving center of innovation underscored his profound attachment to its well-being. His legacy serves as a reminder of the importance of integrating architectural thought with the cultural and environmental context of a city, ensuring its sustainability and resilience for future generations. (Ababsa, 2010)

Jaafar Tuqan's relationship with stone:

Regarding Ja'far Tuqan's proficiency in utilizing stone in Amman, he played a pivotal role in enriching the architectural landscape by employing innovative stone architectural details and striking a balance between traditional stone, described as the city's classic material, and breaking away from repetitive and superficial ornamentation. His approach breathed new life into stone, a material deeply ingrained in Amman's architectural identity, steering clear of mundane and uninspired traditional designs that failed to capture the true essence of the place. Tuqan recognized the potential of stone as a material and emphasized the importance of nurturing and refining it, employing his expertise to push the boundaries of architectural possibilities within his unique architectural concept. (Mahadin, 2011)

His projects displayed meticulous attention to detail, with carefully crafted stone features that exuded elegance and sophistication. Whether through harmonious color schemes or intricate carvings, Tuqan demonstrated a deep understanding of stone's potential for aesthetic enhancement. Moreover, he emphasized the importance of avoiding monotony in stone usage, advocating for exploration of its technical capabilities. This approach not only breathed new life into Amman's architecture but also set new standards for contemporary design in the region. (Saleem, 2014)

Case Study: Ja'far Tuqan's Use of Stone in Amman.

1- The Jordan Museum

Location: Amman – Ras Al Ain
Year: 2010
Building Area: 10,000 square meters

Situated in the heart of the vibrant new city center of Ras Al Ain, The Jordan Museum showcases the cultural heritage of the Kingdom through three exhibition halls equipped with state-of-the-art technologies. It reflects Jordan's history and culture as part of an ongoing narrative of the nation's past, present, and future. (Sameh, 2015)

Ja'far Tuqan employed a traditional Jordanian building style to express the design concept and purpose of the museum. This is evident on the building's exterior, where he symbolically represented the past with rough stones, the present with smooth stones, and the future with glass. The rough stone walls gracefully blend to overlook Amman's hills. The project consists of two main masses: the museum mass and a mass for the shop and cafeteria opposite the museum. A bridge at the first-floor level connects them, while an outdoor plaza serves as a venue for outdoor exhibitions.
Tuqan's Jordan Museum design embraces Jordan's architectural tradition and modern components to create a lively space. His purposeful use of stone shows his grasp of its versatility and importance in Amman's architecture. Tuqan adds meaning to the museum's design by combining old and contemporary materials, enabling visitors to discover Jordan's rich cultural tapestry. (Abu Ghaniy-meh & Pisani, 2001)

Figure 1: The Jordan Museum. Source:("The Jordan Museum," n.d.)

2- Jordan Bank

Location: Amman - Shmeisani
Year: 1997

Ja'far Tuqan strategically utilized the building's location on three significant streets to amplify its importance and influence on the surrounding urban activities and visual design landscape. Tuqan aimed to utilize the vocabulary of his formative language and employ the symmetry created by reinforcing the role of the building's architecture. (Al-Sultani, 2004)

In the design of the Jordan Bank building, Tuqan employed design propositions previously observed in the works of other global architects, such as architectural mass excavations. These were utilized in its stone façades, characterized by a significant presence of orderly engineering. Additionally, the project utilized stone pieces with dimensions of 55 × 110 cm, unprecedented in Amman, and were mechanically suspended. The architectural language of the Jordan Bank building relied on two aspects: clarity of form and grand scale. This is evident in its treatments, emphasizing a sense of solidity in the stone facades with square windows, expressing a strong relationship with the stone while maintaining flexibility. (Al-Sultani, 2004)

Figure 2:Bank of Jordan - Shmeisani Head Office. Source:("Bank of Jordan - Wikimapia," n.d.)

3- Amman Municipality Hall

Location: Amman - Ras Al Ain
Designers: Ja'far Tuqan and Rasem Badran
Year: 1997

The Amman Municipality Hall stands out as a building where stone is used diversely and innovatively. Its design is characterized by a blend of the ancient heritage of Amman and the modernity of its present. The concept draws inspiration from designs of ancient Roman and Greek theaters and venues, while also presenting a meticulous model of how to enhance the techniques of stone material and its flexible utilization, highlighting its characteristics and reflecting the beauty of the building. (Abu Ghneimah et al., 2013)

The design revolves around a central circular courtyard that divides the square-shaped structure into four equal parts. Wide passages run through these parts, leading to three large halls at the edges for hosting celebrations and prestigious art exhibitions. These parts are connected by glass

passages on the upper floors, with a sundial atop the building specially designed to complement its historical architecture. (Abu Ghneimah et al., 2013)

Figure 3: Amman Municipality Hall, Amman. Source:(Tuqan, 2004)

The diversity in the stone formations, the intricacy in highlighting the beauty of architectural details, and the thoughtful spatial distributions have resulted in a blend of simplicity and sophistication, creating a unique elegance and a clear impression of grandeur and contemporaneity. Emphasizing creativity in shaping the stone facades, monumental stone blocks, reaching a height of 75 cm, three times the usual dimensions, were used. Additionally, only two stone rings with a diameter of 110 cm were used to clad the columns on the ground floor. This careful attention to detail and inventive stone utilization showcase Tuqan and Badran's architectural skills and add to the Amman Municipality Hall's eternal beauty. (Tuqan, 2004)

4- Arab Insurance Company Building

Location: Shmeisani, Amman
Year Built: 1991
Total Floor Area: 3300 square meters

Recipient of the Best Building Award from the Jordan Engineers Association for the Arab Insurance Company Building in 1993

The Arab Insurance Company Building stands as a remarkable architectural achievement in the heart of Amman. Erected in 1991, this edifice comprises five floors above ground and two basement levels dedicated to parking facilities. Its construction represents a harmonious fusion of structural integrity with interior flexibility, a hallmark of the meticulous design philosophy of its architect, Ja'far Tuqan. (Abu Ghneimah & Gousha, 2002)

Situated prominently in the bustling district of Shmeisani, this building captivates with its imposing yet elegant facade. It faces westward and offers a dignified presence, accentuated by subtle ornamental details reminiscent of traditional Jordanian architectural motifs. Notably, Tuqan's strategic placement of minimal openings along the western facade ensures optimal natural ventilation and illumination within the interior spaces. (Abu Ghneimah & Gousha, 2002)

A distinctive feature of the Arab Insurance Company Building is its masterful use of locally sourced stone, specifically white and pink hues derived from Ajlouni stone. Tuqan expertly orchestrated the interplay of these stones, employing larger-than-average dimensions, notably 50 cm blocks, to create a sense of visual harmony and sophistication. (Abu Ghanimeh & Pisani, 2001)

This architectural gem exemplifies Ja'far Tuqan's visionary approach, seamlessly blending modern functionality with cultural heritage. Its recognition by the Jordan Engineers Association underscores its significance as a structural marvel and a timeless symbol of architectural excellence in Jordan's urban scene

Figure 4: Arab Insurance Company Building, Amman. Source: (Abu Ghanimeh & Pisani, 2001)

Conclusions

The relationship between Amman, stone, and architect Ja'far Tuqan is important and lasting in Jordanian architecture. Stone is central to Amman's architecture, which dates back to ancient civilizations. The city has evolved while retaining its essence, with stone as a reminder of its past and cultural continuity.

With his innovative approach to building and intimate connection to Amman, architect Ja'far Tuqan helped shape the city's modern architecture. His unique use of stone revitalized Amman's architecture, merging history and modernity to create everlasting monuments representing the city's cultural richness.

Tuqan's stone work is shown in the Jordan Museum, Jordan Bank, Amman Municipality Hall, and Arab Insurance Company Building. Tuqan's architecture went beyond the building, blending form, function, and cultural importance through symbolic representations and careful detailing.

Ja'far Tuqan's legacy in Amman shows how architecture, stone, and identity are intertwined. His work has enhanced Amman's architectural heritage and motivated future architects to embrace the city's culture and innovate with traditional design principles. Tuqan's imaginative work has shaped Amman's architecture, securing its legacy for future generations.

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Hassan Fathy's Stone House on the North Coast

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Abstract

This academic research focuses on documenting and preserving Hassan Fathy's house in Sidi Krier. Hassan Fathy was an architect known for his innovative approach to sustainable and culturally rooted design. The research explores Fathy's architectural concepts and the specific design elements of his house, such as the use of local materials, and attention to human scale. The study also delves into Fathy's vision of creating low-cost structures that could serve as models for tourist accommodations and his desire to promote the Egyptian government's adoption of his design principles.

The research discusses Fathy's adaptation of traditional construction methods and the use of thick walls to achieve insulation and structural stability. Furthermore, the research examines various aspects of Fathy's house, including the ventilation system design, the planning boundaries influenced by Islamic and Egyptian cultural values, the sequence of movement paths, and the materials, light, and shadow that contribute to the atmosphere of the space.

The research aims to develop a comprehensive and efficient 3D scanning methodology for documenting the Fathy House, preserving its architectural heritage, and supporting potential restoration initiatives. Using 3D scanning methods, are evaluated for their capabilities in capturing the architectural details of the Fathy House. The research emphasizes the importance of documenting and preserving this unique architectural heritage highlights the sustainable nature of the materials used in the construction, and analyzes trying to discover the components ratio.

Preserving buildings like Hassan Fathy's house is of utmost importance to maintain their historical significance.

Keywords: documenting- preserving- 3D scanning- sustainability- nature materials.

Research Objectives:

1. Conduct a thorough review of existing documentation and research on the Fathy House, including its architectural design, construction materials, and historical significance.

2. Evaluate the capabilities of different 3D scanning applications (e.g., Polycam, 3DF Zephyr) for accurately capturing the intricate architectural details of the Fathy House.

3. Analyze the 3D models and drawings to identify unique design features, construction methods, and the impact of sustainable materials on the longevity of the Fathy House.

4. Analyze the main materials.

Introduction

The design of the Fathy house exhibits a dignified quality and a sense of simplicity that resonates with the human scale. Every element of the house, from its shapes to its materials, has been meticulously designed to create a harmonious and meaningful composition. Fathy believed that to ensure the success of his architectural proposal, which aimed to promote tourism in Egypt, it was essential to convey a sense of hospitality, privacy, beauty, and permanence. He sought to transmit these qualities to people through the indigenous nature of the design, paying attention to even the smallest details.

In the 1970s, there was a growing trend in Egypt towards the development of "tourist villages" along the coastline. Fathy saw an opportunity to showcase his traditional principles by building his own house in Sidi Krier in 1971. He wanted his house to serve as a successful prototype for low-cost structures that were not only beautiful but also suitable as models for tourist accommodations.

Fathy's main objective was to encourage the Egyptian government to adopt this model as the basis for a future research institute focused on desert settlements. He believed that by working in harmony with nature, even in the desert, one could build aesthetically pleasing, affordable, and simple structures (El-Shorbagy, 2013).

Fathy's innovative approach involved adapting traditional construction methods to the use of local materials. By adjusting the thickness of the walls, he achieved superior insulation and accommodated the structural forces exerted by the vaults and domes. This approach not only enhanced the character and durability of the building but also conveyed a sense of permanence that surpassed that of thin-walled constructions using cement blocks or stones. Interestingly, the increase in wall thickness did not lead to higher costs due to the availability of locally sourced materials, allowing Fathy to keep the construction expenses comparable to those of Bedouin dwellings (Hassan Fathy - Earth and Utopia, 2018).

Fathy's architectural philosophy revolved around alternative approaches to vernacular earth architecture. He advocated for the use of vaults and domes, by using natural material composed of sand and soft stone, found on site. His own house in Sidi Krier, built in 1971, served as a prototype of a low-cost structure and a model for tourist units, demonstrating that beauty and simplicity in design could be achieved anywhere, even in the desert, by working in harmony with nature.

Fathy's concept of designing a house (writing by himself)

"As I have shown in my previous experiments with mudbrick, explained in "Architecture for the Poor", the same principles of construction hold good for any man, poor or rich when he uses any other local material. A site had been chosen in a place called Sidi Kreir located on the Mediterranean coast 34 KM West of Alexandria where there is no mud. The landscape is composed of sand and soft stone which is in reality agglomerated sand, and not real stone however, in the vicinity of the site, I found that all the Bedouin dwellings were built of this very material. There was no better proof as to its strength and durability than the houses themselves, however, to use it in engineering it had to be tested scientifically, and samples were sent to the Cairo University laboratories. It was found to take at least 25 kes/cm compression, and absorbtivity was very low. This was most satisfactory for me I could not have asked for more. so all I had to do was to use it as if it were mudtrick, by increasing the thickness of the walls.

As well as providing better insulation, it was just the right thickness to take the lateral thrust exerted by the vaults and domes which was the type of roofing cnOb el. The character would be enhanced, giving a feeling of permanency more so than if it had been built with thin walls, using cement blocks or even stone.

One would assume that an increase in wall thickness would affect the cost. This is not so, because the material is quarried on the spot and needs no cost of processing. It is a singular advantage to be able to build with materials that are so readily to hand. we were able to keep the cost of the structure at the same level as those built by the poor Bedouins." (A paper found with Nawal, written by Hassan Fathi himself).

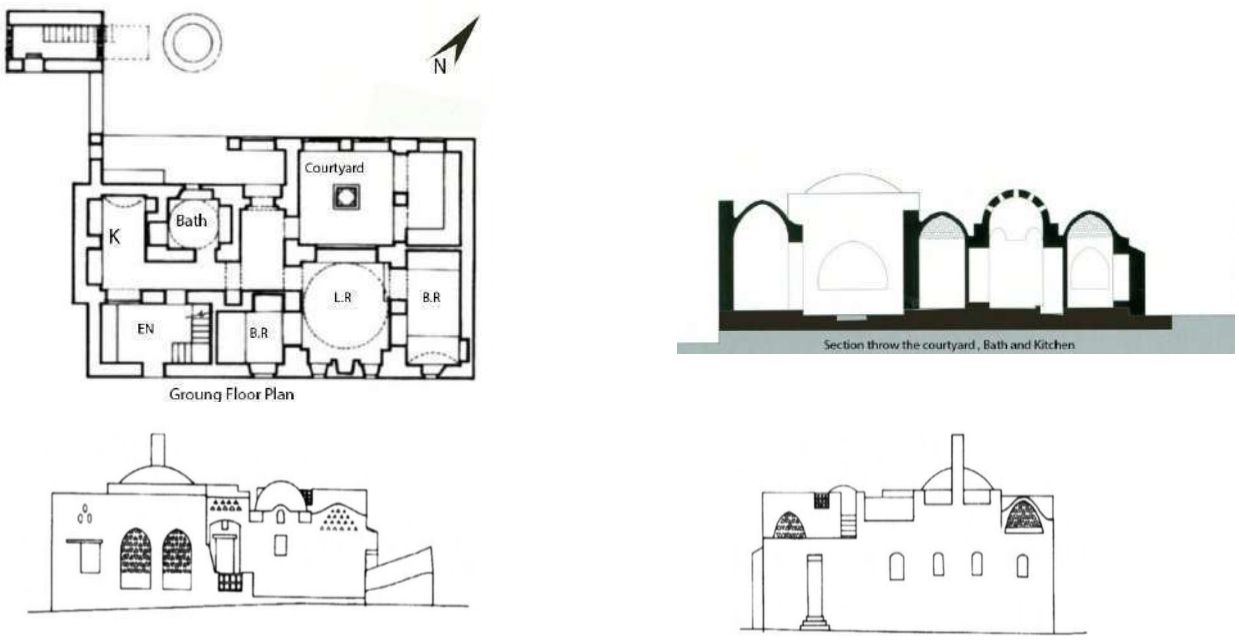


Figure 1: Fathy House architectural drawings, by Hassan Fathy

The layout of the house reflects the traditional(qā'a,) which is the main room, featuring alcoves known as (iwāns), a central courtyard, and a (maq'ad), which is a loggia. This arrangement mirrors the components of an Arab palace and captures the essence of Arab architecture. The (qā'a) serves as the reception room and includes a central (durqā'a), a high-ceilinged hall covered by a dome. The (iwāns) are slightly elevated from the central space, providing privacy, and functioning as sleeping quarters in this instance. The combination of open space and intimate retreats within the (qā'a) creates a sense of grandeur and spaciousness, emphasized by the dome overhead. The (maq'ad), or loggia, offers a secluded observation area with views of the traditional courtyard fountain and the sea beyond. (Mashrabiyyah) screens, intricate latticework windows, filter the light, creating captivating plays of light and shadow. The design of the wooden bars draws the eye across the gaps, superimposing the outside view onto the screen, reminiscent of decorative lacework. Even sunsets, filtered through the (mashrabiya), transform into mesmerizing displays of color, akin to stained-glass windows.

The different elements of the house are clearly defined and marked on the elevations, allowing one to perceive the various functions without entering the spaces. The entrance area is marked by a large dome, which creates a contrast with a smaller dome and vaults, resulting in a dynamic interplay of shapes and proportions. The main facade, characterized by the dome, presents a white wall, while the facade facing the sea ensures privacy.

From an external perspective, the silhouette of the house seamlessly blends with the undulating dunes, establishing a harmonious connection with the surrounding landscape. Despite incorporating traditional design elements and locally sourced materials, the Sidi Krier house remains distinctly contemporary in its approach. It stands as a testament to Fathy's vision of creating an architecture that is not only beautiful but also sustainable and deeply rooted in the cultural context of its people.

In front of Fathy's house, there was a pump for an artesian well that supplied water. Fathy designed a ventilation system using wind power to avoid contamination from the pump's exhaust gas by creating a low-pressure zone with a vaulted and sloping ceiling, he generated a strong current of air that was drawn into an open opening at ground level.

Fig 2: Artesian Well vault

Diagrammatic Analysis

1. Geometry

1.1 Form

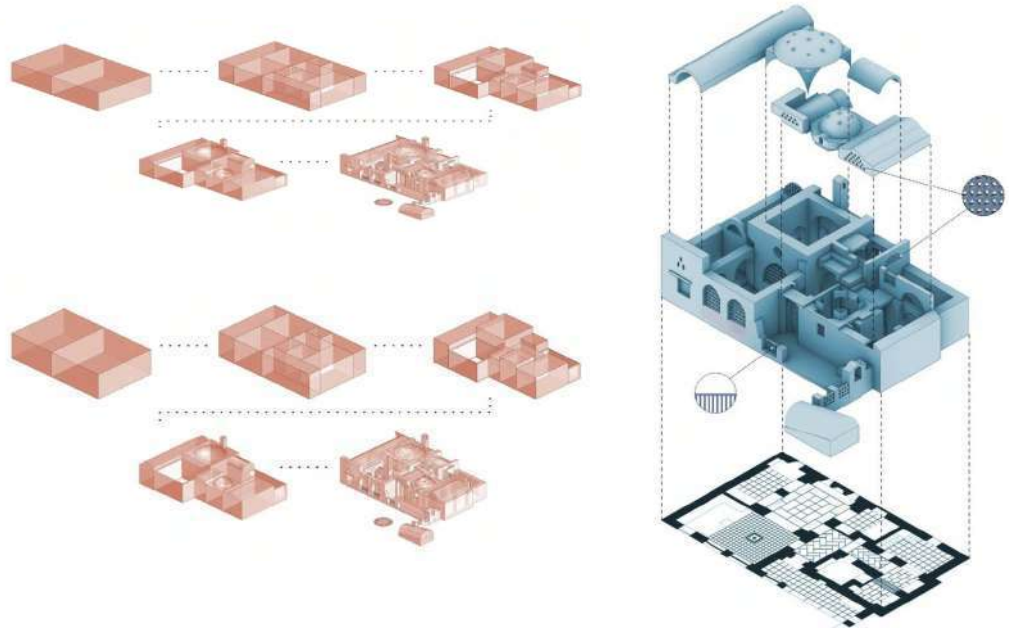


Fig 3: form analysis

1.2 Structure

The Fathy house relies entirely on stone-bearing walls for structural support. Thick walls are used to support domes and vaults, and door and window openings predominantly feature low arches. Even narrow spaces like the entrance hall are covered with elliptical vaults, while areas such as the “Qa’a” and bathroom showcase various beautiful dome designs. The dome pendants add charm to the half-orange shape (qa’ay), creating an inviting space for relaxation.

1.3 Relationship with Human Scale

Figure 4: Fathy House, Scale Diagram

Another design principle of Hassan Fathy that is reflected in this work is its consistency with the human scale and the dimensions of the human body. As he believed that every architectural project should respect and be accessible to its user, the spaces he created are in proportion to the human scale.

The sizes used in the residence derive from the typical basic sizes of traditional houses and the spaces do not take particularly large dimensions. Finally, a pattern can be identified in the handling of spaces, in which movement and transition spaces have lower ceilings and narrower widths, while spaces of particular importance to the residence are housed with higher domes and are longer and wider. However, even when dome housing is chosen, the height remains relatively low so that the user does not feel submitted by the building (Fathy (Sidi Krier) House / Hassan Fathy / 1971, 2020).

2. Planning Boundaries

The design of the boundaries in the Fathy house is largely based on the values espoused by Islam and Egyptian culture. As the achievement of privacy is one of the main goals in the design of houses, in this particular example there are clear boundaries that distinguish the private space of the house from the public space around it, creating an introversion and greatly limiting the interaction of the users of the world outside the building .

While the external boundaries of the building are strict and clear, consisting mainly of load-bearing masonry with little or no openings, inside the house there is a breakdown of the boundaries with many openings that show diversity. More specifically, there are fully permeable elements, such as doors, which connect the spaces, but also semi-permeable boundaries, such as internal windows, covered by perforated elements, which enhance the communication between the spaces. It should, however, be emphasized that despite the possibility of contact between the rooms inside, there is no unification of the spaces and the distinction between them remains clear. Finally, the handling of the boundaries regarding the outdoor space of the residence is also interesting, since both courtyards have clear demarcations and are enclosed, with their only point of contact with the outside space being the two openings on the eastern side, which are covered with perforated elements thus “filtering” the line of sight (Fathy (Sidi Krier) House / Hassan Fathy / 1971, 2020).

2.2 Fluidity of Space

As can be seen in the diagram, the movement areas following the entrance area to the residence display a much-defined flow to guide the visitor toward the stopping areas. In them, the densification that occurs in the movement spaces gradually stops, as these are spaces of larger dimensions where the user is free to move in the way he wishes.

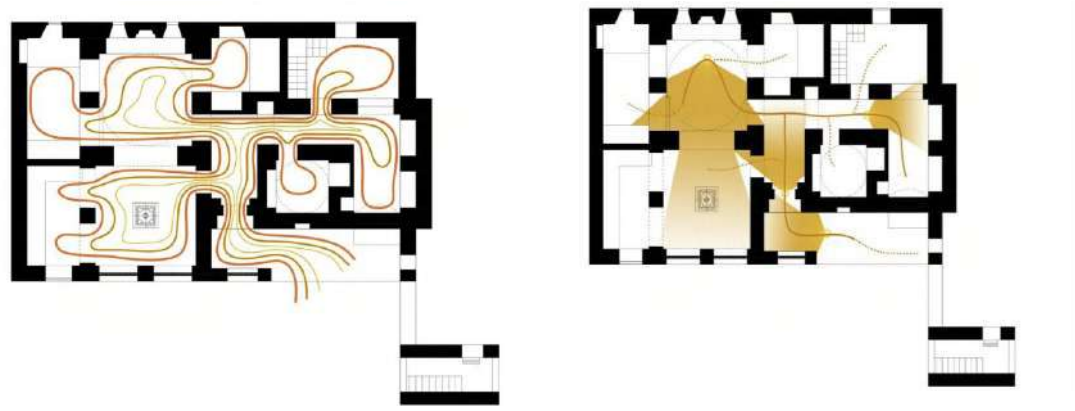


Fig 5: Fluidity &Movement Path and Visual Escapes.

3- Sequence and Function

Movement Path - Visual Escapes

The entrance to the residence is located on the eastern side, where there is a transitional outdoor space. Passing through the entrance threshold, one encounters the central courtyard of the house, surrounded by tall walls. On two of the four sides of the courtyard, the few openings are covered by perforated elements that allow partial communication with the outside, while internally, the courtyard is connected to the central living area through a perforated opening. Continuing the spatial sequence of movement until the end, the user reaches a pivotal point, where on one side, the living room begins, and on the other, they can be led to the bathroom area and the dining preparation area, through a second corridor. On either side of the living room area are the two bedrooms, which have visual and spatial continuity between them, as well as with the living room area. Exiting the circulation space and considering the path defined by the second movement space, one arrives at the bathroom. Subsequently, the corridor leads to the dining preparation area, without having visual contact with the other spaces of the residence, except for the rear interior courtyard.

Inside the residence, there is a division of individual spaces into two wings, which are connected by a corridor where transitions from one space to another are strongly perceived due to the narrow and relatively low openings. One wing includes the main space of the residence, the (qa'a,) which is the large living area that functions as the central core and gathering space, accommodating most of the daily activities. Its role is enhanced by the placement of a fireplace in the center of the room. On the right and left sides, there are openings that connect the central space of the residence to the sleeping areas. This wing communicates with the central courtyard through a window located in the living area, on one side of which there is a covered veranda functioning as an outdoor sitting area. The other wing of the residence includes the bathroom area and the dining preparation space, and through this wing, one is led to the second, smaller courtyard. Most of the spaces feature elements of furniture in the masonry, such as seating areas, beds, closets, and countertops (Fathy (Sidi Krier) House / Hassan Fathy / 1971, 2020).

4. Documented the house by 3d scan

Polycam 3D scanning method to evaluate their capabilities in capturing the architectural details of the house. This program was developed for the 3D capture for iOS and Android, this APP sets us apart with its visually appealing and sophisticated features, including automatic wall color detection, and stunning visual improvements across the board.

Video minutes: 18 min , this app covered less and accurate objects from videos and took less time for render with good quality but need a lot of photos to complete all the details.

5. Materiality

4.1Textures and Materials

The dominant material is stone (composed of sand and soft stone), which is a natural local material suitable for the climate and the character of the site. Soft stone is used to construct load-bearing walls but the roofs vaults and domes, fire brick, and due to its malleable composition, similarly, perforated stone elements with triangular patterns are created to cover openings. The extensive use of the dominant material contributes to the visual coherence of the building, emphasizing its basic forms. Wood is used as a secondary material and is incorporated in doors, windows, railings, and furniture. Additionally, cylindrical glass blocks are used in vaulted ceilings.

The house was built for seasonal residence (a chalet) around 1968 using natural materials such as Limestone, mortar, and tiles from the earth itself. It appears that it has not undergone any maintenance or restoration since its construction. The house was built using vaults for the roof fire bricks and stairs by limestone, with a wall thickness of approximately 50 cm.

4.2 The Samples Selection Materials

The Samples were taken from the site during the field visit, and prepared to facilitate laboratory examinations of the samples directed to us at the laboratory of the Faculty of Science, University of Alexandria. The samples were handed over to the microscopic examination for analysis of the elements and components of those samples.

Below are pictures of those samples before the examination. Date of March 30, 2024.

part of the building stone block

Part of the mortar from the exterior walls

Part of the stone from the site.

4.3 Building Blocks

The following Figure (7) shows the real photograph taken of the material sample from the site, whether, on the other hand, the other Figure (8) shows the microscopic photograph of the sample.

Fig.7 The onsite sample photograph was taken by Researchers.

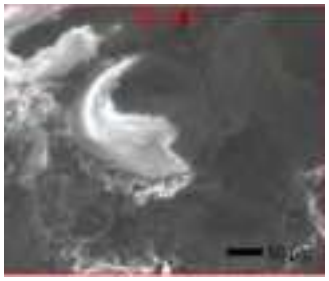
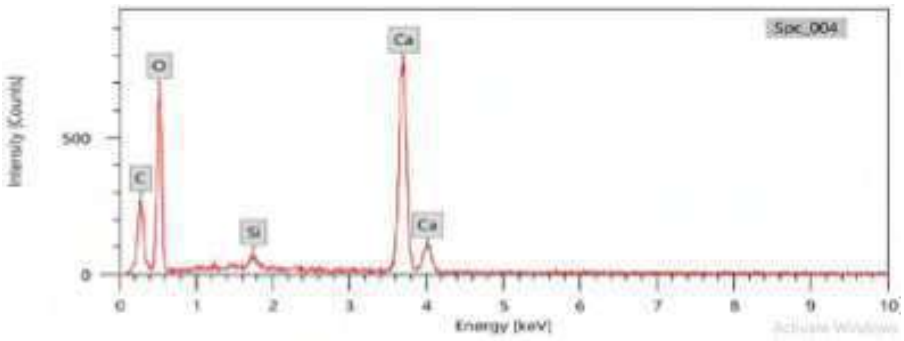


Fig. 8 The electron microscopic photograph with 50µm zoom taken by the Electron Microscopic Unit.

Table 1. Building blocks electron microscopic analysis results for the sample.

Element	Line	Mass%	Atom %
C	K	14.44±0.21	21.38±0.31
O	K	60.73±0.88	67.49±0.98
Si	K	0.58±0.07	0.37±0.04
Ca	K	24.25±0.35	10.76±0.15
Total		100.00	100.00
Spc_004			Fitting ratio 0.0514



The following Figure (9) shows the real photograph taken of the material sample from the site, whether, on the other hand, the other Figure (10) shows the microscopic photograph.

Fig.9 The onsite sample photograph was taken by Researchers.

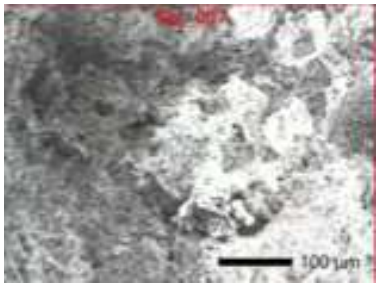
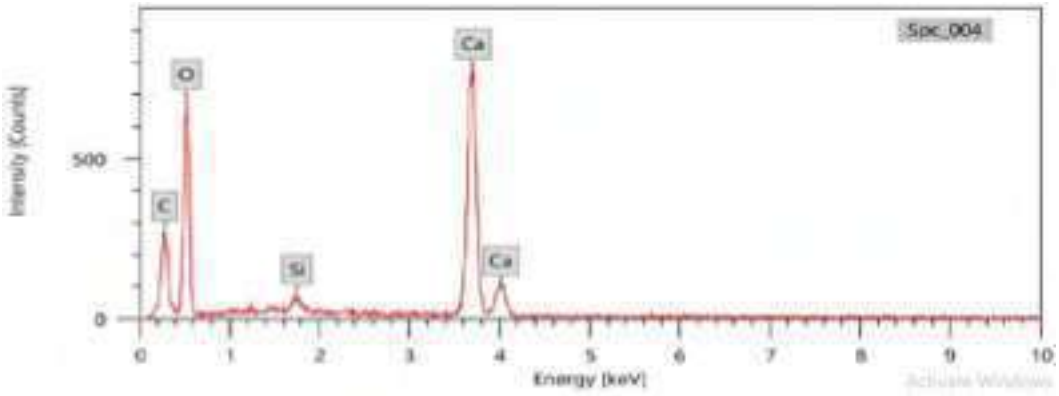


Fig. 10 The electron microscopic photograph with 100µm zoom taken by the Electron Microscopic Unit.

Table 2. Part of the building mortar electron microscopic analysis results.

Element	Line	Mass%	Atom %
C	K	10.59±0.25	16.74±0.39
O	K	55.51±0.92	65.91±1.09
Mg	K	0.26±0.06	0.20±0.05
Al	K	0.65±0.07	0.46±0.05
Si	K	2.57±0.12	1.74±0.08
S	K	4.45±0.14	2.64±0.08
Ca	K	25.97±0.39	12.31±0.18
Total		100.00	100.00
Spc_007			Fitting ratio 0.0644



4.5 Part of the stone from the site.

Fig.11 The onsite sample photograph was taken by Researchers.

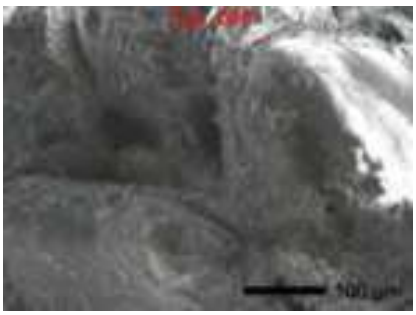


Fig.12 The electron microscopic photograph with 100µm zoom taken by the Electron Microscopic Unit.

Element	Line	Mass%	Atom %
C	K	10.59±0.25	16.74±0.39
O	K	55.51±0.92	65.91±1.09
Mg	K	0.26±0.06	0.20±0.05
Al	K	0.65±0.07	0.46±0.05
Si	K	2.57±0.12	1.74±0.08
S	K	4.45±0.14	2.64±0.08
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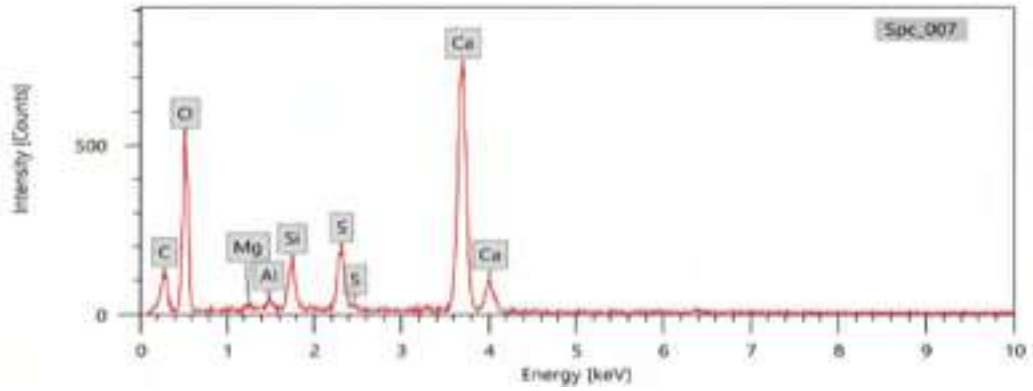
Total		100.00	100.00
Spc_007			Fitting ratio 0.0644



6. CONCLUSION OF SAMPLES ANALYSIS

From the results of the previous analyses, the following is clear:

- There is a great similarity in the components of the oxides of the three samples, especially the stones used in construction and the mortar bonding the stone courses in the building.
- Although the components of the oxides of the stone used in construction are similar, they may differ somewhat from the sample taken from the construction site. This is evidence that the stone used was brought from a location close to the site of the building.
  But they are made of the same ingredients and therefore in the same microclimate and surrounding environment.
- Based on meticulous examination, Fathy's architectural proposal for boosting Egyptian tourism is grounded in principles of hospitality, privacy, beauty, and permanence. Through indigenous design and attention to detail, Fathy aims to create an immersive and authentic experience. By prioritizing these values, his vision not only attracts tourists but also fosters a deep connection to Egypt's cultural legacy. In essence, Fathy's proposal promises to elevate tourism and cultivate lasting appreciation for Egypt's heritage.

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2. *Fathy (Sidi Krier) House / Hassan Fathy / 1971*. (2020, July 7). Issuu. https://issuu.com/anastasiadossa/docs/_____/s/11818038
3. *Hassan Fathy—Earth and Utopia*. (2018, October 16). https://www.architectura.nl/hassan-fathy-earth-and-utopia.html
4. Microscopic examination tests at the Electron Microscope Unit at the Faculty of Science, Alexandria University, March 2024.

The evolution of stone cladding systems in Jordan and Palestine

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Abstract

The emergence of Modern architecture transformed the treatment of stone in Jordan and Palestine, shifting it from a load-bearing material to cladding. Thin stone cladding, introduced the mid-20th century to the present, lacked precedents and required rethinking attachment systems, materials, and detailing. Modern architecture introduced the widespread adoption of thin stone cladding, typically ranging from 3-7 cm in thickness, a practice that persists to this day.

Keywords

stone, cladding, façade, vernacular, masonry

Introduction

In Jordan and Palestine, stone has been integral to construction for centuries, reflecting the regions› rich cultural and historical significance. Landmarks such as Petra in Jordan and the traditional stone houses of Dana and Madaba illustrate the enduring use of limestone in vernacular architecture. Similarly, cities like Jerusalem in Palestine exhibit limestone buildings and ancient fortifications, while Palestinian villages showcase stone houses with distinctive decorative motifs. This paper explores the evolution of stone cladding techniques from the Mamluk era to the present, shedding light on architectural changes and innovations over time.

The application of stones in Mamluk and ottoman architecture

During the Mamluk Sultanate (13th to 16th centuries), Mamluk architecture flourished in Egypt and the Levant, including present-day Egypt, Syria, Jordan, and Palestine. Cairo, Damascus, and Jerusalem are notable cities showcasing Mamluk architectural heritage.[1] Shaped stones were pivotal in constructing exterior facades, entrances, and interior courtyards, as well as in vaults, stairs, arches, and load-bearing supports. Stones adorned flooring, arches, and foundations. Examples like *Aq Palace and Palace of Amir Yashbak* facades feature massive untreated stones, known as *Al-Ajali stone*[2]. Mamluk stone walls varied in thickness, from 66 cm in residences to thicker walls in defensive or monumental buildings, 100 to 150 cm thick (photo 01). The use of medium-sized stones which constructed in coursed ashlar[3] masonry and in ablaq4 techniqe remained prominent in Circassian-era architecture (photo 02), a sturdy lime mortar was utilized for binding.

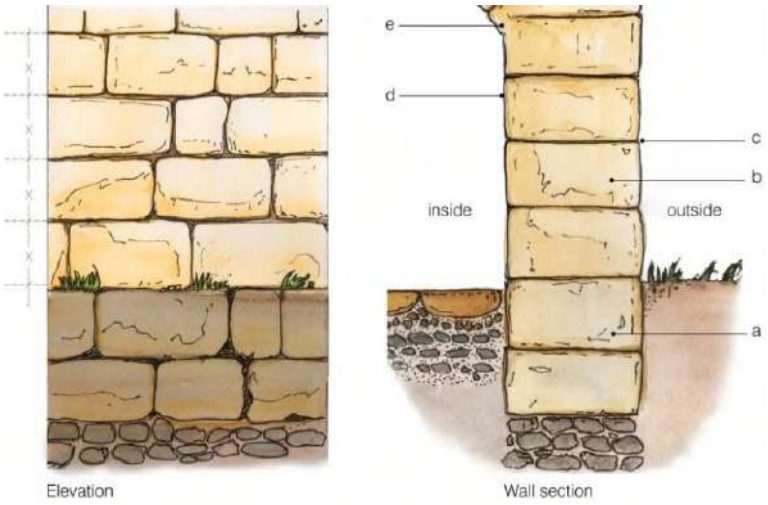
(1) Carl F. Petry, *The Mamluk Sultanate: A History* (Cambridge: Cambridge University Press, 2002).

(2) In Mamluk architecture, the term «Al-Ajali Stone» denotes a massive stone. While it may have been compared to an «Ejil,» meaning calf in Arabic, it is more commonly associated with an «Ajal,» meaning wheel in Arabic, as these large stones were transported on wooden carts pulled by oxen.

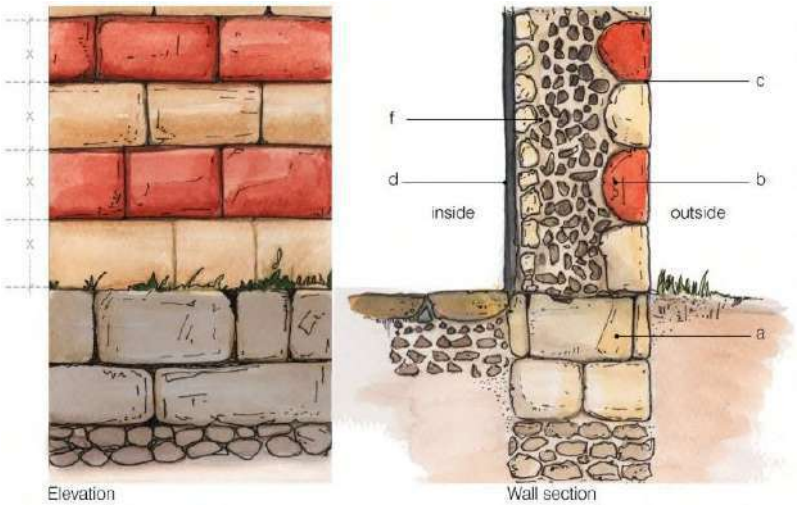
(3) Ashlar masonry is a precise stone construction method, utilizing finely cut and fitted stones to create smooth and uniform walls or facades.

(4) Ablaq is a decorative architectural technique in Islamic architecture where alternating rows of light and dark colored stone or brick create decorative patterns in walls and facades.

Ottoman[5] stone masonry closely mirrored Mamluk techniques, showcasing a shared architectural legacy and cultural exchange. Ottoman builders inherited and adapted Mamluk practices such as ashlar masonry, employing precisely cut stones for uniform facades and incorporating decorative motifs. They also prioritized local building materials, integrating various stone types into structures like



1- Mamluk wall construction in defensive or monumental buildings: a- rough foundation masonry. b- Stone blocks with a thickness ranging from 50 to 100 cm, 50 cm high arranged in a pattern to provide structural stability. c- Mortar made from lime, sand, and water was used to bind the stones together, creating a solid and durable wall. In some cases, alternating layers of stone and brick were used to enhance the strength and resilience of the walls. d- plaster or stucco finishes might have been applied to create smooth and polished surfaces, optional untreated stone surface. e- decorative elements such as painted motifs, ornamental carvings, or tiled panels could adorn the interior walls, adding to the richness and splendor of the architectural space.



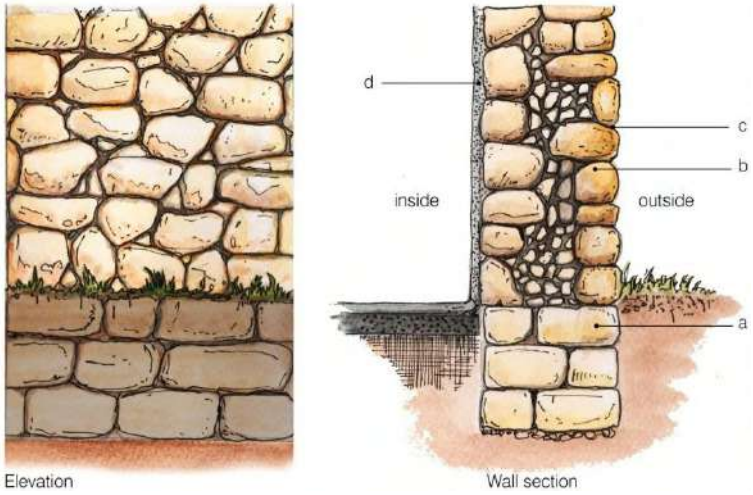
2- Mamluk wall construction (in Circassian-era): a- rough foundation masonry. b- double-walled wet masonry, 66 cm thick, 31 cm high, made of natural stone in ablaq decorative technique. c- Mortar made from lime, sand, and water was used to bind the stones together, creating a solid and durable wall. d- plaster or stucco finishes might have been applied to create smooth and polished surfaces. f- mortar filled with stones mixed with rubble, soil, and loosely arranged interlocking pieces.

palaces, mosques, and fortifications. In residential construction, especially in Jordan and Palestine,

(5) The Ottoman Empire, spanning from the 13th to the early 20th century, encompassed territories across Southeast Europe, Western Asia, and North Africa, including Palestine and Jordan. Its dissolution occurred in 1922.

builders who called locally *Ma`llim hajar* which means “stonemasons» or «stone craftsmen”, incorporate Mamluk, Ottoman traditions while adjusting to local circumstances. They favor materials abundant in the region and techniques suited to the climate and terrain. Irregular quarry-stone masonry was common, producing robust walls ranging from 75 to 100 cm in thickness. These walls provided insulation and structural stability against temperature changes (photo 03).

The evolution of stone cladding from the 19th century Architectural practices witnessed significant shifts with the emergence of concrete driven by advancements in Portland cement (1840s). By the late 19th and early 20th centuries, concrete became a primary material combined with stone cladding, evident in monumental projects like the Haydarpasa Train Station in Istanbul (1908) and Hejaz Railway stations (1901). The Hejaz Railway[6] were constructed using concrete and stones for durability in the harsh desert climate, marking a departure from traditional techniques and materials. These stations exemplify concrete›s versatility and signify a significant architectural transition in the region and profoundly influenced the architecture of Palestine and Jordan in early 20th century. They introduced modern architectural techniques and materials to the region, departing from traditional building methods and inspiring innovation among architects and builders.



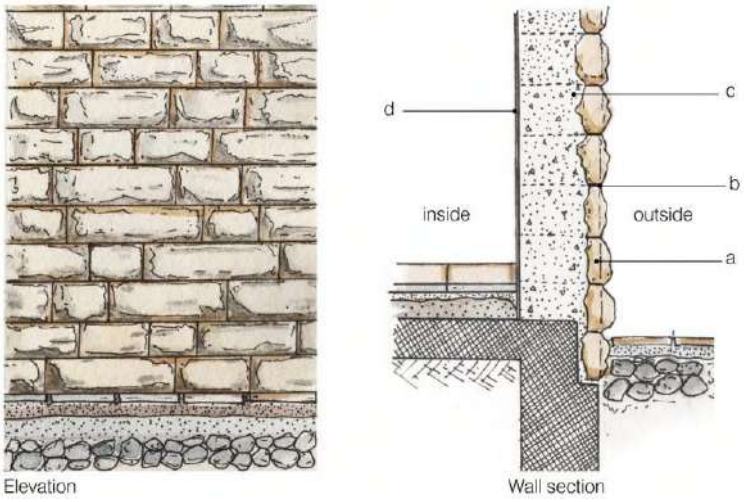
3- Typical wall construction of residential buildings from the Ottoman era: a- rough foundation masonry. b- double-walled dry or wet masonry structure constructed using natural stones, primarily field stones of basalt or limestone filled with rubble, earth, and interspersed interlocking stones. c- Mortar made from lime, sand, and water was used to bind the stones together in wet techniqe d- plastering: loam rendering, chalk whitewash and optional paint coating.

The design of these stations showcased a blend of Ottoman and Western architectural styles, refining the stone masonry, cladding method and its construction to be more slender and in compliance with industry standards[7]. The common construction typically involved laying natural stone in horizontal courses create the façade, this cladding method requires skilled masons who carefully select and position stones to ensure stability, strength, and aesthetic appeal. The stones were sourced locally or quarried specifically for the project, approximately 15-17 cm thick and 25cm high. Cement mortar was often used to bond the stones together, providing structural integrity and preventing moisture penetration. Behind the stone layers a backing reinforced concrete was

(6) The Hejaz Railway connecting Damascus with Medina, was an Ottoman initiative facilitating pilgrimage. Many stations, including those in Jordan, Palestine, and Saudi Arabia,

(7) The Industrial Revolution, spanning from the late 18th to the early 19th century, was a transformative period characterized by technological advancements in manufacturing, transportation, and communication. It introduced machinery, factories, steam power, and new production methods, reshaping economies, societies, and daily life.

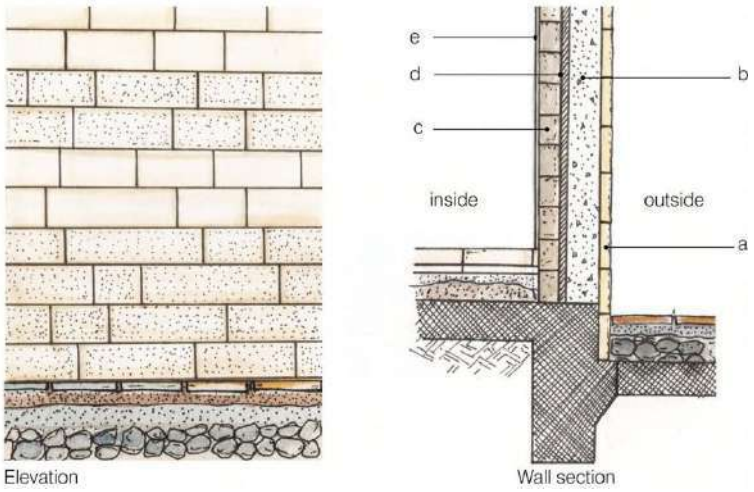
applied, this provides stability and structural support for the stone layers; the thickness of the wall was generally reduced to 35-40 cm. (photo 04). This cladding technique was widely applied and disseminated in both experienced a notable shift propelled by advancements in quarrying technology.



4- Typical wall construction of buildings from 1900: a- 15-17 cm shaped stones finished by skilled stone masons use tools such as chisels, hammers, and saws to shape the stones according to the desired dimensions and angles, the height of each course 25,5 cm: 25 cm+ 0,5 cm each joint between courses. b- Mortar made from cement, sand, and water to bind the stones together in wet techniqe c- 20- 25 cm reinforced concrete d- plastering: a layer of cement-based mortar.1,5-2 cm.

urban areas and rural regions until the late 1960s. During the late 1960s, the stone industry in Jordan and Palestine Mechanization[8], including the utilization of excavators and pneumatic drills, supplanted manual labour, while modern extraction methods such as diamond wire saws and hydraulic splitters enabled precise stone cutting. The adoption of building standards aligned with international norms, specifically targeting the reduction of stone cladding thickness to 3-7 cm. (photo 05). The technique of cladding involves the fusion of stone cladding with cast concrete and hollow block stones (arranged from outside to inside), with an increasing a slim layer of thermal insulation, commonly polystyrene, behind the hollow block. The course height remained constant, with each course measuring 25 cm plus an additional 0.5 cm for each joint between courses, totalling 25,5 cm, the wall thickness was reduced to approximately 33,5 cm. this stone cladding method continues to be widely planned and executed in Jordan and Palestine to the present day.

(8) In the early 1900s, electric stone saws replaced manual stone-cutting methods like chiseling and hand sawing. These saws had powerful motors and cutting blades or wire saws, allowing faster and more precise cutting through different stone types.



5- Typical wall construction of buildings from 1960s: a- 5 cm machine cut stones with different stone finishes done by skilled stonemasons, the height of each course 25,5 cm: 25 cm+ 0,5 cm each joint between courses, the stones are bound together using mortar composed of cement, sand, and water. b- 13 cm cast concrete c-10 cm hollow block stones d- 3 cm thermal insulation, commonly polystyrene e- plastering: a layer of cement-based mortar.1,5-2 cm.

Mechanical stone cladding

Mechanical stone cladding gained significant traction and refinement in the latter half of the 20th century, becoming widely embraced for its efficiency and adaptability driven by advancements in construction technology. This method offers advantages such as speed, precision and versatile design possibilities. However, despite being used in the last decade, Jordan and Palestine still face obstacles hindering the adoption of mechanical stone cladding. Challenges include deeply ingrained traditional construction methods, a shortage of skilled labourers in mechanical techniques, limited access to specialized materials, and unclear regulatory frameworks. Consequently, the widespread adoption of mechanical cladding in the construction sectors of Jordan and Palestine encounters significant impediments.

Conclusion

Old stone cladding techniques often lacked thermal efficiency, posed structural challenges, required extensive labour, limited design options, demanded frequent upkeep, harmed the environment, and could be expensive. Modern stone cladding, including dry stone techniques, which has witnessed increased usage in Jordan and Palestine in the last decade, addresses these issues by prioritizing durability, efficiency, and sustainability through innovations in insulation, structural engineering, design flexibility, and eco-friendly practices to meet contemporary construction needs economically and ecologically. However, there is an urgent need for standardization and wider adoption of this technique in our region and prioritizing thermal insulation and utilizing advanced anchoring systems.

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