CONSERVAR PATRIMÓNIO

ARTICLE / ARTIGO

Conserving Sidi Affane mosque: heritage, building archaeology, and historical challenges

Conservação da mesquita Sidi Affane: património, arqueologia de edifícios e desafios históricos

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Abstract

Heritage preservation requires a personalized approach, with a specific date for each element. For historic buildings, especially religious sites, knowing their history, is crucial to maintain authenticity and guide conservation decisions: complex materials and construction techniques, as well as changes over time, make this task essential. Most of the renovation projects in Constantine since 2014, following its designation as the Arab capital of culture, were carried out after the preparatory works, leaving many mosques closed, including the mosque Sidi Affane. A methodology, derived from building archaeology integrates archaeology and architecture and aims to unveil the mosque's mysteries, offering a holistic understanding of its history through interdisciplinary collaboration. Our analysis of Sidi Affane mosque seeks to establish an archaeological-architectural analysis method based on meticulous elevation readings. This approach not only holds scientific significance but also serves a practical purpose by contributing to the preliminary study for the mosque's restoration and enhancement.

KEYWORDS
Dating
Building archaeology
Mosque
History
Conservation

Resumo

A preservação do património requer uma abordagem personalizada que inclui a datação de cada elemento. Para edifícios históricos, especialmente religiosos, conhecer a sua história é crucial para manter a autenticidade e orientar os planos de conservação: a complexicidade dos materiais e das técnicas de construção, bem como mudanças ao longo do tempo, tornam essa tarefa essencial. Desde 2014, a maioria dos projetos de recuperação em Constantine, após designação como capital árabe da cultura, foi realizada após trabalhos preparatórios, deixando muitas mesquitas fechadas, incluindo a mesquita Sidi Affane. Uma metodologia derivada da arqueologia da construção integra arqueologia e arquitetura, e visa desvendar os mistérios da mesquita, oferecendo uma compreensão holística da sua história através de uma abordagem interdisciplinar. A análise da mesquita de Sidi Affane pretende estabelecer um método de análise arqueológico-arquitetónico baseado em leituras meticulosas de alçados. Esta abordagem científica também contribui para o estudo preliminar do restauro e valorização da mesquita.

PALAVRAS-CHAVE
Datação
Construção arqueológica
Mesquita
História
Conservação

Introduction

Heritage vividly reflects the evolution of society through the ages. Conservation choices, artistic reinterpretations, and intentional additions or losses shape heritage into a dynamic and adaptive phenomenon [1]. This emphasizes the importance of considering not only the inherited legacy but also how we choose to shape and transmit it, weaving a rich and complex canvas over generations.

Over the past two centuries, efforts to preserve and understand historical monuments have been intensified significantly. Multidisciplinary approaches involving archaeology, art history, and heritage conservation [2] have redefined the contours of monuments and influenced our perception of their chronology. By fully understanding heritage history, curators can formulate strategies that respect authenticity while responding to contemporary needs.

Preserving the long-term conservation of monuments requires in-depth knowledge of their different intrinsic heritage values – historical, architectural, ethnological, archaeological, artistic, symbolic, spiritual, identity-related, or memorial [3]. Before intervening on ancient monuments, it is fundamental to identify and analyze these multifaceted dimensions to preserve their historical integrity [4] and cultural value for future generations.

The problem of heritage conservation in the deficiency of historical study

It is essential to have a thorough understanding of a heritage monument/building before undertaking efforts to conserve it, and this involves several aspects. A thorough historical and documentary study is essential before considering the conservation of a monument. The aim is to gather as much information as possible about its history, origins, designers, construction context, and evolution over time [5]. The analysis of the archives, period plans, site reports, and any existing documentation allows us to better understand the genesis of the building, the initial intentions of the builders, and its authenticity. This research also provides information on the successive campaigns of works, modifications, and restorations undergone, helping to understand the transformations and establish a reliable chronology. A thorough study of architecture, construction techniques, and materials is essential before any conservation operation of a monument [6]. This detailed knowledge is essential to understand the behavior of the monument and identify its peculiarities and weaknesses, without compromising its integrity.

The built heritage, consisting of emblematic monuments, historical buildings, and religious buildings, is a valuable tangible testimony to past civilizations. These structures embody much more than just materials, they reflect the lifestyles, know-how, social, cultural, and architectural evolutions that have shaped our history. However, many historical buildings suffer from a crucial lack of written or archival documentation of their origin, construction, and evolution over time. This documentary deficit casts a shadow over efforts to preserve and restore built heritage. Without reliable sources, restoration campaigns move into the unknown, making crucial decisions without the necessary information. This situation exposes the monuments to risks of denaturation. Well-intentioned interventions can then lead to irreversible alterations, distorting the memory and integrity of these unique witnesses of the past [7]. The lack of documentation threatens the faithful preservation of the rich heritage embodied by the built heritage.

Preserving Algerian heritage: the challenge of incomplete documentation

Algeria has initiated several operations to restore its heritage, some of them successful as the rehabilitation of the Kasbah of Algiers and the Ahmed Bey Palace in Constantine [8]. These iconic monuments have been restored and reused for cultural or tourist purposes. However, many projects remain unfinished, leaving partially restored buildings abandoned. To protect this rich heritage, Algeria relies on Law 98-04 establishing the legal basis for the preservation of built heritage. From this law derives the permanent plan for the safeguarding and

development of protected areas (Plan permanent de sauvegarde et de mise en valeur des secteurs sauvegardé – PPSMVSS [9]), which establishes a strict regulatory framework for the conservation of historic buildings, the renovation of old neighborhoods and urban development, while guaranteeing the integrity and authenticity of the monuments.

The PPSMVSS of Constantine's old city outlines strategies for heritage preservation, including creating cultural spaces, museums, and tourist circuits. Financial incentives are offered to encourage private owners to restore old buildings, aiding in the transmission of centuries-old heritage. Despite legal protection, challenges persist, such as deterioration from age and weather, as well as inadequate maintenance. Rapid urban growth poses further risks, potentially leading to the destruction [10].

As part of the accompanying program of the event *Constantine, capital of Arab Culture 2015*, 11 mosques including the Sidi Affane mosque and eight zaouis are concerned with rehabilitation work, launched in 2014 and overseen by the National Office for the Management and Exploitation of Protected Cultural Property (Office de Gestion et d'Exploitation des Biens Culturels – OGEBC). The Sidi Afane mosque in Constantine is considered the oldest mosque in the city, according to the local community; it was built before the arrival of the Ottomans (this age hypothesis is based on word of mouth by the inhabitants without a thorough scientific study). The mosque is spread over a surface of 262 m² [11] (Figure 1a), consisting of a single level, it consists of:

- two separate prayer rooms (1, 2): the separation of prayer rooms for men (Figure 1b-d) and women emphasizes the tradition observed in mosques;
- El maidha (3): strategically located on the left side of the main access;
- Bit el imam (4): this room, positioned at the back of the patio, could serve as a space dedicated to religious and educational activities;
- The central courtyard (5): the heart of the mosque;
- The Maqsoura (6): this area is reserved or fenced, and the Minaret.

Between 1837 and 1915, the Sidi Affane mosque underwent a significant transformation into a school by the General Council of Constantine province, justified by the distance from the existing school in Bab El Kantara. The prayer hall was demolished to create classrooms, the outdoor space was redesigned for a playground, and the minaret was removed due to collapse risk [12, p. 1]. Despite these changes, remnants from before 1863 remain, offering insights into the mosque's original features before its colonial-era conversion. The French later rebuilt the minaret to its original design after 1915.

Despite the great heritage frenzy that there was in 2014, little significant effort was made to study the buildings to be restored, which led to the failure of this project. Together with the pre-arrival work, the study phase was initiated. Once the study report had been submitted, the OGEBC requested a review of the study because the historical-archival analysis component had not been established [13]. This has led to administrative conflicts, resulting in the closure of the place of worship to this day. This situation led to an almost total degradation of the architectural structures and the constructive components of the religious building. What are the long-term implications of the mosque's conservation when no in-depth study has provided any justification for the actions undertaken to transmit history and culture to future generations?

This lack of conservation and understanding of its history exposes the mosque to an increased risk of deterioration and loss of authenticity. The location of the mosque in the heart of the historic city of Constantine accentuates these challenges, as it faces increased urban pressure and a need for preservation in the face of modern development. What are the alternative strategies and approaches used to compensate for the lack of information during the conservation of this heritage?

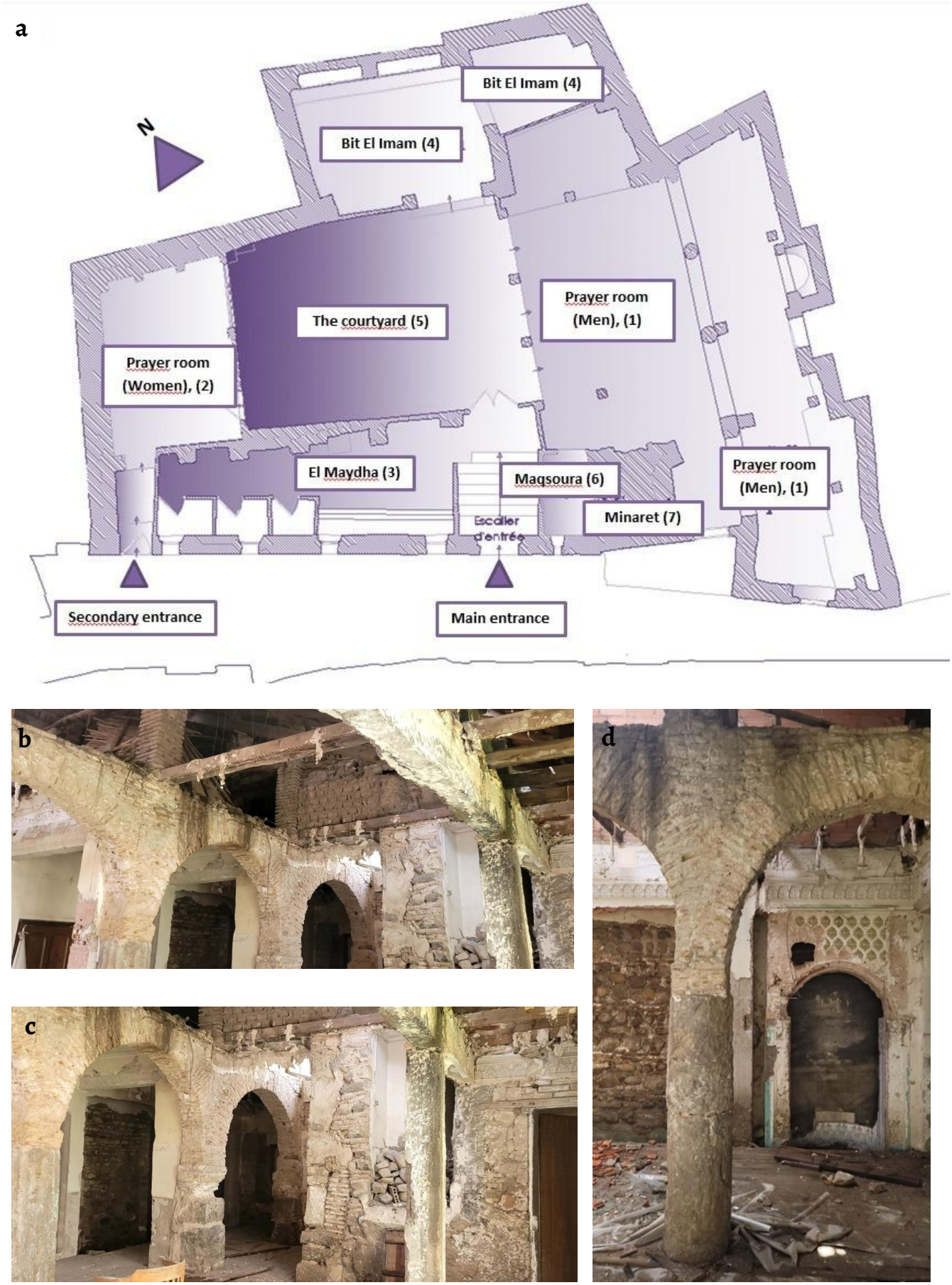

Figure 1. Presentation of the mosque spaces: *a)* architectural plan; *b)* the dome; *c)* prayer room; *d)* mihrab (photography: authors and BET ZIANI).

This documentary deficiency was confirmed after consulting the municipal archives of Constantine, the national archives in Algiers, the national archives, the national library of France, and the Library of Contemporary International Documentation, all in Paris.

The article aims to develop an archaeological-architectural analysis methodology focusing on elevation readings for mosque restoration, linking historical architectural developments to contemporary practice, and emphasizing examination, registration, and maintenance techniques. It aims to contextualize the mosque's appearance by studying construction techniques, space, and stylistic influences while achieving analytical coverage to identify architectural characteristics, technical elements, and chronological phases of construction.

Methodology and applied techniques

The proposed methodology (Figure 2a) is based on an innovative approach combining different methods [14] previously used independently on various buildings, each with different objectives compared to the current research. To understand the suggested methodological approach, it is essential to recall the epistemological foundations of building archaeology [15], the monograph [16], and the heritage diagnosis [17]. Those are three complementary approaches in the study and conservation of built heritage, each with its specificities, strengths, and limitations. Together, they provide a deep and nuanced understanding of historic buildings but also pose unique challenges in their application. The holistic approach to built heritage conservation [18] involves several interconnected disciplines, each contributing uniquely to the understanding and preservation of historical buildings.

Building archaeology is one approach that examines a building's materials, construction techniques, and evolution over time. This method offers insights into the historical journey of a building, allowing experts to understand its past changes and original design. However, building archaeology can involve physically intrusive methods that may damage the structure. Additionally, interpretations of material data can be subjective and lead to varied conclusions. This approach is also noted for being expensive and time-consuming, requiring input from various experts.

A monograph analysis in heritage conservation focuses on the building's history, architecture, and cultural context. This method provides a narrative framework that enriches archaeological discoveries within the built environment. The limitations of a monograph include its dependence on potentially incomplete or biased sources and a perspective that may be narrowly focused due to the author's specialization.

Lastly, the patrimonial diagnosis assesses the condition of the building, identifies conservation issues, and recommends preservation strategies based on a comprehensive understanding of the structure's historical and current state. This diagnostic process is crucial for planning effective interventions. However, it tends to concentrate primarily on the building's current physical state and might overlook the historical and cultural significance of certain elements, which could be vital in a holistic conservation strategy.

Each approach has its limits, underlining the importance of a multidisciplinary method for a complete understanding and conservation of architectural heritage. Hence the proposal of an archeological-architectural methodology that represents a multidisciplinary approach combining the methods of archaeology and architecture to decipher the mysteries of these historic buildings. By its transdisciplinary nature, it offers a holistic approach to deciphering the history of buildings even in the absence of reliable scientific resources. It combines the expertise of various fields to rebuild the puzzle of these monuments, thus allowing a better understanding of their past and preserving their heritage for future generations.

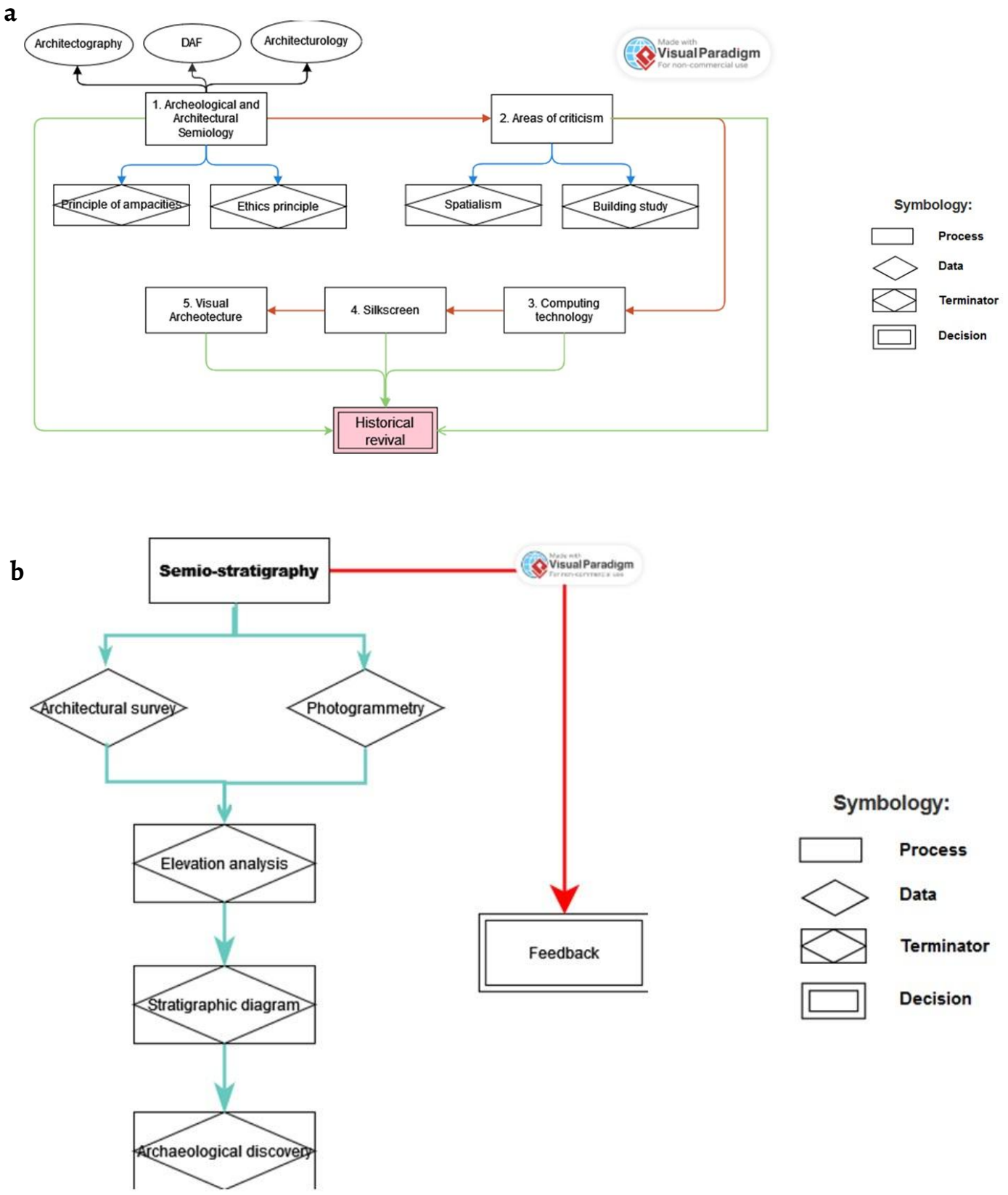

Figure 2. Diagram of the: *a)* archaeological-architectural methodology applicable to historic monuments; *b)* details of the semiostratigraphy.

The method of investigation enables an in-depth reading of the buildings from their base. It focuses on understanding the architectural evolution of buildings using stratigraphic analysis, offering a virtual reading of the different construction phases. This approach makes it possible to virtually reconstruct architectural changes over time (in 2D and 3D).

The concept of semiological architectural-archaeology integrates the fields of semiology and stratigraphy [7] to examine the layering and boundaries of building materials. This approach, known as semiostratigraphy (Figure 2b) [19], utilizes drawn contours to meticulously document the structure's history, aiding in further analyses and interpretations.

The principle of ampacities extends from semiostratigraphy, using the analysis of a building's layering and boundaries to hypothesize about the influential factors behind its construction and evolution. In terms of ethical considerations, the ethics principle in architectural archaeology emphasizes the importance of breaking down details to form a complete picture, weaving between micro and macro perspectives to create a synthesis.
Area of criticism typically focuses on the intersection between architecture and spatialism, exploring how architectural spaces influence and are influenced by human behaviors, social practices, and cultural contexts. This area critically examines the dynamic interactions within architectural environments.

Computing technology in architectural archaeology offers an impartial method to interpret structural changes in old buildings, avoiding biased assumptions about their causes. The concept of silkscreen in building archaeology is studying materials like stone types and sources are vital for understanding construction methods, trade networks, and builders' choices.

Finally, visual archaeo-architecture is similar to ichnology. It examines destruction modes and preserved remnants to uncover the history and context of lost artwork, considering both general and iconic details.

This fragmented and detailed approach offers a rich and contextualized reading of the history of the Sidi Affane mosque. By breaking down the building, part by part, by analyzing each architectural element and each aesthetic detail, we can reconstruct the complex puzzle of its evolution through the ages. This allows us to better understand not only its architectural history but also the cultural diversity that marked its development, thus offering a valuable testimony to the historical and artistic evolution of the region.

Table 1. Tools and techniques used in the proposed methodology for historical research.

Method	Tools used	Definition	Contributions
Architectural survey [20]	TOPCON GTP 3005S tachometer with 360° automatic target recognition system for 2 mm + 2p pm/km and 5" distance accuracy, 0.5 mgon for vertical and horizontal angles Faro X130. It has a 360°x270° scan field	Detailed documentation of the architectural features of a building, including its dimensions, layout, and ornaments	Helps to understand the evolution of structure, styles, and construction techniques over time
Photogrammetry [21]	Nikon D750 NU 80K camera Agisoft Metashape 2.0.4, meshroom, meshlab, and cloudcompare	Technique to reconstruct detailed 3D models from a set of photographs	Helps visualize and analyze architectural features in their spatial context
Elevation Analysis	Autocad	Meticulous study of the elevations (facades, walls) of a building, aimed at identifying the different phases of construction, reworking, and remodeling	Allows to understand architectural and stylistic transformations as renovations and additions
Stratigraphic diagram	The construction of the stratigraphic diagram was carried out analogically. The Stratifying software [22] did not take into account the intrinsic architectural logic in the sequencing of stratigraphic units. The layering of strata does not necessarily reflect the relative chronology, as the upper stratum is not systematically the oldest	Graphical representation of the archaeological layers of a site, showing the chronological relationships between the different strata	Helps to establish a relative chronology of human activities on the site and identify construction phases
Archaeological finds [23]		Objects, structures, or artefacts found during archaeological excavations, provide information about past life	Provides material evidence of human occupation, cultural practices, and historical events

The proposed analytical approach acknowledges inherent epistemological limitations despite its rigorous definition and relevant results. It strives for objectivity to avoid interpretative biases, yet acknowledges the subjective imprint inherent in scientific investigation. Efforts to minimize hermeneutic drifts and uphold scientific objectivity are crucial, especially considering the complex interplay between materiality and architectural symbolism. Interpretations may remain speculative without additional historical documentation, necessitating critical and comparative analysis. Visual renderings may vary based on available documentation, challenging historical accuracy, and emphasizing the importance of rigorous methodologies to minimize interpretative subjectivity.

Results and discussion

The comprehensive study of Sidi Affane Mosque delves into overlooked facets of its history, highlighting details and events absent in traditional narratives, enriching academic understanding, and contextualizing its regional significance.

The architectural survey

Survey points of the Sidi Affane mosque's architectural elements are recorded in XYZ coordinates using the NGA system to prevent errors, with double readings and references for accuracy. Canvas calculations are performed with *COVADIS* software based on site size and configuration [24].

Some details, the importance of which is particularly important, will be meticulously recorded by hand (Figure 3b-c). Beyond the numerical dimensions that the machine will be able to capture, the manual reading of the detail will allow a more refined analysis (sanitary state, materials, chronology).

These surveys (Figure 3a and Figure 3d) were carried out jointly with the design office: Ziani-Mahindad group, under the direction of Boussouf Faima. They are an initial source of a wide range of information that will serve as the initial basis for this study. Indeed, these precise data provide the exact dimensions of the structure, raising the question: why is the prayer hall positioned at a height of 1.20 m from the ground? In addition, they allow us to observe one of the distinctive and symbolic elements of mosques: the mihrab. The latter is distinguished by its deviation from its traditional position; unlike the typical alignment with the dome, there is a clear shift on the south wall.

The hypothesis suggests the initial alignment of the mihrab with the dome's axis, supported by dimensions resembling traditional mihrabs in an adjoining room (Figure 4), yet challenges arise regarding the southeast orientation of this religious element and its adherence to the proper prayer direction over time.

Archival documents referring to the mosque are extremely rare. They include cadastral plans of the town dating from before and after the French conquest of 1837, the Constantine waqfs register drawn up under Salah Bey [25], the work of the Constantine archaeological society [26], the minutes of the general council of the Constantine province in the Constantine department [27], as well as reports documenting recent discoveries made inside the prayer hall in 2014 [28]. The initial state of the mihrab is not discussed in previous documents; this hypothesis is derived from the material traces found on the spot.

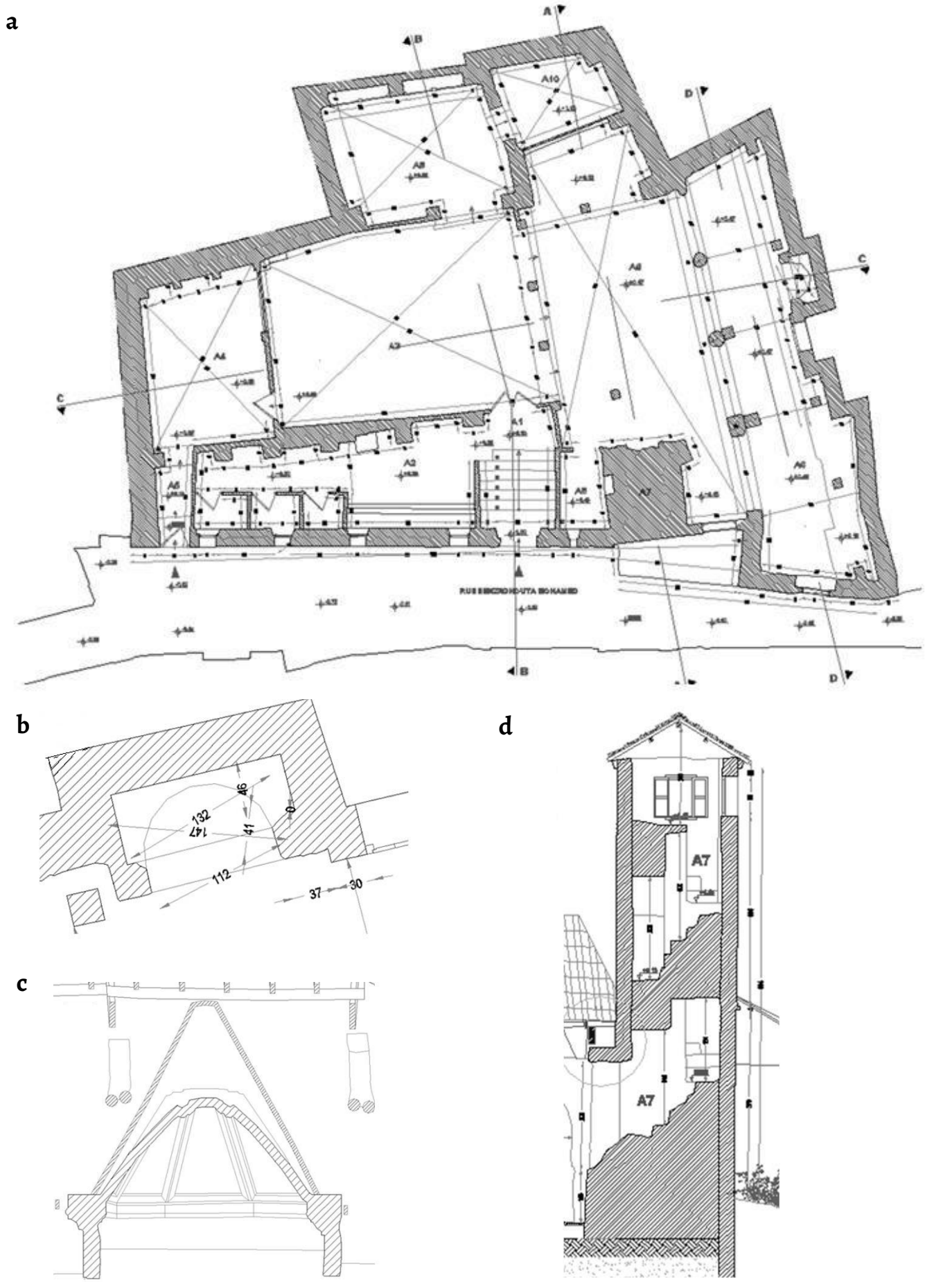

Figure 3. Survey of the Sidi Affane mosque: *a)* general view; *b)* the mihrab, *c)* the dome; *d)* the minaret (sources: authors and BET ZIANI).

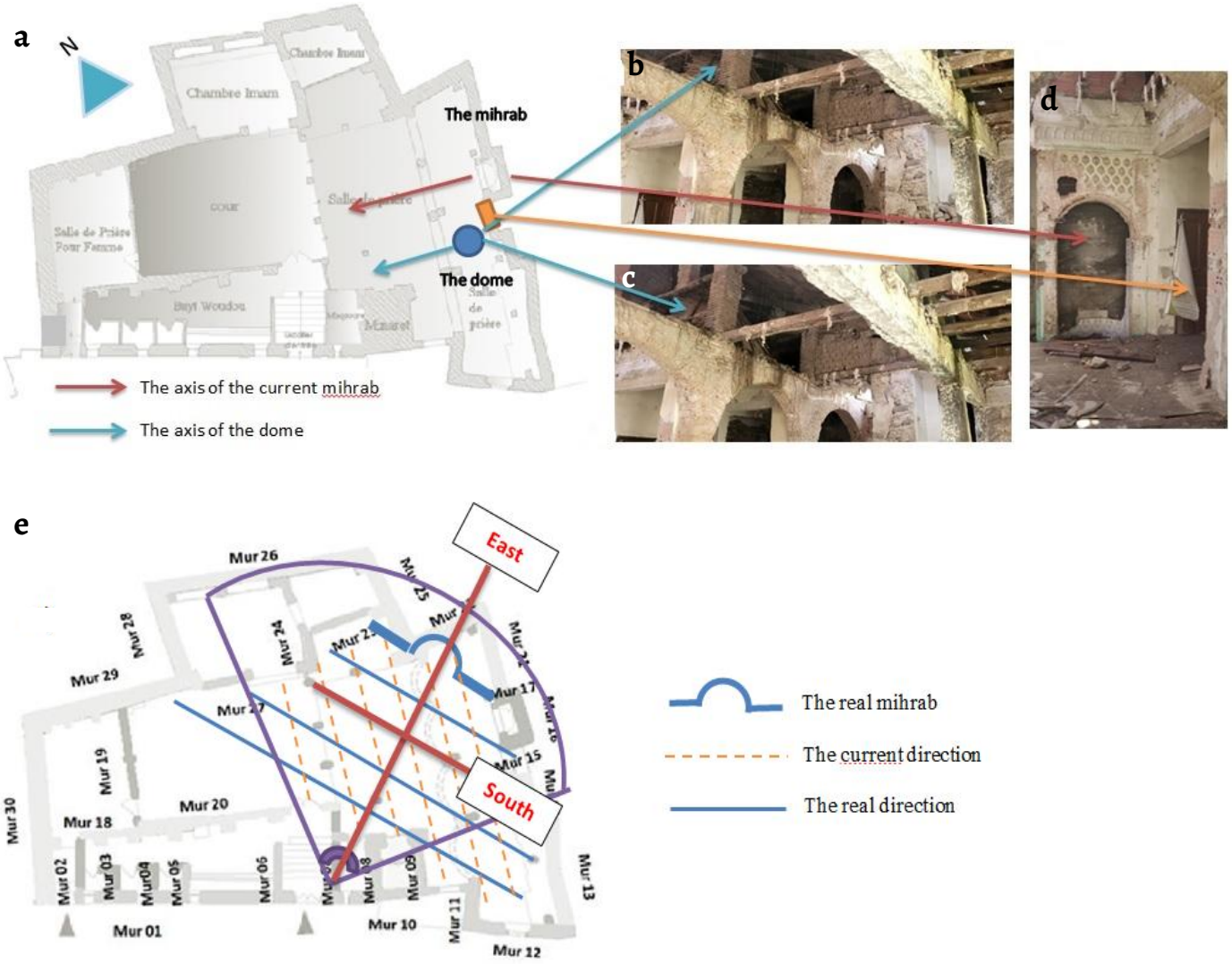

Figure 4. Mihrab: *a-d)* Arrangement of the mihrab axis with respect to the dome axis; *e)* and its real orientation.

The photogrammetry of the mosque

Photogrammetry was applied to the Sidi Affane mosque using *Agisoft Metashape*, *Meshroom*, *Meshlab*, and *Cloudcompare* software to generate accurate 3D models of this heritage structure. Particular attention was paid to the wall of the mihrab, which is difficult to access. Image processing resulted in a densified cloud of about 3 million points for this elevation, leading to detailed orthophotography. The main objective was the high-resolution 3D digital documentation for in-depth architectural analysis, recording of the current state, support for further studies, and heritage valuation.

By transposing the architectural photogrammetry project to the Sidi Affane mosque (Figure 5), we obtain:

- Data acquisition: the camera covers multiple wide and close-up overlays of at least 60 % between each shot to account for complex volumes;
- Data processing: alignment of photos into four separate blocks, manual filtering of outliers on surrounding vegetation areas (those installed by abandonment); final mesh generated with a density of 2 cm;
- Final results: 3 million point dense scatter; textured 3D model;
- Analysis and discussion: comparison to existing 2D plans: maximum deviations of 5 cm noted. Clarity of constructive details is acceptable under these conditions. Detection of mihrab degradation zones to quantify their replacement.

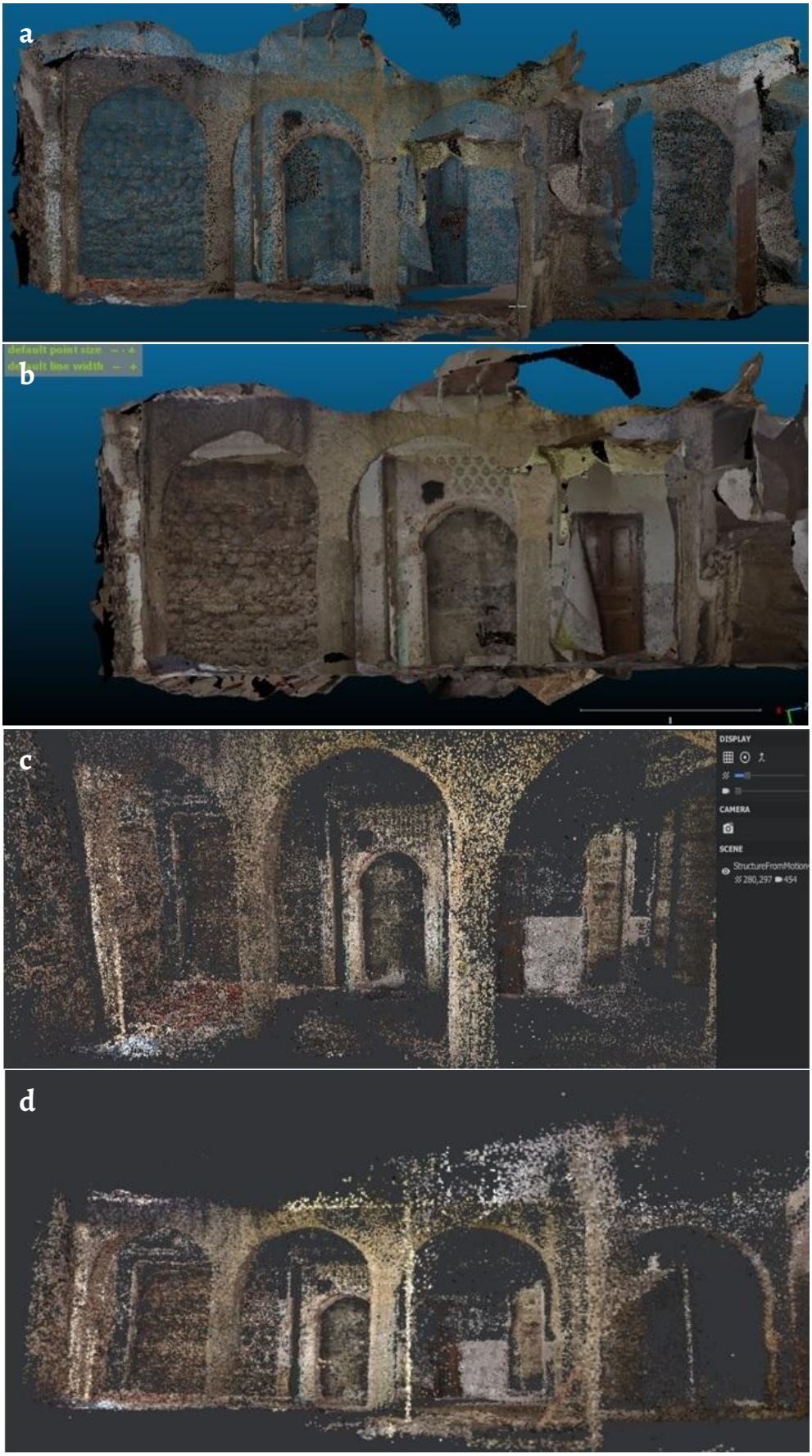

Figure 5. Result of densification points of the prayer room from different angles: *a-b)* taken from CloudCompare; *c-d)* taken from Meshroom.

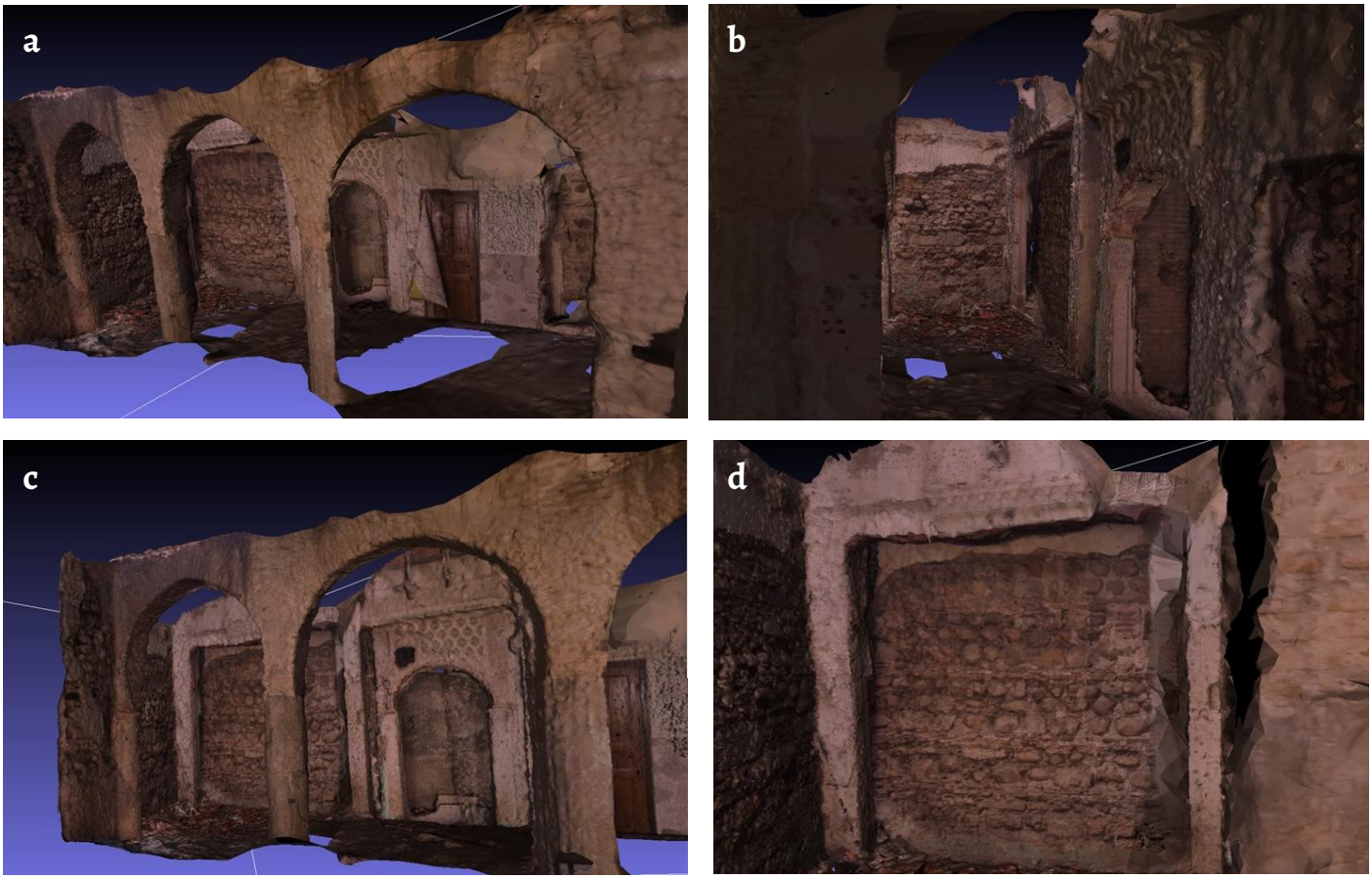

Figure 6. Textured 3D models of the south wall of the prayer hall: *a-c)* at different angles; *d)* detail on the corner.

Photogrammetry of the mihrab wall of the Sidi Affane mosque generated a detailed 3D metric data set. The final 3D model of this section contains more than 3 million points with an overall accuracy estimated at ±5 cm, which meets the expected specifications. The orthophotos produced for the inner facade of the mihrab have a pixel resolution of 5 mm, enabling details to be visualized precisely. Some areas, such as the upper part of the wall, could not be fully documented, due to the inaccessibility of certain camera angles.

This photogrammetry applied to the Sidi Affane mosque will allow its detailed architectural analysis (elevation analysis) (Figure 6). By meticulously capturing the complex geometry of this ancient structure, including the wall housing the mihrab, it has created a faithful virtual model for archival purposes and in-depth study of the transformations undergone over the centuries. This 3D representation facilitates the contextualization of the recent archaeological discoveries of the intramural necropolis and the future development of immersive cultural mediation experiences around this building.

Elevation analysis

The study of facades encompasses areas of exploration defined by their link with reality, whether tangible objects, traces of human activities, or symbols. We distinguish the artefacts [29], the clues, that is to say, the traces left in the building by human actions, (the testimonies), all these formally unclassifiable archaeological facts that are the punctual result of a specific action and preserve the memory of a minor or major event or decor that enters this part of the history of art and that participates in the archaeological analysis either for the dating.

On the wall of the mihrab persists the same method of construction, the Opus Mixtum, but with a contrasting visual diversity on both sides of the mihrab. To the left of it, the load-bearing walls consist of two distinct materials: solid brick and rubble, forming a wall of a thickness varying between 60 and 70 cm. This structure consists of several rows of rubble, separated by two rows of solid bricks, with a spacing of 60 to 80 cm between two successive rows of the same

material. Lime mortar ensures the cohesion of these elements. However, on the right side, disturbances in the filling are noticeable at the location of the old mihrab. The difference in materials appears distinctly: alternating between bricks and stones, with interruptions in masonry: differences in the types of materials used at different levels of an elevation could indicate distinct phases of construction. The upper part of the wall is very distinct: a much later brick. The identification of the date thanks to the decorative elements is difficult because they come from reuse.

Stratigraphic diagrams

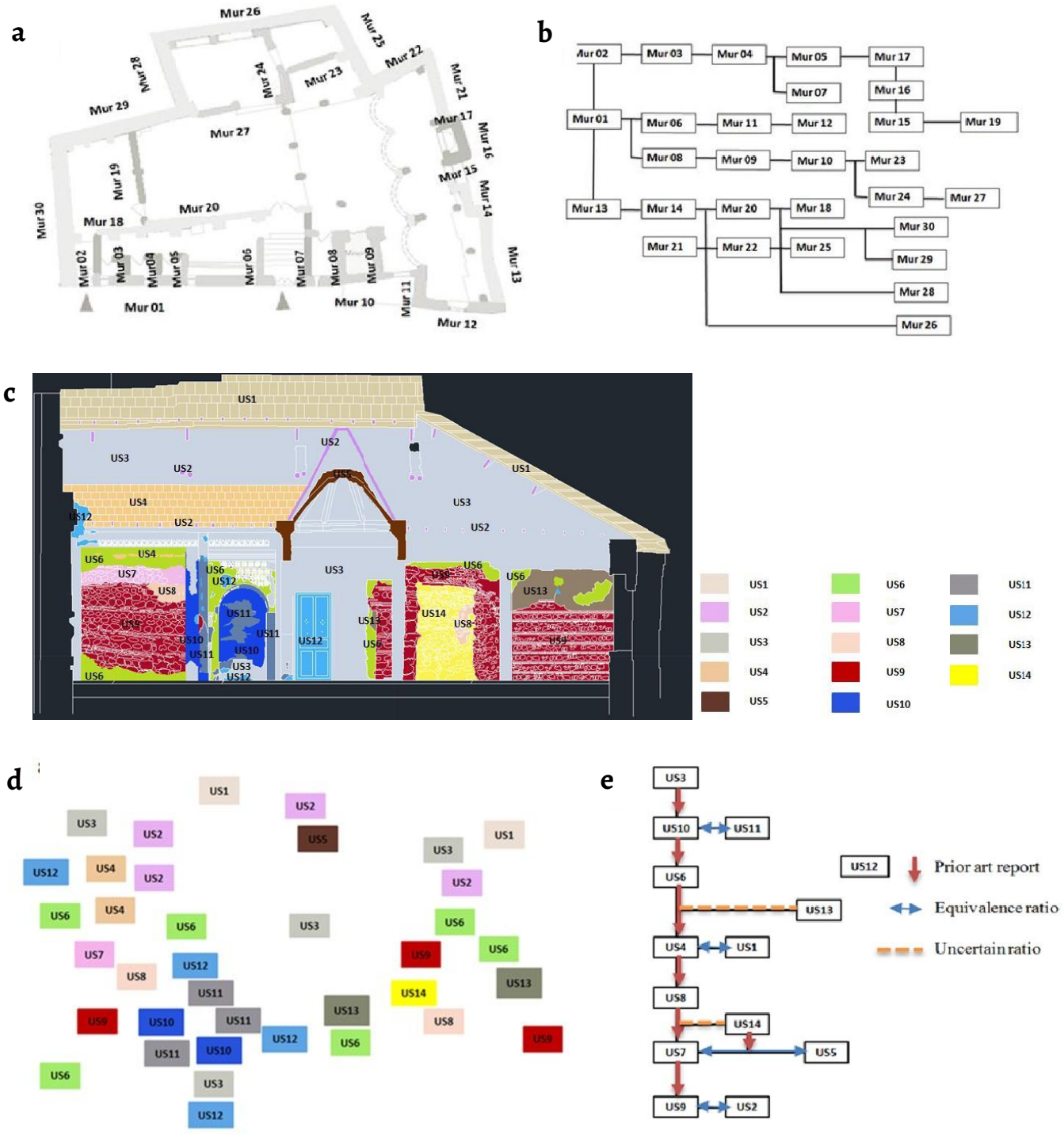

Figure 7. Walls of the Sidi Affane mosque: *a-b)* localization; *c)* identification of Us on walls 13, 14, 15, 16, 17, and 21; *d-e)* Us diagrams.

This archaeological stratification enables the phasing of the edifice's structural development and the interpretation of its primary building campaigns through the identification of construction units and their temporal relationships (Figure 7). Following on from the analysis of the mosque, the south wall was studied in depth, revealing evidence and marks from three distinctly different periods. Interface analysis led to the identification of 13 distinct positive layers and one negative layer (US12), potentially the result of deliberate demolition or modification to create an opening.

The graphic representation aims to detail the structural complexity of a single wall by highlighting its evolution and diachronic aspect. This approach allows us to understand its dual nature, both physical and historical, from its origins.

Archaeological findings

According to the work of E.Mercier in 1902 [30, pp. 43-96], an inscription was found inside the prayer hall, recorded under No. 55, written in Barbary characters carved in relief on the head Machhed (epitaph) of a wooden tomb 0.30 m in diameter. Here is the text with its translation:

بسم الله الرحمان الرحيم
هذا ضريح الولي الصالح
القطب الناصح سيدي جامع بن علي توفي
رحمه الله تعالي في اخر مولد محمد
صلي الله عليه و سلم
١٢٤٩ سنة

In the name of God's mercy
This is the mausoleum of a good guardian,
Consulting Pole Sidi Jammeh Ben Ali,
May God's mercy come at the last birth of Muhammad
Pray God upon Him and Peace,
Year 1249.

This date is very important in the historical genesis

In 2014, during the first restoration works of the mosque, a major archaeological discovery emerged under the floor of the prayer hall, at a depth of 40 cm. This discovery included several sepulchres (Figure 8) containing bone remains and ceramic fragments. In the preliminary report of the local national museum, it is specified that three of these tombs were erected using terracotta bricks, with lime-coated foundations, covered with slabs made of stone and terracotta. One of these tombs was 1.75 m long and 0.54 m wide. A team from the National Centre for Archaeological Research (NCAR), dispatched by the Ministry of Culture to conduct expertise, noted in its June 2014 report that these graves were aligned from west to east and that there seemed to have been a reuse of some of them for other burials.

The report of the rescue search, carried out between late June and mid-July 2014 by another team from the same establishment, presents limited information. This excavation allowed the discovery of about thirty sepulchres, facing northwest, as well as several unidentified tools, although these discoveries were not considered particularly significant.

What is certain is that among these graves, some are Muslim, and the direction of the mihrab towards the south could have distorted their orientation. In Islam, during funerals, it is common to bury the deceased in alignment with the Qibla (direction of Mecca) [31]. If the mihrab, which indicates the direction of prayer, is facing south instead of the Qibla, this could have affected the alignment of the graves of the deceased faithful.

Figure 8. Tomb discovered inside the prayer room (photography: NCAR, 2014).

Visual archaeotecture

Image archaeology for this mosque involves studying traces of destroyed or modified elements to potentially reconstruct the original architectural and decorative programs. For example, the southern part of the mosque, having been the first object of study, reveals a remarkable case study at the level of the mihrab part. One evokes a questionable form to describe a partially destroyed figure, retaining recognizable iconic monèmes or residual elements of its original structure.

On the southern wall of the building, to the right of the current mihrab niche, a striking contrast is observable: although the contours of the latter remain discernible on the elevation, the canonical influence of Islamic religious architecture seems curiously lacking. This deficiency is manifested by the blatant absence of moucharabiehs with characteristic geometric or arabesque floral patterns, the absence of zelliges – these famous glazed and glazed ceramic tiles – and even the total absence of any complex polychrome architectural decor. This architectural singularity raises intriguing questions about the evolution of aesthetic canons and craftsmanship in this region over time, perhaps suggesting various non-native cultural influences or major changes in vernacular artistic practices over time.

Historical genesis

The Sidi Affane mosque provided rich information (Figure 9). It is the result of constructions, ruins, and successive modifications and is the result of constant adaptations of the place to the needs of its occupants. This archeological-architectural study leads to certain conclusions and opens the way to other questions.

Occupied at least since 1249, the site of the mosque is installed inside the lower Souika. The care taken in the implementation of masonry (walls, basement) indicates that the primitive building has a typical architecture of the Hammadite period, characterized by its simplicity and sobriety, favoring simple forms and minimalist decorations, often in stone, indicating structural strength. The current structure retains features of this period, presenting an organized arrangement for prayers and architectural elements reflecting the mastery of stone at that time.

Figure 9. Sidi Affane mosque: *a)* chronological plan following the construction of the walls; *b)* the restoration of the interior of the mosque before 1830; *c)* restitution of the mosque environment with its accesses.

The mosque underwent a succession of alterations and destructions. The results of this research made it possible to highlight several states of the building. Unfortunately, they are difficult to relate to the events mentioned in the history of the city of Constantine. Although it is tempting to associate certain similarities with the Djemââ Lekbir [32] (the Great Mosque built in 1135) no physical trace can confirm this hypothesis.

On the other hand, what reinforces it is the similarity between the two mosques. The columns of the prayer rooms come from the reuse of ancient barrels and capitals and those of the mihrab remain purely Hammadid [33]. The two naves of the mihrabs are out of alignment with the prayer hall due to urban renovations during the French occupation. The facades and minarets also date from this period, but the location of the minarets may be original. They have a square base.

That said, the Sidi Affane mosque is poor in architectural elements and noble materials and it does not appear on most historical maps (contradictions with the list of waqf mosques where it is cited). Where it appears, it is associated with a courtyard (overlapping plots). Just behind, there is a sabat and a dead end that directly overlooks this courtyard [34] of the mosque and the axis of its entrance, or a passage that directly overlooks the main street from where the reason for its elevation. In its configuration and size, there was only the prayer room, the rather spacious backyard, the minaret, and the mihrab placed under the axis of the dome.

From this analysis, a chronological plan is proposed as well as a restitution of accesses.

While the stratigraphic analysis provides a valuable relative chronology, its limitations must be emphasized. The numerous repairs, re-workings, and additions of new mortar and cement observed in the structures inevitably disrupt the stratigraphic reading, introducing residual units and complex rearrangements in the sequence.

Conclusion

The comprehensive study of the Sidi Affane mosque has resulted in a detailed architectural documentation, providing new avenues for analysis and comprehension of this heritage site. Utilizing photogrammetry, particularly for the mihrab wall, has yielded a comprehensive 3D model, serving as a robust foundation for future research and the enhancement of the mosque's valorization. Examination of elevations unveiled notable disparities in building materials, hinting at distinct construction phases. Embedded within an epistemological framework, this architectural inquiry strives to advance understanding of the mosque within its regional context.

The determination of the mosque's age holds significant implications for Constantine's historical narrative and broader regional development. This insight facilitates a deeper comprehension of architectural evolution and cultural dynamics over time. Furthermore, the study evaluates the applicability and limitations of analytical methods on such structures, prompting methodological advancements. Graphic restitutions are utilized for heuristic purposes, exploring interpretative hypotheses and refining understanding while literary narratives aim to disseminate research outcomes to diverse audiences.

Accurate dating informs conservation strategies, guiding heritage practitioners in selecting suitable methods and materials to uphold the mosque's authenticity. Despite methodological challenges, the rigor of the study has significantly reshaped perceptions of the mosque, furnishing an essential documentary foundation for addressing regional historical inquiries linked to this architectural heritage. Through a combination of graphical representations and narrative approaches, a more intuitive and synthesized understanding of the mosque's architectural and historical evolution is promoted, fostering broader public engagement and appreciation.

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