

# MATERIALS, TRADES AND TECHNICITIES: THE RESTORATION SITE OF THE MERINID CITY MANSOURAH (TLEMCEM, ALGERIA) IN THE WORK OF THE ARCHITECT EDMOND DUTHOIT (1874-1884). GENESIS AND APPROPRIATION OF A PRODUCTION PROCESS

Amel BENGUEDDA<sup>1\*</sup>, Malika KACEMI<sup>1</sup>, Chehrazed NAFA<sup>2</sup>

<sup>1</sup> University of Sciences and Technology of Oran, Faculty of Architecture and Civil Engineering, Department of Architecture, BP 1505, Bir El Djir 31000, Oran, Algeria.

<sup>2</sup> National School of Architecture of Paris Val de Seine, 3 Quai Panhard et Levassor, 75013 Paris, France.

---

## Abstract

*The restoration of the heritage is conceived as a direct intervention on an "exceptional building" built, which proves a particular attention from the point of view of its architectural quality, the historical or ethnological interest. The restorative practice on historical constructions calls for a methodology specific to intervention with the existing. This methodology includes several operations of acquisition and graphical restitution of data, and analyzes for the widest possible knowledge of the construction or the studied ensemble. At the end of the 19th century, many scientific and artistic structures initiated to establish new debates on the issues of the conservation of buildings in danger in Algeria. Between 1872 and 1889, Edmond Duthoit architect, intervenes on various remarkable buildings in Tlemcen, to make known their states of conservation and the necessary needs for possible interventions. These interventions raise cognitive and practical questions about the technical corpus that has formed the basis for our current knowledge of the restoration of historical monuments. The restoration of the historic site of Mansourah is offered to our study as the most significant and exhaustive case, because of the abundance of almost unpublished sources. By giving a privileged place to textual studies and to material analysis, it is the discovery of a process of production of the techniques, the gestures of the construction, the knowledge that they suppose and more fully the symbolization that expresses the aesthetics of forms and social uses that contain and organize the enclosure and the mosque of Mansourah.*

**Keywords:** Conservation; Monograph; Artistic knowledge; Materiality; Investigation.

---

## Introduction

In the 19th century, new French practices were applied to the preservation of historical monuments in Algeria [1, 2]. Once the remarkable buildings of great aesthetic and historical value have been identified and classified, the Chief Architects of historical monuments under the authority of the historical monuments service are responsible for the establishment of protection and restoration projects [3]. As early as 1880, Edmond Duthoit, in his capacity as chief architect of historical monuments in Algeria, drew up reports on the state of conservation of the buildings, specified the restoration operations, entrusted the work to the inspectors of the site and ensured the follow-up. The question arises of the dissemination of knowledge on the

---

\* Corresponding author: amel.benguedda@yahoo.fr

methods and techniques of restoration of the Algerian historical monuments in the nineteenth century. It is within this intellectual framework that the study of the different scales of technicality adopted in the organization of sites for the restoration of endangered monuments is required: this is the case of the Marinid city of Mansourah.

To understand the restorative work of Edmond Duthoit on the city of Mansourah, it is appropriate to retrace in short his life and his career. Restoration architect since 1868, chief architect of the historical monuments of Algeria from 1880 until 1889, Edmond-Clément-Marie-Louis Duthoit lives his vocation as a draftsman waking up early in the family atmosphere largely traced by *Jacques Foucart-Borville* [4], *Nabila Oulebsir* [5] and recently *Monique Dondin-Payre* and *Lucie Bonato* [6]. The meeting around the medieval sites of Viollet Le Duc and members of his family, participated actively in the training of architect Edmond Duthoit (from 1857 to 1872) within the agency that Viollet Le Duc had just opened in Paris [7]. Quickly, Edmond Duthoit, studied with great care the Phoenician architecture in Lebanon and Cyprus, "as also the ramparts and tombs of Jerusalem, the Christian churches of Syria to determine the respective play of Egyptian, Phoenician and Greek influences [8].

Beyond the case study considered, it is also the study of architects, craftsmen who are at the heart of the conceptualization, realization, use and interpretation of architecture. As part of this text, the description of the work done in the various reports and sites found represents an undeniable source that allows us to bring new historical knowledge on the previous state of the mosque of Mansourah and a knowledge of the material of organization of the restoration site by analyzing the prices of supplies, materials and tools used for this vast restoration project, which will last from 1874 to 1904.

#### *Some historical landmarks of the Mansourah city in Tlemcen*

Capital of the central Maghreb in the eleventh and thirteenth to the sixteenth century, Tlemcen was born from the Roman presence under the name of "Pomaria"[9]. The city "Pomaria", found itself coveted in particular by Mérinides or Beni-Mer, whose capital was Fez [10]. Resisting the multiple assaults of its neighbors, Tlemcen was finally besieged under the reign of Abu Said Othman ben Ya`qub, Merinid Sultan for eight long years (from May 6, 1299 to May 13, 1307). The Merinid Sultan Abu Yacoub Youcef had built the town of Mansourah near the city [11]. Mansourah, a military camp that means "Victorious Camp", eventually replaced Tlemcen. The mosque of Mansourah would have been built around 1303 by the sultan Abu Yacoub [9].

After the departure of the merinides, Mansourah or "Tlemcen the new" was ruined and the enclosure itself was partly dismantled [12, 13]. This was not until thirty years later, when the merinides returned, under the leadership of Sultan Abou al Hacem, to besiege Tlemcen in 1335 that the city of Mansourah was rebuilt. However, the return of the Zianid kingdom to Tlemcen in 1348 marked the final ruin of the city of Mansourah and the conquest of the new Tlemcen. In the day after of the colonization, a French military center was created in Mansourah and this since 1849, followed by the decree establishing the village was dated May 6, 1850. Subsequently, restoration works were conducted with great empowered by Duthoit assisted by Lefebvre, architect at Tlemcen in 1877 [5], who designed and directed the restoration, consolidation of the minaret and the repair of some parts of the enclosure of the city of Mansourah.

## **Materials and Methods**

The Mansourah site has undergone various restoration campaigns in previous decades: restoration of the minaret, creation of landscaping and consolidation of structures and masonry. These operations were completed in 2016 initiated as part of the cultural event "Tlemcen Capital of Islamic Culture in 2011". The interest of this research is to return to this real case of restoration after more than a century of natural aging and prepared interventions.

The objective is to highlight the process of restoration of the Mansourah site in the 19th century (knowledge of the building, line of intellectual action of the architect Edmond Duthoit, setting up the site, until the exploitation), around architectural and ethnographic knowledge. The research program is conducted from the angle of a fine archeology of the building (study of the building) and the discovery of the material history of the building site (reading of the textual and graphical archives).

***Specificities and historical value of the fund***

The Edmond Duthoit fund has been given several times, the fund which concerns the work done on the historical monuments in Algeria, has been the object of a family legacy only recently to the Museum of local art and regional history - Hotel of Berny in the city of Amiens. This fund includes correspondence, about twenty travel diaries and constructions sites, several editorials on the history of the buildings visited, documented by various photographs and a series of surveys completed by views of the monuments, offering an unprecedented testimony on buildings since disappeared (this is the case of the Medersa Tachfiniya in Tlemcen [14]). The graphic and textual documents realised by Duthoit, located at various centers of conservation have made the classification of the fund more complex.

All these textual documents, kept in the Library of Architecture and Heritage in Charenton le Pont in Paris, is written in French. As part of our reflection, some parts of these documents are transcribed in their entirety. The original text is in upright characters, everything in italics and between (-) marks what is not there or what is uncertain (*word uncertain*). Our archives are composed of technical documents, architectural documents, minutes of letters addressed to the Ministry of Public Education and Fine Arts. The restoration of the city of Mansourah calls for a methodology specific to the intervention with the existing and imposes an order and perspective of knowledge developed for the design of the restoration project of Mansourah. As a result, Edmond Duthoit collects the necessary information to have a global knowledge of the ruined monument from an administrative, historical, archaeological, technical and architectural point of view.

**Results and discussions**

***Archeological and architectural file: initiation of the site before intervention***

The excavation is the first step in archaeological research to start a restoration project [15]. It is fundamental since all historical interpretation depends on the quality and reliability of observations and data collected in the field [16]. The stage following the exploratory excavations corresponds to the processing of the data coming from them [17]. In Mansourah, it is estimated that excavation time is about three times needed for the study of the data that comes from it to begin the restoration work. The search itself required a lot of work. The study of the material and the writing of the elements on the "post-excavation" are made by the chief architect of the historical monuments, Duthoit, the inspector of the public works, Collignon, Head of the service of the civil buildings of the department of Oran from 1850 to 1872, later named diocesan architect of Oran on January 19, 1873 [5].

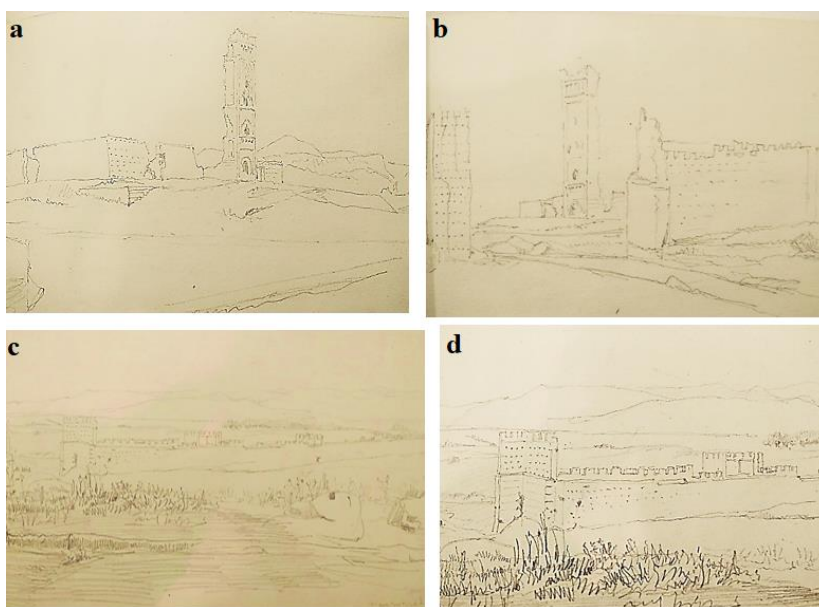
The excavations conducted on the site of Mansourah took place in two stages, and on two different parts that make up the site: the minaret of the Masnourah mosque, quickly threatening to collapse and the enclosure of the city. A first attempt of excavations carried out by the French military engineer, in order to establish a medical ambulance in the mosque was undertaken in 1874, evidenced by a letter from Le Sieur Penabert, owner of houses bordering with the site of the mosque of Mansourah, addressed to the Ministry of Public Instruction of the Cults and the Fine Arts, November 05, 1874. A second excavation campaign was conducted at the end of the nineteenth century, to finally begin the work of surveys, drawings, reconstruction and restoration of the elements composing the citadel. A second letter from the metropolis attests ongoing work on the Arab monuments of Tlemcen was going well. Indeed, the

excavation operation began with the installation of site facilities and the organization of an earthworks plan on the site [18].

The stripping of the area to be treated then consisted in the removal by the care of the historical monuments department, bushes and shrubs which grow on a part of the ruins of Mansourah's adobe enclosure and thus be able to reach the first stratigraphic levels. But the soils of the different periods do not always reach the "archaeologists", because of the collapse of a part of the Mansourah precinct and the minaret of its mosque, as attested by the letter sent from the governor General of Algeria to the Minister of Public Instruction and the Directorate of Fine Arts in Paris. In this case, it is the archaeological furniture that allows these structures to be linked to a given period, such was the case of the discoveries of a set of capitals by the architect Duthoit.

***Architectural studies and drawings of the Mansourah site by the architect E. Duthoit***

During the operations, cuts and surveys are done to reveal the memory of the site as early as 1872. The architect Edmond Duthoit, assisted by his construction inspector Collignon, takes detailed steps to establish a precise plan of the remains (Fig. 1a and b). A correspondence of the architect E. Duthoit preserved with one of these subjects, testifies to the beginning of the investigations carried out on the site of Mansourah. Duthoit quotes: "Our work in Tlemcen is going well, (...) I have already revealed the city walls of Mansourah (Fig. 1c and d), a town whose perimeter was no less than 5,000 meters, in the middle a magnificent mosque with a minaret 57 meters high, all covered with sculptures of onyx columns, multicolored faience ... some of these columns of translucent onyx still exist in the shops of the city, but most of 'between them were sold by the Genius ... what a barbarity! (...)" [6].



**Fig. 1.** Freehand drawing of the Mansourah site:  
 a - North East View, b - North-West view, 1872,  
 c - The Enclosure and Towers of Mansourah, South Side, 1872,  
 d - Enclosure and Towers of Mansourah, South Side, 1872

***Diagnosis of the archaeological record***

The archaeological excavations, the in situ observations, the detailed description of the ornamental elements and the analysis of the artistic influences, allowed the architect Edmond

Duhoit to send a detailed report to the Ministry of Public Education of the Cults and the Fine Arts on August 10, 1875, these conclusions are summarized as follows:

- **The plan of the mosque:** The M'salla, discovered mosque consists of a large rectangular enclosure, 109/95m pierced on three sides of six doors opening on gates salient. In the axis of the fourth side was reserved the niches of M'rab (Mihrab). The walls of 1.20m thick, are built of rammed earth of a height of 7m. Entering the mosque through the pierced gates and into the base of the minaret, there was a gallery which led to three naves on the right and three naves on the left (Fig. 2).

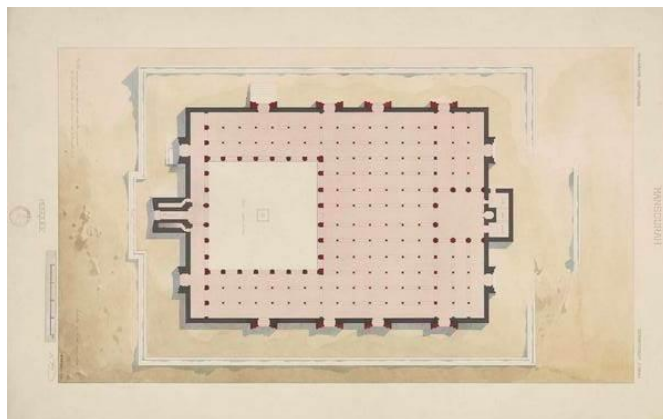


Fig. 2. Architectural plan of the mosque restored by the architect Edmond Duthoit, 1872

- **The structure of the minaret** The general plan is a rectangle of 86 meters by 61 meters. In the basement of the minaret opens the main door. Duthoit reports that the total height of the ground at the top of the dome covering the lantern was 57 to 58 meters. A 26-flight ramp with right-angle landings was developed on all four internal faces. A 27th flight ramp develops towards the top of the minaret. All the creeping vaults, on the top floor of the inner minaret there was brick; below the arcature, the walls were judiciously dug to reduce the load.

The minaret has a square base of 4.63m<sup>2</sup>. The walls of this tower had a thickness of 1.05 meter; two small rooms of 2.10m<sup>2</sup> were on the ground floor of the minaret. The large banister was largely lit by panoramic bays and loopholes hidden inside the tower (Fig. 3).

- **Ornamentation.** To the north the main face of the looking minaret is almost intact. The part that accused the gallery of Mueddin has retained no ornament but some enamelled bricks and some pieces of green and black faiences.

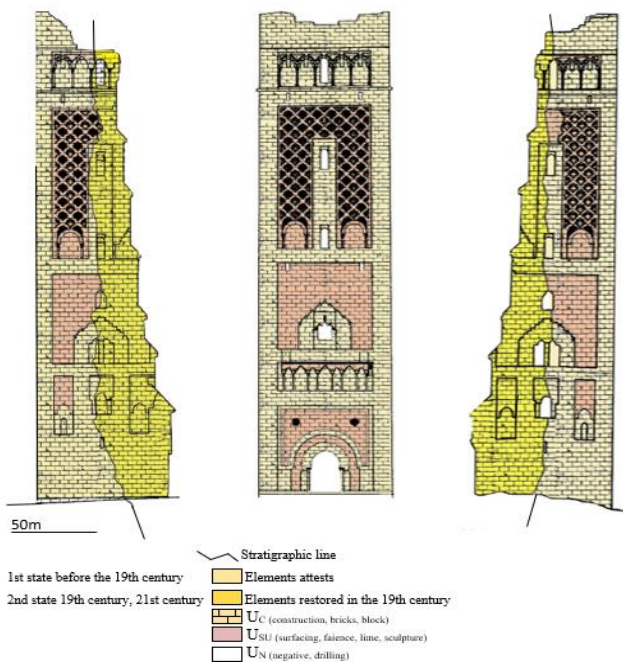
Many columns with bases and very simple capitals, in onyx support the curvilinear triangles formed by arches. The latter were still decorated with mosaics in the nineteenth century. As always the borders are green and the ornaments black, green and a yellow.

Duthoit also certifies the presence of alternately black or pale blue glazed tiles on the black and green main facade on the other two faces still visible (Fig. 4).

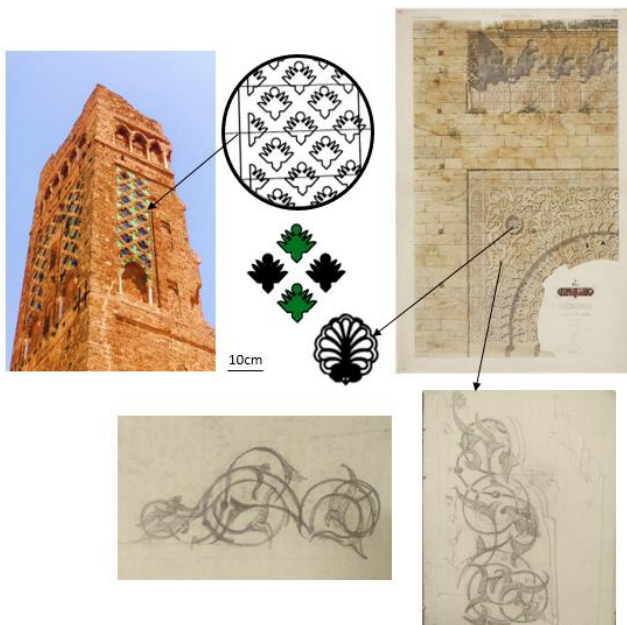
- **Description of the decorative and architectural elements of the minaret.** Duthoit notes the presence of bays (simple or geminate) closed by semicircular horseshoe arches pierced in the minaret. It also reveals barely visible friezes and intertwined panels over the awning. The canopy was composed of two consoles cut into stalactites, blocking a kind of less prominent bandage supported by seven corbelled niches. These niches are formed of stalactites decorated with arabesques and interlacing. Ten missing columns would benefit from the advantages of these niches and two consoles, explains the architect. Duthoit noted the existence of several sculpted and enameled niches, enhanced with fillets of color.

- **Disorders threatening the structure** Major disorders in the construction threatened to ruin what was left of the minaret (natural landslide produced by the fall of half of the minaret,

presence of cracks and tears, detachment of the facade of the side walls, weakening of the structure under the action of the rains in particular).



**Fig. 3.** Stratigraphic analysis and archeology of minaret: decomposition of morphological structures



**Fig. 4.** Detail of the carved decoration of the minaret.  
Drawing of the architect Duthoit in support, 1874

***The material study of the construction site: between organization, economy and construction***

To evoke a construction, a building site that is not mummified in a technicist approach, pushes us to give their entire place to economic and social factors [19]. The variety highlighted is not, in fact, the result of the mere juxtaposition of "sectors of activity", it is part of a negotiation with space and time related to a process of production itself [20].

*The restoration site and its "annexes"*

Among the annexes come, in the first place, most sources of supply of the buildings: quarry, forest etc. The widespread practice of recovering the materials found on the site has, moreover, undoubtedly contributed to a concentration of the site on its own resources. But, it was always necessary to seek, sometimes at Tlemcen, some of the numerous raw or manufactured materials indispensable for the realization of a part of the construction, in our case the elements of carpentry and marble work. The management and services of the Mansourah site have signed several contracts with suppliers (simple operators or real merchants attesting to ancestral know-how) to acquire the supplies and materials needed to conduct the work.

*Resources and construction expenses: a matter of means*

Any financial organization has two components (revenues and expenses), both of which are presented to us with more or less complexity. Through the various worksheets, the sheets of designation of the works and the prices presented in the file of restoration of Mansourah and written by the architect E.Duthoit since his workshop in Amiens, it is not any more to return on the price of construction but to question the nature of the sums collected (solicited at the Ministry of Education of Public Works and Fine Arts) and disbursements. In this regard, a letter sent by the architect Duthoit summarizes all the expenses planned and approved by the Historic Monuments Commission and on the funds of the Beaux-arts budget.

For the Mansourah site, the accounting has classified its expenses by categories; by thematic classification: carpentry, locksmithing, marble and painting (combining the purchase price of the tools and elements by unit and their transport and displacement if necessary). It should also be borne in mind that our information comes from accounting sources and therefore, in principle, only records what has been paid for. The chore, the recovery of materials in-situ, the collection or volunteering can thus affect the expenditure in a difficult part to evaluate.

*The logic of the construction site: a professional hierarchy*

A group of individuals in various categories (stonemasons, laborers, carpenters, but also quarrymen, blacksmiths, carters, sailors, masons and assistants) took part in the restoration work. With the administrative staff, represented by the architect Duthoit, it is not less than a dozen types of actors that reveals us in particular the sheets of the prices established by the commission of the historical monuments and the daily tables written in Duthoit's site notebooks. However, this analysis grid cannot be used as such as the only representative document of the Mansourah site. However, attempting to draw up a complete catalogue of these occupations does not make much sense in terms of vocabulary, dates and sources. Finally, certain designations such as "project manager", "contractor" always mark a distinction between masters (skilled workers and architects) on the one hand and manoeuvre on the other.

***Operations and conservation work - restoration***

Let us take the funding as granted and now we examine the progress of the consolidation work of the elements (minaret and enclosure) of the Mansourah site. In order to have the proposed works executed, the sponsors or their representatives were faced with two solutions: take the construction under direct management or entrust the work to a contractor (works inspector). In the case of Mansourah, both of these possibilities were used together, with certain tasks being performed by the limited partner while others were the responsibility of an independent contractor. Therefore, from this point on, we will try to understand the organization

of the restoration site by jointly addressing the typology of the place, the materials, the tools and then the people [21].

#### ***Intervention on the minaret and the mosque of Mansourah 1874-1890***

Edmond Duthoit, reports that the minaret was 57m and dates from the first half of the fourteenth century. It was raised by the Moroccans siege of Tlemcen, it threatened ruin when its restoration was undertaken in 1876 by the care of the commission of the Historical Monuments and largely on the funds of the fine Arts budget. The supervision of these works was handed over to Chevallier, an architect in Algiers [22], who, for an allowance of 1,200,000 francs, was to serve the execution under the direction of Duthoit, of which he thus became the inspector. The department of works of conservation and restoration of the historical monuments, department of Oran, Mansourah municipality has approved the restoration of the minaret of the mosque through several series of works to be carried out to complete the restoration of the minaret.

These works consist of masonry, carpentry, painting, locksmithing, marble works that were executed to complete the restoration of the minaret of the mosque of Mansourah. The method implemented for the repair was fixed following a study which investigated the causes of the disorders of the minaret landslide and the development of a repair project. It remains the responsibility of the architect and the inspector of public works to choose the materials and products, the equipment for implementation, to carry out the works and finally to control the entire operation [23].

#### ***Partial reconstruction of part of the structure after the latter collapsed***

In an attempt to repair the disorders such as those caused by the collapse of the south face of the minaret, it was necessary, after having secured the existing structure, to diagnose the masonry and to rebuild it by using the various techniques applicable to brick masonry in new construction at the time. However, particular care must be taken to ensure that the connection between the preserved masonry and the new masonry is maintained. The various techniques consisted in first recovering the fallen stones and identifying their position in the structure. The architect E. Duthoit surveyed, on a map, the location in the structure of all the stones and bricks that will have to be put back in place (Fig. 5a and b).

The body of the main tower of the minaret is made of brickwork cut with pink sandstone and the structure of the vaults supporting the ramps of the stairs is made of terracotta brick (natural brick, resulting from very old design processes), using a binder. The apparatus of the bricks is fixed according to the provisions of the existing masonry and the presence of cut stones, for example in the corner chains or the bands. For the minaret of Mansourah, at least the non-arched part on the ground floor, the bricks are laid in a mortar bath, the vertical joints of two successive seats had to respect a minimum offset of 5 cm and the thickness of the horizontal and vertical joints had to be less than 2 cm thick. A so-called joining technique for the facade has been used for this purpose.

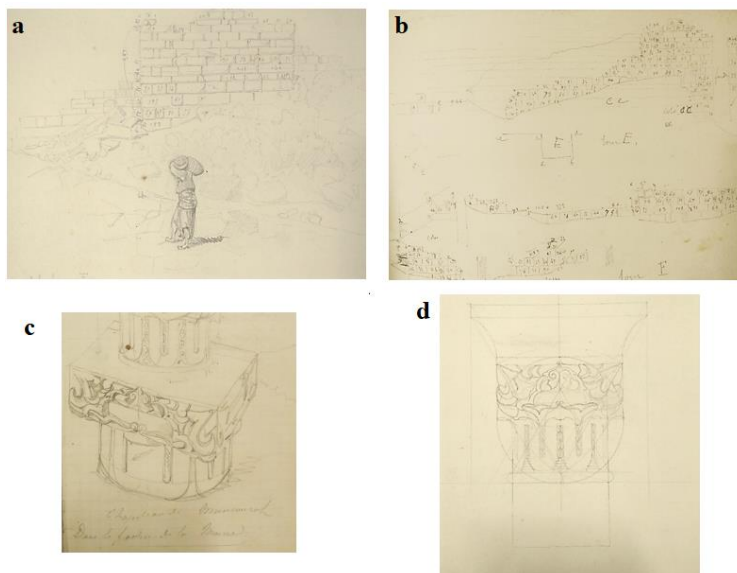
In order to avoid any breakdowns and cracks in the grout caused by moisture problems, as well as other problems, the utility of the grouting was thus necessary for the durability of the minaret façade [24]. The workers had also to remove the wrong eroded joints as deep as possible without damaging the existing masonry. Then, a facelift of the whole facade was carried out so that all the dust, all the clogging and all the remains of joint are removed. Once the preoperative work was done on the wall, the joint mortar was placed. We do not have enough details on the type of mortar used among a wide range of mortars of the time. This work was completed in 1879, according to a letter from the controller of conservation works of the Mansourah minaret.

#### ***Intervention on the main door of the mosque***

In 1880, a more detailed intervention on the structure, carpentry and ornamentation of the door located in the R.D.C minaret was started. The work consisted of a series of carpentry and painting works to complete the restoration of the minaret of the mosque. The wood was



used to reconstruct the two-leaf door with window in each leaf, in a workshop in Tlemcen. To complete the restoration of the door, a series of painting works were undertaken, there was a three-layer oil painting on new wood that was used to repaint the front door and then, the marble work began. This series of works consisted of providing a white marble column of 0.25m in diameter, including the base and the capital (Fig. 5c). The sculpture of the white marble capital was to be executed according to the detailed drawings reported by Edmond Duthoit (Fig. 5d).



**Fig. 5.** Survey of the location in the structure of all the bricks of the Mansourah precinct, 1876, drawing by the architect Edmond Duthoit (a and b), c - metric survey of the capitals of the columns located at the entrance of the minaret, 1876; d - Geometric drawing of one of the capitals of the minaret, 1876

### ***Intervention on the enclosure El Mansourah 1883-1904***

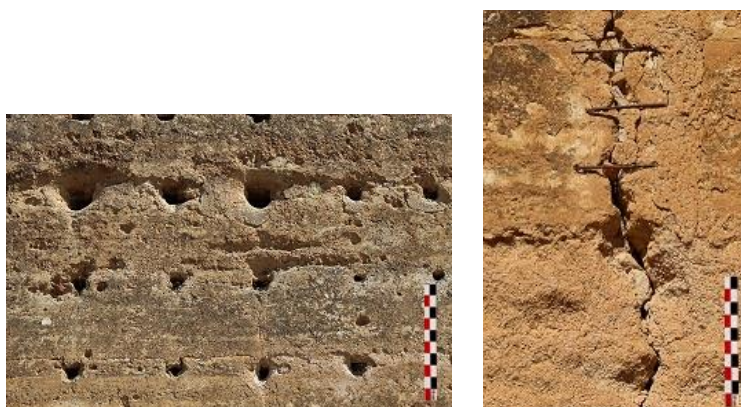
***Study of the constructive systems*** The construction technique used in the realization of the defense elements of the ramparts of Mansourah is adobe [25], a method of building mud walls, compacted in a formwork in successive layers using a pestle (or lady, pisor, pisou) [26]. The adobe, technique of construction in the mud, involves the compaction of the clay, slightly humidified, in a formwork system sufficiently solid and stable to withstand the damages and the solicitations generated by the earth (Fig. 6a).

During archaeological excavations and preliminary studies, Duthoit noted that angles are fragile because adobe has no chaining. To overcome this weakness, the workers are working on the realization of reinforcement elements internally, with logs of wood about 10cm in section. The intervention of the commission of historical monuments on the enclosure of Mansourah mainly focused on the eighty bastions flanked walls of the enclosure (Fig. 6b). The latter are spaced from a variable distance ranging from thirty to fifty meters.

The constructive gesture established by the architect consisted in taking over the structure of the damaged bastions by realizing a new formwork of board's characteristic of the adobe technique mentioned previously (Fig. 7). The workers secured the formwork in the lower part on cross bars or keys that, once the formwork was finished, were removed and left a series of characteristic holes, still visible today. Once the wooden formwork was put in place, they were filled with adobe itself. The "big blocks of land" that eventually formed the walls of the ramparts Mansourah neighborhood compound were linked by a mortar (based cement) [27].



**Fig. 6.** Tower of the Mansourah enclosure in its initial state, represented (drawing and photography) by E. Duthoit, 1872



**Fig. 7.** Structural layout of the wall of the Mansourah mosque (current state, 2020)

The study of the restoration site of Mansourah under the responsibility of the architect Edmond Duthoit gave the following results:

***Valorization of the private archival fonds of the architect Edmond Duthoit***

The study of this private fonds conserved in France today allows to enlighten the artistic and academic activities, of which we too often do not know the primordial character in the current restoration project on historical monuments.

***Historical contribution of the original building***

The initial state of Mansourah in the 19th century, before the French and Algerian colonial interventions, was entirely restored and reconstituted in part (3D plan of the mosque) on the basis of data provided by the architect. The stratification analysis (US statistical unit) corresponding to the restoration phases allowed us to record a quantity of data and to produce precise documentation in order to better inform us about the organization of the worksite under the direction of Edmond Duthoit .

To reveal the genesis of the process of restoration of the monument of Mansourah, an archaeological study of the building was necessary. This one revealed the previous state of the monument of Mansourah before all forms of restorations. In addition to an applied reading of iconographic sources (archives, legal texts, cadastres and reports of previous restorations), it has been proved that the in-depth study of the building in its visible part has brought new and reliable elements of information from one point, historical and architectural view.

## Conclusion

The exterior walls of the Mansourah Mosque are now standing alone. The plan is still completely in place thanks to the excavations made by the Civil Buildings department in 1872. This building was undoubtedly the largest, the most ordered and one of the largest mosques that formed French Algeria yesterday. Mansurah's enclosure, built of adobe of great consistency like all the walls of Tlemcen, contained a hundred-hectare town, which does not appear to have contained much durable constructions, as it now surrounds only cultivated fields where only very rare masonry remains. However, in the centre of this vast enclosure, there remains the ruins of the largest mosque and the most remarkable minaret in terms of its size and height, its carved brick construction and the richness of its decoration.

The restoration work on the Mansourah camp, led by the Chief Architect of Historical Monuments, E. Duthoit, revealed the involvement of material, technical, economic, social and spiritual issues related to history, archeology, anthropology and sociology. The latter allowed us to acquire new notions related to the material history of the restoration sites in Algeria in terms of technical processes and know-how of the trades (of the main work as the second-work) as well as the internal organization of the sites (human, political and economic aspects). The exploration of almost unpublished documentation, historical and archaeological sources has enlightened us on the men, the materials and the practices related to the restorative doctrines of Tlemcen's heritage during the period of French colonisation.

## Reference

- [1] M. Bourget (ed), **L'invention scientifique de la Méditerranée: Egypte, Morée, Algérie**, Ed. de l'EHESS, Paris, 1998.
- [2] M. Maynadies, **Bibliographie algérienne. Répertoire des sources documentaires relatives à l'Algérie**, OPU, Alger, 1989, 337p.
- [3] A. Koumas, C. Nafa, **L'Algérie et son patrimoine, dessins français du XIXe siècle**, Éditions du Patrimoine, Paris, 2003.
- [4] J. Foucart-Borville, *Une collaboration exemplaire: Viollet-le-Duc et Edmond Duthoit à Roquetaillade*, **Bulletin de la Société de l'Histoire de l'Art Français**, 1985-1987, pp. 269-281.
- [5] N. Oulebsir, **Les usages du patrimoine, Monuments, musées et politique coloniale en Algérie, 1830-1930**, Maison des Sciences de L'homme, 2004.
- [6] L. Bonato, **La Méditerranée d'Edmond Duthoit, archéologue et architecte, XIXe siècle**, Librairie orientaliste Paul Geuthner, 2017.
- [7] L. Bonato, *Edmond Duthoit à Chypre (1862 et 1865): l'exploration de l'île et la découverte des monuments gothiques des Lusignan*, **Cahiers du Centre d'Etudes Chypriotes**, 29, 1999, pp. 117-140.
- [8] N. Oulebsir, *Edmond Duthoit. Un architecte néogothique et moderne, entre Picardie et Méditerranée*, **L'Orientalisme architectural entre imaginaires et savoirs**, (Editors : N. Oulebsir et M. Volait), Ed. Picard (« Collection d'InVisu »), Paris, 2009, p. 155-176.
- [9] L. Abadie, **Pomaria: riche verger blotti au pied d'une montagne rouge. Tlemcen de ma jeunesse**, Editions Jacques GANDINI, Nîmes, 2005.
- [10] C. Claude, *L'or du Soudan avant les Almoravides, mythe ou réalité ?*, **Revue française d'histoire d'outre-mer**, 66(242-243), 1979, pp. 169-175.
- [11] J. Charles-Andre, **Histoire de l'Afrique du Nord, des origines à 1830**, édition originale 1931, réédition Payot, Paris, 1994
- [12] F. Provenzali, **El Bostan: ou, Jardin des biographies des saints et savants de Tlemcen**, Fontana Frères, Alger, 1910.

- [13] C. Brosselard, **Tlemcen et Tombouctou**, Impr. D'A. Bourget, Alger, 1861.
- [14] A. Charpentier, **Tlemcen médiévale (urbanisme, architecture et arts)**, Ed. de Boccard, Paris, 2018, 296p. (Orient & Méditerranée, no 26) ISBN 978-2-7018-0525-2 (ISSN : 2101-3195)
- [15] B. Boissavit-Camus, D. Darraud, C. Bonnet, *Prior archaeological studies*, **Bulletin Monumental**, **161**(3), 2003. pp. 195-222.
- [16] D. Mason, V. Shacklock, *Restoration to Conservation*, **Journal of Architectural Conservation**, **1**(1), 1995, pp. 8-26, DOI: 10.1080/13556207.1995.10785123
- [17] J.-D. Richards, **Data Processing in Archaeology (Cambridge Manuals in Archaeology)**, Hardcover, 1985.
- [18] J. Summerson, *The Place of Preservation in a Restoration Programme*, **Journal of the Royal Institute of British Architects**, **49**(3), 1941, pp. 24–28.
- [19] J.J. Stevenson, *Architectural Restoration: its principles and practice*, **Sessional Papers of the Royal Institute of British Architects 1876–1877**, Vol. 27, 1877.
- [20] W.D. Carøe, *The Preservation of Ancient Buildings*, **The Builder**, **LXXXII**, 1902, pp. 388–394.
- [21] F. Baines, *Preservation of Ancient Monuments and Historic Buildings*, **Journal of the Royal Institute of British Architects**, **31**(3), 1923-1924, pp. 104-106.
- [22] M. Chebahi, *Les architectes d'Alger, 1830-1940*, **Alger, architectures 1830-1940**, (Editors: B. Aïche, J. Hueber, T. Lochar and C. Piaton), Honoré Clair, Arles, 2016, pp. 30-49.
- [23] N. Stanley-Price, *The Reconstruction of Ruins: Principles and Practices*, **Conservation: Principles, Dilemmas and Uncomfortable Truths**, (Editors: A. Richmond and A. Bracker), Elsevier, Amsterdam, 2009.
- [24] M. Hall, Y. Djerbib, *Moisture ingress in rammed earth: Part 1–The effect of the soil particle–size distribution on the rate of capillary suction*, **Construction and Building Materials**, **18**(4), 2004, pp. 269-280.
- [25] G. McHenry, **Adobe and Rammed Earth Buildings: Design and Construction**. Tucson, University of Arizona Press. ISBN 978-0816511242
- [26] L. Holliday, *Collapse of a historic adobe wall*, **Journal of Structural Integrity and Maintenance**, **1**(1), 2016, pp. 18-21, DOI: 10.1080/24705314.2016.1153322.
- [27] R. Carvais, A. Guillerme, **Nuts & Bolts of Construction History - Culture, Technology and Society**, Ed. Picard, Paris, 2012.

---

Received: May 22, 2019

Accepted: June 04, 2020