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Closing Systems of the 12th and 13th Century Buildings in the Near East

Submitted by

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To Roudy and my family

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Notes on Supervisors

Balázs Major is an archaeologist and historian and the head of the Syro-Hungarian Archaeological Mission. He holds a PhD from Cardiff University. He is the director of the Institute of Archaeology at Pázmány Péter Catholic University and a lecturer in the Department of Arabic Studies. He has conducted and directed archaeological fieldwork at numerous sites in Syria, Lebanon, Iraqi Kurdistan and Hungary and has published extensively on his work at these sites for the Crusader and medieval periods.

Denys Pringle is Emeritus Professor in the School of History, Archaeology and Religion at Cardiff University. In addition to his four-volume corpus, The Churches of the Crusader Kingdom of Jerusalem (1993–2009), his recent publications include a volume of translated texts, Pilgrimage to Jerusalem and the Holy Land, 1187–1291 (2012), and a volume of collected studies, Churches, Castles and Landscape in the Frankish East (2013). His detailed historical and archaeological study of the town walls of Byzantine, early Islamic and Crusader Ascalon is about to appear in Ashkelon VIII.

Summary

The research examines doors and windows of medieval Near Eastern buildings of the 12th and 13th centuries, which synthesized European and native architectural knowledge, and shows that closing systems can reveal additional data on the builders and the historical context of the structures. The study is divided into a theoretical and practical part. The theoretical study involves examining written and visual sources to establish the origins of builders and construction techniques used in the medieval period, and analysing the structure, types, locking systems, and metal elements of medieval doors and windows. The practical study involves selecting case studies chosen to represent a diverse range of buildings, conducting on-site investigations, and creating virtual reconstructions and 3D models of doors and windows to provide insights into their original states. Although the reconstructions may not be completely accurate due to the absence of surviving material evidence or prototypes, the findings contribute to a deeper understanding of the evolution and main types of doors and windows used in the Crusader Near East.

Contents

Introduction

In the field of material culture studies, the presence of doors and windows is a common feature in the design and construction of buildings. These elements are primarily conceived to keep out intruders and protect the building from the effects of weather. However, besides their physical function, their construction has a cultural significance and material importance so deeply embedded in our consciousness that they often go unspoken.[1] They make all the difference in architecture, marking the line between what is properly inside and what is properly outside. Their absence would render a castle devoid of its fortification and a church devoid of its sanctity. Indeed, doors and windows, as architectural elements, hold a remarkable influence over human behaviour, generating a series of cultural laws that pressure on the person who crosses to change status.[2]

During the 12th and early 13th centuries, the Near East experienced a significant historical epoch marked by the Crusades and the settlement of Europeans, resulting in unprecedented levels of cultural changes. Once the Crusader states were established, the settlers erected numerous buildings throughout the newly conquered lands. The structures varied from small chapels to considerable fortifications. This research focuses on the study of their closing systems, specifically doors and windows, encompassing their typology, constituent elements, materials, installation techniques, and other related aspects. The primary objective is to answer the question: What were the characteristics and construction techniques of medieval Near Eastern doors and windows, and how can this knowledge aid in the historical understanding of these structures? This research might answer several other questions: Were the same leaf design and closing mechanism conceived for military buildings and ecclesiastical buildings? Did the geographical location play a role in the conception and design of church doors? Do the closing and locking systems differ when the church is more frequented and more important? When were the leaves more decorated?

While some publications may contain photographs and drawings of contemporary and historical doors and windows, they often lack written information, limiting their usefulness for this study. Moreover, the availability of relevant sources on this topic is scarce in Western literature and almost non-existent in Eastern literature, further emphasizing the significance of shedding light on a lesser-explored aspect of architectural history in the Near East. In addition to the lack of

[1] Cicero 1936: 740.
[2] Sieghert & Peter 2012: 11.

written sources, the surviving material data is extremely limited. Despite the increasing number of precise studies in medieval architecture in the 20th century, the perishability of doors and windows posed challenges for scholars in the fields of architectural history and archaeology.

This is not a research on the cultural significance of doors and windows, it is a guide to provide architects and archaeologists with insights into the physical characteristics of doors and windows in medieval buildings in the Near East, including their composition, construction techniques, and dating methods. The aim is to foster a more realistic approach to the reconstruction of these elements based on historical evidence while trying to understand their evolution in the area and in the same building. This will be achieved by various research methods. Written sources, including historical documents and descriptions will be examined. Drawings and photographs of existing medieval buildings can provide visual references for understanding their form and details. Parallels from similar buildings in the region and in the West can be studied to identify common features. In addition to the theoretical work, field investigations were conducted, including on-site inspections, documentation, and photographs. Finally, creating virtual reconstructions and 3D models based on the available evidence will provide visual representations of how these elements may have looked in their original states.

The preservation and restoration of the selected structures is of paramount importance to safeguard the cultural heritage of the area. However, in many places, the process of closing these structures is not carried out effectively. Even, many of these medieval sites still do not have doors or window shutters. By understanding how these elements were originally built and functioned, restoration efforts can prioritize historical accuracy. The findings of this research have practical implications for the restoration of medieval and Crusader monuments in the Levant and other European countries. It will also help the periodization of the buildings and the better understanding of the defensive measures taken by the Crusaders.

It is worth mentioning that in addition to the lack of resources, one challenge has been the deteriorated state of many medieval buildings, including their doors and windows. These elements have often been destroyed, blocked, or heavily restored with new stones, making it difficult to discern their original closing systems. Moreover, the restrictions imposed by the COVID-19 pandemic and limited travel opportunities have further limited access to the sites for detailed investigations. While this study can be developed much further, it can be considered a foundational effort in the field of medieval buildings of the Levant.

This research will move from a macro context of the material aspects and techniques of medieval Near Eastern windows and doors to the visualization of the ornamentation and the details used in the design of leaves and shutters in selected case studies in Lebanon and Syria.

PART I: METHODOLOGY AND PREVIOUS RESEARCH

Chapter I: Bibliographic and Methodological Introduction

1. Previous Research and Methodology

Insufficient research has been conducted on medieval shutters and leaves in the Near East, resulting in limited information about these elements in the medieval buildings of the region. The majority of available knowledge concerning the designs of these elements comes from Western sources, which themselves are scarce. Eugène Viollet-le-Duc, one of the most famous architectural historians of the 19th century, is one of the few who published about architectural elements, such as doors and windows, in his Dictionary of Architecture.[3] The present study has also benefited significantly from the extensive research on door leaves from the 14th to the 19th century in France by Rachel Touzé.[4] Her research has offered pivotal insights into the carpentry and architectural aspects of installing door leaves during the medieval period, providing valuable context for the study's analysis of the medieval shutters and leaves in the Near East. Furthermore, a few articles about the medieval doors of English churches have contributed to our understanding of their installation practices.[5] However, sources that specifically discuss locking medieval doors are limited. One helpful source in this regard is the book of John Potter on early church security.[6] Naif Haddad has also discussed this subject in the context of the East.[7]

Due to the limited availability of written sources on the topic, other historical sources were explored, specifically medieval depictions in manuscripts. These small drawings provided insights into the systems used for decorating and locking door leaves and window shutters. The focus was narrowed to manuscripts from the 11th to the 14th centuries since this research focuses on doors and windows of the 12th and 13th centuries. Moreover, old photographs were useful in determining the closings used for doors and windows. They were mostly provided by the Open Heritage Platform of the French Ministry of Culture,[8] and the Atlas of the Orthodox Churches of the

[3] Viollet-le-Duc 1854-1868.
[4] Touzé 2009; Touzé 2016.
[5] Caple 1999; Yeomans, Harrison & Smith 2013.
[6] Potter 2020.
[7] Haddad 2016.
[8] Ministère de la Culture, POP: la Plateforme Ouverte du Patrimoine: https://www.pop.culture.gouv.fr.

Patriarchate of Antioch of the University of Balamand.[9] Other relevant photographs were given by colleagues and friends.

The most important part of this research is the survey conducted on buildings. However, uniform treatment of all the studied buildings presented a challenge, particularly in relation to the reconstruction of doors and windows, which risked being imprecise. Therefore, it was essential to isolate each building and try to understand the chronological differences in its construction. This dating is done to infer the type of doors or windows of the specific period based on the knowledge provided by previous research and historical sources. There are several ways to determine the period of a door or a window. One such technique is dendrochronology, which involves studying the characteristic pattern of rings in tree trunks to date preserved wooden leaves or shutters, although such specimens are relatively rare.[10] In the absence of a preserved wooden leaf or shutter, dating a door or window can be a challenging task. It is often according to the time of construction of the building or an important restoration phase, or by similarity with other examples of well-dated leaves.[11] The dating can also be according to the shape or arch of the door or window. This feature is datable since each period has its own architecture.[12] Beyond the dating of the door or window provided by the architectural style, the periodization is possible by the detailed construction methods like the placement of the blocks of stone. For example, Professor Potter was able to differentiate between Anglo-Saxon and Norman architecture by examining the blocks of stone used in arches and window jambs.[13] The second and most important part when surveying a case study is scrutinizing evidence on the stones and frames, which provided the most informative data. Breakouts and holes can indicate the method used to install a leaf or a shutter. They can also indicate how a window or door was shut and possibly the material used. In addition to measuring and documenting the remains, a thorough 3D photography of the openings was the most precise and fastest way to approach the issue. Lastly, reconstructions are only possible when understanding and studying parallels which is detailed below. Reconstructions are done using architectural surveying and 3D software such as AutoCAD, 3Dmax, SketchUP, and Agisoft Metashape.

[9] University of Balamand, ARPOA: Architecture Regligieuse du Patriarcat Orthodoxe d'Antioche: home.balamand.edu.lb/ARPOA.
[10] Bernabei 2019: 203.
[11] Touzé 2009 : 8.
[12] Viollet-le-Duc 1856, 'Fenêtre', 365-419.
[13] Potter 2020: 7-13.

2. Parallels

In this research, most of the case studies discussed in Part II were built by Crusaders during the 12th and 13th centuries. The settlers, who potentially received aid from natives, certainly brought with them certain traditions from their homelands. Consequently, in order to understand how doors and windows were installed in the medieval period, it is useful to investigate their creators and origins.

2.1. Crusader builders

One of the main motives for the initiation of the Crusades was the calling of Pope Urban II in 1095 for Western Christians to take the cross and help recapture the Holy Land from Muslim control. His message spread wide and was met with tremendous response.[14] Among those who headed to the Holy Lands were knights, burgesses, and peasants. Even if the recruitment to the first Crusade was directed at those who were financially able to take the long journey,[15] the *plebs* were mostly peasants.[16] These non-knightly classes were often mentioned in chronicles, either as serfs who were granted permission to go by their lords or as recruited freemen.[17] The *burgensis*, who came with pilgrims, were part of the Crusades before choosing to settle in the Holy Land. Among the *burgensis* mentioned in 12th and 13th century sources were craftsmen, artisans, and merchants.[18] Although they had certain rights they were never knights or churchmen.[19]

It is difficult to determine whether these non-feudatories who headed East were driven by spiritual motivation or by materialism. In all cases, after the capture of Jerusalem, many returned to Europe upon fulfilling their vows.[20] Enlart believes that most of western artists, engineers, and builders were not permanent settlers. They either came for short stays, sometimes requested by clients, or to offer their services in the embellishment of the Holy Lands while fulfilling their spiritual duty.[21]

[14] Cowdrey 1970: 177-188; Riley-Smith 2003: 31-57.
[15] Nader 2006: 19.
[16] Prawer 1980: 384-385.
[17] Nader 2006: 2.
[18] *Ibid*. 1.
[19] Duby 1971: 271.
[20] Nader 2006: 25.
[21] Enlart 1925: 21.

2.2. Origins of the builders

Latin non-feudatories who joined the Crusades came from different regions of Europe.[22] Even though a good number of European settlers were not of Frankish origin, the term "*Franj*" in Arabic was used by the local population to identify the Westerners whatever their ethnic origins.[23] In the late 19th century, some historians did not establish connections between the buildings erected in the Levant and the ones built in Europe. For Renan, Crusader constructions in the East offer no unity and each nation had its own way of building.[24] Archaeologist Emmanuel Guillaume Rey affirmed that there is direct connection between the design of Crusader and European architecture, but it is negligible.[25] However, many Frankish monuments deemed this to be untrue as they show the work of western builders and non-native works. Dussaud clearly states that Frankish architects in Syria had more freedom to create masterpieces than their counterparts in Europe.[26]

Numerous instances exist wherein European craftsmen have left their imprints on medieval Near Eastern buildings. According to Rhené-Spiers, the architecture of the Crusades came from Europe. Everything, including the pointed arches and the domes, came specially from France and Italy; there is nothing German or English. He adds that the Western monuments most analogous to those of the Crusades are to be found in southern Italy and Sicily.[27] Lawrence gave all credit to Western builders when writing about Crusader fortresses claiming that the builders brought all the necessary knowledge from Europe.[28] According to Boas, the Crusaders imported two-storey hall-houses from the West, which were accessed by an external staircase.[29] Additional examples encompass smaller elements, such as the glass window fragments discovered in the Frankish settlement of Greece, which suggest the involvement of Western artists who had come to reconfigure churches for the Latin rite.[30] Moreover, Boase postulates that the carver responsible for the ornamental carvings in Plaimpied and Nazareth was the same individual who arrived in Palestine during the Second Crusade and integrated Syrian Hellenistic and Western stylistic

[22] Nader 2006: 1.
[23] Boas 1999: 7; Riley-Smith 2003: 86.
[24] Renan 1864: 43.
[25] Rey 1883: 179.
[26] Dussaud 1896: 317
[27] Rhené-Spiers 1905: 209.
[28] Lawrence 1988: 56.
[29] Boas 2010: 100.
[30] Wallace & Boase 1977: 210.

influences into his work.[31] The door of the Cathedral of Nazareth was done by sculptors recruited in Europe to work on this specific project.[32] In Cyprus, The Catalans aided considerably in the reconstruction of Livadia.[33] Vandekerckhove also states that the Military Orders counted on their own workers, materials, and conceptions.[34] Finally, Henry of Flanders, the second Latin emperor of Constantinople, ordered all his men to aid workers and masons to fortify Pamphilon in 1208.[35] Nevertheless, noblemen were rarely mentioned in constructions.[36]

It is now established beyond doubt that Europeans contributed to the design of medieval buildings in the Near East. However, it is crucial to ascertain which group of Europeans had the greatest influence in shaping the architectural elements of Crusader buildings. This knowledge will facilitate the identification of parallels to be studied when analysing elements of medieval Near Eastern architecture. Firstly, the Crusades, did not mention the identities of the workers in their documents. Nonetheless, several names were mentioned in old letters and chronicles. For instance, Philippe Chinard, who was among the French settlers of Cyprus, worked in the defense of castles around 1230. He then travelled to continue his work for Frederic II in Pouille.[37] Another name that was mentioned is Eudes de Montreuil, an engineer who was brought to the Holy Land by Saint Louis along with other engineers from France to build fortresses and churches.[38] Most of the people who helped in building Crusader buildings were rather on a temporary mission like Maitre Aussaut, a renowned engineer, who was hired by Alphonse de Poitiers in 1268 and worked only for one year.[39]

Despite Crusaders originating from diverse regions, the comparison of Crusader architecture with French or Italian architecture is commonplace, with a particular emphasis on French architecture. The greatest Crusader fortresses bear French elements, but were bigger than the contemporary French castles.[40] Melchior de Vogüé observed that Syria, Rhodes and Cyprus followed all the architectural evolution of France.[41] He adds that Crusader architecture was well-

[31] Boase 1977: 104.
[32] Riley-Smith 2005: 60.
[33] Wallace & Boase 1977: 216.
[34] Vandekerckhove 2014: 142-143.
[35] *Henri de Valenciennes* 1882: 334.
[36] An example is King Louis repairing Sidon castle with his own hands. Boase 1977: 161.
[37] Bertaux 1904: 742-743.
[38] Enlart 1929, part 1, 741-743.
[39] Molinier 1891: 505 n783, 554 n864.
[40] Ellenblum 2007: 63.
[41] *Melchior de Vogüé* 1860: 377.

defined and composed of almost entirely French elements with a few well-assimilated borrowings.[42] Boase adds that the statements of Enlart are too strong but there is no explicit evidence against them.[43] In some areas, such as Tartous, the art is believed to be purely French,[44] and in Palestine, sporadic influences of several areas of France can be noted.[45] For instance, Saint Paul of Tarsus bears a strong resemblance to some early French Romanesque churches.[46]

Most of the lapidary signs adopted by the Crusaders are frequently used in France.[47] Albert Gabriel, French architect, states that the measurement methods in the Crusader states are from the French region of Provence. The accounts left from the ramparts of Avignon and Rhodes show the same adopted measurement methods.[48] It is clear that the artists and engineers remained faithful to the methods adopted in France. Deschamps even claims that there are connections between the architects and workers of some monuments like in the cases of Tartous and Chastel Blanc.[49] Prawer claims that the migration of the 12th century was from the southern parts of France.[50] Enlart agrees, specifying that Crusaders were influenced by South France and Burgundy. For example, the plan and structure of Crusader churches resemble the ones of Burgundy and Provence, the sharp joints are found in the Rhône valley in Southwestern France, and the decorations can be found in Limousin, Languedoc, and Auvergne.[51] Moreover, many Orders built churches in the Holy Lands such as the Benedictines, the Cistercians, and Premonstratensians.[52] It is expected that they brought their traditions from their homelands as some of them built their sanctuaries themselves.[53] All in all, it is evident that many builders and architects came from France and Italy and brought architectural practices from there.

[42] Enlart 1925: 207.
[43] Boase 1977: 73.
[44] Enlart 1925: 210.
[45] The communes include Chartres, Etampes, Chalons, Saint-Germain-des-Prés and Mantes.
[46] Boase 1977: 74.
[47] Enlart 1925: 25.
[48] Gabriel 1923: 111.
[49] Deschamps 1973: 258.
[50] Prawer 1985: 154.
[51] Enlart 1925: 29-32.
[52] Boase 1977: 110.
[53] Dion 1878: 18; Chaaya 2015: 49.

2.3. Native workforce

It would be unfair to solely attribute the elements present in Crusader architecture to Westerners. The settlers often employed native workers to learn from them, sometimes by force.[54] The native population included Jews, Muslims, Samaritans and Eastern Christians.[55] For instance, a Syrian Emir, named Ousama, told the story of a young man named Raoul who became a slave along with his mother and sister after 1126. He was a fine Muslim worker who gave lessons to the Franks in marble works.[56] Another example is the basin of Damascus adorned with French inscriptions executed by the Muslim slave of King Hugues IV of Cyprus.[57] In addition, Boase points out native workforce several times. He believes that a mid-twelfth century Crusading acanthus capital in the southern façade of the priory of the Holy Sepulcher was the work of Syrian Masons who followed their traditions.[58] He states that Syrian masons also built the western keep at Saone after a European noble settled in it, and that a large part of the castles of Kerak and Subaihah was the work of Arab workmanship.[59] Deschamps specifies the work of Arab craftsmen in some decorations of Crac des Chevaliers in the county of Tripoli.[60] Moreover, the rebuilding of the castle of Safed in 1240 was done by knights, citizens, and prisoners.[61] Muslim masons worked there in the techniques known to them.[62] Ousterhout also indicated employing indigenous work force in the rib-vaulting of the Crusaders.[63] There are many other instances about local inhabitants aiding Westerners when building in the Near East in Cilician Armenia as well.[64]

[54] Enlart 1925: 69.
[55] Enlart 1999: 7.
[56] Derenbourg 1889: 482.
[57] Enlart 1899: Appendix.
[58] Boase 1977: 80.
[59] *Ibid.* 148, 150.
[60] Deschamps 1934: 148, 167.
[61] Boase 1977: 159.
[62] Kennedy 1994: 194.
[63] Ousterhout 2004: 91.
[64] Vandekerckhove 2014: 137, 139, 141.

Chapter II: Characteristics of Medieval Doors and Windows

1. Design and Engineering

1.1. Medieval doors

1.1.1. Structural characteristics

Door leaves are major pieces of private and public architecture, including both civil and religious buildings. Medieval doors in the Near East were of various sizes and shapes. Certain doors weigh as much as one ton per leaf, such as main doors and cathedral doors. Other doors were much smaller, serving as back doors or posterns, and could be either double-leaved or single-leaved.[65] Normally, the structure of the door had to serve two functions. The first one is to avoid racking by being strong enough to transmit the weight of the wooden leaf to the hinges, and the second function is to be thick enough to resist wind loads and intruders.[66] In any case, leaves must protect while remaining mobile, that is why their construction requires the use of structures that are both resistant and easy to handle. For instance, even if the bronze leaves of Antiquity met the needs of protection, handling them using the principle of pivoting was difficult. In order to make them more practical, the leaves of a door were usually made of wooden boards. The wooden leaves may offer less resistance, but being lighter, they move more easily. To respond to the concern of steadiness, the leaves are equipped with structuring element: large iron hinges, double course of planks, applied frames, etc.[67] Moreover, the door has to have a strong symbolic load conforming to the architecture that surrounds it.

In large structures, doors are protected by a portcullis, a drawbridge, or both. There is a difference between single-leaf doors for pedestrians, and double-leaf doors used for the passage of crowds or vehicles, such as carts. Big doors may or may not be equipped with a wicket door locked with a padlock or a latch. This system has two variants: the side wicket door in one of the leaves, such as in the Meslay farm in Parçay-Meslay in France, and the central wicket door, very widespread in the south of France, like in Narbonne or Avignon.[68]

[65] Boas 2010: 62.
[66] Yeomans, Harrison & Smith 2013: 739.
[67] Touzé 2009: 13.
[68] *Ibid*. 14.

The evolution of the carpentry practices, combined with the concern for comfort, led to other modifications: the disappearance of doors with very heavy decorative hinges, a progress in thermal insulation with the development of rabbets (grooves cut into the edge of a wooden plank), the appearance of frames, and the development of various reinforcement measures to avoid warping.

1.1.2. Boarding methods

Viollet-le-Duc rightly explains that "*two main conditions were imposed on carpentry work in the Middle Ages: economy of the material and ensuring the greatest possible strength of the wood at the time of assembly*."[69] This means that medieval carpenters avoided any reinforcement of the shutters if they cannot fit them in the frame to avoid additional costs, and that they tried to keep the full strength of the boards as much as possible by avoiding chamfers, decorations, and mouldings. With the exception of doors and windows, timber was infrequently utilized for building in the Eastern region. Boas claims that the northern Crusader states had a better timber supply. However, because of its organic nature, timber did not survive in dry environments.[70]

A reliable source for determining the dimensions of boards used in medieval times is the survey conducted by Touzé on medieval leaves in France.[71] The study suggests that the width of the boards was rarely less than 17 centimetres approximately. Their length varies according to the dimensions of the bay and the vertical or horizontal arrangement of the boards. However, the length rarely exceeds 4 meters. One of the exceptions that can be noted is the leaves of Saint-Gilles church in Chamalières-sur-Loire in France, which date back to the end of the 11th century, [72] and have a length of 4.13 meters. As for the height of the door leaves, it varied according to the type of door. Single-leaf doors typically ranged from 1.80 to 2.27 meters in height, while double-leaf doors ranged from 2 to 5.27 meters. Architectural treatises give few details concerning the treatment of wood surfaces, we simply learn that, between the 11th and the 14th centuries, the wood was "bleached". Nevertheless, polychrome traces also indicate that some facings could be covered with colored layers.[73] Other means of decoration were nail heads and bronze or iron plaques.[74]

[69] Viollet-le-Duc 1854-1868, "*menuiserie*": 348.
[70] Boas 2010: 34.
[71] Touzé 2009: 24.
[72] Mairie de Chamalières sur Loire: www.chamalieres-sur-loire.fr/pages/loisirs_tourisme/histoire.php consulted on the 20th of December, 2020.
[73] Touzé 2009: 18.
[74] Viollet-le-Duc 1854-1868, "*vantail*": 348.

The earliest medieval door leaves were made of close boarding. Planked structures were used long before the medieval times: the oldest example of a carpentry leaf is believed to be kept in the Egyptian Museum of Cairo and dates back to the 18th Dynasty (1552-1292).[75] With time, the execution of a door leaf became more and more delicate and, by the 12th century, there were several methods to join the wooden boards of a leaf. The methods of boarding which will be discussed are simple 12th and 13th century methods, involving the attachment of planks to one another. During the 14th century, there was a significant shift in the execution of frames as oblique assembly of wooden panels became more used.[76]

Method 1 (Figure 1, left)*:*

The method consists of putting thin horizontal wooden planks into the thick vertical boards, this technique avoids rotation in their joints and prevents the toe from dropping (flexing in the direction of their width by their own weight).[77] In fact, the early leaves of Durham Cathedral, completed in the year 1133, are a proof of the efficiency of this method.[78]

Method 2 (Figure 1, middle)*:*

This is the simplest way to join the boards of a door leaf. It involves constructing a double-layered leaf by horizontally attaching planks to vertical boards. Sometimes the whole is consolidated even further with long iron strips or long hinges which will be discussed later. The same approach is used for window shutters.

Method 3 (Figure 1, right)*:*

The third method of boarding is to transmit vertical forces from a vertical board to another by joining them like puzzles or cogs, preventing vertical movements. Two examples of this method are the door at the head of the night stairs to the sacristy of Bristol Cathedral,[79] and the one of Saint Mary's Church in Little Hormead.

[75] According to the monk Théophile's description of the process at the end of the 13th century, the boards may have been affixed to the field using casein glue, which could have been applied through a gluing process. Théophile 1843: 31-32.
[76] Husson 1902: 63; Touzé 2009: 24.
[77] Yeomans, Harrison & Smith 2013: 739.
[78] Caple 1999: 131-140.
[79] Bettey & Harrison 2004: 169-171.

Larger doors, such as castle gates, were expected to be more defensible, which necessitated the addition of various wooden elements on the back of the planks to strengthen the door leaf. These elements may be simple straight bars, oblique bars, Saltire crosses (Saint Andrew's Crosses) etc. As most of the technique of rectangular grillage on the back of a door with mortice and tenon joints was only developed with the beginning of the 14th century, this is the case of most of the doors that are built before the 14th century. Two methods can be noted in this case:

Method 1 (Figure 2, left)*:*

This method involves the placement of diagonal wooden bars to reinforce the door leaf while ensuring its rotation.[80] The exterior of the door is composed of a set of straight wooden boards, while the interior is reinforced by diagonal bars and may or may not have a frame.

Method 2 (Figure 2, right)*:*

The final technique for building a gate leaf that involves superimposing wooden boards in opposite directions is known as the "braced" method, which led to multiple variants. This method is considered the simplest and most economical way to install a "strong door".[81] Justin Storck defined the "braced door" as a door without a frame that is composed of boards nailed onto other boards in a diamond pattern.[82] This diamond arrangement is easier to repair because the short boards could be replaced. This type of door is commonly utilized for citadel entrances due to its thickness, as they are often double or triple the thickness of other door types.[83] This observation is exemplified by the example of the royal gate of Blaye citadel in France (Figure 3).

This "braced" method exhibits a wide range of variations, particularly in the manner of joining the boards together. Therefore, it is not essential for the boards to be nailed in a diamond pattern, as the door can also consist of counter-thread planks nailed onto vertically or horizontally joined planks. However, the downside of the latter arrangement is that it makes it easier for rainwater runoff. The pattern of their arrangement, sometimes still visible, is drawn before the

[80] Touzé 2009: 30.
[81] Saint-Wandrille 2002, December: 2.
[82] Storck 1899: 697.
[83] Touzé 2009: 32.

installation.[84] Actually, setting wood in geometric compartments or arrangements is also known to be practiced by Arabs.[85]

1.1.3. Hinged and pivoted leaves

During the medieval period, there were two primary methods for installing door leaves: hinged and pivoted. Pivot leaves are also known as har-hung leaves. Their rotation is ensured by the vertical pivoting of the leaf on its own axis and by the use of dowels set in the wood. This principal was known since the Antiquity and consists of dowels, cut in the jamb or doorpost, which enter cavities under the lintel or the soffit.[86] This practice was commonplace during the medieval period.

Hinges, on the other hand, are long iron straps, one end of which is rolled into a knot to receive the pin. They are sealed in the masonry for the rotation of the shutter as well as for its reinforcement: their length corresponded approximately to 4/5th of the width of the shutter in case of a castle or a fortification.[87] Their pins were monobloc and would fit into a very precise notch in the stone. These hinges manipulate the leaves easier by eliminating the friction of heavy wooden pieces and keep the boards together while ensuring the rotation.[88]

1.1.4. Locks and keys

Padlocks are always installed inside fortifications and never on the outside in military situations. This is to ensure the safety and security of those inside the fortification and to have better control over who enters and exits.[89] The oldest known metal locks date back to the 12th century.[90] During the Middle Ages, locks were not exclusively constructed of iron. Some of them were fashioned out of wood, while others featured a wooden exterior box and an internal metal system.[91] Archaeological excavations conducted in the Near East have produced no key, but have shown some evidence of the locking mechanism of the time. Notably, a lock was found on a door of a

[84] *Ibid.*
[85] Geometric compartments are seen on the leaves of the western doors of the Sées Cathedral in Normandy that has a sort of grid made up of rows of small, finely worked arches. Also, the chapter dedicated to carpentry (*menuiserie*) of Viollet-le-Duc in his Dictionary of French Architecture shows a fairly wide variety of decorated leaves by geometric shapes. Viollet-le-Duc 1854-1868, "*vantail*": 350.
[86] Viollet-le-Duc mentions stone leaves found in Northern Syria dating to the 4th and 5th centuries. Viollet-le-Duc 1854-1868, "*vantail*": 348.
[87] Saint-Wandrille 2003, April: 2.
[88] Touzé 2009: 44.
[89] Saint-Wandrille 2003, April: 3.
[90] Some examples are the churches of Saint-Pardoux and Notre-Dame-des-Fers in Puy-de-Dôme.
[91] Dervieu 1914: 200.

farmhouse in Jerusalem.[92] Additional evidence supporting the use of locks and keys in the medieval Near East can be proven by the presence of lock and key designs depicted on glazed bowls,[93] and masons' marks.[94]

In Figure 4, we observe the typical appearance of 12th century locks, which primarily comprised of padlocks with a flat or raised hasp. These locks had a bevelled edged box, square or rectangular, placed on an iron plate (f) with the bolt (b) sliding horizontally placed outside the plate. The box is usually fixed on the wood by nails (d). The entrance hole of the key is then pierced in the iron plate (e), above or under the bolt which could be held back by tie-backs (a),[95] and manipulated by a handle (c). The end of the bold that does not penetrate the striker was sometimes bent and decorated. If the door is thick, the box cannot be seen on the outside because it is embedded in the thickness of the leaf. The mechanism consists of putting the key inside the hole of the box and turning it to manipulate the bolt.[96] These types of locks traditionally featured a single point of entry and continue to be used in modern times. However, in some rare instances, padlocks with dual entries were also installed.

The design of locks remained relatively unchanged until the 15th century, with only minor variations in the form of boxes being observed. For instance, the 13th century has provided highly decorated locks with animals and other patterns.[97] Decoration of keys and locks is especially true in the Islamic period when important improvements of the mechanism took place and even documented. IsmÁÝÐl al-JazarÐ, a scholar from the 12th century, documented an exceptional a case of a door lock with four bolts.[98]

1.2. Medieval windows

Despite the increasing number of studies in medieval architecture during the 20th century, certain elements, such as windows, remain completely in the shade because of the absence of sufficient data to trace their evolution. The ephemeral nature of windows, coupled with their tendency to perish over time, could be the reason why architectural historians and archaeologists saw this

[92] Boas 2010: 96.
[93] Boas shows a key motif on a Cypriot bowl with Sgraffito design. Boas 2010: 63.
[94] *Ibid.* 62.
[95] This could be seen on the door of the sacristy of the church of Montreal in Yonne which dates back to the beginning of the 13th century.
[96] A detailed figure of the mechanism is drawn by Viollet-le-Duc. Viollet-le-Duc 1854-1868, "*serrurerie*": 319.
[97] Dervieu 1914: 202.
[98] Çelik 2015, March, 98.

subject as a dead end. As a result, the study of window frames and shutters has largely relied upon observations made more than a century and a half ago.

The evolution of window frames and shutters was hardly linear. The design of windows varied significantly depending on the type of building, be it ecclesiastical, military, or civil in nature, and in some cases, a single building could feature multiple frame types. Furthermore, regional variations also played a crucial role in the design of window frames. The majority of surviving examples of medieval windows date back to the High and Late Middle Ages, providing researchers a fairly precise vision of the techniques used by carpenters and locksmiths.

1.2.1. Types

Up to the 12th century, the majority of windows were small unglazed openings, serving primarily to provide ventilation and natural light while simultaneously preventing unwanted intrusions.[99] In the context of churches, the need for large windows was limited due to the nature of their function as places of worship.[100] The windows had to be narrow and placed high above ground level especially when the church was also a refuge in times of danger.[101] The notion of defensive architecture was a prevalent feature of the medieval period, particularly during the period spanning from the 8th to the 11th centuries. This emphasis on defence was reflected in the design of windows, which were so narrow in the lower levels that a man could not pass through them. In contrast, windows located in the upper levels were often longer.[102] Windows needed to be big only when the room is big. In other words, it is the interior dimensions of the rooms to be illuminated that control the shape and size of the window. In that case, windows were sub-divided into two or more bays vertically or horizontally and secured by iron or wooden bars. In the Crusader States, church windows constructed prior to the mid-12th century commonly featured a double jamb design, consisting of two vertical supports located on the interior and exterior of the window frame. In some cases, these jambs were accompanied by small columns. The windows of the middle and second half of the 12th century lacked columns and instead featured a double jamb design with splays.[103]

[99] Boas 2010: 43.
[100] Viollet-le-Duc 1854-1868, "*fenêtre*": 365.
[101] Potter 2020: 54.
[102] Viollet-le-Duc 1854-1868, "*fenêtre*": 365.
[103] Enlart 1925: 79-80.

Wooden lattice or plaster tiles were employed in some windows to allow air and light to pass through, while preventing birds from entering. This was an oriental device observed in certain mosques in Cyprus.[104] In the houses of the cities, as the streets were generally narrow, the window frames were either covered with a timber grid or simply closed with an oiled cloth nailed to the frame or to the thin timber grid.[105] Moreover, other materials that were utilized to close windows in the Near East were iron or wooden bars occasionally used in military and domestic architecture.

Glass was not always considered a fixture as it was very expensive in the Middle Ages.[106] Although the glass industry flourished in the Levant under the Franks, it is known that using glass for windows or doors was limited to castles and churches.[107] Enlart claims that during the Crusader period, the majority of glass used in the region was imported from Europe in a finished state.[108] Despite this, some glassware were inevitably produced in Crusader Syria. A notable example is a beaker, dating back to approximately 1240, which was found in Syria combining Arabic scripture and an important Christian decorative theme. The glassware can be found in Walters Art Museum, Accession number 47.18. Moreover, a treaty between Bohemond IV, prince of Antioch, and the Doge of Venice in 1277 seemingly reveal that Syrian glass was also exported to the city-state of Venice. It mentions the transportation of broken glass from Tripoli to Venice as a raw material.[109] In the same context, round glass window panes were occasionally found in some excavations in the Levant. They were green and flat with a swelled center and a folded lip.[110] Moreover, there are several examples of medieval churches in which glass was utilized to better illuminate the interior. For instance, in the apses of Belmont, Tartous, and Beirut, glass was introduced to windows to better allow light to penetrate into the rooms. Furthermore, the presence of iron reinforcement and sealing in the rebates of the windows of the cathedral of Tartous prove the use of glass to close the windows.[111] Coloured stained glass was excavated in excavated in the churches of Chastel Pelerin,[112] and Montfort castle.[113]

[104] Enlart 1925: 81.
[105] Pickles, McCaig & Wood 2014: 9.
[106] *Ibid*. 8.
[107] Boas 2010: 43.
[108] Enlart 1925: 83.
[109] Al-Hassan & Hill 1987: 153; Mack 2002: 113.
[110] Boas 2010: 44.
[111] Enlart 1925: 82.
[112] Johns & Pringle 1997: 51.
[113] Dean 1927: 14.

Based on all this available material and written evidence, it can be concluded that the production of glass suitable for use in windows was not unfeasible in the Near East during the medieval period.

1.2.2. Window shutters

The importance of window shutters in effectively securing buildings had a significant impact on the design of windows during the medieval period. For instance, the challenge of closing Romanesque windows with arches through shutters led to their abandonment, and the subsequent widening of openings and introduction of mullions.[114] By the beginning of the 11th century, the introduction of shutters, instead of oiled leather, cloth or glass, for the windows began timidly.[115] Shutters were opened when the room needed air and light. During the night, the shutters were closed by a wooden drawbar or a latch. Soon after, wooden frames were installed for stained glass, papers, or fabrics. As for military settlements, when the castle was not the primary residence of a lord or his family, the interior design aspects were often overlooked. In such cases, the castles still preserved the old techniques like covering the window with a timber grid, with or without a frame. In instances where the castle featured arched bays that did not seem to have been originally fitted with shutters, solid wooden shutters were later installed, as evidenced by the castle of Carcassone.[116] Window shutters structures remained almost the same until the end of the medieval period. One noteworthy example of window mentioned in the Crusader States is when Jacques de Vitry mentioned he can see the holy and Mount Carmel when "opening" his window.[117]

1.3. Drawbars

Drawbars were utilized extensively at the beginning of the medieval period and, even in the 12th and 13th centuries, they continued to be employed to assist the lock and key mechanism. Because of their simplicity and efficiency, bars were used from the Antiquity until this day. They are known to be the oldest locking mechanism. In the medieval period, castles and churches were often a target of raids and required a high level of protection. As a result, the installation of drawbars for

[114] Viollet-le-Duc 1854-1868, "*fenêtre*": 401.
[115] Bancroft-Hunt 2008: 32.
[116] Viollet-le-Duc 1854-1868, "*fenêtre*": 401-403.
[117] Jacques de Vitry, "Epistolae": 113.

both windows and doors was a common practice.[118] The system requires a long sliding cross bar made of wood, steel, or iron attached by means of brackets to the inside or outside of a door leaf or a window shutter to be fitted into a hole or channel in the door jamb. This means that usually the person locking the door or window would remain inside unless the bar lock is on the exterior face of the leaf or shutter. Usually, a ring was placed at its end to pull the bar and a mortise was carved to allow the hand to bring it out of the socket.[119] In certain instances, windows and doors were reinforced with a dual drawbar system, one located towards the upper part of the leaf and the other towards the bottom. Other instances require only one bar so heavy that it required several people to fit it into the hole.[120] Figure 5 shows two known methods of using the bar to lock a door. To open the shutters using method 1, the bar should be pushed back inside the hole in the doorpost which was deep enough to fit the full length of the bar. Method 2 simply consists of removing the bar whenever people needed to open the door. In this case, the bar-socket might be cut triangularly in the wall. In some double-leaf doors, such as the ones of Narbonne Gate of the city of Carcassonne, the bar is fixed horizontally to one of the leaves and held to the other one to have time to lock the door with latches and install other movable bars.[121] As stated above, simple drawbars are usually strengthened with padlocks. Therefore, in case of an attack, the leaf is pushed and the bar is pulled in order to keep it securely closed and give time to lock the door with a key.[122] With the evolution of the mechanical lock and key system, drawbars fell in disuse especially after the 13th century and the holes in the wall were filled.[123]

1.4. Metal elements

The integrity of medieval doors relied heavily on the small but significant pieces that held them together, such as safety devices, nails, and metal hinges. These elements were often joined through the process of welding and fixed to the wooden boards using nails, the rod of which is bent on the interior facing. The craftsmen of the medieval period were highly skilled and capable of welding pieces without damaging or breaking them.[124] Indeed, Viollet-le-Duc underlined the difficulty of

[118] Potter 2020: 2.
[119] Viollet-le-Duc 1854-1868, ‘barre, barrière’, 122.
[120] Potter 2020, 6.
[121] Viollet-le-Duc 1854-1868, ‘barre, barrière’, 122.
[122] *Ibid*. 123-124.
[123] Viollet-le-Duc 1854-1868, ‘fenêtre’, 406.
[124] Touzé 2009: 19-21.

forging some of these pieces like the hinges of Neuvy-Saint-Sepulchre in France.[125] The most common pieces that cover medieval leaves are hinges and nails.

1.4.1. Hinges

Architectural treatises give us little to no information on the stages of production and transformation of iron at the time when decorative hinges were used. Certainly, iron elements from the 11th to the 13th centuries were thicker than those of the 14th and 15th centuries in the East as well as in the West. This can be attributed to the continuous evolution of carpentry techniques, which increasingly required fewer metal elements to maintain structural integrity. As carpentry techniques continued to develop, the primary function of hinges evolved to solely suspending the door leaf and ornate hinges lost their decorative role by the end of the medieval period.

Hinges were secured across the leaf on its back or on its front. They can also be "sandwiched" between two sets of wooden boards to increase the thickness of the leaves without preventing their movement, but this technique was more difficult and required on-site work.[126] An example of this technique is the door of the old church of Saint-Martin d'Avallon shown in Figure 6.[127] Furthermore, these elements can be real or false, welded together or independent. When welded together, the whole form a complex network with a geometric pattern embellished with curves, animal figures, or plant figures. In some cases, the ends of the iron straps have shapes of human or animal heads.[128]

The simple straight hinges were generally fixed on the back of the leaf whereas the ornate ones are placed on the exterior face to maintain the joined planks and decorate the leaves. However, excavations of the Latin East have failed to produce examples of highly decorative hinges. When the metal strap envelops the two sides of the leaf, the hinge is then called "belting".[129] Moreover, in the case of two iron straps, the nail crosses the two straps, then it is flattened on the back. As for the placement of the hinges, they can be fastened to the rail or ledge of the door, or they can be put between two rails. Although some doors had three hinges, a two-hinge door is more common in the medieval period.[130]

[125] Viollet-le-Duc 1854-1868, "*serruerie*": 294.
[126] Saint-Wandrille 2003, April, 2.
[127] Viollet-le-Duc 1854-1868, "*vantail*": 348.
[128] Touzé 2009: 47.
[129] Touzé 2009: 21.
[130] Yeomans, Harrison & Smith 2013: 741.

There are various types of hinges used between the 11th and the 14th centuries: Straight hinges, spiral hinges, branching hinges, C-shaped hinges, etc. (Figure 7).[131] First of all, C-shaped hinges are most often real hinges with iron straps in the centre of the C. They are assembled by welding and fixed to the wood by nails.[132] A network of rigorously ordered false hinges usually complete them. These false hinges are made up of simple bars with split ends that take the form of leaves, palmettes, or other more complex shapes. They used to reinforce the leaf and join the boards as tightly as possible and were widespread in the medieval period. Only rare examples of these hinges were seen until the 19th century.[133]

Spiral hinges were crafted from thick iron that was split at the end to form single or multiple winding shapes or flutes. These shapes were secured with nails and attached to the central bar by either facing each other or backing up against the central bar. Welding is common in this case. It is used to attach the flutes to the central bar or, when the central bar needed to be doubled. The principle of spiral hinges can be reduced to its simplest expression or cover the entire leaf.[134]

In addition to spiral hinges, other hinge types are present during the medieval period included those with ramifications or branches. They can be real or false and were more diverse in appearance. Variations in the composition of these hinges on the door leaf, their distribution, and shape, were observed. Nevertheless, hinges with ramifications can be simple, where two or three hinges are adorned with small branches, or extensive, where they cover the entire leaf which is more frequent.[135]

1.4.2. Nails

Nails can cover a large part of the door and constitute a network so dense that their function goes far beyond the fixing of the various elements composing the leaf. Usually, the nails cross the thicknesses of the planks and their rods are folded on the back. A dense network of nails can be seen in small medieval churches, in big cathedrals, and in castles. Examples of nail imprints can still be seen in medieval fortifications in Syria, such as the Crac des Chevaliers (Figure 127) and Aleppo citadel. These imprints represent the nails used to secure the iron plates covering wooden

[131] Touzé 2009: 9.
[132] *Ibid*. 47-48.
[133] When restoring Notre-Dame de Paris, the false hinges of the central door of the western façade were redone by Eugène Viollet-le-Duc.
[134] Touzé 2009: 46.
[135] *Ibid*.

doors. Moreover, the heads of nails can have various shapes, they can be pyramidal, round, square, or even rosettes. On top of their aesthetic feature, Touzé underlines that rosette nail heads can efficiently prevent the nail from going in the wooden leaf too much and damaging it.[136] However, in most cases, nails are only decorative and are limited to embellishing the door or filling the frame.[137]

As said before, with the introduction of new carpentry techniques and the generalization of dados combined with the concern for comfort, a gradual decrease in the metal elements, including nails, was observed. The progressive disappearance of nails is the result of the use of other techniques such as pegging and using a series of planks which allow the structure to be lighter.

2. Historical Sources

2.1. Medieval depictions in Europe: 12th - 14th century

2.1.1. Depictions of doors

In the beginning of the 12th century, depictions of door leaves were not consistently included in manuscript miniatures, and even when present, their details were often not illustrated. However, the depictions changed gradually. Notably, a great number of doors with ornamented hinges started to appear in depictions between the 12th and 13th century. By the beginning of the 14th century, hinges were always shown. Additionally, it became customary to include door knockers in conjunction with hinges. Figure 8 presents certain selected doors depicted in miniatures of manuscripts between the 12th and 14th century.

As stated before, there are three main types of hinges in the medieval period: C-shaped hinges, Spiral hinges, and hinges with ramifications.[138] Hinges depicted in manuscripts are usually with ramifications, but some of them were drawn as C-shaped hinges like the ones in Folio 162v in "*Codex Calixtinus*" and Folio 189r in "*Le Roman de Tristan*" (Figure 8, 2 and 4). The door depicted in "Bible of Stephen Harding" (Figure 8, 1) is very ornamented. It has long hinges with ramifications covering the whole length of the leaves. Considering that the depiction goes back to the beginning of the 12th century, and that hinges are rarely depicted at that time, the drawing is

[136] Touzé 2009: 23.
[137] *Ibid*. 22.
[138] Touzé 2009: 9.

considered ahead of its time. There is even a horizontal bar to strengthen the boards. Folio 210 in "*Vies de Saints*" (Figure 8, 3) presents hinges that could be categorized as spiral hinges. As for Folio 345v in "*Chroniques de France ou de Saint Denis*" (Figure 8, 5), it shows hinges with ramifications which is very common between the 12th and 14th century.

The depiction of padlocks, as well as locking systems in general, in manuscript miniatures was relatively rare prior to the 13th century. However, historical evidence suggests that locks were indeed utilized during the 11th and 12th centuries in both Europe and the Levant.[139] Visual representations of locks followed a pattern similar to that of hinges, gradually becoming more prominent and detailed over time. By the 14th century, locks were always shown in drawings of doors. It seems that all metal elements became clearer and more detailed with time. It is unclear whether this shift reflects a growing prevalence of locks and keys in medieval buildings during the 13th century, or simply a change in artistic priorities. In some miniatures, even a draw bar can be seen. Figure 9 showcases some examples of locks depicted in the medieval period. Clear padlocks are drawn in Folio 94v of "*Le Roman de Tristan*" (Figure 9, 1), in Folio 99v of "*Dictys Cretensis, De bello Trojano libri sex*" (Figure 9, 3), and in Folio 38v of "Seven Sages of Rome" (Figure 9, 5). The one in "*Dictys Cretensis, De bello Trojano libri sex*" depicts also what it seems to be a draw bar. The door depicted in "Seven Sages of Rome" has an additional latch and a clear portcullis. Indeed, it seems that latches were common by the beginning of the 13th century (Figure 9, 2, 3, and 5). While the depictions of locks in manuscript miniatures became more common, depictions of multiple padlocks on a single door remain rare. One example of a door with two padlocks can be seen in "*Vita et Passio Beati Dionysii*" (Figure 9, 4).

Lastly, the boards of the doors are sometimes clearly depicted as can be seen in the Madrid Skylitzes manuscript, or *Codex Græcus Matritensis Ioannis Skyllitzes*, by John Skylitzes. This richly illustrated manuscript dates back to the 12th century and presents several doors with detailed wooden boards. Many of them have clear Saltire crosses added to the leaf, which is the method discussed in the boarding techniques (Figure 10). In fact, these elements, are present in several 12th century manuscripts of France and Italy.[140] Moreover, certain drawings show nails constituting a dense network that covers the whole leaf (Figure 11). This is also common in the

[139] Dervieu 1914: 201; Çelik 2015: 98.
[140] Some examples include doors of Folio 109r-1 and Folio 115r in "*Liber ad honorem Augusti sive de rebus Siculis*" (BBB Cod. 120.II, Burger Library, Bern, 1194-1196) and folio 73r in "*Morte Artu*" (BL Additional 10294, British museum, 1316).

medieval period as nails were sometimes limited to embellishing the door.[141] In the 14th century, many doors were depicted with simple horizontal wooden bars.[142]

The observations of all these manuscripts lead to the following conclusions: Among the most commonly depicted elements are padlocks, door knockers, and reinforcing ramification hinges. While locks were rarely drawn prior to the 13th century, they became a more commonly depicted element with time. Long hinges with ramifications are the most common type of hinges depicted in manuscripts between the 12th and 14th century. In addition to these functional elements, decorative features such as nails and Saltire crosses are also distinguishable in many depictions.

2.1.2. Depictions of windows

The use of bars to secure windows during the medieval period is well documented in numerous depictions between the 12th and 14th century. In the 12th century, the bars were made of wood or iron,[143] and were installed horizontally and vertically. Even in the 13th and 14th centuries, bars were continued to be painted to close windows, meaning not all windows were secured with wooden shutters at that time. Figure 12 provides three examples of depicted iron bars: The preserved Byzantine manuscript The Jaharis Gospel Lectionary,[144] and two examples from the 14th century translation of Valerius Maximus' "Nine books of memorable deeds and sayings" (*Facta et dicta memorabilia*).[145]

By the beginning of the 13th century, most paintings indicated lattice windows. They usually have strips of metal set in diamond patterns to hold pieces of glass (Figure 14). This change in representation reflects the introduction of glass and its increasing use in European castles during this period. The use of this type of windows continued in the 14th century, as depicted in the translation of Valerius Maximus' "Nine books of memorable deeds and sayings".[146] Notably,

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[141] Touzé 2009: 22.
[142] Folio 24v in "*Chroniques de France ou de Saint Denis*" (BL Royal 20 C VII, British Library, 1380-1400), Folio 305 in "*Histoire ancienne jusq'à César*" (BL Royal 20 D I, Naples, Italy, 1325-1350), Folio 21v in "*Queste del Saint Graal Tristan de Léonois*" (BNF Français 343, Milan, Italy, 1380-1385), Folios 43r and 39r-1 in "Alexander Narration" (AEIB χγφ. αρ. 5, Archive of of the Hellenistic Institute of Venice, 1300-1350).
[143] Viollet-le-Duc 1854-1868, "*fenêtre*": 365
[144] Met Museum, The Jaharis Gospel Lectionary: The Story of a Byzantine Book, available on www.metmuseum.org/art/metpublications/The_Jaharis_Gospel_Lectionary_The_Story_of_a_Byzantine_Book, consulted the 5th of March, 2021.
[145] The historical anecdotes "*Facta et dicta memorabilia"* were written around 30 or 31 A.D during the reign of Tiberius, but translated and printed in the 14th century. Some examples that include irons bars installed for windows are in Folios 420r and 425r.
[146] Examples: Folio 33v and Folio 254v.

lattice windows seem to be almost only depicted in miniatures that presented castles, proving that glass was associated with nobility and suggesting that it was likely an expensive commodity at the time. Adrian Boas' assertion that the use of glass for windows or doors was limited to castles and churches in Europe and the East is also supported by these depictions.[147]

Although some shutters are seen in miniatures of the 13th century, it is not until the beginning of the 14th century that they began to be widely represented. For example, in Folio 101v of the 13th century manuscript "*Li Livre des Ansienes Estoires*" (Figure 15, left), obvious wooden shutters are seen, possibly having a lock or a chain. Moreover, the manuscripts of Valerius Maximus gave an idea on how windows were closed by means of a shutter in the 14th century, as seen in Figure 13. The drawings show lattice windows accompanied with wooden shutters. These windows are typically divided into four parts, with the upper portions featuring glass panels. Folio 272r (Figure 13, left) of Valerius Maximus' manuscripts features two nearly identical windows, each consisting of four parts with glass. The upper portions of these windows are squared, while the lower portions are rectangular in shape. All of them are closed by means of shutters. In the window to the left (1), the bigger rectangular bays have two layers. In addition to the glass panels that cover them, a second lattice layer covers half their height. Judging by the colour brown, it could be made of wood. As for the shutters, each of their openings is closed by its own shutter, the hinges of which are visible. In the same Folio, the window to the right (2) is very similar to the one on the left with only one difference: there are only two long shutters that close the four openings. Slightly different, Folio 202r (Figure 13, middle) presents a window with folded upper shutters and rectangular bays with no glass (3). The folded shutters depicted in this window design are reminiscent of those described by Viollet-le-Duc in his observations in Carcassonne Castle.[148] Also, the hinges are not visible. The window depicted in Folio 356v (Figure 13, right) is similar to the one in Folio 202r, with the notable difference being the increased level of detail in the illustration. The shutters of the rectangular bays are clearly folded, but there are no details about the hinges or the locking system. All in all, these depictions showcase a certain degree of flexibility and adaptability in the construction of these types of windows during this period.

In 14th century French manuscripts, many window shutters were depicted as opening vertically, known as sliding shutters (Figure 15, middle). These types of shutters are mostly found

[147] Boas 2010: 43.
[148] Viollet-le-Duc 1854-1868, "*fenêtre*": 401-403.

and documented in Northern France which will be discussed below. They are also presented in the 15th century painting The Merode Altarpiece, or *Triptyque de Mérode*, by Robert Campin.[149] However, most window shutters painted in the 14th century are simple shutters with long hinges (Figure 15, right).

2.2. Photographs

After revealing significant similarities between Crusader architecture and the architectural styles prevalent in France during the same period, it is prudent to inspect photographs of medieval French buildings. Regardless of whether the doors and windows of these medieval structures have been restored or remain in their original state, they provide valuable insights into the closing systems of that time. For this matter, POP, the French heritage platform provides documents, drawings, and photographs. The following photographs will be described briefly, offering a general idea of the elements present in the leaves and shutters of 12th and 13th century structures.

2.2.1. Metal elements on doors

In central France, Puy-de-Dôme is home to a great number of 12th and 13th century churches having hinges with ramifications that cover the entire leaves. Besides their structural function, the hinges had undeniably an ornamental role. The bibliography on the subject is relatively abundant. For example, the Romanesque church of Saint-Pardoux in La Tour-d'Auvergne and Saint-Blaise Church in Auzelles have doorways closed by leaves adorned with hinges (Figure 16, left),[150] bearing witness to the mastery of the forging techniques in the 12th century. The main door of Saint-Blaise Church dates back to the 13th century and is locked with a wooden bar that assist a lock and key system.[151] Moreover, the 12th century southern gate of Notre-Dame-des-Fers in Orcival has an ornamented latch with a small padlock (Figure 16, right).

Another significant example is the Benedictine church of Notre-Dame de Mailhat in Lamontgie (Figure 17). Despite undergoing notable modifications introduced in the 15th and 16th centuries, the original hinges of the lower part of the south side entrance door survived. They have been replaced on more recent wooden leaves, the upper part of which is carved. These hinges are

[149] Met Museum, Annunciation Triptych (Merode Altarpiece) available on www.metmuseum.org/art/collection/search/470304, consulted the 19th of March, 2021.
[150] Ministère de la Culture, Eglise Saint-Pardoux, available on www.pop.culture.gouv.fr.
[151] Ministère de la Culture, Eglise Saint-Blaise, available on www.pop.culture.gouv.fr.

dated to the second half of the 12th century or the beginning of the 13th century. The door has three locks and a latch with a circular handle. This is, more or less, similar to folio 14v in "*Vita et Passio Beati Dionysii*" (Figure 9, 4) which shows a single door with several padlocks. Moreover, the door of its cloister (Figure 17, left) is notable for its unconventional design, consisting of two shutters reinforced by large iron straps that span both horizontally and vertically across the door. Another noteworthy door is that of the sacristy of the 12th century church of Saint-Victor-et-Sainte-Couronne in Ennezat (Figure 18). Covered with nails, its original leaves survived and are made of painted horizontal wooden boards reinforced with long hinges on the interior side. The placements of a latch and an exterior padlock, non-existent today, is still seen.

In the southern regions of France, there are additional noteworthy examples of decorated hinges. The leaves of Pyrénées-Orientales, a department on France's Mediterranean coast, had often spiral hinges especially in the churches dedicated to the Virgin Mary (Figure 21).[152] Among several churches: Sainte-Marie in Corneilla-de-Conflent, Sainte-Marie in Serralongue, Saint-Fructueux parish church in Camélas, Sainte-Marie in Coustouges… These leaves probably date to the period between the 12th and 13th century. In addition to the hinges that cover the whole leaves, they also have a lock, a latch, and door knockers. Furthermore, two churches in South France, offer interesting examples of hinges: the Saint-Julien Basilica in Brioude and the Saint-Laurent parish church in Auzon. The leaves of the southern door of Saint-Julien in Brioude could go back to the 12th and the 13th centuries.[153] They are adorned with hinges and door knockers with animal heads decorating their ends (Figure 19, left). The same thing is seen in the Romanesque parish church of Saint-Laurent in Auzon (Figure 19, right). It is not uncommon to find ironwork decorations featuring animal heads in churches throughout France. Such ornate features can be found in several other churches in the same region, including the Saint-Jacques-le-Majeur Church in Cantal, the hinges of which can be dated to the 13th century.[154] Moreover, the leaves of Saint-Julien Basilica and Saint-Laurent parish church were covered with skin which traces can still be seen (Figure 19).

2.2.2. Wooden elements of doors

While much of the discussion has focused on the hinges and metal elements of door leaves, the inspected photographs also reveal other methods of decorating these elements during the medieval

[152] See page 31 for information on Spiral hinges.
[153] Ministère de la Culture, Basilique Saint-Julien, available on www.pop.culture.gouv.fr.
[154] Ministère de la Culture, Eglise Saint-Jacques-le-Majeur, available on www.pop.culture.gouv.fr.

period. For example, also in South France, two churches bear carved leaves: Saint-Gilles Church in Chamalières-sur-Loire (Figure 20) and the 11th century priory of Lavoûte-Chilhac. The 12th century original wooden door leaves of Saint-Gilles were previously carved with crosses and floral motifs. They were made of double layered planks joined together with nails, with some of the nail heads taking on a pyramidal shape. The planks of the upper part of the leaves are arranged in two crosses, one on each leaf, and below them are eight smaller crosses. However, the leaves were damaged and pieces were missing at the time they were photographed. Figure 23 shows the described leaf and its reconstruction attempt. The author proposes a restitution of the lower part as a mirror of the upper part, but the few remains of the lower part show that this restitution is inaccurate.[155] Moreover, the door leaf of the sacristy at the priory of Lavoûte-Chilhac is believed to date back to the 11th or 12th century.[156] Similar to the door leaves of the Saint-Gilles Church, it is made of two layers of wooden planks forming a single cross in the upper part of the door (Figure 24). From the middle of the leaf and downwards, the wooden planks are carved with letters and motifs. More carved wooden doors are also seen in Provence-Alpes-Côte d'Azur region, in the churches of Le Bar-sur-Loup commune in Alpes-Maritimes and in Saint-Michel of Salon-de-Provence in Bouches-du-Rhône. Both of them have door leaves built in the first half of the 13th century.[157]

Finally, in Nouvelle-Aquitaine, the largest administrative region in France, a citadel built initially in the 11th century is located in Blaye. Between 1686 and 1689, Vauban, a French military engineer who served under Louis XIV, rebuilt and enlarged it many times.[158] Access to the interior of the citadel, which still retains all its buildings, is via two monumental gates preceded by a bridge. One of them is the Royal gate following the principle of the “braced doors” (Figure 2). It is made of a 1.70 meter wide frame of joined planks built on a network of tight diamond shaped boards (Figure 22, 1 and 2). The citadel has another door following the same principal which is the Dauphine door (Figure 22, 3 and 4).

[155] Touzé 2009: 35.
[156] Fikry 1934: 171-184.
[157] Ministère de la Culture, Eglise Le Bar-sur-Loup ; Eglise Saint-Michel, available on www.pop.culture.gouv.fr
[158] Touzé 2009: 34.

2.2.3. Church windows

Almost all medieval churches captured in the photographs have the same composition of windows. Specifically, a two-layered closing system is present, with the outer frame consisting of vertical and horizontal bars. These are completed on the interior side by stained glass panels which are usually held together by long strips of lead. The whole composition have saddle bars that are fixated in the stone frame to keep glass from blowing into the building. The stained glass windows in medieval churches exhibit a range of shapes and colours, often featuring simple geometric designs as seen in the windows of the Gothic Cathedral of Saint-Étienne in Bourges (Figure 26). They are estimated to date back to 1220.[159] However, not all Gothic churches follow the same pattern as some display intricate and complex illustrations with glass panels, such as the churches of Beaujeau-Saint-Vallier-Pierrejux-et-Quitteur in Haute-Saône and Saint Julien in Chauriat (Figure 25).

In addition to the traditional vertical and horizontal bars, some medieval churches feature a metal grid on the outer frame of the window instead. The design of the grid can vary from simple to very elaborate, as can be seen in the windows of Le Thor Church in Vaucluse and Saint-Gengoux-le-National in Haute-Saône (Figure 25).

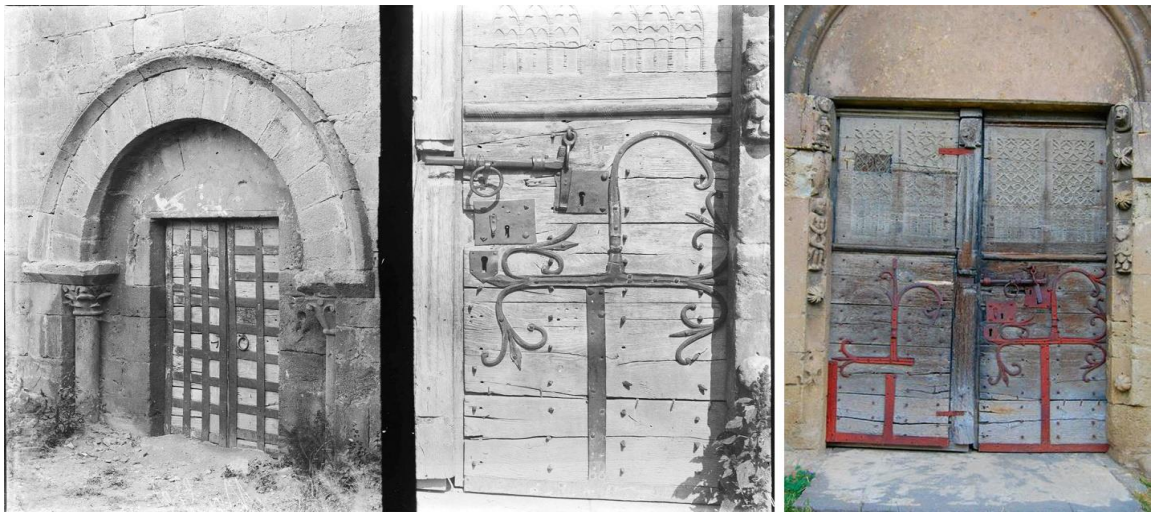

Figure 1: The doors of Notre-Dame de Mailhat church. Left: The cloister door; middle and right: the shutters of the Southern door (POP: La Plateforme Ouverte du Patrimoine, Monuments historiques, 1992).

[159] Boinet 1936: 118.

Figure 2: The sacristy door of Saint-Victor-et-Sainte-Couronne Church in Ennezat (POP: La Plateforme Ouverte du Patrimoine, Monuments historiques, 1992).

Figure 3: First two pictures from the left: details of hinges of Saint-Julien Basilica in Brioude (Cl. O. D. M. H. 242a, 1942); and right: a detail of the hinges of Saint-Laurent parish church in Auzon (POP: La Plateforme Ouverte du Patrimoine, Monuments historiques, 1992).

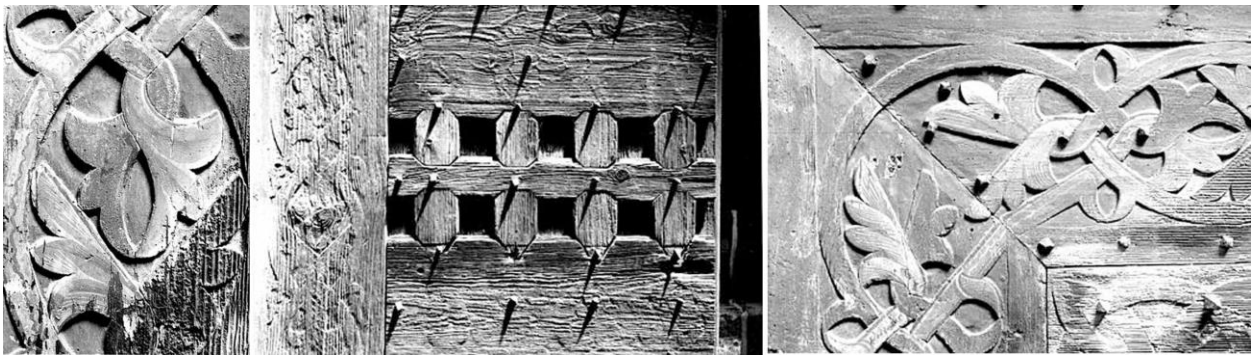

Figure 4: Details of the door of Saint-Gilles Church in Chamalières-sur-Loire (Cl. O. D. MH 125711, 1943).

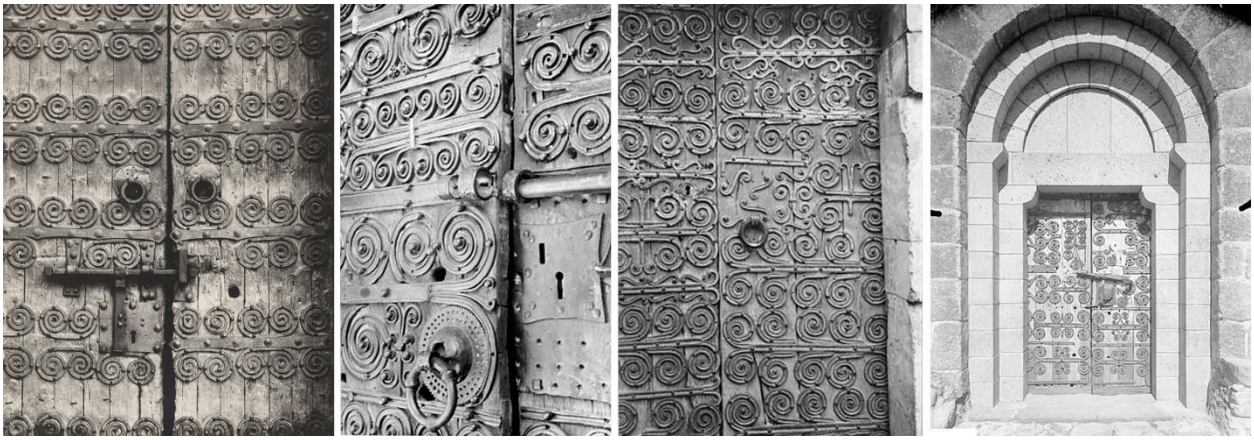

Figure 5: The spiral hinges of the churches in Pyrénées-Orientales. From left to right: Sainte-Marie in Corneilla-de-Conflent, Sainte-Marie in Serralongue, Saint-Fructueux parish church, and Saint-Marie in Coustouges (POP: La Plateforme Ouverte du Patrimoine, Monuments historiques, 1992).

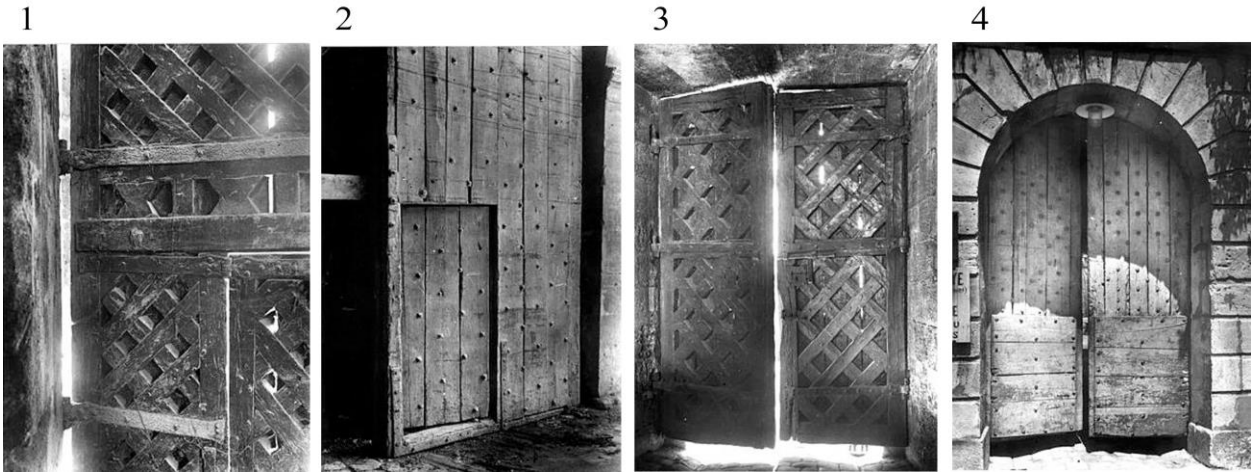

Figure 6: Details of the doors of Blaye citadel in Gironde. Gironde. Hurault, P. Cl.M.H 251824, Cl.M.H 251823, Cl.M.H 251831, and Cl.M.H 251830, 1956.

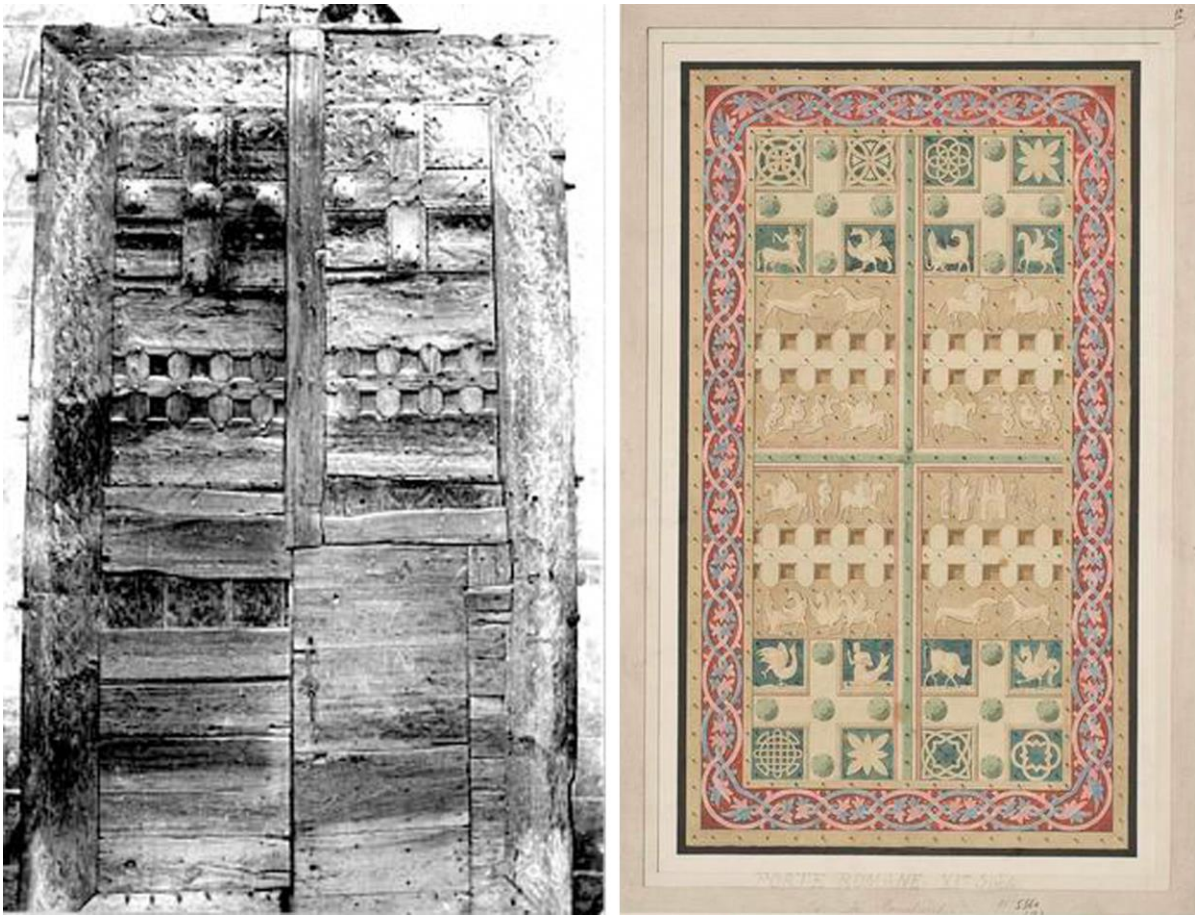

Figure 7: Left: The original leaves of Saint-Gilles Church in Chamalières-sur-Loire (C.Arch. L904, pp 68-69). Right: Restitution of the leaves (A. Normand Aquarelle, s.d., MAP, inv. 5560 (013), MH 08R00138).

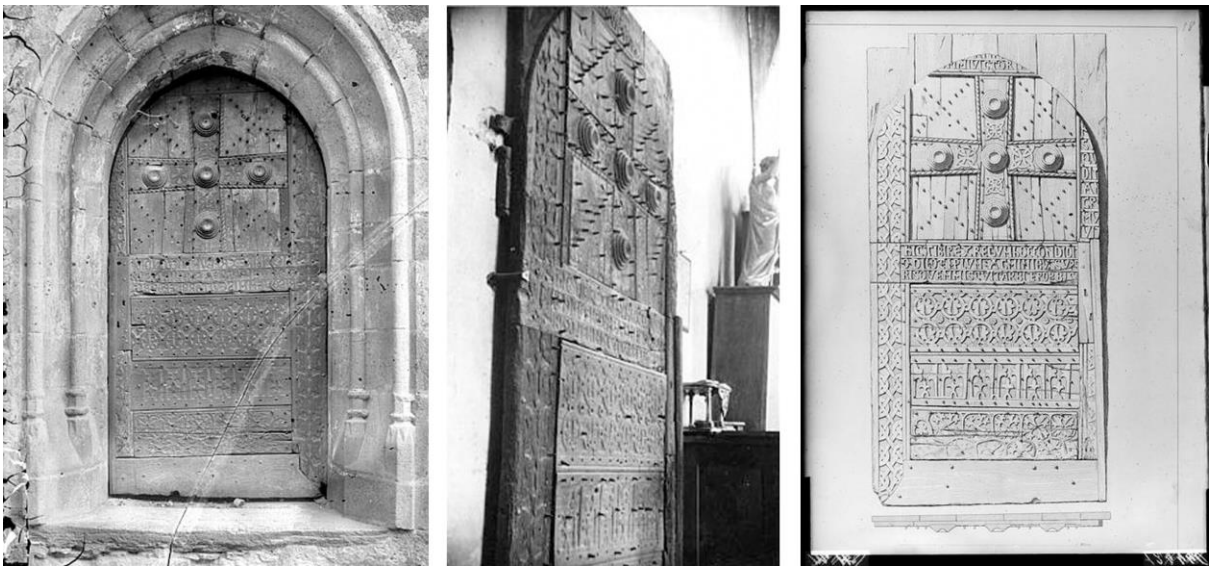

Figure 8: Door leaves of the sacristy of the Priory of Lavoûte-Chilhac (POP: La Plateforme Ouverte du Patrimoine, Monuments historiques, 1992).

Figure 9: Examples of medieval church windows in France (POP: La Plateforme Ouverte du Patrimoine, Monuments historiques).

Figure 10: Stained glass windows of Saint-Étienne Cathedral in Bourges, France (Ph. Hurault Cl.M.H, 1945).

PART II: CASE STUDIES

Chapter I: Choice of Sites and Limitations

In the present study, several factors were considered when selecting the medieval structures to be examined. Firstly, the focus was on medieval churches and two of the most well-preserved Crusader castles, al-Marqab and the Crac des Chevaliers in Syria. The case studies were geographically diverse, including Saint John of Jubayl and the Church of Balamand in present-day Lebanon, with the former situated on the coast and the latter in the mountains. The case study included from present-day Syria is Tartous Cathedral, located on the coast. In addition, a thorough survey of Mount Lebanon was conducted, where a high concentration of medieval churches and chapels are located. Secondly, the selected case studies also differed in importance and the number of people who frequented these structures. For instance, Tartous Cathedral was much more frequented than the Church of Balamand. Additionally, the case studies varied in terms of who built them. For example, many churches in Mount Lebanon were vernacular, Saint John in Jubayl was constructed by Crusaders from Toulouse, Balamand is a Cistercian church, and the Crac des Chevaliers was mostly built by Hospitallers.

Furthermore, these surveys and reconstructions aimed to add more information to previous studies and help to establish a periodization of the construction of the al-Marqab and the Crac des Chevaliers. They also helped to answer important questions related to the doors and windows of the medieval Near East. These cases helped answer some of the questions mentioned in the introduction: Were the same leaf design and closing mechanism conceived for military buildings and ecclesiastical buildings? Did the geographical location play a role in the conception and design of church doors? Do the closing and locking systems differ when the church is more frequented and more important? When were the leaves more decorated?

However, it is important to note that limitations were encountered. This research is done during two field works in 2021 and 2022. Before that, additional access was impossible due to the COVID-19 pandemic and the lack of travel opportunities. Furthermore, the state of Al-Marqab and Crac des Chevaliers was not optimal, with many doors and windows, as well as other elements, being destroyed, blocked, or completely restored with new stones, obscuring any trace of their past closing systems.

Chapter II: Observations on Church Doors of Mount Lebanon

1. Jubayl (Byblos)

1.1. Medieval shutters

Jubayl is one of the richest territories of the coastal region in the medieval period, which resulted in a dense network of village churches that had a better chance of survival in general. Therefore, the hinterland of Byblos is a good starting point for the research of medieval shutters in Lebanon. The district has a total of 65 medieval churches and chapels, not counting the cavernous ones. 40 of them were in good shape where all the openings could be inspected. Many of the visited churches replaced old Byzantine ones and even Roman temples, and do not have surviving details of their ancient locking mechanism or elements that could indicate how the old door shutter could look like. There are several publications on medieval churches of Byblos, however, they do not give information about the doorways.[160]

As stated before, bar-sockets in particular, are not visible probably due to the plaster cast and heavy restorations executed in these churches. Many doorways investigated either have sockets already filled with cement or do not have deep holes. The majority do not show evidence of having a drawbar in the past (category A). Out of the 65 churches visited in Byblos, only 7.7% (category B) have evident and strong drawbars, which means they were intended to be refuges in times of danger and needed to be locked from the inside. They are located in the northern part of the district, but more field surveys might alter the picture and no definite conclusions can be drawn at this point. Around 15.4% of the churches (category C) were locked by combining different elements or show pieces of hybrid systems. Table 1 list the churches that appear to maintain evidence for having a drawbar in the past with preserved bar-sockets or holes, and the possible date of the use of the drawbar according to the date of construction of the church, for which the traditionally accepted general dating was applied, such as “Crusader period”. The orientation stated in the table is determined from the exterior side of the door, unless stated otherwise.

Many door leaves of medieval churches were installed using pivots. This is clear by the pivot holes in the lintels (soffits) of some churches built before the 10th century, like Saint Phocas church in Chmout and Saint Nohra and Saint Sophia church in Dmalsa. The pegs of the pivots were

[160] Nordiguian 2013: 169-196; Kahwagy-Janho 2019: 107-140.

probably part of the leaf itself and fitted into cylindrical holes in the soffit and in the threshold that held the leaf in place. They could also be attached to the leaf like dowels. No medieval threshold was found, but besides the modernization done to the doorways, it is possible that there was a separate threshold slab that has sockets. In fact, long before the medieval period, separate thresholds were used for tomb doors in Egypt.[161] These doors usually have two leaves, and they are prevented from swinging by a stop on the threshold and a high wooden crosspiece.[162] By the 11th century, door leaves were generally installed using hinges as they became lighter and could carry the weight of the leaf. The church of Saint Nohra (St. Lucius) and Saint Sophia church in Dmalsa was presumably built in the 13th century although a banner on the entrance indicates that it was built in the 7th century.[163] The two doors in the western elevation of the church have obvious pivot holes in the soffit set behind the door frame. This placement of the sockets in both of the doors would prevent the door from opening outward. Examining these holes confirms that there were double-leaf doors since there is a socket towards each end of the lintel. The door towards the south (Figure 27, middle) even has a cutting in the middle of the lintel which further confirms the number of the leaves. Its lintel has also several cylindrical and rectangular sockets. The rectangular ones could not be pivots because if the shutter has rectangular pivots, it would not rotate. The probable explanation is that the rectangular holes are for the stile (frame) of the window and the shutter is installed behind it. In the same perspective, the lintel of the window of Saint Charbel in Maad (Figure 27, right) also has rectangular holes on each side of the lintel (north elevation). In addition, two superposed bar-sockets are located on the left doorpost of the window. The bigger one is the lower one (Length: 12 cm, width: 14 cm, depth: 8 cm).

Most of the doors of the medieval churches in Byblos had two shutter; still there were some exceptions. For instance, the lintel of Saint Phocas church in Chmout also shows pivot holes (Figure 28, left), but the two cylindrical holes are towards the left doorpost which indicates a single leaf that opens to the left. The lintel might be reused from older structures due to the number and locations of the pivot holes.

[161] Accetta 2020.
[162] Viollet-le-Duc 1854-1868, "*vantail*": 346.
[163] Immerzeel 2004: 55.

Name of the church	Town or Settlement	State of bar-socket	Possible date of construction	Comments
Category B				
Saint Abda (monastery)	Maad, MaẎÁd, مَعاد	One square bar hole in the right doorpost of the entrance of the monastery.	Ottoman period	
Saint John Mark (cathedral)	Jbeil, Jubayl, جُبَيْل	Deep rectangular bar holes on each doorpost of both of the doors of the western elevation and the northern elevation (the first one to the right from the inside).	First half of the 12th century	All the other entrances of the cathedral do not have evidence of drawbars.
Our Lady of Harvest	Bijji, بِجِّهْ	One square bar hole in the right doorpost.	Around 11th century	
Saint Taqla	Chikhane, ShĐkhÁn, شيخان	Two bar holes in the same doorpost.	Crusader period	A bar-socket is close to the threshold, the second bar-socket is deep and square almost mid-length of the doorpost.
Saint George	Tartij, تَرْتِج	Two circular bar-sockets in each of the doorpost of the entrance.	Crusader period	
Category C				
Saint Charbel	Maad, MaẎÁd, مَعاد	Two superposed bar-sockets in the window in the north elevation.	Originally built in the 12th century.[164] Rebuilt in 1723.	It is built over a Roman temple.

[164] Kahwagy-Janho 2016: 95.

Saint George	Amchit, ÝAmshÐt, عَمشيت	Three square bar-sockets in the left doorpost.	Medieval period	
Our Lady of Illige	Maifouk, MayfÙq, مَيْفوق	A circular bar-socket in the right doorpost of the entrance.	Medieval period	
Saint Nohra (Saint Light)	Jbeil, Jubayl, جُبَيْل	Two superposed bar-sockets in the doorpost.	Around 9th century	
Saint Nohra and Saint Sophia	Dmalsa, DmalṣÁ, دْمَلْصا	A circular bar-socket in the right doorpost of the left door in the western elevation.	7th century	It is a double-nave church.
Saint Elysha	Eddeh, Idda, إدّه	A small bar-socket in the left doorpost.	Crusader period	
Saint Rouhana	Ain Kfaa, ÝAyn KfÁÝ, عَين كْفاع	One oval bar-socket in the right doorpost of the eastern elevation.	Byzantine period	The other door in the western elevation does not have evidence of a drawbar.
Saint Sava	Mastita, MastÐtÁ, مَسْتيتا	Oval bar-socket in the left doorpost.	Crusader period	Thick plaster cast over the bar-socket.
Saint Theodore	Rihani, RÐÎÁni, ريحانِه	One small bar-socket in the left doorpost.	Around 8th century	
Saint Theodore	Hisrayel - Kawer al-Hawa, ḤiÒrÁyil - Kawr al-HawÁ, حِصْرايِل - كَوْرِ الهَوى	One rectangular bar-socket in the left doorpost.	Crusader period	Thick plaster cast over the bar-socket.

Table 1: Medieval churches in Byblos that still have their bar-sockets and their possible date of construction.

1.2. Locking bars

The bar-sockets encountered vary considerably in size and shape according to the dimension of the space that the drawbar was securing, and most of them are filled completely or partially. The

churches of Saint Theodore in Rihani and Saint Elysha in Edde are single-naved rectangular churches with only one door facing the altar. A filled but shallow socket can been seen on the side of their door jamb, and among the investigated churches, they have a particularly small socket (Figure 29).

There are several possible explanations for the small diameter of the socket (3.5 cm) with regard to the width of the doorway. The first one is that the drawbar used is covered with iron plating. Even if there are limited archaeological evidences of blacksmith's workshops in the Byzantine Near East, iron trades are not uncommon. In fact, way before the Byzantine era, metal bars were found in Macedonia and Greece dating back to the Hellenistic period.[165] Another possibility is that the drawbar is assisted by a lock and key mechanism, but it must have been a primitive padlock since its technology and complexity did not progress much until the 18th century. Using metal locks is more or less expensive at that period. Finally, the fact that restorations carried out on this church might have altered the real dimensions of the bar-socket can be also an explanation.

Some churches present several sockets in their doorpost. For instance, the little church of Saint Nohra in Jubayl (Figure 30, left) is a small Byzantine church that has two oval bar-sockets in the right doorway post with the upper one greater than the lower one, recorded as follows:

Upper socket: Length: 9 cm

Height: 12 cm

Depth: 6 cm

Lower socket: Length: 7 cm

Height: 11 cm

Depth: 3 cm

[165] Haddad 2016: 55.

The bar-sockets are more or less similar to those of Saint Charbelius in Maad (Figure 27, right). Hypothetically speaking, two bar-sockets and one bar mean that one socket is for the bar to slide in, and the other one is to secure it. This method is used since the Roman period, and it is seen in the *horrea* of Roman Ostia,[166] or even in ancient Jerash. However, there is a possibility that the door was modified several times throughout the history of the church. As for Saint Georges of Amchit, it also has several rectangular sockets in the door jamb (Figure 30, right). The deepest one is approximately 4 cm deep, and it is the most evident and the highest one from the floor with an almost square shape (length: 3.5 cm, width: 3 cm). Several bar locks are unlikely for the span of the space of this church. It is more likely that the door has been changed several times or the church was using reemployed elements that already had traces of sockets.

Usually, the bar-sockets observed are located at the mid-length of the door jamb. However, Saint Taqla in Chikhane has two sockets in the same doorpost in the door of the western elevation, one of them is very close to the threshold. Having two bar holes in the same doorpost was a rare encounter in Byblos, and the importance of this church is well reflected by the fine defensibility of its doorway: the door was well secured with two bars, one towards the upper part of the leaf and the other one towards its bottom. The bar towards the upper part of the leaf is square and deep enough to host the full length of the locking bolt (Figure 31, right, bottom). It is comparable to the bar hole of two churches. Both of them are square-shaped with a side length of 14 cm: the one of Our Lady of Harvest in Bijji (Figure 31, right, top) located in the right jamb of the door, and the one of Mar Abda monastery in Maad (Figure 31, left) also located in the right door jamb of the entrance (although this bar-socket may be from the Ottoman period). The church has another door in the northern elevation, but it does not have any detail of the old locking mechanism or the original door leaf. Saint Rouhana church of Ain Kfaa as well as Saint Nohra and Saint Sophia church in Dmalsa both have a very similar socket in their doorways.

Saint Rouhana in Ain Kfaa town is a single-nave medieval church, the base of which is made of monoliths of a Roman temple. It has two entrance doors, one on the eastern façade (the main entrance), and the other one facing it. Only the right doorway post of the main entrance has a socket above a niche. It is small almost rectangular, approximately 5 cm deep. In addition, the church of Saint Nohra and Saint Sophia in Dmalsa also has an almost circular bar-socket in the

[166] Rickman 1971: 33.

right door jamb which indicates that the two shutters of the original door were secured by one bar (length: 6 cm, width: 8 cm).

In all cases, the locking bar could be cylindrical even if the hole is square or rectangular, but occasionally, large bar-sockets with dimensions bigger than 10 cm take a circular shape. Our lady of Illige in Maifouk (Figure 32, left) also has a circular bar-socket in the right doorpost of its entrance, however the socket has a diameter of 16 cm which is much bigger than the ones mentioned before. Alongside the bar-socket, the placement of the old upper stone gudgeons and the stile (frame) is visible which makes it easier to image how the old doorway and its locking bolt looked like. It was most probably a two-leaf door. One church that has similar sockets in its door jambs is the church of Saint George of Tartij (Figure 32, right). The sockets have a diameter of 12 cm, so almost as large as the one of Our Lady of Illige, almost perfectly facing each other on each doorpost of the entrance. The locking bar used was likely fitted into the two holes without being attached to the leaves. Furthermore, a deep square hole is also on each doorpost below the bar-sockets. The hole is deep enough to be considered the host of a locking bar which might have been an extra help for locking the doorway.

Many other medieval churches in Byblos have preserved evidence of having a drawbar in the past, such as Saint Theodore church in Kawer al-Hawa (Hisrayel) and Saint Sava church in Mastita. Although their restorations have already altered the true dimensions of the bar-sockets, the sockets are still apparent in the left door jamb of both of the churches. Saint Theodore Church in Eddeh, the one next to the little church of Saint John, has several sockets in the left doorpost of the entrance, the most distinctive one is the biggest one as it is large and oval. It is not known whether it was a bar-socket, but if it was, then the method of using the bar to lock the door was method 2 of Figure 5 because of its elongated form. The bar or bolt would have been simply removed to open the door. The same applies to the church of Saint Sava in Mastita, as the socket has a very elongated form (length: 5 cm, width: 14 cm).

2. Koura

The region of Koura, much like Jubayl, exhibits a concentration of medieval chapels and churches. A total of 61 medieval churches were visited in Koura, with a majority being affiliated with the Greek Orthodox Church. Nevertheless, unlike Jubayl, only a limited number of these churches

have preserved elements that offer insights into their original locking mechanisms or the appearance of their ancient door shutters. These examples will be described herein.

2.1. Saint Georges in Amioun

The Church of Saint George in Amioun is located on the highest hill of the town and is locally referred to as "al-Dihliz," which translates to "the passageway" or "the labyrinth." According to the locals, the church was connected to neighbouring structures, including the churches of Saint Phocas, Saint John, and the tower "al-Burj," through subterranean passages. Others claim the existence of underground catacombs accessed from the northern nave.[167] However, no official excavations or research have been found on this topic. While the exact date of the church's construction remains uncertain, it has undoubtedly witnessed several eras. Some elements recall the tradition of Crusader architecture such as its window which can be seen in other Crusader period churches like Saint John Mark Cathedral in Byblos and Saint Catherine in Enfe. Even if the church was completed later, the extant details of the door leaves closely resemble those found in Crusader-period churches.

The church consists of three naves and apses, each having a facing door in the opposite wall. The doors are identified as Doors A, B, and C, with Door A being the closest to the current main entrance of the church. Door A has 5 holes in its right door jamb (Figure 33, right). All of them are almost similar with a length ranging between 5 and 7 cm and a width ranging between 9 and 7 cm. The left jamb of Door A also features two bar-sockets, one being smaller and almost square-shaped with a length and width of 6 cm and 6.5 cm, respectively, while the other is rectangular, measuring 6 cm in length and 9 cm in width. The sockets have a depth of 4 to 5 cm. As for Door B, it has inclined door jambs with a single socket in each of them (Figure 33, left); both of the sockets are square-shaped of a 6 cm side. Door C is the oldest of the three doors, still retaining the upper stone that received the original pivoting single shutter. Although Door C (Figure 34, left) lacks a socket in its threshold, this technique of rotating the leaf is identical to the one mentioned by Viollet-le-Duc in the monuments of the 4th and 5th centuries in northern Syria (Figure, right).[168] Door C also features a socket in its left door jamb and two deeper sockets in its right jamb, measuring 8 cm in depth and 7 to 8 cm in width, with a length of 6 cm. All doors are

[167] Issa 2020: 107.
[168] Viollet-le-Duc 1854-1868, "*vantail*": 348.

secured with an iron bar. The presence of multiple sockets in the door jambs suggests that the leaves of the doors may have been replaced several times throughout the history of the church, or that the jambs already had traces of sockets when they were repurposed for the doorways. Based on the width of the doorways, it is unlikely that Doors A and C had more than one bar lock.

2.2. Saint Theodore and Saint George in Kfar Hazir

The church of Saint Theodore and Saint George in Kfar Hazir underwent extensive restoration, obscuring any visible indications of the original appearance of the doors from the Crusader period. Nevertheless, the structure adjacent to the church, which was previously a mill, retains characteristics that suggest its association with the medieval period. The building maintains details of the closing system of one of its doors (Figure 35), which is currently a modern window. The door's single-leafed design is secured by the same mechanism as that of Door C in the Saint George church of Amioun (Figure 34). Additionally, two holes in the door jamb indicate the use of two bars to lock the door. Bar-sockets are also visible in some buildings of this village.

2.3. Our Lady of Bkiftin

The interior of the Greek Orthodox monastery of Our Lady of Bkiftin features circular bar-sockets located in each doorpost (Figure 36). Positioned at a height of approximately 117 cm from the floor, the sockets have a diameter of roughly 15 cm. At present, the sockets are obstructed with wood, rendering it impossible to ascertain their precise depth.

Chapter III: Doors of Crusader Buildings and their reconstruction

1. Jubayl (Byblos)

1.2. Souk Gate

In the old town of Jubayl, the big gate that opens up to the now known old souk, preserves a lot of elements of the old gate and its locking mechanism. Obviously, it was a double-leaf gate that closed the doorway since it was used for the passage of vehicles (carts). It may or may not be equipped with a wicket door. This door system has two variants: the side wicket door in one of the leaves, or the central wicket door. There are no survived similar gates in Lebanon, but some examples exist in France, like in Meslay farm in Parçay-Meslay or in Narbonne town.[169] There are two rectangular sockets on each jamb of the doorway, the dimensions of which are recorded in Table 2, which means that the principal approach of the locking mechanism was by means of a double bar. A doorway in Batroun town also have very similar bar sockets. Also, two stone support that held the stiles of the door are also visible on each jamb.

A simple reconstruction attempt of the gate is shown in Figure 37 presenting the principle of the so-called "crossed doors" mentioned as boarding method 5 in Part I of this research (Figure 2). It is a technique of increasing the defensibility of the leaf by installing several layers of wooden boards and laying them in opposite directions. Then, the boards are joined by nails that cross the thicknesses of the planks with their rods folded on the back side. Justin Storck defined the "crossed door" as a door without a case which was formed of boards nailed on other boards in a diamond pattern.[170] However, even though the diamond arrangement is easier to repair because the short boards could be replaced, this type of door has multiple variants. The original door gate of Jubayl was not necessarily made of boards nailed in a diamond pattern, but it can be made of counter-thread planks nailed on vertical or horizontal simple joined planks. Furthermore, the shape of the door could be a pointed arch like the shape of the frame, or just with a triangular top like in the reconstruction. The wicket door is usually closed with a latch.

[169] Touzé 2009: 14.
[170] Storck 1899: 697.

1.3. Saint John Cathedral

1.3.1. Dating and choosing the door

In the 12th century, the small episcopal town of Jubayl, which was built on the ruins of ancient Byblos,[171] was besieged by the Geonese noble Hugues who was nicknamed L'embriac. The maritime town was known to the Crusaders as Giblet or Gibelet as we find in the letters of Jacques de Vitry for example.[172]

The church was established in the year 1115 and was dedicated to Saint John the Baptist. As seen in its plan (Figure 38), it has five doors: one in the southern façade (Door 5), one in the northern one (Door 1), and three in the western one (Doors 2, 3, 4). Even if the precise date of the establishment of the cathedral is known, the construction of the church probably took decades. It was also disrupted and was restored several times after the earthquake of 1170 and the invasions of 1188, 1190, and 1266.[173] With the return of Christians in 1190, the whole cathedral was also restored.[174] Therefore, it is easy to suggest that not all doorways were built in the same year.

Historians agree that the Romanesque church belongs to the first half of the 12th century.[175] Actually, its plan is rather irregular and has three naves and three apses facing the northeast. The French archaeologist Camille Enlart, who gave the first comprehensive study of Crusader architecture, state that the irregularity of the plan and the sudden shift of the northern half from the East to the West is due to rectifying the error of the orientation of the plan by respect to the liturgical rules.[176] The western façade must be a new addition as the church was bigger and was once extended further to the West probably in the 18th century.[177] Therefore, the three doors of the western façade cannot be medieval. As for the doors of the northern façade, above the door to the left of the baptistry, a marble plaque is embedded bearing a Syriac inscription of four lines dated 1776 A.D.[178] Although The historians Max Van Berchem and Julius Heinrich Petermann attributed

[171] Rey 1883: 367.
[172] Fresne 1869: 316.
[173] Enlart 1928 : 118.
[174] *Ibid*. 119.
[175] *Melchior de Vogüé* 1860: 374; Van Berchem 1914: 111.
[176] Enlart 1928: 118-119.
[177] Van Berchem 1914: 111; Enlart 1928: 122.
[178] Van Berchem 1914: 112.

this date to the restoration of the western façade,[179] Enlart doesn't agree and affirms that the northern door was obviously an Arab and recent work.[180]

All in all, in order to avoid the enigma of the date in which the northern door (Door 1) is built, the southern door of the church was a clear choice for the reconstruction as it was evidently medieval.[181]

1.3.2. Survey

Examining all the doors of Saint John Mark cathedral reveal that Doors 1 and 2 have the biggest bar-sockets. They are deep rectangular holes on each doorpost. The other doorways of the cathedral do not have similar preserved bar-sockets. Many cathedrals and churches belonging to castles have been intended as a fortified refuge in times of danger when the city walls fell. This was one of the duties of Saint John Mark Cathedral. From the interior face of the door, the dimensions of the sockets are:

As for the southern door, it is pointed arched, relatively small, and with decorated mouldings richer than those of the northern one.[182] The doorway is now closed with leaves that have a length of 2.40 cm and a width of 1.60 cm without the pointed arch. The original leaves most certainly had the same dimensions because of the upper stone gudgeons that still exist in the inner face of the door (Figure 40). As the church is modernised and has been restored several times, the lower stone gudgeons are not visible because they are probably covered with modern tiles. Moreover, a bar-socket is noticeable in the right door jamb, 50 cm from the ground (Figure 41). No evidence of another one in the left jamb can be seen. It is square shaped with 10 cm long sides, and is 7 cm deep.

[179] Petermann 1861: 330; Van Berchem 1914: 111.
[180] Enlart 1928: 121.
[181] *Melchior de Vogüé* 1860: 375; Enlart 1928: 121.
[182] Van Berchem 1914: 111.

1.3.3. Parallels

Enlart described attentively the church of Saint John. He emphasized that the areas of Burgundy and Southern France influenced the architecture of Crusade churches in general, and the architecture of the cathedral in particular. He also commented on the profile of the archivolt of the southern door being fairly used in Burgundy and Provence.[183] According to him, in addition to Burgundy and Southern France, the capital's decorations are seen in the area of Ile-de-France as well.[184] Less frequently he mentions the Auvergne region and Northern France (Hauts-de-France). On the other hand, he notes some Arab influence like in the columns of the southern apse and the modillons.[185] Table 4 represents the sites containing the analogous elements of Saint John Church mentioned by Enlart.

Based on table 4 and the writings of travellers and historians, the architecture of the church was fairly observed in churches of France, and sometimes in churches of Italy such as Saint-Marie of Agramunt in Catalonia,[186] and the Burgundian Church of Casamari.[187] Whether the architecture of Saint John in Jubayl affected the churches of France or the other way around, collecting examples in France is required for a reconstruction in the closest way possible to the original state of the door. Accordingly, the regions less frequently repeated in literature were Hauts-de-France (Nord-Pas-de-Calais-Picardie), Île-de-France, and Auvergne, hence this study concentrated more on the regions of Grand-Est (Alsace-Champagne-Ardenne-Lorraine), Burgundy, and Provence (Figure 42).

	Elements	Region in France
Saint-Marthe of Tarascon	The southern door	Provence-Alpes-Côte d'Azur
Our Lady of Étampes	The angles of the threshold of the southern door	Île-de-France
Verdun Cathedral	Transoms and abacuses	Grand-Est (Alsace-Champagne-Ardenne-Lorraine)
Epinal Cathedral	Transoms and abacuses	Grand-Est (Alsace-Champagne-Ardenne-Lorraine)

[183] Enlart 1925: 96.
[184] Enlart 1928: 119.
[185] *Ibid*. 120-121.
[186] Enlart 1925: 88.
[187] *Ibid.* 95.

Relanges (Vosges) Church	Transoms and abacuses	Grand-Est (Alsace-Champagne-Ardenne-Lorraine)
Wassy Church	Transoms and abacuses	Grand-Est (Alsace-Champagne-Ardenne-Lorraine)
Cloister of Fréjus	Transoms and abacuses	Provence-Alpes-Côte d'Azur
Vézelay Church	Narthex	Bourgogne-Franche-Comté
Noyon Cathedral	The profile of the southern door	Hauts-de-France (Nord-Pas-de-Calais-Picardie)
Saint-Wlmer of Boulogne	Capitals of the northern windows	Hauts-de-France (Nord-Pas-de-Calais-Picardie)

Table 2: Elements of Saint John Cathedral dating to the 12th century and their parallels mentioned by Enlart in “Les Monuments des Croisés dans le Royaume de Jérusalem. Architecture religieuse et civile”.

Figure 11: Highlighted regions containing the churches listed by Enlart in Table 4.

1.3.4. Reconstruction of the southern door

The southern door of the church was a clear choice for the reconstruction as it was evidently built together with the southern wall of the cathedral in the beginning of the 12th century.[188] With the date being clear, the reconstruction is made by understanding theoretically how the leaves were made in the early 12th century, the material evidence still existing in the doorway, and the parallels of the church.

The inner side

Firstly, the door is more or less small, and as mentioned before, the whole building was subject to several invasions.[189] Therefore, the door must have been made strong enough to withstand intruders and attacks. The most logical way of boarding would have been installing a two-layered door made of horizontal and vertical wooden boards. This technique is mentioned as boarding method 4 in Part I (Figure 2). It avoids rotation in their joints and prevents the flexing in the direction of the width of the boards by their own weight.[190] Furthermore, doors would have been locked with a padlock and key at that time.

The evidence of the past closing system on site makes the picture of the original leaves clearer. The upper stone gudgeons indicate that the door rotated with the assistance of wooden dowels or pins that pivot in them. In addition, the bar-socket shows that the door, which opens to the inside, could have been locked with a half-bar that assisted a padlock. Accordingly, in case of an attack, the leaves were closed and the bar was set in order to have time to lock the door with a key and a latch.[191]

The outer side

The doors of churches were often seen as a shifting point between the secular and the sacred. The outer face of the door would have been decorated as a way of visual engagement that enable the leaves to act as status symbol in the feudal system for those passing through and across them.[192] First of all, door knockers were more or less widespread on the outer face of church doors in the

[188] *Melchior de Vogüé* 1860: 375; Enlart 1928: 121.
[189] Enlart 1928: 118.
[190] Yeomans, Harrison & Smith 2013: 739.
[191] Viollet-le-Duc 1854-1868, "*Barre, Barrière*": 123.
[192] Boulton 2021.

medieval period. We can see them in various medieval depictions and on original church leaves.[193] Moreover, as stated before, the door was probably locked with a key, so a key hole must have been visible on the outer face.

Since most of the towns of the Crusader states are situated along the Mediterranean littoral with a climate more or less humid, wooden structures rarely survived in this weather because of its organic nature.[194] Additionally, the instability witnessed by the Levant would mean that door leaves were often changed so iron elements on them usually don't survive; besides many iron pieces would have been stolen. As for France, wooden doors rarely survived as well, but a small number of medieval iron hinges and locks remained and sometimes reused on more recent wooden leaves. 12th century doors could not be found in Provence. Examples of original pieces of doors that belong simultaneously to the 12th and 13th centuries and the areas of Grand-Est, Burgundy, are represented in Figure 43:

- In Grand-Est: Saint Peter and Paul Church in Wissembourg (13th century), Saint-Etienne Church in Marmoutier (3rd quarter 12th century), and Saint-Pierre Church in Châtillon-sur-Seine (13th century).
- In Burgundy: Saint-Martin Church in Chablis (12th century), Mont Saint-Vincent Church in Saône-et-Loire (1100 – 1220 A.D.), and Abbey Church in Pontigny (first half of the 12th century).[195]

Collecting the examples led to the following conclusion: highly decorated leaves were common in these areas in the 12th and 13th centuries. Particularly, the use of C-shaped hinges was widespread on churches' wooden leaves. These hinges can be real or false, independent from other iron elements, but predominantly they are false and are fixed to the wood by nails. In fact, false hinges, used to reinforce the leaf and join the boards as tightly as possible, were very widespread in the medieval period but, they were suddenly abandoned because they couldn't keep up with the evolution of carpentry techniques. Only rare examples of these hinges were seen until the 19th century like in Notre-Dame cathedral in Paris.[196] If the Crusaders brought their traditions from

[193] Dervieu 1914; Folio 99v in "Dictys Cretensis, De bello Trojano libri sex" (National Library, Rome, 1300-1325); Folio 38v in "Seven Sages of Rome" (BNF Français 22550, National library, Paris, 1325-1350).
[194] Boas 2010: 34.
[195] Aubert 1959: 163-168.
[196] Touzé 2009: 47-48.

Europe, the church of Saint John in Jubayl is likely to have had decorated false C-shaped hinges on its outer face as the door is pivoted. There is also a slight possibility that the ornamentation of the door influenced that of the churches in Burgundy and Grand-Est. As a result, Figures 44 and 45 show the possible reconstruction of the southern door.

2. Balamand Church

2.4. Architecture and influences

The church is located in Balamand abbey, previously called Belmont, Velmont, and Beaumont.[197] The abbey is the work of Cistercian monks who built it as a daughter-abbey for Morimond.[198] It is located in today's northern Lebanon overlooking the entire Tripoli region,[199] and was the first Cistercian foundation in Syria.[200] The church occupies the northern side of the cloister and was probably built over an earlier Byzantine monastery.[201] Like many other early Cistercian churches, it is a single-nave rectangular church with a slight misalignment towards the northeast.[202]

Being a reformed branch of the Benedictines, the Cistercian Order follows the rule of Saint Benedict developed by Saint Bernard of Clairvaux who was regarded as the spiritual leader of the Order.[203] He believed that monastic architecture must be austere since it frames a more demanding spiritual life, therefore the architecture of a Cistercian abbey church has to be humble. Superfluous ornamentation should be avoided so as not to distract people from prayer to seek clarity and serenity.[204] Nevertheless, establishing Balamand doesn't entirely follow the rule of Saint Bernard because he had always opposed building a Cistercian monastery in the Holy Land.[205] The church itself is simpler and was built on a higher altitude than most European Cistercian monasteries.[206] Enlart thinks it's most probably for security reasons.[207] The church bears a remarkable resemblance to the churches affiliated with the Order of Grandmont,[208] evident in its construction

[197] Janauscheck 1877: 199.
[198] Enlart 1928: 45; Bredero 1960: 67.
[199] Enlart 1925: 16.
[200] Bredero 1960: 67.
[201] Enlart 1925: 35; Enlart 1928: 48, 53.
[202] Enlart 1928: 48; Breycha-Vautier 1967: 17; Asmar 1972: 22-23; Chaaya 2015: 50.
[203] Duby 1971: 9.
[204] Chaaya 2015: 50; Vander Eecken 2021: 29.
[205] Bredero 1960: 67.
[206] Enlart 1925: 16; Vander Eecken 2021: 27.
[207] Enlart 1928: 48, 50.
[208] Dion 1874: 1876-1878; Enlart 1928: 50; Durand-Sendrail 1995: 5-34.

in an isolated a mountainous area, as well as its placement within the northern precincts of the monastery.[209] Grandmontine buildings were small, similar to those of the Cistercians, and built with such modesty that can sometimes be regarded as harsh.[210]

Whether talking about the Cistercians, Morimond abbey, or the Order of Grandmont, their ideology is to denounce pride and build simple churches deprived of ornamentation. However, many of the churches that belong to these organizations present decorated thresholds or door leaves all while maintaining humble interiors, even when they are essentially intended for monks. Some examples include the western door of Flaran abbey in Armagnac that has decorated leaves and archivolts,[211] and the leaves of the front door of the church in the Abbey of Fontenay that were armed with long decorative hinges.[212] Accordingly, the significance of a doorway can be perceived even when the whole structure reflects simplicity.

2.5. Choosing and dating the door

The abbey was founded on the 30th of May, 1157;[213] its buildings were probably completed 12 years later around 1169.[214] The whole abbey has seen several modifications including at least two Romanesque-style programs followed by a major Gothic-style remodeling,[215] such as enlarging the apses' windows.[216] According to Enlart, a total reconstruction took place in the 16th century.[217] One or more reconstructions took place as well in the 20th century as the drawings of Enlart do not represent the current state of the abbey. The church is one of the oldest buildings in the abbey and was built in the second half of the 12th century, between 1157 and 1169. Some elements were added during the 13th century like the old bell tower.[218] The actual state of the church is after being enlarged to the West to annex the old church porch.[219]

The Cistercian community in Belmont existed for a finite duration, spanning from its foundation in 1157 until the capture of the Count of Tripoli by Sultan QalÁwÙn, leading to the

[209] Durand-Sendrail 1995: 10, 14.
[210] Dion 1878: 5; Deshoulières 1928: 161; Grezillier 1963: 331.
[211] Benouville 1890. Pl. II.
[212] Bégule 1912: 25.
[213] Manrique 1642: 508; Enlart 1925: 69; Asmar 1972: 13-15; Nordiguian 1999: 126-127.
[214] Enlart 1928: 45; Chaaya 2015: 49.
[215] Chaaya 2015: 50.
[216] Enlart 1925: 81; Asmar 1972: 27-28; Slim 1995: 38.
[217] Enlart 1928: 46.
[218] Enlart 1925: 139; Enlart 1928: 51.
[219] Chaaya 2010: 385-389.

departure of the religious members in 1289. From the start of the 15th century, a Greek Orthodox community was installed in the abbey and the work they undertook did not affect the general plan of the abbey.[220] It can be accessed through three doors, one in the northern façade, one in the southern one, and one in the western one; excluding the ones that lead to the sacristies. The oldest one was in the middle of the southern façade.[221] That same façade has undergone several modifications as evidenced by nine openings, doors and windows, four of which are blocked.[222] As for the northern door, it is one of the simplest Crusader doors but it is not likely that it is the oldest.[223] Therefore, considering the adjustments made to the southern façade and the fact that the northern door is not the oldest one of the building, choosing the western one to remodel is natural as the western façade dates to the second half of the 12th century. By that time, most doors were hinged and not pivoted.[224]

Finally, the monks who built this monastery in an unstable region and on a higher altitude than most Cistercian monasteries definitely had security concerns. Boase even claims that it was so remote that Muslims did not bother to destroy it.[225] However, given its location on the edge of a ridge overlooking the most frequented road of the Levant, it is not unreasonable to believe that the church may have been vulnerable to robbery attempts. If valuable items were indeed stored within its confines, and if the community sought refuge within the church during times of danger, it is highly likely that such items would have been hidden inside the church. Consequently, it is reasonable to assume that the doors of the church would have been given special consideration as protective barriers.

2.6. Parallels

Firstly, even if Balamand monastery shows some collaborations between western and native artists, most of the details were brought from Europe.[226] It would be natural as Cistercians usually built their sanctuaries themselves.[227] Since the chapel is a daughter house for Morimond and looks almost exactly like Grandmontine churches, the abbey of Balamand would be built by monks

[220] Chaaya 2010: 385.
[221] Antaki-Masson 2012: 406-408.
[222] Chaaya 2015: 50.
[223] Enlart 1925: 83.
[224] Touzé 2009: 19-21.
[225] Boase 1977: 111.
[226] Enlart 1925: 23, 30, 72.
[227] Dion 1878: 18; Chaaya 2015: 49.

affiliated with the Morimond monastery but influenced by the buildings of the Order of Grandmont such as Comberoumal priory in Aveyron. Therefore, reconstructing the door of the chapel in the closest way possible to how it could have been in the 12th century requires knowing the location of the mentioned religious monasteries in France and studying the parallels described by Camille Enlart.

Enlart affirms that even if Balamand had some minor Italian influences,[228] it is a witness of the distant influence of Burgundian and Provençal models.[229] In fact, the disposition of the façade of the chapel is characterized as Burgundian art.[230] The sites containing the analogous elements of the abbey dating to the 12th century mentioned by Enlart are in table 5. Moreover, Morimond abbey was founded in 1115 as one of the four daughter abbeys of Cîteaux.[231] After establishing the motherhouse in the diocese of Langres located in Haute-Marne in the region of Grand-Est,[232] their monasteries expanded and clustered mainly in northeastern and southwestern France (Figure 46, black).[233] As for the Grandmontines monasteries, most of them are located in western France (Figure 46, red).[234] Their architecture is close to that of the Cistercians but influenced by Limousin characters,[235] which is not surprising since their motherhouse was located in this region. Most Grandmontine doors are more or less related to Limousin-type doors characterized according to Anthyme Saint-Paul.[236]

Figure 46 shows that Grandmontine and Morimond buildings mostly meet in southwestern France in the areas of Pyrénnées or Aquitaine. Less populated in the area of Burgundy. Consequently, this is possibly where the monks migrated to build Balamand monastery; especially since the southern Grandmontine churches were built in the second half of the 12th century just like Balamand.[237] This theory is further supported by table 5 showing Occitanie as the place that influenced the monastery the most.

[228] Enlart 1925: 23, 72, 94, 151; Enlart 1928: 47, 50.
[229] Enlart 1923: 22; Enlart 1925: 135.
[230] Enlart 1925: 81.
[231] Bredero 1960: 65.
[232] Williams 1939: 370.
[233] Rasmussen 2015: 35.
[234] Grezillier 1963: 331.
[235] Salet 1947:135-136.
[236] Fage 1922: 43.
[237] Durand-Sendrail 1995: 29.

2.7. Survey

Investigating details of past closing systems on the interior side of the studied door showed two bar-sockets in each of its door jambs. The sockets are similarly rectangular with a length of around 15 cm and a width of around 18 cm. The lower socket of the right jamb and the higher one of the left jamb are deep enough to fit the full length of the bars. The remaining sockets are around 10 cm deep. In addition, four holes, two in each jamb, indicate the exact location of the hinges of the door (Figure 47). The lower hinge hole is about 45 cm from the ground and the higher one is 45 cm from the lintel.

The exterior side shows fairly small door leaves of 233 cm x 165 cm. The doorway is adorned by an arch decorated by a zigzagging line. The lintel has three carved crosses, one in the middle and one on each end. The lintel has also a Byzantine motif: Quarter-round corbels emerging from a square.[238]

2.8. Reconstruction

Being located in an abbey, the church is mainly intended for monks and strangers are not allowed;[239] as is the case of the churches inside Cistercian monasteries that do not, at least initially, have a parochial function.[240] Usually, the door reserved for lay-brothers and choir-monks is more modest compared to the one intended for the laity who are familiar with the church.[241] That being the case, the studied door is presumably the most decorated especially that it would ordinarily open on specific occasions to be seen by the laity.[242] Human or animal heads were definitely not used as Saint Bernard deemed the figurative catechism unnecessary.[243]

Examples of bigger churches affiliated with Morimond abbey in the southwestern part of France are shown in Figure 49. The similarity or their main façades with the one of Balamand church is striking. Concerning their door leaves, and even though they may not be the originals, their reconstruction suggest heavy branched hinges with a decorative C-shaped hinge. Balamand church is a less-sophisticated version of Cistercian churches affiliated with Morimond abbey.

[238] Enlart 1928: 412.
[239] Chaaya 2015: 50; Vander Eecken 2021: 27.
[240] Durand-Sendrail 1992: 156.
[241] *Ibid.*158.
[242] Untermann 2001: 268.
[243] Pascal 2003: 148.

Excessive decoration on door leaves is doubtful considering the high influence by the architecture of the Order of Grandmont. There are no remains of door leaves or hinges belonging to the Order of Grandmont in France but some sort of decoration is anticipated as there are instances where the door leaves of deserted Grandmontine abbeys were stolen and sold.[244] Figure 48 represents the design of the leaves of Balamand, which were modeled after the Cistercian churches of Flaran and Silvacane, both situated in the southwestern region of France. As stated above, this choice is based on the premise that the closest parallels to the architecture of Balamand are to be found in this region.

The exterior faces of the door would have four real hinges, two on each leaf, branched and possibly foliated. No big decorative C-shaped hinges would adorn the leaves especially that its small surface would not permit it. The possible reconstruction of the exterior side of the door is given in Figure 50 (left). The interior face is simpler and the whole reconstruction follows the logic of boarding methods 1 or 2 in part I (Figure 1). The hinges would be long rectangular iron straps and two heavy draw-bars would lock the door assisted by a key and latch lock. Multi-layered boarding might not be necessary because it is a humble abbey church. The possible reconstruction of the interior side of the door is given in Figure 50 (right).

[244] Bresson 2011: 10.

3. Tartous Cathedral

3.1. History

Tartous, also referred to Tartus or Antartus, was conquered definitely by Crusaders from Toulouse in 1102,[245] and had its cathedral built next to its wall just like the ones of France.[246] The church held an important place in the Christian history of Syria as it possessed the oldest chapel consecrated to the Virgin and an altar believed to be built by the apostle Peter.[247] The cathedral is much bigger and shows an alliance between a Romanesque structure and Gothic decorations.[248] Renan even refers to it as "the most beautiful Gothic building in Syria".[249]

3.2. Chronological differences in the construction

There are no precise documents dating the erection or the completion of the cathedral. Most historians attribute its elevation to the 12th century.[250] The construction certainly began after the Franks settled in Tartous definitively in 1102.[251] Enlart suspects that the construction began with the organization of the ecclesiastic province of Tyre in 1123.[252] The construction was interrupted and damaged several times during the 12th century,[253] but Folda believes that it was carried on continuously during the 13th century.[254]

The church has three naves, divided into five bays and terminated by a main apse and two semi-circular side apses. It has three doors, a main one in the western façade, and two side doors arranged in the north and south facades.[255] According to Enlart, the outer walls of the last southern bay and the two lasts northern bays date to the 13th century. When Saladin took Tartous in 1188, the apse and the three bays following it had to be completed as well as the fourth bay to the south.[256] Additional works were done around 1200.[257] In that same year, the church would have been built

[245] Van Berchem 1914: 322; Enlart 1925: 5; Enlart 1928: 395; Deschamps 1973: 13.
[246] Van Berchem 1914: 326; Enlart 1928: 409.
[247] Guillaume de Tyre 1844: 411; Rey 1883: 286; Van Berchem 1914: 329; Enlart 1928: 403.
[248] Enlart 1928: 34.
[249] Renan 1864: 54.
[250] Rey 1871: 71; Rey 1883: 286; Dussaud 1896: 317; Deschamps 1973: 287.
[251] Rey 1871: 80.
[252] Enlart 1928: 425.
[253] al-Maqdisī 1898: 253- 254; Van Berchem 1914: 306; Enlart 1928: 397; Rey 1871: 33; Deschamps 1973: 127.
[254] Folda 2005: 179.
[255] Van Berchem 1914: 326.
[256] Enlart 1928: 425-426.
[257] Enlart 1928: 420; Folda 2005: 178.

exclusively in the southern part up to the last bay; and to the North up to the penultimate bay.[258] By 1210, the church was probably in good conditions except the western part that needed construction.[259]

The western main façade, its capitals and its windows, indicate the works of the 13th century.[260] It is also the last part of the church to be completed. The vaults also date to the 13th century.[261] Enlart and Deschamps both believe that the completion was done between 1250 and 1254 when Louis IX was present in the Holy Land for the completion of important monuments.[262] However, Folda doesn't see why the finishing works would have been delayed until the arrival of Louis IX and affirms that it was finished in the late 1220s.[263] Enlart also states that the aisle windows were enlarged around 1260, adding new capitals to their columns but keeping their 12th century bases. The church was repaired and fortified in 1265 but these works remained unfinished.[264] Figure 52 shows the summary of the chronological construction of the cathedral.

3.3. Choosing the door

Figure 52 shows that the church was already half-built and the southern door installed by the end of the 12th century. Even if the other doors were installed at that time as well, the church was particularly damaged by the earthquake of 1170,[265] and by Saladin, between the 3rd and the 8th of July 1188,[266] who seized Tartous and took its inhabitants as slaves.[267] The church might already have been fortified back then and these incidents affected its fortifications as the geographer al-IdrÐsÐ described an already fortified monument in the 12th century.[268] In May 1202, another earthquake also damaged the monument.[269] Again in 1291, the city was destroyed by QalÁwÙn,[270]

[258] Enlart 1928: 420.
[259] Folda 2005: 179.
[260] Enlart 1928: 413, 423, 424; Folda 2005: 178-179.
[261] Enlart 1928: 424.
[262] Enlart 1928: 426; Deschamps 1973: 287.
[263] Folda 2005: 179.
[264] Enlart 1928: 415, 426.
[265] Ambraseys 2004: 736-738.
[266] Ibn al-AthÐr, XII: 3; AbuÞl-FidÁÞ, III: 78; BahÁÞ al-DÐn: 80; Deschamps 1973 : 287.
[267] al-MaqdisÐ 1898: 353- 354; Van Berchem 1914: 306; Enlart 1928 : 397; Rey 1871: 33; Deschamps 1973: 127.
[268] al-IdrÐsÐ 1996: 359; Van Berchem: 333.
[269] Röhricht 1898: 684; Van Berchem 1914: 332; Enlart 1928: 397; Folda 2005: 178.
[270] Enlart 1925: 10.

and it is possible that the church suffered as well. The definitive surrender of the city to ʻAlam ad-Dīn was on the 3rd of August, 1291.[271]

It is natural to think that all the doors were altered after these events and it is not possible to determine a less-damaged door. The main doorway, the western one, was mentioned to have been damaged and reconstructed several times.[272] Enlart even claims that the marble plaques of the arches were forcibly removed by Englishmen in 1840, but he successfully rehabilitated the door with the help of a local mason in the beginning of the 20th century.[273] The state of the door before the restoration of Enlart is shown in Figure 51. All in all, there is no way of telling how the original western doors were installed. The northern door, on the other hand, was clearly restored but some details of its past closing mechanism remain. Its photographs and a survey drawing of its threshold is provided later.

3.4. Parallels

Dussaud describes the cathedral of Tartous having a more Gothic style than the churches of the same period in France but he also mentions that, unlike in France, architects in Syria were free to create these masterpieces.[274] As for Enlart, he mentions several regions of France that generally influenced the architecture of the cathedral (Figure 53). As only the northern door is to be reconstructed, it is more practical to show the regions that influenced the western part of the church that was completed in the 13th century.[275] Figure 54 shows that the western part of the church was mostly influenced by the regions of Burgundy, Provence, and Occitanie which are logical places to look for parallels as Tartous was firstly conquered by people from Toulouse, the capital of Occitanie today.[276] Occitanie also remained an integral part of the County of Tripoli where the main influence remained in Southern French hands. Enlart, and Boase later, also mention that the cathedral has the same aspect as that of Saint-Victor de Marseille, located in southern France, but Enlart insisted that the master who completed the church took the same construction procedure as

[271] Enlart 1928: 399 ; Deschamps 1973: 13.
[272] Van Berchem 1914: 327.
[273] Enlart 1928: 413-414.
[274] Dussaud 1896: 317.
[275] For example, Enlart mentions the churches of Gironde and Yonne to have the same elevated 13th century mezzanine behind the main façade, and the windows of the central nave being similar to those of the churches in Côte d'Or, Saône-et-Loire, Corrèze, Aveyron, etc. Enlart 1925: 61, 78, 146; Enlart 1928: 415.
[276] Enlart 1925: 5.

that of Notre Dame de Beaune in Burgundy.[277] In other words, the architect of the cathedral might have worked or came from Burgundy but was executing the church in the style of the churches of southern France. Consequently, the parallels that will be cited are located in these areas.

First of all, several churches in southern France, like Saint-Trophime church in Bouches-du-Rhône (Provence) and Saint-Exupère church in Hautes-Pyrénées (Occitanie), present leaves covered in metal sheets and assembled with nails (Figure 55). Even some castles in the same region like in Salses-le-Château use this type of armored doors. The possibility of using metal sheets or bronze in the leaves of Tartous cathedral is further validated by its appearance as a fortification similar to a small castle. Al-IdrĐsĐ, the Arab geographer, mentions a church on Arwad Island in the middle of the 12th century describing it as *"a large frequented church, of solid construction, high and fortified that has iron doors and is similar to a fortress"*.[278] With the absence of such a building on the island, it is likely he was referring to Tartous cathedral. Furthermore, bishop Jibrāʾīl ibn al-QilÁÝĐ, also known as Gabriel Bar KalaÝĐ, described a beautifully decorated sandalwood enclosure encrusted with silver, gems, gold, and golden images in a 15th century poem about the fall of Tripoli.[279] Enlart thinks that this is the case in Tartous cathedral, because the notches for this kind of enclosure still exists.[280]

Two ideas can be considered: the use of iron or bronze elements and the excessive ornamentation. Viollet-le-Duc talks in detail about the plates of metal, bronze or iron that cover the leaves and richly decorate it.[281] Actually, bronze doors are a representation of economic and social power.[282] They are usually made by nailing bronze panels onto a wooden core. Weinryb argues that when a building presents large-scale bronze objects, such as doors, it usually shows the importance of the durable nature of the material as a mean to immortalize the memory of who erected the monument.[283] In the case of Tartous, a unique holy and pilgrimage site, it is very likely that all its doors were highly decorated. As for the ornamentation, the link between the poem of Gabriel Bar Kalaʿī and Tartous Cathedral as stated by Enlart is valid. In fact, the display of jewel encrusted surfaces is a widespread practice for the Church in the West and in the East. The most

[277] Enlart 1925: 55, 75, 135-136; Enlart 1928: 413, Boase 1977: 108.
[278] Al-IdrĐsĐ 1996: 359; Van Berchem states that the original text of the passage is mutilated in the Rome edition in 1552.
[279] Röhricht 1884: 462-463.
[280] Enlart 1925: 164.
[281] Viollet-le-Duc 1854-1868, "*vantail*": 350-353.
[282] Bloch 1986: 100-125.
[283] Weinryb 2016: 77-79.

precious materials of Earth represent both the historical city of Jerusalem and the future city of heaven as given in revelation 21 of the Bible:[284]

"18 *The construction of its wall was of jasper; and the city was pure gold, like clear glass.*

19 *The foundations of the wall of the city were adorned with all kinds of precious stones: the first foundation was jasper, the second sapphire, the third chalcedony, the fourth emerald,*

20 *the fifth sardonyx, the sixth sardius, the seventh chrysolite, the eighth beryl, the ninth topaz, the tenth chrysoprase, the eleventh jacinth, and the twelfth amethyst.*

21 *The twelve gates were twelve pearls: each individual gate was of one pearl.*" [285]

3.5. Survey and reconstruction of the northern door

The financial condition of the cathedral during the 13th century plays a primordial role in the reconstruction of the door. Visited by both Christians and Muslims,[286] Tortosa was a bisphoric of the Latin Church, enjoyed great renown, and was visited by important figures.[287] The pilgrimage lasted until the end of the Crusades,[288] but its peak was during the 13th century,[289] the time by which the northern door was likely to have been completed. This is also the period when the church showed a magnificent development from Romanesque art to the Gothic in the Levant. The decoration and the initiative of the artists is indeed reflected in some of the contemporary sources mentioning Tartous.[290]

Examining the northern door shows a threshold that was reused several times (Figure 56). The door was clearly closed at one time by twin leaves turning on pivots, whose pivot-holes or gudgeons survive in the threshold. A small piece of the right upper stone gudgeons still exist. However, the current door is hanged on hinges. It was also closed by a door stop and internal draw-bar. The inner right jamb has a 6 cm deep with an 8 cm long side square bar socket. As seen in Figure 56, it can be posited that the door stop notch is not located at the center of the threshold. This asymmetrical positioning suggests the possibility that the door consisted of two leaves of unequal length. Consequently, the door stop was likely utilized solely to secure the smaller of the

[284] Boulton 2021.
[285] The Bible, Revelation 21:18 to 21:21.
[286] Guillaume de Tyre 1844: 1065; Rey 1871: 71; Van Berchem 1914: 328; Enlart 1925: 12; Enlart 1928: 398; Deschamps 1973: 287; Folda 2005: 179.
[287] Enlart 1928: 396, 404.
[288] Rey 1871: 71; Van Berchem 1914: 330.
[289] Dussaud 1896: 315; Enlart 1928: 398; Folda 2005: 179.
[290] Enlart 1925: 28, 147.

two leaves, resulting in its placement off-center on the threshold. All this led to the following conclusions for the reconstruction drawings of the northern door presented in Figures 57 to 60:

- The leaves, turning on pivots, are not of equal length. Specifically, one leaf measures 75.5 cm in length, while the other leaf measures 109.5 cm in length.
- It had a door stop for the smaller leaf.
- The door was locked using a drawbar, which is postulated to have secured both leaves of the door, based on a lack of visible evidence on the left wall. The relatively small size of the drawbar, in comparison to the door's dimensions, suggests that it may have been made of iron rather than wood, potentially to withstand unauthorized access.
- Given the strategical place of the church and its political importance, it must have been thick and strong enough to resist attacks just like in fortresses. This is achieved by superimposing wooden boards in opposite directions which was certainly the simplest and most economical way to install a "strong door", as in boarding methods 4 or 5 (Figure 2).[291]
- The door must have been decorated in a way to reflect the significance of the site politically and spiritually. Based on available evidence, it is reasonable to conclude that the exterior of the door may have been fortified with metal sheeting to give it the appearance of a fortress. Similar decorated doors can be found in the southern regions of France, as depicted in Figure 55.

[291] Storck 1899: 697.

Chapter IV: Closing systems of Crusader Castles

1. Introduction

Beside the doors and windows castles have another basic opening type, the arrow slits. In this study, arrow slits are only discussed as subjects when there is clear evidence of markings on the stones, indicating that they had closures. Additionally, windows under 30 cm in length are not mentioned. On the other hand, modern windows and doors are not addressed in the research. Instead, the focus is placed on doors and windows from the pre-Ottoman period, and if there is any uncertainty regarding their dating, they are still documented. The survey was conducted in the years 2021 and 2022, resulting in a representation of the state of the doors and windows at that time period. It should be noted that the height measurements mentioned are based on the actual height of the castle as it stands today, taking into consideration any modifications that may have been made to the floor level over time. Finally, the pictures and details of all the mentioned doors and windows as well as any other opening that possibly had closing barriers or mechanisms are presented in plates 1 to 8. These catalogues may not include openings that have been extensively damaged.

2. Margat Castle (al-Marqab)

2.1. History and Architecture

Margat is a concentric castle, designed in the form of a triangle, shaped by the promontory's configuration.[292] It served as a guard for the borders of the principality of Antioch and the county of Tripoli,[293] and its strongest defenses were situated on the southern side. As noted by Deschamps, its fortifications were unparalleled in France during the same period.[294] The outer enclosure was protected by circular towers, a design that was similar to the castles in France during the thirteenth century.[295] Although Rey is on the opinion that by the end of the twelfth century, a village had been established on the same site as the castle,[296] it is more likely that a civilian settlement always existed on the plateau of the castle. Although most of the present structures seem

[292] Rey 1871: 21.
[293] Enlart 1928: 441.
[294] Deschamps p 284
[295] Rey 1871: 23.
[296] *Ibid*. 21.

to have been constructed within about 15 years, the castle continued to be developed until it was conquered by Sultan Qalāwūn and the Mamluk armies on May 25, 1285.[297] This chapter will examine the doors and windows of the castle, excluding arrow slits, which were predominantly constructed by the Knights of Saint John.

Pre-Hospitaller construction period:

Overlooking the Mediterranean coast, QalÝat al-Marqab, commonly referred to as Margat, was constructed in 1062 by a local Muslim tribe.[298] In 1104, the castle fell into Byzantine hands, but was retaken by the Muslims before being occupied by the Franks in 1117/18.[299] This marked the beginning of the first true enlargement of the existing castle.[300] In the 1140s, Renaud II Mazoirs acquired the castle and undertook a complete reconstruction.[301] At the conclusion of the Mazoir era, the castle situated on the southern plateau featured a lower courtyard that was surrounded by a wall along the natural escarpment. Several structures were present on the elevated central area of the southern plateau, likely establishing a defensive alignment.[302]

First construction phase of the Hospitaller period:

The Mazoirs sold the castle to the Hospitallers on February 1, 1187.[303] The exact shape of the southern part of the mountain before this date is unclear due to later alterations by the Hospitallers.[304] Despite the fall of many other fortresses after the campaign of Saladin following the battle of Hattin, Margat remained in Crusader hands and became one of the largest Crusader strongholds in the Levant.

The first construction phase at Margat involved the addition of a new outer wall and a castle within, arranged in a concentric defensive line.[305] Concerning the outer walls, the main plan for fortifications focused on the southern part of the plateau because it was considered the most vulnerable during a siege. The pre-Hospitaller outer walls that were retained were primarily on the southern side of the former Mazoir lower courtyard and were elevated in height to function as the

[297] Ibn ÝAbdaÛÛÁhir: 77-81.
[298] Al-ḤamwÐ: 500; Van Berchem 1914: 259 n3, 300.
[299] Deschamps 1973: 259-260; Ibn ÝAbd al-ÚÁhir 1961: 85–86.
[300] Major 2019: 2.
[301] Caffaro de Caschifellone 1895: 66–67.
[302] Major 2019: 2.
[303] Deschamps 1973: 264; Mayer 1993: 176.
[304] Major 2019: 2.
[305] Major 2019: 5-13.

outer defense. Additionally, the western side's old defensive perimeter on the plateau underwent a substantial expansion northward, with the addition of three square towers (144, 147, and 149) to form the new outer wall. Similar to the Mazoir structures that came before them, these new buildings were made from locally sourced vesicular basalt.[306] In this construction phase, the primary aim concerning the inner castle was to rapidly establish a secure outer ring of defensive structures that will enable the demolition of the old inner structures to give way to the construction of a new inner castle. The process of building the new castle included the removal of existing buildings, the excavation of a primary trench to separate the inner fortifications from the rest of the plateau, and the development of a water management system.[307]

One of the first structures to be erected was the church (12) and the southern section of the vaulted hall (6c and 6d) which probably functioned as the first dormitory. The western side wall of the hall 6 extended northward in a L-shape forming the halls 3 and 5 marking the northern boundary of the castle. A substantial rectangular corner tower (4) was constructed at the northernmost point of the L-shaped structure.[308] In the western defensive line, the inner gate-tower complex (1) and the building located south of it (25) were the most remarkable structures.[309] In addition, during the initial construction phase, through excavations and the examination of sculpted stones gathered during surveys, it becomes evident that the castle's initial chapter hall (21) was one of the most prominent structures.[310] Additionally, there was another rectangular hall (18), probably intended as the main kitchen from the outset.[311] Moreover, the original southern castle entrance featured a massive pointed-arched gate situated beneath the eastern part of hall 18. This gate led to a pointed-arched vaulted corridor providing the exclusive access to the inner courtyard from the south. There was also a small courtyard (30), accessible through a narrow opening between hall 18 and the church. Towards the end of the initial construction phase, an extension northward was incorporated into hall 6, referred to as 6a and 6b, and it included a small rectangular turret projecting from its north-eastern corner. The final stages of the initial

[306] Major 2019: 8.
[307] *Ibid*. 9.
[308] *Ibid.*
[309] *Ibid*. 10.
[310] *Ibid.* 11.
[311] *Ibid.*

construction period saw the establishment of the first Hospitaller castle, replacing the largely demolished Mazoir structure.[312]

Second construction phase of the Hospitaller period:

The second phase saw the completion of circular towers and other structures within the castle.[313] In this phase, massive basalt was used instead of vesicular basalt for most structures. In a single campaign, many new structures were erected such as the donjon (14), refectory complex (18), residential wing (13), and vaulted hall (134).[314] The donjon (14), created primarily to withstand enemy artillery attacks, notably from the southern and eastern directions, emerged as the most remarkable architectural achievement of this phase. It was also the final element completed in this phase. The newly constructed residential wing (13) was divided into two levels: the ground floor housed a cistern, while the upper floor functioned as the dormitory for the knights. Another addition to the fortification was structure 15, consisting of a ground-floor storeroom and cellar, with the main dining area located on the floor above. Furthermore, a small courtyard (30) was added situated between the kitchen (18), church (12), and building 13, with original plans to cover it. However, this construction project remained unfinished. Additionally, a dormitory (134) was built on the eastern wall of the outer castle, and the area between it and building 13 was originally planned to be covered.[315] In the north-eastern corner, the rounded tower 6a was constructed, creating a concentric defensive system on the eastern side of the castle similar to the existing one on the west. Nevertheless, the northern side of the castle, which faced the inner suburb, featured just a single row of vaulted structures along with a rock-cut ditch.[316]

Post-1202 construction period:

The castle suffered several difficulties in the 13th century, beginning with a devastating earthquake in May 1202.[317] It serves as a crucial reference for establishing the dates of numerous buildings. The donjon was greatly damaged and the first Chapter House was destroyed.[318] The Order

[312] Major 2019: 13.
[313] *Ibid.* 14-17.
[314] *Ibid.* 14.
[315] *Ibid.* 16.
[316] *Ibid.* 17.
[317] Mayer 1972: 303.
[318] Major 2019: 17.

convened its Chapter General in Margat between 1204 and 1206, [319] which necessitated the construction of a larger Chapter House (21).[320] A new structure (19) was constructed in the space between the newly erected Chapter House (21) and the kitchen (18) following the earthquake. The earthquake possibly had an impact on the L-shaped structure (3-5), which could have resulted in alterations to its structure.[321]

The structure, which includes rooms 8, 9, 10, and 11a, is believed to have been planned from the outset. However, radiocarbon dating of a burial discovered at its southern end suggests that it was constructed after 1210, following the period of the Chapter-General. A bathhouse (31) was constructed in the northeast corner of the inner courtyard, either concurrently with or shortly after the completion of this structure.[322] At some point in time not specified, the top of the southern end of the same structure received an installation of a circular foundation for a treadwheel crane.[323] Also after 1202, a new structure was added to the roof of building 15.[324] Finally, the two western gatehouse complexes, 1 and 101, underwent significant changes, with structure 101 representing one of the last significant constructions by the Hospitallers. Both of these structures date back to the middle of the 13th century.[325]

2.2. Doors

Being one of the most imposing castles in the Near East and given the difficult history of Margat, the Franks tried to lock themselves in as best they could, therefore doors were an integral part of the defence strategies of the Crusaders. Doors in Margat are obviously not all the same age and were not made by the same mason. In some cases, features such as the shape or the closing mechanism have been considered unusual enough to be datable.[326] A thorough typology on the closing systems of the doors as well as their shape might be practical in dating them and understanding the security they provided in fraught circumstances.

[319] Luttrell 2014: 206.
[320] Major 2019: 18.
[321] *Ibid.*
[322] *Ibid.*
[323] *Ibid.* 20.
[324] *Ibid.*
[325] *Ibid.* 21.
[326] Potter 2020: 7.

2.2.1. Typologies

2.2.1.1.Typology based on frame type

The doors in Margat vary in size and shape. Conventionally in all medieval buildings, the smaller ones are posterns and service doors, and the bigger ones are entrances and church doors. Among the 64 doors recorded in Margat, four archivolts shapes can be considered: The pointed arch, the superimposed arches, the segmental arch, and the noncircular curve meaning a straight lintel.

Type 1: Pointed arch

The pointed arch, also known as the ogival arch, is characterized by two curving sides that meet at a sharp angle at the top. It is used in a great number of window and door openings of castles and churches throughout the Crusader states for its structural efficiency.[327]

There are 26 doors with a pointed arch in Margat castle; most of them are extremely slightly pointed. The smaller ones in length, such as doors 5.0.07, 5.0.08, 6b.0.01, 6c.0.02, 6d.0.01, 13a.1.01, 13a.1.02, 13a.1.03, and 14f.1.10 are naturally the most pointed. Their arch is considered a lancet as its span is much smaller than its radius.[328] Only door 13a.1.03 is original and has apparently endured a great fire considering the black colour of its stones. Although doors 5.0.01, 5.0.02, 8.0.02, and 6a.0.03 are damaged, they had clearly a pointed arch. Moreover, doors 6c.0.01 and 6d.0.02 both lead to the same latrines of the western part of the castle. They are completely reconstructed and made of an exterior pointed segmental arch covering a barrel vaulted door.

Doors 3.0.01, 18.0.02, 11a.0.03, and 25.0.01 are slightly bigger than the ones mentioned earlier thus having a less pointed arch. They all have their voussoirs and jambs made of white ashlar limestone whereas the whole façade is made of black basalt stones. Moreover, the arches of doors 1c.0.01, 2.0.02, 3.0.03, 13.0.01, 13.0.08, 13a.1.04, 18.0.01 have a much attenuated point due to their considerable size. Doors 2.0.02 and 13a.1.04 are considered to have a four-centred arch which is defined in as “an arch of four arcs, the two outer and lower ones springing from centres on the springing line, the two inner and upper arcs from centres below the springing line.”[329]

[327] Fai & Rafeiro 2014: 124.
[328] Fleming, Honour & Pevsne 1998: 19.
[329] *Ibid.*

Type 2: Superimposed arches

Most of the superimposed arches are pointed. Door 8.0.01 has voussoirs arranged in three separate concentric rings forming three arches similar to those of a Rowlock arch. We can assume that the arch of door 10.0.01 is similar under the plaster cast. Door 13b.0.01 is set in a similar way but only has two arches with the upper one made with bigger voussoirs than the lower one. It is similar to doors 15.1.02 and 141.0.01 that have two sets of voussoirs of the same dimension.

Door 1a.0.01 is the most unique as it has two exterior arches, each comprising two sets of voussoirs, one consisting of a row of light stone and the other of a row of dark stone. This is originally a Muslim decorative technique called *ablaq*, but by the 12th century was widely used in Europe too both in domestic and military architecture.[330] The only door with segmental superimposed arches is door 101.0.01. It is endowed with an exterior arch consisting of two sets of voussoirs also using the *ablaq* decorative technique.

Type 3: Segmental arch

The segmental arch has its centre below the springing line.[331] It can be rounded like in doors 11a.0.05, 14f.1.08, 18.0.04, and 43b.0.02 or pointed like in doors 8.0.03, 10.0.02, 11a.0.01, 15.0.01, and 25.1.06 which means drawn from two centres instead of one. The segmental pointed arch is also used in some doors of the village nearby (Figure 61).

Type 4: Straight lintel

There are fifteen doors that have straight lintels in Margat and they are usually small doors like doors 1h1.01, 15.0.02, 15.1.01, 30c.0.01, and 31.0.01. Many of them lead to staircases such as 11b.0.01, 13c.2.01, 14e.0.01, 14f.1.01, 35.0.01, and 35.0.02. Some of them have a relieving arch above the lintel to carry the weight of the wall and keep the lintel from cracking such as in doors 14f.1.01, 35.0.01, and 35.0.02. In addition to the mentioned doors, all the doors of the chapel have a straight lintel (12a.0.01, 12a.0.04, 12b.0.01, and 12c.0.01). Some doors of the village on the plateau also have straight lintels (Figure 61).

[330] Boas 2010: 58, Deschamp 1973: 167.
[331] Fleming, Honour & Pevsne 1998: 20.

2.2.1.2. Typology based on closing systems

The closing mechanisms of the doors in Margat can be used to classify them. They can have hinged leaves, pivot leaves, or a combination of the two. Also, several doors are blocked, damaged, or completely rebuilt, leaving no trace of their previous closing system.

Type 1: Doors with pivot leaves

These primitive doors have been used since Greek Antiquity and can still be seen in many fourth and fifth century monuments in Syria.[332] They can have leaves that rotate with the help of dowels entering in holes under the lintel and in the threshold. This is the case of 12b.0.01, 12c.0.01, 15.0.02, and 35.0.02. Although door 6c.0.01 do not have an upper stone gudgeons, a hole in the threshold of door indicate that a one pivot leaf used to close it. It is assumed that door 6d.0.02 was closed with the same system. In many cases, the dowels go into separate stones referred to upper and lower stone gudgeons. Doors 5.0.07, 6a.0.03, and 135.0.06 all still have the upper stone gudgeons partially or completely.

Bigger doors of this type all have upper and lower stone gudgeons to accommodate two leaves instead of one. This includes doors 1a.0.01, 1c.0.01, 2.0.02, 12a.0.01, 25.0.01, 101.0.01, and 141.0.01. However, many of these stones are missing today leaving empty holes in both ends of their inner arch of the door such as in doors 8.0.02, 11a.0.01, 13.0.01, 13.0.07, and 13.0.08. Although damaged, 14f.1.08 still has their lower stone gudgeons.

Type 2: Doors with hinged leaves

Historically, simple solid shutters were for a long time the most common way of closing medieval windows and many European windows have breakouts in one or both sides attesting to their use in the 12th century.[333] This practice is also corroborated in Margat, as indicated by the presence of breakouts in the jambs of several doorways, such as 5.0.02, 13a.1.01, 13a.1.02, 14f.1.01, 14f.1.10, 14k.2.01, 15.1.01, 30c.0.01, 31.0.01, and 35.0.01. Only door 12a.0.04 of the chapel had two hinged leaves. Hinges are long iron straps fixed to the wooden boards using nails, one end of which is

[332] Viollet-le-Duc 1854-1868, "*vantail*": 346.
[333] Séraphin 2002: 192.

rolled into a knot to receive the pin. The pins are sealed in the masonry for the rotation of the shutter as well as for its reinforcement.[334]

Type 3: Doors combining two closing systems

In some doorways, such as doors 8.0.01, 10.0.01, 11a.0.03, 13a.1.03, 13a.1.04, 13b.0.01 and 15.1.02, the upper stone gudgeons, or the holes accommodating them, and notches in the wall indicating the location of the pins of the hinges are both present. It is possible that these doors were changed several times throughout the centuries, using a different closing system each time.

Undetermined closing systems

Figure 63 shows the number of doors with an undetermined closing system. The reasons are the following:

- They were completely redesigned and their voussoirs have been rebuilt without leaving evidence of their previous closing systems: 1h.1.01, 3.0.01, 3.0.02, 5.0.08, 6b.0.01, 6c.0.02, 6d.0.01, 14e.0.01, 25.1.06, and 43b.0.02.
- They are too damaged to determine a closing system: 3.0.04, 5.0.01, 5.0.09, 8.0.03, 10.0.02, 11a.0.05, 13c.2.01, and 14b.0.01.
- The doors were blocked at the time of the survey: 18.0.01 and 18.0.02.
- They do not seem to have any leaf in the past: 11b.0.01, 15.0.01, and 18.0.04.

2.2.2. Reconstructions

Three doors are chosen to be reconstructed using a 3D design software, AutoCAD, and Agisoft Metashape. One door of each closing system and frame type is chosen as a basis for the reconstruction of other doors of the same type in the castle.

Door 101.0.01

Rey dated the works in tower 101 to the first years of the thirteen century,[335] whereas Deschamps is convinced that it was built around 1270 meaning the last days of the occupation of the

[334] Saint-Wandrille 2003, April: 2.
[335] Rey 1871: 23.

Hospitallers.[336] Analyses of charcoal samples collected from the upper floor support a middle of the 13th century dating for the first floor, however the gate opening itself must date from the earthquake of 1202. A section of the outer arch of the gate has jutted out from its line and this could only have been caused by an earthquake, when the heavy load of the first floor room was still not ready that would have prevented the earthquake dislocation to happen. As the main entrance of the castle, it is protected with a bar, leaves, a portcullis, and machicolation, a defence system similar to that of 1c.0.01 which was the main access from the outer castle to the inner castle (Figure 67).[337] The upper floor of the tower where the machicolation and portcullis were controlled is shown in Figure 63, where we can see the position of the portcullis (a), the machicolation (b), and a pointed arch window with two stone benches. Rey also mentions that there were notches in the wall that received the pulley system of the portcullis.[338] However, nothing original remains in the second floor and according to Deschamps, it was restored by M. Coupel around 1939.[339]

As Enlart affirms when describing military architecture, the leaves of the gates of fortresses were usually thick and covered with iron, sometimes all iron, to withstand intruders.[340] Therefore door 101.0.01 should have been made of several layers of wooden planks. In the reconstructions, the outer side of the leaves is made of twelve horizontal planks set in a wooden frame (Figures 64 and 65), each plank having a length of 20 cm. The inner side is made of vertical and horizontal planks joined by means of brackets (Figures 65 and 66). This is according to boarding method 5 (Figure 2). The survey showed that the width of the leaves should not be more than 12.5 cm, which means that the first layer should be around 6 cm and the second layer (Figure 66) should be around 6.5 cm. It is reasonable to have a small pedestrian door since the larger door will not remain open at all times.[341]

From the inner side, the leaves rotated with the help of upper and lower stone gudgeons (Figure 66). The left upper stone is still present (Figure 66, a) while a thick concrete cast was added to the right stone (Figure 66, c). The dimensions of the door suggest that hinges used to help the pins to rotate the leaves. The bar-sockets are 23 cm long. The left one from the inner side is around 3 meters deep indicating a bar covering the full length of the door and entering a socket in the

[336] Deschamps 1973: 274.
[337] Deschamps 1973: 273.
[338] Rey 1871: 23.
[339] Deschamps 1973: 274.
[340] Enlart 1928: 357.
[341] Touzé 2009: 14.

opposite side. The reconstruction in Figure 65 shows the draw bar (c) set before locking the big leaves by pulling the latch (d) with its handle (e), a hinge of the wicket door (f), and the latch (g) and lock (h) of the wicket door.

Door 35.0.02

Being less than 1 meter wide, door 35.0.02 (Figure 68, top left) may not be highly decorated so simple nails should be placed on its outer face (Figure 68, top right). Nevertheless, it is one of the most significant doors as it gives access to the donjon (14) which is the strongest fortified element of the whole castle. Due to its size, the reconstruction is according to boarding method 1 or 2, but can also be according to boarding method 3 (Figure 1). That is why it may have had iron coating on it. Its importance is also demonstrated by its locking bar that has 16 centimeters long sides which is large for a small postern (Figure 68, bottom left). The latch was set around 74 cm from the ground according to the position of the bolt-hole in the right side wall. The door must be two-layered to ensure the safety of the tower. Furthermore, a circular cavity about 5 centimeter in diameter and 13 centimetres in depth indicates that the door had a one-sided pivot leaf (Figure 68, bottom right).

.Door 13a.1.02

Decoration, sculptures, and finely dressed stones are usually applied when visitors and people who are not familiar with the castle can see them such as the northern and western facades of the church which are endowed with richly ornamented doors and large black carefully dressed stones.[342] Door 13a.1.02 (Figure 69, top left) is located in room 13a.1 leading to the terrace. It is a little less than one meter wide and is only intended for people who live and work in the castle. Accordingly, one can assume that this narrow door was simple with minimum decoration.

Although door 13a.1.02 is completely restored, two breakouts in the right jamb (from the inner side) specify the approximate locations of the applied hinges (Figure 69, bottom left). The location of the bolt of the lock exists on the left jamb (from the inner side). The bolt-hole is square with a 2.5 cm side. Moreover, the door does not need several layers of wood as it only leads to a terrace in the inner castle therefore the reconstruction suggest four simple vertical planks (Figure 69, top right and bottom right). All the pointed arch doors of the same façade are assumed to have

[342] Deschamps 1973: 277.

the same arrangement: two simple hinges, a lock, a latch, and a small door-knocker. As this is a simple door, the reconstruction is made according to boarding method 1 (Figure 1).

2.3.Windows

2.3.1. Typology based on closing systems

The windows in Margat can fall into five types of closing systems: bars, hinged shutters and bars, pivot shutters and bars, and glass windows and bars. Just like doors in this castle, we cannot determine the closing mechanism of some windows.

Type 1: Windows with bars

Windows 9.0.02, 11a.0.02, 11a.0.06, 13a.1.08, 15.0.03, 15.1.04, 15.1.06, 15.1.08, 18.0.03, 18b.1.03, 25.0.02, 25.0.03, 25.1.07, 41.0.01, and 102a.0.01 are small and do not require shutters. They are secured with simple vertical and horizontal wooden or iron bars.[343]

Type 2: Windows with pivot shutters and bars

In addition to bars, some windows are closed with shutters similar to pivot doors. The circular hole under the window's lintel indicate the position of the rotating dowel of the wooden shutter. Windows 6a.0.02, 6a.0.04, 6a.1.08, 12b.0.02, 12c.0.02, 12c.0.03, 43b.0.03, and 43b.0.04 fall into this type and they all required one shutter except 6a.1.08 which had two.

Type 3: Windows with hinged shutters and bars

Just like doors, breakouts in window jambs usually indicate the positions of the hinges of the shutters. Most of the windows in Margat do not require two shutters and have two breakouts on one side only. This type includes windows 13.0.02, 13.0.03, 13.0.04, 13a.1.05, 13a.1.06, 13a.1.07, 13b.1.01, 13c.2.02, 14b.0.02, 14b.0.04, 14f.1.06, 14k.2.03, 44.0.04, 135.0.03, and 135.0.04. Only windows 1h.1.02, 101.1.01, and 104.0.03 seem to have had two shutters in the past. Also, we can assume that 14f.1.03 is similar to 14f.1.06 as they lit the same rooms.

Type 4: Glass windows

[343] See "Medieval depictions" page 33.

The church windows in Margat, windows 12a.0.02, 12a.0.03, 12a.0.06, 12a.0.08, 12a.0.11, and 12a.0.13, were secured with glass panels and bars. This was very popular in French twelfth and thirteenth century churches. Although these windows do not preserve many remains in their jambs and frames, some of them, like 12a.0.06, 12a.0.11, and 12a.0.13, still have holes in their inner side walls which accommodated the iron crossbar that held together the glass panels.

Undetermined closing system

There are multiple reasons that can contribute to the indeterminacy of the closing mechanism of certain windows. Windows 1h.1.03, 22.0.02, and 141.0.02 have their frame reconstructed hence having no remains to indicate their closing system. Moreover, windows 5.0.10, 11a.0.04, 13b.2.01, 14i.1.01, 15.1.03, 15.1.05, 15.1.07, 18.0.05, 18.0.06, 18.0.07, 135.0.01, and 135.0.02 are too damaged to determine their past closing system.

Other windows, such as 6b.0.02, 6c.0.03, and 141.0.03, have been obstructed thus hiding any evidence of their original closing mechanism. Windows 17.1.01 and 43b.0.05 appear to have remained unclosed throughout their history. While no closing system can be detected in *in-situ* window 22.0.02, it is plausible that shutters were used to close it.

2.3.2. Reconstructions

14f.1.06

In the donjon (14), windows 14b.0.02, 14f.1.03, and 14f.1.06 present the same characteristics: cupboards in the side walls (Figure 70, 5, b, d, f) and a voided tympanum (Figure 70, 5, a, c, e). Window 14f.1.03 is fully restored so there are no traces of closing systems. In window 14b.0.02, a plaster cast masked the breakouts of the former hinges. Although its right side is damaged (Figure 70, f) and its jambs were rebuilt, only window 14f.1.06 still has breakouts on one side designating the hinges of the former shutter and some of the holes of the bars in the left jamb. Therefore, the reconstruction of window 14f.1.06 will be a model for those of windows 14b.0.02 and 14f.1.03.

Enlart affirms in his "French Archeology Manual" that in the thick walls of many castles, the openings can take the proportions of small rooms.[344] This is the case of windows 14b.0.02, 14f.1.03, and 14f.1.06 as the space in front of them is sufficient to classify them as rooms. In light

[344] Enlart 1925: 124.

of the fact that these windows are the only ones to present cupboards, it can be argued that these spaces were used as rooms. Moreover, their tympanum definitely represents a domestic window, further cementing their residential character.

Examining these tympanums (Figure 70, a, c, e) reveal no trace of vertical bars to close the void. This observation suggests that these spaces were likely covered with a translucent material, such as glass, in order to prevent water, wind, and other environmental elements from entering the room. In his work entitled "Dictionary of French Architecture from the 11th to the 16th centuries", Viollet-le-Duc highlights that the space sandwiched between the lintel and the arch is designated as dormant, which is filled with glass that is enclosed by lead. The idea behind such a design is to allow light to enter the room even when the shutter is closed, improving the overall illumination of the liveable space.[345] He gave the example of a window in Harcourt castle in Lillebonne (Figure 72), asserting that this window design is replicated in numerous other Norman castles of the twelfth century.[346] He adds that when you want to look out of a window, it was inconvenient to open a shutter three or four meters high, often difficult to maneuver, allowing much more air than is needed in winter.[347] In the same perspective, it was inconvenient to keep the shutters of windows 14b.0.02, 14f.1.03, and 14f.1.06 open all the time. There are many examples of domestic windows that have dormant glass (Figures 72, 73, and 74).

As for the rectangular bay located below the voided tympanum, only a few bar notches survived in window 14f.1.06. However, a comprehensive survey of all windows of the donjon (14) revealed that there are a minimum of five horizontal bars and a maximum of three vertical bars utilized. The diameter of the bars is around three centimeters, a conclusion that has been inferred based on the surviving holes of the windows of the same building (Figure 76, b). The fixed window is then placed in the tympanum (Figure 76, c). It is made of round glass panes with a swelled center fixed in a wooden frame (Figure 76). The example of the reconstructed dormant window of 14f.1.03 is given Figure 75. This type of glass, also known as "crown glass" or "bottle glass", was commonly found in excavations of the Frankish Near East such as those of the Frankish keep of BaysÁn, the monastery of Saint Euthymios,[348] and Acre.[349] Similarly, in many medieval churches

[345] Viollet-le-Duc 1854-1868, "*fenêtre*": 402.
[346] *Ibid*. 405.
[347] *Ibid*.
[348] Meimaris 1989: 36; Boas 2010: 44-45.
[349] Ganor 2015: 669.

in Cyprus, round glass panes were used for doors and dormant windows (Figure 74). As for the shutter, it is made of four horizontal planks and has two long hinges placed in the position of the two breakouts of the right side wall (Figure 76, d). Upon surveying buildings 13 and 14, it was noted that the majority of the windows had a small hole on the opposite side of the hinges' breakouts. It was most probably designed to accommodate the bolt of a lock (Figure 71). Consequently, a small latch and bolt mechanism must have been fixed to the wooden planks using nails, thereby facilitating the shutters closed (Figure 76, d, e).

1h.1.02

Double windows

Window 1h.1.02 used to lit DĐwÁn al-Malik or the king's room as called by Rey.[350] Deschamps speculates that it is maybe where Byzantine prince Issaac Comnène was held captive.[351] In the photo taken by Van Berchem in the beginning of the twentieth century, and in the ones taken by Deschamps in the third part of his book "Les Châteaux des Croisés en Terre Sainte", the archivolt looks mutilated and two windows are closed with wooden shutters (Figure 77, a, b, and c). Deschamps explains that two marble capitals remain and that they must have been executed at the end of the twelfth century.[352] Today, the archivolt is restored (Figure 77, d) and the whole structure of in situ window 1h.1.02 can be divided into four parts as seen in Figure 81:

a. A big pointed archivolt made of white stones resting on two columns with capitals adorned with leaves. The base is made of two torus.
b. A rounded segmental arch under the arch (a).
c. Two broken columns on each end of the window next to the columns of (a).
d. A wall pierced with two rectangular windows.

It seems that the window has gone through some modifications and almost no original element was preserved. However, having two identical openings with a pointed archivolt, 1h.1.0w looks like the Italian *bifora*. In fact, numerous carved stones from the end of the twelfth century were found scattered all over the castle forming a double window in which no panes were inserted.

[350] Rey 1871: 29.
[351] Deschamps 1973: 279.
[352] *Ibid.*

Gergely Buzás did the 3d reconstruction of the window and he believes that they belonged to the first chapter house of Margat (Figure 79).[353]

It was not until the nineteenth and twentieth centuries that historians and architects started to shed light on these kinds of windows. For example, François Cattois and Aymar Verdier gave many examples in their books on civil and domestic architecture in the Middle Ages (Figure 82). Eugène Viollet-le-Duc was the one who gave the most comprehensive description of geminated windows in his Dictionary of French Architecture.[354] Then Camille Enlart described these windows mentioning that they were adopted from the beginning of the twelfth century to the fourteenth century, giving a few examples in his French Archeology Manual.[355] Gilles Séraphin attempted to date and understand the evolution of geminated medieval windows in Aquitaine and Languedoc in France (Figure 83).[356] Lastly, many Italian *bifora* windows were documented by Laura Inzerillo in western Sicily giving us more than enough examples from the end of the thirteenth century until the early fourteenth century (Figure 84).[357] Similar windows in the Levant include the first floor windows of the Templar chapter house in Tartous. The evidence of the closing mechanism employed in window 1h.1.02 is limited. As a result, the reconstruction is hypothetical based on the parallels given.

First of all, Enlart mentioned that this type of windows has a round stone column as a central support to give as much light and visibility as possible. He adds that builders sometimes installed small arches in the lintel which is set into the large archivolt.[358] Gilles Séraphin noticed that geminated windows endowed many prestigious buildings which meant the reminiscence of the palatial model at the same time as the re-interpretation of the antique architrave.[359] He suggests that this technique reduced the thickness of the walls and assured the stability of the masonry. However these windows did not survive after the first third of the thirteenth century.[360] Viollet-le-Duc gave a detailed example of a Romanesque window from the end of the eleventh century in the Castle of Carcassonne in France (Figure 80). The described window provided a remarkable

[353] Buzás 2012: 61.
[354] Viollet-le-Duc 1854-1868, "*fenêtre*": 401.
[355] Enlart 1925: 125.
[356] Séraphin 2002: 145-201.
[357] Inzerillo 2008.
[358] Enlart 1925: 125, 126.
[359] Séraphin 2003: 157. Séraphin adds that in Limousin, these windows were endowed with a pointed archivolt.
[360] *Ibid*. 158.

example of the closing mechanism generally adopted at that time.[361] Its lintel is made of two arches resting in the middle on a white marble column and is lined internally with two other lintels with no arches in the interior (Figure 80, section). As for the shutter, Viollet-le-Duc explains that it was divided in two along with the hinges to be able to shut half the window when needed. The two pins that received the hinges were still in place (see pins G in Figure 80) and the shutter was pierced and filled with glass fixed in lead to give light into the room when the shutter was closed (Figure 81, left).[362] A bar used to lock the shutter as indicated by a socket in the wall (see section in Figure 80). According to Séraphin, the use of the bar lock for windows is quite widespread in the window frames of rural dwellings or castles of southern France as well.[363] Viollet-le-Duc cited a similar instance of these window types located in the citadel of Verdun. The window in question was closed by a four fixed glass panels and a shutter held in place by bolts that were inserted into a hole behind the mullions (Figure 81, right).

Reconstruction

In the twelfth and thirteen century, French double windows were mostly recessed into a segmental arch (Figures 82 and 83). The pointed archivolt is more common in Italy, especially in Sicily (Figure 84), which demonstrates the Italian influence on the form of window 1h.1.02 (Figure 78, a). The window seems to have been modified more than once as the part of the wall above the segmental arch (Figure 78, b) looks original but the segmental arch does not. In fact, the rectangular openings (Figure 78, d) seem to be the last part added in this window. They are now closed with a modern iron lattice shutter and glass. While lacking holes for bars like most of the windows of Margat, the frames of window 1h.1.02 feature indentation or breakouts which may have accommodated the former outwards-opening shutters, as is evident from photographs captured by Deschamps (Figure 77, c). In addition, just like the reconstruction of Buzás (Figure 79), the two broken side columns (Figure 78, c) were most probably completed with a third column installed in the middle in order to create two arched windows just like any *bifora* window. Accordingly, the 3D reconstruction attempt of this window shows two side columns forming two

[361] Viollet-le-Duc 1854-1868, "*fenêtre*": 401-403.
[362] *Ibid.* 402.
[363] Séraphin 2003: 193.

arched windows with a central column (Figure 85). An *oeil-de-boeuf* or an ox-eye window might have also existed below the pointed archivolt in the middle of the two windows.

Wooden shutters are easily perishable thus there are rarely any medieval examples left, and if a shutter survived it is usually from the 15th or the 16th century. Therefore, the reconstruction of the shutters of window 1h.1.02 is inspired by the description of Viollet-le-Duc of the shutter of Carcassonne castle and other parallels. The reconstruction of Viollet-le-Duc shows a shutter that can fold with the help of two long hinges, which are divided into two sections to enable the closure of one window at a time. This type of arrangement would not be suitable for window 1h.1.02 due to the larger size of its bays in comparison to the castle's window. Therefore, a more appropriate approach would be to use a single shutter with two hinges fixed on a wooden frame to close each bay. The interior side would resemble the shutter of the Cluny house seen in Figure 82. To ensure sufficient lighting when the shutters are closed, each shutter is pierced by a rectangular opening filled with glass panes, similar to the shutters described by Viollet-le-Duc. The size of these openings can be increased to let more light in. The reconstruction is represented in Figure 85.

2.4.The church

The church is the work of the Hospitallers,[364] it was the chapel of the fortress and the chapel of the bishop of Valénie.[365] Judging by the style and details, Van Berchem, Enlart, and Deschamps believe that it was built in the end of the twelfth century.[366] Deschamps also believes that it was built in the end of the twelfth century, precisely 1186 or immediately after, because according to historian Marcel Aubert, its coving profiles are close to those seen in Île-de-France in the third quarter of the twelfth century.[367]

The nave of the chapel is divided into two groin-vaulted bays terminating in a semi-circular apse covered by a semi-dome. It has actually two entrance doors, two sacristy doors and six windows. Unfortunately, the original leaves of the chapel did not survive and excavations did not produce locks, hinges, or glass. Nevertheless, some details on the frame stones, thresholds, and

[364] Deschamps 1973: 277; Major & Galambos 2012: 29.
[365] Enlart 1928: 442.
[366] Van Berchem 1914: 307; Enlart 1928: 443 ; Deschamps 1973: 277.
[367] Deschamps 1973: 277.

lintels may indicate how the doors and windows of Margat chapel were shut in the Hospitaller period.

2.4.1. The sacristies

Two stairs lead to the apse flanked by almost triangular sacristies which can be reached through low doors (12b.0.01 and 12c.0.01). Sacristies were often adopted in Crusader churches and they were common in many Syrian churches from the fifth to the eighth century.[368] The southern sacristy (12c.0) is believed to be a former vestry whereas the northern one (12b.0) was probably a personal oratory as it has a small window well placed to provide a view of the altar.[369]Analogous to the southern and northern walls of the chapel, the apse was painted.[370] While these paintings were periodically interrupted and altered,[371] the same can be observed with respect to the sacristies' doors.

Door 12b.0.01

Door 12b.0.01 is 182 cm high and 67.5 cm long. It had and still has a leaf rotating on its own axis to the right with the help of a dowel set in the wood that enters in a hole under the lintel. However, the examination of the doorway shows that the current position of the leaf is not original. It seems that the leaf was placed in the frame where the hole in the threshold still exists (Figure 87). There is no similar hole above it under the lintel which suggests that it was later blocked.

The presence of two sockets in the interior right jamb indicate former bar locks (Figure 86, 3 and 4). Of the two, the higher one (Figure 86, 3) is both the largest and the deepest, measuring approximately 16 cm in depth. However, given the dimensions of 12b.0.01, it is unlikely that two bars would have been necessary to secure the room, as a single bar would suffice. Probably, the door was changed in the past and its bar lock was repositioned to accommodate the new leaf. There are also two holes in the right upright of the frame higher than the position of the actual lock (Figure 86, 1 and 2). The location of these holes towards the outer side of the door indicates their likely function as locks. This suggests the possibility of either the existence of two locks, or that the original lock was replaced at some point. Although instances of double locks on a single leaf

[368] Enlart 1925: 48; Deschamps 1973: 277.
[369] Major & Galambos 2012: 29.
[370] *Ibid*. 37-39.
[371] *Ibid*. 37.

have been documented in the twelfth and thirteenth centuries, they are rare. The number of breakouts and holes on the frame of door 12b.0.01 reveal the importance of securing the door and the room to which it provided access which increase the probability that it accommodated an important figure.

Door 12c.0.01

Door 12c.0.01 has almost the same dimensions as door 12b.0.01 but the breakouts and holes in the frame are less numerous. Most of them are insignificant in size and the door has no leaf actually. Pivot holes in the threshold and under the lintel (Figure 88, 1 and 2) prove that the original leaf opened to the left and was also placed in the frame of the door. The dowels of the wooden leaf were around 6 cm in diameter as indicated by the pivot holes.

It was not as secured as door 12b.0.01 as there are no deep sockets for bars or much evidence for changes in the leaf or the locking system. In fact, a simple vestry would not need to be greatly defended or secured. The only significant remain on the frame is an almost rectangular socket in the left upright of the frame (Figure 88, 3). Its size, 6.5 x 10 cm, is bigger than common sockets for iron bolts of medieval locks which suggests that it was a wooden latch or an iron plated latch that secured the leaf in the closed position.

Windows

Arrow slits lit sacristies 12b.0 and 12c.0. Window 12c.0.03 was later blocked when building 13 was erected. Considered the smallest windows in the castle, they all originally had a single vertical bar indicated by two holes facing each other in the frame as shown in the example of window 12c.0.03 (Figure 89, 1 and 3).

12b.0.02, 12c.0.02, and 12c.0.03 are wide enough to need a shutter. They were all closed with a pivot shutter that opened to the right as evidenced by a hole in the head jamb (Figure 89, 2). The lower hole is only clear in window 12c.0.02. Like all the windows of this castle, windows 12b.0.02, 12c.0.02, and 12c.0.03 remained shut with the help of a small latch and bolt. The bolt-hole is currently only present in window 12c.0.02. While the reconstruction is only done for 12c.0.02 as depicted in Figure 90, this configuration is identical for the remaining two arrow slits.

2.4.2. Doors

Currently, the chapel is equipped with four doors: one for each sacristy (12b.0.01 and 12c.0.01), and one for each entrance (12a.0.01 and 12a.0.04). Two additional doors existed in the southern façade but were blocked when building 13 was attached to the eastern half of the southern façade of the chapel.[372] Enlart claims that the lintels of the western and northern entrance doors have an erased cross, which was a common feature in early basilicas in Syria. He adds that their profiles were used in the regions of Burgundy and Provence.[373]

Door 12a.0.01

The western door 12a.0.01 is preceded by a wide staircase. It was adorned on each side with two separate columns that do not exist today. Three bases and four capitals decorated with leaves remain. The base of the left column, the nearest to the door, does not exist and only one capital to the right, the nearest to the door, seems to be original.

Two upper and lower stone gudgeons received the pins of the door (Figure 91, a). The door was probably made of two layers of wooden planks, the outer ones being vertical (Figure 91, b) and the inner ones forming a frame and horizontal reinforcements (Figure 91, c and d). The reconstruction if made following boarding method 4 (figure 2). With a height of more than 2m, the pins and gudgeons do not suffice to rotate the door properly without the help of hinges (Figure 91, e). Moreover, two bar sockets in the inner side walls still exist indicating the presence of a former drawbar. The right socket is the deepest socket (Figure 91, g) in order to accommodate the length of the bar which is pulled before locking the door with a key and a latch (Figure 91, f and g). The reconstruction of the inner side of the leaves is demonstrated in Figure 92.

Door 12a.0.04

Just like the western door, the outer side of the northern door 12a.0.04 is flanked on each side by two separate columns, their capitals are decorated with water leaves. The arches and archivolts extend to the right and left in a straight line. Deschamps affirms that this extension is very frequent

[372] Major & Galambos 2012: 29.
[373] Enlart 1925: 84, 96.

in the Christian architecture of Syria in the first centuries. He adds that a stone above the north door on the left suggests the existence of a former porch.[374]

The inner side has a 216 cm deep left bar socket (Figure 93, 5), which is enough to accommodate the full length of the bar. There is no socket facing it, instead there is a small notch in the right side wall (Figure 93, 6, fig. 7, 6) which might be where the handle of the bar struck when the bar was pulled. Two holes facing each other in the upper half of the door are blocked with cement (Figure 93, 1 and 2) and two additional ones facing each other are under them (Figure 93, 3 and 4). These holes suggest the positions of the hinges of the previous leaves. Moreover, there is a small piece of metal (Figure 93, 8, fig. 7, 8) in the lower half of the door facing a hole in the left side wall (Figure 93, 7, fig. 7, 7) indicating two lower hinges. Therefore, the original leaves might have had three sets of hinges and a bar to lock the door as indicated in Figure 94. Although a two-hinge door is more common in the medieval period, three hinges on some doors could be found sometimes.[375]

The reconstruction of the door in Figure 96 shows two layers of wooden planks, the outer layer is horizontal while the inner layer is vertical, as in boarding method 2 (Figure 1). Additional decorations on the wood such as carvings and false hinges may apply considering the importance of the chapel for the town. Long hinges are drawn according to their approximate positions as indicated by the evidences in Figure 93. The leaves are secured by a long drawbar and a lock and latch just like most medieval doors.

2.4.3. Windows

Originally six lancet windows lit the church. Window 12a.0.02 is exactly above the western door 12a.0.01, window 12a.0.08 is on in the apse, and windows 12a.0.03, 12a.0.13, 12a.0.06, and 12a.0.11 face each other on the northern and southern facades. Based on the examination of the preserved remains on their frames, seven simple horizontal bars and no more than four vertical bars were used as the method of closing bars (Figure 98, a).

Some notches in the intrados suggest the presence of a former saddle bar, an iron crosspiece that holds the glass panels to the masonry (Figure 98, b), as seen in many church windows in medieval France (Figure 25). Although no stained glass was found in the vicinity of the chapel,

[374] Deschamp 1973: 278.
[375] Yeomans, Harrison & Smith 2013: 741.

the use of glass for windows is attested to the middle of the 13th century at least. Many coloured fragments of windowpanes were unearthed from Crusader period sites such as Akko and Montfort.[376] Blue, red, amber, and white pieces of glass were also found outside the west door of the town church of ÝAtlÐt, which led to the reconstruction of the window from west end given in Figure 97. [377] Windows of Margat chapel would also have stained glass set in similar geometric patterns as the reconstructed window of ÝAtlÐt.

2.5. Conclusions

Conclusion regarding doors

First of all, studying the frame types and closing systems present in al-Maqab Castle revealed that there are no specific types for any main construction periods. However, certain observations are worth mentioning.

Certainly, the majority of doors has a pointed arch or one of its variants (Figure 99), and although this type of arch is considered the logical development of the Romanesque's movement,[378] it is also a recognized Arab work.[379] Rhené-Spiers believes that the Western monuments and elements most analogous to those of the Crusades are to be found in southern Italy and Sicily so the pointed arches are of Sicilian inspiration.[380] However, modern scholars affirm that Sicily and Spain might have served as an intermediary for the introduction of several Muslim features in Europe, including the pointed arch.[381] In addition, the four-centred arch, a variant of the pointed arch, is also used in some doors; for instance, in doors 2.0.02 and 13a.1.04. This type of arch is also used in Islamic architecture, most commonly in Muslim Spain and Egypt. [382] It was common in Abbasid architecture as well, such as in QaÒr al-ÝÀshiq in Sammara and in the Baghdad gate built by the Abbasid Caliph al-ManÒÙr in Raqqa. It became more pointed in Fatimid architecture, such as in Cairo's al-Aqmar Mosque, and was called a keel arch after the year 1100.[383]

[376] Ganor 2015: 668-671.
[377] Johns 1947: 79-80.
[378] Corroyer 1893.
[379] Boase 1977: 74; Boas 2010: 33; Hill 1993: 223.
[380] Rhené-Spiers 1905: 209.
[381] Draper 2005: 17.
[382] Bloom & Blair 2009: 67, 149.
[383] Bloom & Blair 2009: 109; Darke 2020: 205.

Doors with straight lintels are primarily found in the church and doors leading to stairs, such as 14e.0.01 and 11b.0.01, as well as smaller doors like 31.0.01 and 30c.0.01. Finally, in addition to the mentioned doors, others, such as 3.0.04, 5.0.03, 5.0.09, 13.0.07, 14b.0.01, 14k.2.01, and 135.0.06 are either too damaged or completely restored to be classified.

Superimposed arches come in two types: one with larger ashlars displaying alternating colours such as door 1a.0.01, and another with smaller white ashlars such as door 8.0.01. For all doors featuring superimposed arches of the second type, there is evidence of both closing systems, hinges and pivots, even though they may not be located in the same place in the castle. At some points, all of the doors with superimposed or double arches had pivot leaves.

In regard to the closing systems, we can also conclude that most of the door leaves were pivoted (Figure 100), except for smaller doors like 31.0.01 and 30c.0.01. This type of doors can be installed either by fitting the pins of the leaf into holes in the threshold and under the lintel, or by fitting them into separate upper and lower stone gudgeons. The latter is especially done in greater doors. Furthermore, several doors had hinged leaves. They manipulated the leaves easier by eliminating the friction of heavy wooden pieces and keeping the boards together while ensuring the rotation.[384] Finally, some doorways seemed to have had pivot leaves in the first place replaced by hinged leaves in later times as they have breakouts in the side walls indicating the presence of former hinges and the presence of holes on both ends of the inner arch of the door indicating the presence of former upper stone gudgeons.

It is evident that there has been a change in the closing system within stretch 8-11a. Most of the doors in this area show indications of both pivot doors and hinged doors. It is likely that the entire structure existed from the beginning, with some alterations, such as the partitions inside, possibly added at a later time. The triangular area between the cisterns (13) and the refectory complex (15, 18) appears to have undergone some alterations, as indicated by the changes made to doors 13b.0.01 and 15.1.02, which show indications of both closing systems as well. Moreover, the majority of hinged doors are situated on the second floor of the donjon (14f.1) and its adjacent room (13a.1). The only doors that seem to have both closing systems on the same level are 13a.1.03 and 13a.1.04, possibly due to initial damage caused by a fire. This suggests that hinges were predominantly introduced during the second construction phase of the Hospitaller period. In contrast, pivots were largely used in the first construction phase of the Hospitaller period, such as

[384] Touzé 2009: 44.

in the inner gate-tower complex (1) and the church (12). Nevertheless, pivots continued to be used, albeit less frequently, during the second period, as indicated by the doors of the cisterns (13.0).

Conclusion regarding windows

All windows in Margat seem to have been closed with bars at first. Shutters are then added to secure the windows further. Smaller windows are closed only with bars with or without a pivoting shutter, but hinged shutters accompanied with bars were the most prevalent way to secure big windows, especially in the donjon (14b.0 and 14f.1) and the adjacent dormitory room (13a.1) as indicated in Figure 101. The use of glass in windows was limited in the medieval period as it was expensive and not considered a fixture.[385] Boas affirms that the use of glass was limited to castles and churches in both Europe and the East.[386] Notably, in Margat, only the most embellished parts of the fortification could have used glass such as the church (12a.0) and the bishop's ward (43.0 and 44.

[385] Pickles, McCaig & Wood 2014: 8.
[386] Boas 2010: 43.

3. Crac des Chevaliers (QalÝat al-ḤuÒn)

3.1. History and Architecture

Crac des Chevalier, also referred to QalÝat al-ḤuÒn, is one of the best preserved castles from the Crusader period in the Near East. First mentioned as a military establishment, further fortified and settled by Kurds under the emir of Homs in 1031, it was henceforth known as ḤiÒn al-AkrÁd, which translates to the fortress of the Kurds. The Crusaders later adopted and transformed the word akrÁd, calling it "Crat'" or "Crac".[387] In 1099, the Crusaders captured it without opposition en route from Maṣyāf, and it became their stronghold until Raymond de Saint-Gilles, one of the leaders of the first Crusade, abandoned it.[388] In 1110, a Frankish garrison was installed there by Tancred of Antioch.[389] Two years later, he donated it to Pons, the count of Tripoli, along with ÓarÔÙÒ (Tortosa), ÑÁfÐtÁ (Chastel Blanc) and KharÁb Marqiyya (Maraclée).[390] The inability of its lords to restore their fortifications and protect this highly strategic region of the county against the Muslim invasions led to its donation in 1142 by Raymond II of Tripoli to the Hospitallers.[391] Between 1163 and 1167, NÙr ad-DÐn ZingÐ tried to conquer it twice.[392]

The construction of the current fortification began after the earthquake of 1170, which led to the erasure of all remnants of previous structures. It was then constantly enlarged until its fall in several clearly distinguishable phases. The vast project in this most strategic entrance to the northern Crusader states was sponsored by the Order himself and by donations like that of Andrew II king of Hungary in 1218 or the donation of the pope in 1255.[393] However, six years later, Sultan Baybars overcame the Mongols in Syria, seized power in Egypt, and launched a total war against the last Christian places.[394] On 3 March 1271, Baybars and the Mamluks began the last siege of the fortification and took it. The Hospitallers retired to Margat, the last Crusader place in the country.[395] The Mamluks repaired the damaged parts and added to the castle until the beginning

[387] Rey 1871: 39.
[388] Deschamps 1934: 113
[389] SibÔ ibn al-JawzÐ: 537, 539; Gibb 2012: 90.
[390] Gibb 2012: 127.
[391] Deschamps 1934: 116-117.
[392] *Ibid*. 118-120.
[393] *Ibid.* 130.
[394] *Ibid*. 130-131.
[395] Al-MakrÐzÐ: 85.

of the 14th century.[396] These were the last real additions to the castle. Crac des Chevaliers served as a military garrison throughout the Middle Ages but was eventually abandoned in the early 19th century. Village dwellings settled there by the end of the 19th century. However, during the French mandate in 1927, the French administration proceeded to evacuate the site, clearing the lower parts, and undertaking other restorations.[397]

The castle is 300 meters long and 140 meters wide. Its oval shape is defined by a row of towers along its southern border and a ditch. This architecture was specifically designed to protect the southern front, which is comparatively exposed to opposing weapon fire. The concentric castle has two enclosures, the results of different campaigns. The outer one was established on a rocky promontory, likely natural, which emerged at the end of the spur. The inner one was created around the primitive site holding now the church and the Chapter House among other buildings.

Construction periods

The established periodization of Crac des Chevaliers can be categorized into four primary Frankish periods (Franc 1, Franc 2, Franc 3, and Franc 4), as well as two Mamluk periods (Mamluk 1 and Mamluk 2). Additionally, there are elements introduced during the Ottoman and modern eras that have impacted the castle's layout. This periodization framework is based on the research of Jean Mesqui, as documented in his book "Le Crac des Chevaliers: Histoire et Architecture".[398]

Franc 1: It mainly resulted in the construction of the inner castle which was a towered enclosure with vaulted ranges running on its inner side. This is suspected to have had an outer wall making it an early example of a concentric castle and also had two additional baileys, one on the eastern and another one on the southern side. Notable elements include the outer walls of the old stable situated to the east of the castle (108),[399] sections of the southern walls of the outer castle like parts of the southern wall of the southern stable (132),[400] and the wall extending to room 103, which includes door 104.0.01.[401] Furthermore, it encompasses the majority of walls within the inner castle, with exceptions being the stairs attached to the western façade of the church,

[396] Biller et al. 2006: 374-378.
[397] *Ibid*. 378.
[398] Mesqui 2018.
[399] *Ibid*. 117, 120.
[400] *Ibid*. 156, 157.
[401] *Ibid*. 109.

esplanade 4b, the northern latrine tower 16a, and the Chapter House (18) and its gallery (19).[402] This includes the church building itself, in conjunction with the northern wall of courtyard 41 on the second floor,[403] as well the upper section of the main gate tower entrance which include rooms 28 and 29.

Franc 2: Firstly, it entailed reinforcing the walls of the existing old stable (108), resulting in increased thickness of the inner walls. [404] Additionally, a new stable (132) was introduced in the southern section of the castle. [405] Other significant architectural developments included the construction of the latrine tower 16a,[406] the creation of esplanade 4b in the inner courtyard,[407] and the installation of stairs fixed to the western façade of the church.[408]

Franc 3: Key features of this phase include the construction of the Lion tower (128)[409] in conjunction with rooms 126c and 126b, where the specific window 126c.0.01 is located and discussed in detail (Figure 120).[410] The commander tower 39, along with towers 36 and 49, were also erected during this phase. [411] Notable elements further include the installation of door 2b.0.01,[412] the development of rooms 26, 27, and 30.[413] The northwest outer wall, including the first level of tower 137, along with towers 139b, 141a, 143a, 145, and 147, were also part of this construction phase.[414]

Franc 4: This phase includes the construction of the gate tower 101. [415] Further developments in this phase involve the southwestern corner of the gallery located in the southern part of the castle.[416] The most famous addition during this phase is the Great Hall (18) and the adjacent Gothic gallery (19).[417]

[402] Mesqui 2018: 246-297.
[403] *Ibid*.
[404] *Ibid*. 120.
[405] *Ibid*. 156.
[406] *Ibid*. 304-308.
[407] *Ibid*. 309-312.
[408] *Ibid*. 261-263, 268.
[409] *Ibid*. 228-237.
[410] *Ibid*. 129-131.
[411] *Ibid*. 322-344.
[412] *Ibid*. 314.
[413] *Ibid*. 354-357.
[414] *Ibid*. 192, 195-197.
[415] *Ibid*. 102, 106-107.
[416] *Ibid*. 136-144.
[417] *Ibid*. 359-373.

Phases Franc 3 and Franc 4, representing the final period of the Hospitaller additions, include several structures for which we are uncertain about their precise classification. Notably, these structures encompass the shooting galleries surrounding the southern and western sides of the inner castle 3b, 14, and 40.[418] Rooms 42 and 44 as well as the arrow slit space 41 bare also Hospitaller work.[419] In the outer castle, the eastern wall of arrow slit room 125 and the adjacent toilets 124b,[420] as well as certain portions of room 126b[421] were built during the Frankish period.

Mamluk 1: The Mamluks fortified the eastern part by adding arrow slits room 102 and the adjacent tower 103,[422] as well as arrow slits room 125.[423] Furthermore, the Mamluks implemented alterations in the northern section, notably transforming tower 47 from its original rectangular shape into a rounded one and introducing arrow slits to both its sides, which corresponds to structures 115 and 116.[424] The most important additions were made in the southern side of the castle where Baybars Tower (135) was erected,[425] and tower 130 featuring a southern gate (130.0.02) providing access to the exterior.[426] The internal wall of corridor 138 was also added.[427]

Mamluk 2: The last additions to the castle include the establishment of a *hammam* in the southeastern corner of the castle,[428] and the creation of a northern postern (115.0.02) providing access to the exterior.[429] Moreover, this phase involved the addition of tower 151, complete with arrow slits, as an expansion to the main entrance to the inner castle,[430] as well as the construction of the ramp entrance 152.[431] Finally, a square tower (133), known as QalÁwÙn Tower, in the middle of the southern outer wall was built.[432]

[418] Mesqui 2018: 314, 318-319.
[419] *Ibid*. 299-303.
[420] *Ibid*. 126-128.
[421] *Ibid*. 126, 129-131.
[422] *Ibid*. 102-106.
[423] *Ibid*. 126-127.
[424] *Ibid*. 206-209, 218.
[425] *Ibid*. 160-163.
[426] *Ibid*. 178-179.
[427] *Ibid*. 198-200.
[428] *Ibid*. 144-150, 402.
[429] *Ibid*. 210-213.
[430] *Ibid*. 228, 239-240.
[431] *Ibid*. 240-241.
[432] *Ibid*. 184-186.

3.2. Doors

3.2.1. Typologies

3.2.1.1. Typology based on frame type

The 156 recorded doors and 19 recorded doorways in Crac des Chevaliers have four types of door frames, similar to those found in Margat. These include the straight lintel, pointed arch, segmental arch, and superimposed arches.

Type 1: Straight lintel

There are 74 doors with a straight lintel in the castle, it is the most frequent type of door frames used, especially in smaller doors. Some of these doors also have an arch on the interior side, for example, 19b.1.01, 20.0.05, 31.0.01, 32a.0.01, 32b.0.01, and 128.0.02.

Type 2: Pointed arch

The pointed or the ogival arch is also frequently used by the Crusaders and the Mamluk in the castle due to its structural efficiency.[433] There are 56 doors with a pointed arch. Naturally, doors with smaller dimensions such as doors 1b.0.01, 1c.0.01, 111c.1.09, 132.0.08, 136.0.01, and 137.1.09, have the most pointed arches whereas greater doors, such as 1a.0.01, 17b.0.02, 19.0.06, and 101.0.01, are less pointed.

Type 3: Segmental arch

With its centre below the springing line,[434] the segmental arch of doors can be rounded or pointed. Ten doors have a rounded segmental arch (11.0.01, 19.0.09, 31.0.02, 34.0.02, 34.0.06 49.0.01, 49.0.02, 49.0.04, 118.0.07, 125.0.10, and 153.0.01), and only seven have a pointed segmental arch (2a.0.05, 13.0.04, 17c.0.01, 40.0.01, 111c.1.03, 111c.1.06, and 114.3.04).

Type 4: Superimposed arches

There are only seven doors endowed with two exterior arches and they are all pointed. Doors 13.0.01, 17a.0.01, 20.0.01, 22.0.01, and 125.0.01 are very similar with the outer arch embossed and the inner one set at the same level of the door.

[433] Fai & Rafeiro 2014: 124.
[434] Fleming, Honour & Pevsne 1998: 20.

Moreover, door 51.0.03 is endowed with two sets of voussoirs alternating light and dark stones. Similarly, entrance 101.0.01 has also two sets of voussoirs, one consisting of light stones and the other of dark stones, in addition to engraved Arabic inscriptions. The only doorway with three arches is 114.1.01. The stones of the arches are made of white ashlar limestone except the outer one which is made of smaller black basalt stones.

The shape of two doors, 126b.0.01 and 155.0.02, cannot be determined. Door 126b.0.01, which might have had a pointed arch, is partially blocked when room 126 was added. Door 155.0.02 is too damaged to know its initial shape.

3.2.1.2.Typology based on closing systems

Three types of closing systems can be considered in Crac des Chevaliers: doors with pivoted leaves, doors with hinged leaves, and doors combining two closing systems. Moreover, the closing mechanism of a great number of doors cannot even be determined.

Type 1: Doors with pivoted leaves

Pivoted leaves are one of the most primitive types of doors and have been used since Greek Antiquity and can still be seen in many fourth and fifth century monuments in Syria.[435] Doors in Crac des Chevaliers can be closed with two leaves or one leaf depending on their size.

There are 23 doors with two pivot leaves, the smaller ones, such as 22.0.02, 103.1.03, 133.1.01, 135.0.01, 137.0.01, 138.0.02, 138.0.03, 138.0.06, and 155.1.04, have a hole on each end of the soffit or lintel to fit the dowels of the leaves. The bigger doors usually have two upper stone gudgeons to fit the pin of the leaves that rotate. However, many of these stones are missing today, and two big breakouts remain on each end of the doorway, such as in the case of doors 19b.1.01, 36.1.02, 103.1.01, 118.0.06, 119.0.10, 130.0.01, and 155.1.01. The other doors, 1a.0.01, 101.0.01, 103.0.01, 104.0.01, 127.0.01, 128.0.02, and 130.0.02, still have visible upper stone gudgeons.

Seventeen doors have only one pivot leaf. Similarly to those with two pivot leaves, a separate stone is sometimes installed to receive the dowel of the rotating leaf. This can be seen in doors 17a.0.04, 17d.0.02, 34.0.02, 34.0.06, 112a.0.01, and 132.0.08. In contrast, doors 3b.0.02,

[435] Viollet-le-Duc 1854-1868, "*vantail*": 346.

42.0.02, 46a.0.02, 46b.0.01, 126b.0.07, 126c.0.02, 126d.0.01, 133.0.01, 134.0.01, 134.1.01, and 135.0.02 have a simple hole cut in the lintel to accommodate the rotating leaf.

Type 2: Doors with hinged leaves

Hinges are long iron straps fixed to wooden boards using nails, with one end rolled into a knot to receive the pin. The pins are sealed in the masonry for the rotation of the shutter, as well as for its reinforcement. Several doorways still have holes in their jambs indicating the presence of former hinges.

Breakouts on one jamb indicate the presence of a single leaf only. This is the case for 21 doors: 1b.0.01, 1c.0.01, 3b.0.01, 20.0.05, 28.0.01, 36.0.05, 36.0.09, 36.1.01, 36.1.03, 38.0.03, 49.0.03, 49.0.08, 112a.0.02, 112g.0.01, 115.0.02, 124b.0.01, 141b.0.02, 143b.0.01, 143c.0.02, 154.0.02, and 155.1.03. In most cases, there are two breakouts indicating the presence of two parallel hinges. However, three breakouts, as in doors 36.1.01, 38.0.03, 49.0.03, and 112g.0.01, suggest the presence of three hinges on the same leaf, which is highly unusual in the medieval period.[436] Furthermore, on the other jamb, a hole usually suggests the position of a padlock or a bolt that was used to lock the door.

If breakouts on both jambs exist, then two leaves were used to shut the door. This case is more prevalent in the castle, with 24 doors: 2a.0.01, 2a.0.05, 7.0.01, 8.0.02, 10.0.01, 12.0.01, 13.0.01, 13.0.04, 17a.0.01, 17d.0.01, 18.0.03, 18.0.06, 19.0.03, 19.0.06, 20.0.01, 20.0.17, 22.0.01, 29.0.01, 31.0.02, 39.1.02, 49.0.04, 125.0.01, and 141b.0.01.

Type 3: Doors combining several closing systems

There are 16 doors that combine the use of pivot leaves and hinged leaves at Crac des Chevaliers, due to the fact that the castle was built, occupied, and destroyed several times over its history. As a result, these doors have evidence of both breakouts on the jambs indicating the position of former hinges, as well as holes that receive the dowels of the wooden leaves. Whether there was only one leaf, as in doors 26.0.04, 36.0.02, 113.1.01, 114.2.03, and 143a.0.01, or two leaves, as in doors 31.0.01, 32a.0.01, 32b.0.01, 34.0.01, 39.1.07, 49.0.01, 49.0.02, 51.0.03, 108.0.01, 125.0.10, and 132.0.01, pivot leaves were most likely installed before the door was changed and its hinges were

[436] Yeomans, Harrison & Smith 2013: 741

added. Therefore, in many cases, such as doors 36.0.02, 49.0.02, 51.0.03, 108.0.01, 132.0.01, and 114.2.03, large holes towards the lintel can be seen where the upper stone gudgeons existed.

Undetermined closing systems

The closing system of 55 doors is unknown for several reasons represented in Figure 102:

- The remains in the frame and jambs do not give enough information to determine the former closing system, such as in doors 16b.0.01, 40.0.01, 40.0.02, 40.0.03, 111c.1.01, 111c.1.03, 111c.1.06, 114.3.04, 116b.1.02, 132.0.09, 135.0.04, 136.0.01, 137.1.09, 138.1.01 and 138.1.02.
- Many doors are too damaged, such as 2b.0.01, 2d.0.06, 11.0.01, 17c.0.01, 20.1.01, 20.1.04, 35.0.07, 42.0.01, 112f.0.01, 112f.0.02, 112i.0.01, 112j.0.01, 135.0.03, 141a.0.01, 143c.0.01, 153.0.01 and 155.0.02.
- Several doors were recently restored and the original stones that carry the evidence of the past closing system were replaced, such as in 39.1.03, 46a.0.01, 46a.0.05, 116b.0.07, 121.0.01 and 122.0.06.
- It is impossible to determine the closing system of blocked or partially blocked doors, such as 2d.0.03, 7.0.02, 105.0.01, 126b.0.01 and 128.1.04.
- Many doors seem not to have been closed from the beginning, thus having no original leaves, such as in doors 3a.0.02, 17b.0.02, 17b.0.04, 19.0.09, 111b.0.01, 111b.1.01, 111b.1.02, 111c.1.09, 111d.0.01, 118.0.07, 151.0.07 and 151.0.09.

3.2.2. Missing doors

The castle still has many doors that do not exist completely today because the building that held them was destroyed intentionally or unintentionally. Some remaining parts of these doors, such as the frame, the threshold, or evidence of their closing systems in the stone, may help locate destroyed walls or structures. For example, several thresholds can be found on the premises of the castle. Examples of partly preserved stone thresholds are displayed in Figure 104, but other thresholds can be found on other levels, such as in doorway 39.0.01 on level 4 (Figure 105). Although their lengths cannot be determined, they clearly held pivot leaves because a cavity on

one end is preserved. The rotation of the leaf was ensured by the vertical pivoting of the leaf on its own axis by using dowels or pins set in the wood, which enter the cavities in the threshold and in the lintel. These thresholds indicate the presence of previous walls in the esplanade 4b, room 17d, and corridor 14. Moreover, other missing doors are located on the western outer wall, which originally had two floors. The first floor is endowed with arrow slits niches but probably had other functions in the Ottoman and modern periods. The doors of the second floor, completely damaged today, still have their frames or thresholds visible and indicate the presence of a previous mezzanine (Figure 106).

Some places, such as arrow slits and pointed arch doorways in galleries, did not have leaves, but instead had panels or wooden barriers. Although these are missing now, evidence of their presence can be found in holes and breakouts in the intrados of arches or side walls (Figure 103). Examples include 9.0.01, 9.0.02, 113.1.06, 114.2.02, 113.1.07, 114.1.01, 114.1.03, 114.2.01, 118.0.02, 118.0.03, 118.0.05, 118.0.04, and 119.0.13. This is particularly plausible in buildings 113, 114, and 119, as their galleries appear to open onto "nowhere," suggesting the presence of a mezzanine, similar to building 140 (Figure 106). The possible reconstruction of these doorways will be discussed below, but there are also larger doorways, such as 23.0.01, 23.0.04, 35.0.01, 38.0.01, and 39.0.01, which may have had closings in the past, particularly 39.0.01, where the threshold of a door on the left end can be seen (Figure 105). Additionally, many arrow slits appear to have been used as rooms for one defender. Most of them are located inside a vaulted niche wide enough to accommodate a small room, with side walls featuring two or three holes where the closing barrier would be fixed, similar to the aforementioned gallery doorways. They were probably used as rooms when the castle became overpopulated. Whether talking about doorways or arrow slits, the missing closings could have been wooden panels reinforced and fixed with rods that enter the jambs and intrados of the arch, or simple bars fixed in the side walls. Arrow slits that could have been used as rooms are 3b.0.04, 3b.0.05, 3b.0.06, 3b.0.10, 36.0.10, 36.1.08, 49.0.09, 130.0.03, 138.0.08, 138.0.09, 138.0.10, 138.0.12, 138.1.14, 138.1.15, 139b.0.02, 139b.0.03, 141a.0.02, 141a.0.03, 141a.0.04, 143a.0.03, 143a.0.04, 155.0.05, 155.0.07, 155.0.10, and 155.0.11. Their locations, along with the locations of doorways that may have had closing systems, are represented in yellow in Figure 107.

The same figure also shows the movement inside the castle, from inside to the outside, and the relationship between the rooms. The opening directions of the documented doors are indicated

by the arrows. It is important to note that the tip of the arrow indicates the outside, therefore the door leaf or leaves open to the inside, on the opposite side of the tip of the arrow.

3.2.3. Reconstructions

The galleries

Galleries 13, 14, and 118 all have holes or breakouts in the jambs of the arches, but not all of them have the same position, size, or number. It is not possible to determine their dating, but certainly, they determine the locations of fixed elements added after the construction of the galleries. The arches of buildings 13 and 14 have a common feature, which is two breakouts facing each other in the intrados (Figure 108). The holes are generally neatly cut, and their shape suggests that the shape of the inserted element followed that of the arch. Therefore, it is possible that the upper part of these galleries was filled with a perishable element such as wood. Filling the arch of doorways, whether big or small, is common between the 12th and 14th centuries, especially in France and Italy. Documentations of filled arches of doorways are rare in military architecture, but can be seen in many domestic buildings, such as the ones highlighted in blue in figure 109. These include not only wooden elements but also metal and glass insertions.

The most common location of holes in the doorways of galleries 13, 14, and 118 is close to the floor on both ends, which suggests a kind of banister like the ones seen in green in Figure 109. These "banisters" are also seen in many medieval depictions and manuscripts such as in Folio 356v in "*Facta et dicta memorabilia*" of Valerius Maximus (Figure 13). The only exceptions are 114.1.01 and 114.2.02. The doorway 114.1.01 might not have had any insertion to prevent passers-by from falling because it was located on the ground floor. In that perspective, the *Hammam*, which was built after most of building 14, must have been already built when elements were added to the galleries. Therefore, these elements were either inserted during the Mamluk period or after it.

Moreover, the quantity and positions of the holes are dissimilar, suggesting that banisters were destroyed and rebuilt several times. Sometimes they are on the inner side, and other times on the outer side. Figure 110 shows the example of 113.1.07 with the position of its breakouts. Points "a" are the ones located on the intrados and would indicate the position of the element that fills the arch, and points "c" are where a banister would be fixed. However, there are additional points "b" that exist on both inner sides of 113.1.07 and similar breakouts are seen in 114.2.01 and 119.0.13 (Figure 108).

128.0.02

Made of large tabular bossage stones, this door, referred to as the "Lion Tower" door, is named for the two carved lion figures head on the exterior of the tower. It is a prominent feature of the castle and one of the best-preserved parts. The three-story structure is located in the east of the castle complex and is connected to the inner ward by a bridge. It is believed to have been used as a defensive structure, with arrow slits for archers and a machicolation for dropping projectiles on attackers (Figure 111).

The door was designed to provide a high level of security for the castle. Therefore it has to have boarding method 5 (Figure 2). On the interior side, two upper stone gudgeons, almost perfectly intact, helped rotate the two leaves of the gate. The lower stone gudgeons are higher than the current floor level, indicating that the original height of the leaves was around 330 cm. A bar-socket is set into each side wall to accommodate the bar that locked the door. The right one is 23 cm deep, but the left one is blocked, making it impossible to determine the length of the bar. Nonetheless, the distance between these bar-sockets and the door suggests that the thickness of the leaves was probably around 17 cm. In addition, the leaves were certainly reinforced with nails, similar to any common castle gate, to withstand intruders. This is apparent by the nail imprints on the stone that cover the entire area of the leaves (Figure 112, left). By counting the imprints, there were about 1500 nails with a diameter of about 3 cm, but we cannot know the exact quantity because not all nails are visible. It is likely that they were pyramidal or pointed due to their strong marks. From the exterior side, the entrance was protected with a portcullis and a series of three square machicolations (Figure 111). Between the carved lions, a square window is pierced to monitor the surroundings and to control the machicolation and the portcullis. The whole tower is believed to date from the third Frankish period, constructed around the beginning of the 13th century. According to the local information, a possible reconstruction of 128.0.02 was created (Figures 112 and 113).

To summarize, one leaf of 128.0.02 was around 330 cm high, 160 cm long, and less than 17 cm thick. The lower stone gudgeons suggest that there was probably one step on the interior side and two steps on the exterior side. On the interior side, the leaves rotated with the help of upper and lower stone gudgeons and remained closed with the help of a bar-lock and a bolt lock that assisted the draw bar. The left bar-socket accommodated most of the length of the bar, but the right one was larger in height due to the stone being worn away by the continuous pulling and

pushing of the bar. The illustrated reconstruction of figure 112 shows the draw bar in an opening or closing position, not in a resting position. In addition, the leaves were likely made of several intersecting layers of wood to strengthen the door, especially since their total thickness is about 17 cm. From the exterior side, the door was protected by three machicolations and a 15 cm thick portcullis, which was most likely made of welded or riveted iron bars because they were more durable than wooden bars and less susceptible to fire. As seen in the reconstruction of figure 128, the pivot leaves of the door were possibly reinforced with metal sheets and pointed nails that left strong marks on the stones. This setting resembles the one of the leaves of the castle of Salses-le-Château in France,[437] or the outer gatehouse of Durham Castle.[438]

17a.0.01

When Deschamps cleared the right side of the Great Hall in the 1920s, a large hinged door, now coded as 17a.0.01, emerged opening into the 120m room.[439] Hinged doors are the most common type of doors in this castle (Figure 123), but the metal elements of almost all of them do not remain at all because they were either stolen or removed. Metal elements that still partly exist are in doors 10.0.01, 36.1.03, and 49.0.01. However, the pin of door 17a.0.01 is almost intact and is located in the lower side of its right jamb (Figure 116). This is probably due to the fact that it was blocked and hard to reach before Deschamps cleared it. This element, along with three holes, gives us the accurate positions of the former hinges.

The pin is around 56 cm from the threshold and is attached to the wall to receive the strap which rolled into it and was fixed to the leaf for its rotation and reinforcement. The straps are definitely covering more than half the length of the leaves to be able to rotate them easily as they are 119 cm long each. The distance between the pin (Figure 116, right) and the hole above it is around 220 cm, thus the distance between the straps of the hinges would be no more than 220 cm. In addition, two bar-sockets are visible in each jamb to accommodate the bar that used to lock the door. These 16.5 cm square sockets are about 6.5 cm from the door frame and are located above the end side of the lower pins, which suggests that the iron straps were not "sandwiched" between two sets of wooden boards but were simply attached to the inner and outer sides of the leaf (Figure

[437] Touzé 2009: 264-269
[438] Burton 2010: 251.
[439] Deschamps 1934: 215.

114) as seen in their possible 3D reconstructions (Figure 115). This reconstruction is done according to boarding method 2 (Figure 1).

3.3. Windows

3.3.1. Typology based on closing systems

The research study in question documents a total of 97 windows, which have been classified into five distinct categories based on their closing system mechanism. These categories include windows with bars, those that incorporate both bars and glass, pivot shutter closures, hinged shutter closures, and a combination of hinged and pivot shutter closures.

Type 1: Windows with bars

Twenty-two windows, designated as 2b.0.02, 2c.0.02, 2c.0.03, 2d.0.04, 3b.0.03, 7.0.03, 19a.1.01, 20.1.02, 26.0.05, 32a.0.02, 32b.0.02, 32b.0.03, 36.0.07, 36.0.08, 39.0.02, 51.0.02, 51.0.04, 126b.0.05, 128.0.01, 138.1.01, 151.1.01, and 155.0.12, are characterized by the use of bars as their means of closure. An examination of the windows in question reveals no evidence of past shutter or glass closure mechanisms, likely due to their relatively small size.

Type 2: Windows with bars and glass

Only six windows are confirmed to have employed glass as their primary means of closure. It is possible that there were additional windows with glass closures, however, the lack of evidence in the present day suggests that these windows may have been altered or restored, effectively obscuring any remnants of the original glass closure mechanism. The majority of the windows with glass closures at the study site are located in the chapel and are designated as 20.0.09, 20.0.19, 20.0.20, 20.0.21, and 20.0.22. Furthermore, a close inspection of window 42.0.06 reveals the presence of holes for saddle bars, suggesting that it may have once had a glass panel.

Type 3: Windows with hinged shutters

Just like in doors, positioning of hinges for shutters in windows can often be inferred from the presence of breakouts in the window jambs. In this castle, the number of shutters employed in a given window is dependent on its size, with some windows featuring a single shutter and others employing two. The majority of windows with shutters at the study site are equipped with two, with a total of 14 such windows, designated as 8.0.01, 18.0.05, 18.0.08, 18.0.11, 19.0.02, 19.0.04,

19.0.05, 19.0.07, 19.0.08, 36.0.03, 36.1.05, 36.1.06, 39.1.05, and 49.0.07. In contrast, windows equipped with only a single hinged shutter are six and include 18.0.02, 18.0.04, 18.0.09, 39.1.06, 49.0.05, and 126c.0.01. It is likely that all of these windows were equipped with bars as well, however, evidence of their past existence is only present in a few windows, such as 18.0.09 and 126c.0.01, which exhibit apparent holes that accommodated the bars. It is worth noting that window 49.0.05 appears to have been equipped with three hinges, a configuration that is uncommon in this castle and in medieval sites more broadly.

Type 4: Windows with pivot shutters

Pivot shutters, which are comparable to pivot leaves, can be identified by the presence of a pivot hole located in the soffit or threshold, or both, of a window. This pivot hole accommodates a rotating dowel in the wooden shutter. Some windows have a single pivot shutter, while others have two. For example, windows that feature one pivot shutter include 26.0.02, 26.0.03, 46a.0.04, 51.0.05, 138.1.03, and 143a.0.02. On the other hand, windows that feature two pivot shutters include 19c.1.01, 34.0.04, 151.0.05, 151.0.06, and 151.0.08. Similarly to hinged shutters, not all windows exhibit bar holes in their jambs.

Type 5: Windows combining several closing systems

The presence of pivot holes in the threshold and lintel of some windows, as well as the evidence of breakouts in the jambs, suggests that the original window shutters have been replaced with new ones featuring a different closing mechanism. Some of these windows were capable of accommodating two shutters, such as 36.1.07, 39.0.04, and 49.0.06, while others had only one shutter, including 36.0.01, 36.0.04, and 128.1.02.

Undetermined closing systems

It is not possible to ascertain the method of closure for the remaining windows. Some windows, such as 12.0.02, 17b.0.01, 18.0.10, 19c.1.02, 35.0.02, 35.0.03, 35.0.04, 36.1.08, 51.0.01, 103.1.10, 111a.1.01, 111c.1.08, 113.2.01, 121.0.02, 121.0.03, and 152.0.02, have sustained such extensive damage that any remnants of their prior closure mechanism within their jamb frames are no longer discernible. Conversely, other windows, including 28.0.02, 29.0.02, 34.0.03, 34.0.05, 35.0.10, 46a.0.03, 128.1.03, 137.1.01, 138.1.05, and 152.0.01, have undergone recent restoration with new stone, thus making it similarly impossible to determine their prior method of closure. Finally,

windows 132.0.02 is blocked and windows 17d.0.03, 18.0.07, 19.0.10, and 116b.1.01 appear to have never possessed any closure system.

3.3.2. Reconstructions

42.0.06

The current state of this window is noteworthy due to the presence of visible remnants on its jambs, which suggest the prior installation of glass panels and bars. It should be noted that the overall condition of the window is poor and deteriorated, and some holes and breakouts are no longer visible. Nevertheless, the visible evidence on the frame appears to resemble the closing system commonly found in medieval church windows, which utilized bars and glass panels held in place by saddle bars within the stone frame, as illustrated in Figure 25.

The meticulous examination of this window reveals that it was approximately 69 cm in length and its current state reveals several holes on its jambs, as depicted in Figures 137 and 138. The evidence suggests that simple horizontal bars were utilized to secure the bay from the exterior, as evidenced by the placement of these bars in holes 2 and 2', 4 and 4', and 5 and 5', as shown in Figure 119 b. The presence of additional holes that are not aligned with 2, 4, and 5, leads us to conclude that the window was modified at some point and new bars may have been installed, such as in holes 1 and 3.

Furthermore, larger holes are present on the inner side, which likely served as the points of fixation for the saddle bars that held the glass panels. For example, one bar was fixed in holes c and c' and another in holes d and d'. These holes are 7 to 9 cm deep. The schematic installation of these bars and the panels they held are represented in Figure 119 c and Figure 119 d. The distance between the remaining stone that has hole 5' and hole f suggests that the glass frame was no more than 5 cm in thickness. Additionally, the black holes in Figure 117, specifically holes a, 3, and d, still contain remnants of metal elements. Finally, it must be noted that, due to the number of holes present and variations in their width, it is not feasible to accurately determine the precise width of the bars.

126c.0.01

This Frankish window features a carved stone in the shape of half a circle at its base. Mesqui postulates that this stone originally constituted a circular tank, but has since been broken and partially removed. Based on this evidence, he concludes that the stone was part of a bathtub with a seat and that room 126c served as a hygienic chamber.[440]

The accuracy of Mesqui's suggestion regarding the stone in the Frankish window remains subject to further investigation. Nonetheless, it is clear that the window was fitted with a shutter of approximately 78 cm in length, which was able to rotate via two hinges and remain secured in a closed position via a latch mechanism. This conclusion is supported by the presence of two indentations in the left jamb that indicate the former location of the hinges (Figure 120, left), as well as a small hole in the opposite jamb where the bolt extending from the door would have been inserted (Figure 120, right). It can also be noted that the Frankish window was fitted with five horizontal bars on its exterior. It is currently not possible to determine the number of vertical bars that were present. However, by measuring the distances between the horizontal bars, one can estimate a possible quantity of three vertical bars. The potential reconstruction of Window 126c.0.01 is depicted in Figure 121, wherein picture c illustrates the bars, and picture c displays the closed shutter, as well as the placement of the hinges, latch, and bolt.

3.4. Conclusions and periodisation

Conclusions regarding doors' typologies

Figure 122 reveals that the majority of doors in the castle have a straight lintel. As shown in Figures 103 to 105, most of these doors are small and located in levels 4 and 5 of the castle, specifically in the southern towers 36, 38, and 49 of the inner castle. Additionally, many doors on the first level of the western outer wall also have straight lintels, as seen in Figure 124.

With 57 doors, the pointed arch is the second most prevalent door frame used in the fortification. This type of arch can be found in the biggest doors, such as 1a.0.01, 17d.0.01 and 17b.0.02, as well as in the doors of the *hammam*. Additionally, many of the doors in the inner castle, particularly those leading to the inner courtyard, have pointed arches. This is also true for doorways in corridors such as corridors 119, 138, and 140, regardless of whether they were

[440] Mesqui 2018: 131.

previously closed or open. It is also worth noting that all superimposed arches in the castle are pointed and are located in the western and northern walls of the inner courtyard (as seen in Figure 125, top). The only exceptions are the entrance 101.0.01 and door 51.0.03, which are a unique type of double arches.

As mentioned before, segmental arches can be either rounded or pointed. Both types are rare in the castle, with the pointed segmental arch being mainly used in the last levels of the eastern towers 34 and 49 of the inner castle. In addition to the previously mentioned doors, 126b.0.01 and 155.0.02 are too damaged to be properly classified.

Although not much different in quantity, hinged leaves are overall more used than pivot leaves (Figure 123). There are 45 hinged leaves in the castle and most of them are located in the buildings around the inner courtyard as can be seen in level 3 (Figure 125, top).

Forty doors had pivot leaves. The leaves of most of the big doors, such as 101.0.01, 127.0.01, and 128.0.02, rotated with the help of upper and lower stone gudgeons. Smaller doors that have pivot leaves usually have holes cut in the soffit that receive the pins of the leaves; they are mostly located in the first two levels of the castle (Figure 124). Furthermore, the doors of the western outer wall all have pivot leaves as seen in level 2 (Figure 124, bottom).

Doors with both closing mechanisms, pivoted and hinged, exist mainly on the eastern part of the castle, especially on level 4 (Figure 125, bottom). Towers 39 and 49 also have their doors changed more than once and have hinged and pivot leaves used in the same doorways, as can be seen in level 5 (Figure 126). It is possible that some hinged leaves were added in the Ottoman period when the castle was still inhabited by locals.

Conclusions regarding windows' typologies

Among the various closing systems employed for windows in castles, bars have been found to be the most prevalent, with 21 windows utilizing this method (Figure 130). The majority of these windows are either high windows, such as those located above doors (designated as 2b.0.02, 3b.0.03, and 39.0.02), or arrow slits (such as 38.0.03 and 128.0.01), while some are more contemporary windows (such as 32a.0.02, 32b.0.02, and 32b.0.03).

Furthermore, in addition to bars, a number of windows also feature shutters as a means of closure. These shutters can either be hinged or pivoted, similarly to doors. Hinged shutters appear to be the most functional closing system employed in this castle, with a total of 19 windows

utilizing this method, while windows with bars and pivot shutters are found in only 11 windows (Figure 130). In particular, windows featuring two hinged shutters are particularly widespread, being employed in the windows of tower 36, as well as in the Great Hall and the adjacent gallery 19 (Figure 132). This is anticipated because the Hospitallers were noted for their frequent utilization of hinges in the leaves and shutters. In contrast to widespread usage, pivot shutters seem to have been employed sparingly throughout the castle, with the Mamluks being the primary users, as seen in building 151. Moreover, similarly to the doors in Crac des Chevaliers, some windows appear to have originally been equipped with one or two pivot shutters before they were replaced with hinged shutters, particularly in the southern towers 35, 36, 39, and 49 of the inner castle (Figure 134). This observation also holds true for the doors in the same towers, indicating that this area has undergone extensive alteration and redesign.

The presence of glass as a component in the castle is uncertain due to a lack of evidence for its utilization in the past, or potentially due to its deterioration over time. Only the windows of the church seem to have been fitted with glass, consistent with the typical usage in medieval chapels of the 12th or 13th century. Notably, window 42.0.06 deviates from this pattern as it appears to have been fitted with both bars and glass, making it a unique exception along with the church windows. This distinctive closure system will be subjected to further examination later. Moreover, while the number of windows with indeterminate closure systems is lower compared to doors with such systems, the reasons for their undetermined state are similar (Figure 131). Some windows have been severely damaged, rendering any remnants of their former closure mechanism unrecognizable. Others have undergone complete restoration, replacing the original voussoirs with new ones. Some windows appear to have never been equipped with a closure system, and one window has been permanently blocked.

Table 11 presents the distribution of the various closing systems utilized in the castle, as per its established periodization. It is evident from the data that a majority of the windows were constructed during the last Frankish period, particularly during the third period, where 31 windows were added. During this period, all windows equipped with pivot shutters were substituted with hinged ones, specifically windows 128.1.02, 36.0.01, 36.0.04, 39.0.04, 36.1.07, and 49.0.06. During the final Frankish period, the construction of the Chapter House and the annexed gallery was carried out, and all their windows were fitted with hinged shutters, highlighting the frequent usage of hinged shutters by the Hospitallers in window closures. Window 19.0.04 in the gallery of

the Great Hall has the most well-preserved hinges, even though they only exist as metal fragments in the side walls, indicating the former location of hinged shutters (Figure 132). It can be surmised that these metal fragments were component parts of hinge pins, much like the intact hinge pin of door 17a.0.01 (Figure 116). Remarkably, the Mamluk period saw limited window installations, and when present, they were either equipped with pivot shutters or simple bars.

Periodisation

The established periodization of the Crac des Chevaliers can be grouped into four main Frankish periods (Franc 1, Franc 2, Franc 3, and Franc 4) and two Mamluk periods (Mamluk 1 and Mamluk 2), in addition to the Ottoman and modern introductions to the castle plan. Naturally there were several lesser additions, and a main construction period could also have been executed in several phases. The typologies established during this research can confirm some aspects of this periodization.

Superimposed arches as indicators of Frankish building techniques

First of all, inspecting the distribution of frame and closing types on the maps of the castle reveals that the superimposed or double arched doors, 13.0.01, 17a.0.01, 20.0.01, and 22.0.01, are Frankish and can be found in the same wall that surrounds the northern and western sides of the inner courtyard, which dates from the earliest construction phase soon after 1170 (Figure 135). The only door with two arches that looks similar to the above-mentioned ones is 125.0.01, the doorway to room 125 above the eastern stable (Figure 135). Its frame type and voussoirs suggest it was also Frankish. Based on Mesqui's research, it is clear that the hall of the original eastern stable (108) was timber-roofed and its construction took place during the second Frankish period.[441] The construction of the upper floor (125) might have coincided with the construction of the eastern stable, but the form of door 125.0.01 suggests it was added later. This suggests the likelihood of two distinct construction phases as different phases could have occurred even within a single Frankish period. In the same room 125, the second entrance 125.0.10 is completely different: it is smaller and has a rounded segmental arch (Figure 136) therefore it was definitely not installed at the same time as 125.0.01. Its arch is made of a series of five voussoirs forming a

[441] Mesqui 2018: 120, 122-125.

gentle curve. Although slightly bigger, this shape is only seen in the castle in doors 34.0.02 and 34.0.06 on the fourth level. However they are post-medieval constructions.

Hinges and pointed arches as indicators of Frankish building techniques

In the inner castle, the predominant type of door is hinged and pointed-arched, including those featuring superimposed arches (as depicted in Figure 125, top, and Figure 128, top). The only doors exhibiting pivot leaves are located in the southern and western shooting galleries 3b, 14, and 15. Additionally, the majority of the doors in the last two levels of the castle utilize hinges, with the exception of the eastern part of level 4, comprising rooms 26 to 34, which possess diverse frame types and exhibit a heterogeneous mix of closure systems and frame types. The doors leading to the esplanade present a similar appearance (as depicted in Figure 138); they all feature a straight lintel, multiple steps, and have incorporated both pivot leaves and hinged leaves in the past. Internally, the doors can be classified into three distinct categories:

- The doors with a straight lintel 26.0.04 and 28.0.01 (Figure 137).
- The doors with a pointed arch 29.0.01 and 31.0.02 (Figure 137).
- The doors with a rounded segmental arch 34.0.02 and 34.0.06 of room 34 (Figure 136).

Although doors 26.0.04 and 28.0.01 are similar in size and shape, door 28.0.01 had hinges, indicated by the breakouts in its jambs, whereas door 26.0.04 had a pivot leaf that was later replaced with two hinged leaves. Additionally, they are made of different types of stones, indicating that rooms 27 and 28 were not built in the same period. Pivot leaves were infrequently employed during the Frankish period. However, in towers 36, 39, and 49, they were eventually replaced with hinged leaves. Based on this information, it can be inferred that door 26.0.04 dates from the same period as the doors in these towers. Furthermore, door 29.0.01 is definitely a Frankish work and is similar in appearance to doors 1b.0.01 and 1c.0.01, which were made during the first Frankish period. It has the same frame type and closing system as door 31.0.02, but is made of different types of stones, suggesting that 31.0.02 was added later to resemble door 29.0.01. Finally, doors 34.0.02 and 34.0.06 are found to be identical, exhibiting a characteristic rounded segmental arch and pivot leaves. This similarity is comparable to door 125.0.10 as depicted in Figure 136 but it is important to acknowledge that this similarity in design does not necessarily infer contemporaneous construction, as it is possible that the stones utilized in the creation of doors

34.0.02 and 34.0.06 originated from the Crusader period. It is noteworthy that door 125.0.10 shares a similar design with doors 49.0.01 and 49.9.02.

One of the doors that stands out on level 5 is 51.0.03 (Figure 139). It is similar to the window 51.0.01 next to it, but with two sets of voussoirs alternating light and dark stones, a technique called *ablaq* which is a decorative technique used in both domestic and military architecture. This door has had two upper stone gudgeons, as indicated by large breakouts on each end of the arch, and two hinged leaves, as indicated by two holes on each jamb facing each other. The other doors on the same level, such as those in towers 36, 39, and 49, mostly have straight lintels, except for the two entrances to tower 49, which have segmental arches.

Tables 10 and 11 were created to classify the number of each frame type and closing system according to their respective known periods according to past scholars. Table 10 shows that during the first two Frankish periods, the frames of the doors were mostly pointed. It wasn't until the third Frankish period that the straight lintel began to be heavily introduced. As for the closing systems, the Hospitallers primarily used hinges when installing their doors, as evidenced by Table 11. There were 41 hinged doors built by the Hospitallers and only 4 hinged doors built by the Mamluks. Furthermore, it is clear that the doors that appear to have both closing systems are those installed during the third and fourth Frankish periods, as well as during the Ottoman period. It is unclear when these adjustments were made, but certainly, it was the pivot leaves that were replaced by hinged leaves.

As the Hospitallers were the primary builders and main occupants of Crac des Chevaliers, most of the big doors, with lengths greater than 150 cm, were built by them (Figure 140). The only exception of a big doorway not installed during the Frankish period is the entrance door 130.0.02, built during the first Mamluk period. The majority of small doors, with lengths less than 90 cm, are related to the defense of the fortification, such as doors that lead to shooting galleries. However, they can also be doors for toilets, stairs, or the Mamluk bath (Figure 141).

Pivot leaves and straight lintels as indicators of Mamluk building techniques

Most of the doors in the outer castle, built by the Mamluks, had pivot leaves and straight lintels, similar to those in the Baybars and Qalawun towers. The only exception is the northern part of the western outer wall, between towers 141a and 145 (Figure 127, bottom), where hinges were installed. This suggests that the builders who worked on the outer wall before tower 141a, and

possibly before tower 139b, were not the same as those who worked on towers 141a and onward. Additionally, the only place where the Mamluks used pointed arches for doors is in the *Hammam*, which was clearly built in one phase, and in tower 130.

Based on the information provided by tables 10 and 11, the opposite of what was observed in the Hospitallers' case can be observed during the Mamluk period: in the first period, the Mamluks built most of their doors with straight lintels. In the second Mamluk period, the number of doors with straight lintels declined, and the number of doors with pointed arches increased. However, as mentioned before, most of the pointed arches were used in the *Hammam*, so it is reasonable to affirm that pointed arches were not a common feature during the Mamluk period. Furthermore, according to the periodization, the segmental arch is mostly used during the third Frankish period.

Pivot leaves were present throughout the centuries and were used by all groups who modified and expanded the castle. Nevertheless, table 11 shows that Mamluks used pivot leaves significantly more than the Hospitallers, who only installed them in small posterns or big entrances that have upper and lower stone gudgeons, such as 127.0.01 and 128.0.02.

Conclusion

This research focuses on the medieval Near Eastern buildings of the 12th and 13th centuries, when a unique architecture emerged by the synthesis of European and native architectural knowledge. It shows that closing systems are not mere protective barriers, but also indicators of the people who built them and the historical context in which they were constructed.

The research was structured into two parts, comprising a theoretical study, followed by a practical and fieldwork study. In the first part, the demographic origins of those who built in the Near East during the 12th and 13th centuries were established, revealing that most of the builders were from France and Italy. Consequently, an examination of sources about medieval closing systems of these areas was conducted. This included the analysis of the structure, types, main boarding methods, locking systems, and metal elements of medieval doors and windows. After that, historical sources were inspected, including medieval depictions and photographs, to gain a clearer picture of the construction techniques employed in the medieval period.

The second part of the research involved the selection of case studies for investigation. The case studies were chosen to provide a diverse representation within the scope of this research. They ranged from small churches to one of the biggest and most preserved Crusader castle, the Crac des Chevaliers. They also varied in terms of their builders, location, construction techniques, and size. The research also aimed to determine the probable origins of the builders of these case studies. For example, based on the acquired common features, the builders of Saint John Cathedral in Jubayl came from Grand-Est, Burgundy, and Provence, while the builders of Balamand Church in Koura were associated with the Cistercian Orders in southwestern France, specifically in the regions of Pyrénnées or Aquitaine. However, it is essential to note that establishing the precise origins of the builders was not the main objective of this research, and the findings in this matter only serve as a basis for further exploration in future studies.

The castles chosen for study were al-Marqab or Margat and the Crac des Chevaliers, as they are well-preserved examples of Crusader castles that offer a diverse range of medieval frame types. This led to the codification of all the doors and windows present, as well as establishing the spatial relationships between rooms. Also, it helped knowing the main types of doors and windows used in the Crusader Near East, and the reconstruction of some of these elements, which can serve as a reference for copying similar doors and windows of the same type. In the case of Crac des

Chevaliers, examining common patterns and features in the construction techniques of doors and windows aided in the periodisation of the castle. This periodisation resulted in three distinct conclusions: superimposed arches are indicators of Frankish building techniques, hinges and pointed arches are indicators of Frankish building techniques, and pivot leaves and straight lintels are indicators of Mamluk building techniques.

Despite sharing a common Crusader origin in the 12th and 13th centuries, both al-Marqab Castle and the Crac des Chevaliers occasionally demonstrate distinct architectural characteristics, particularly in doors. Al-Marqab, featuring a prevalence of pointed arches, has straight lintels as the second most prevalent frame. In terms of closing systems, the study underscores alterations over time, transitioning from predominantly pivot doors to the introduction of hinges during the second Hospitaller construction phase. In contrast, Crac des Chevaliers showcases a dominance of straight lintel doors, with pointed arches as the second most prevalent frame. The utilisation of hinged leaves surpasses pivot leaves, and the study identifies instances of both closing mechanisms coexisting, particularly on the second floor of the eastern part of the castle. Both castles share a common trend of alterations over time. The window analyses, on the other hand, reveal patterns in closure systems, with bars and hinged shutters being predominant in both castles.

This study also concludes that the function of a building and its location do not significantly influence the level of ornamentation on leaves and shutters. For instance, both military structures and ecclesiastical buildings may exhibit ornate leaves and shutters, even if surviving examples are scarce. The underlying goals, however, differ. In large structures frequented by prominent figures, such as the Crac des Chevaliers castle and Tartous Cathedral, ornamented doors can serve as symbols of economic and social power.[442] Weinryb emphasizes the enduring nature of materials as a means to immortalize the memory of those who erected such monuments.[443] In churches, the decoration and motifs on doors aim to make the heavenly kingdom palpable for the earthly-bound Christian viewer. Church doors, according to Arnold van Gennep, signify a direct rite of passage, where individuals unite themselves with a new world, marking the transition from the earthly realm to heaven.[444] Of course, when the church is more frequented and holds greater importance, both

[442] Bloch 1986: 100 -125.
[443] Weinryb 2016: 77 - 79.
[444] Van Gennep 1977: 20.

doors and windows have to be more secure and decorated. This can be observed when comparing the iron door reconstruction of Tartous Cathedral to the wooden leaves of Balamand Church.

It should be noted that the reconstructions created cannot be completely accurate due to the absence of surviving material evidence or prototypes of doors and windows in the region. Therefore, the reconstructions were based on an understanding of medieval architectural techniques as analysed and described in Part I of this research, and the examination of the surviving remains on frames and lintels, as elaborated in Part II. Moreover, due to the numerous medieval buildings in the Levant, it was not feasible to include all of them due to the limitations of time within the scope of the thesis. The findings presented in this study represent only a partial exploration of the medieval closing systems in the Near East. The whole subject can only be understood if surviving wooden leaves or shutters can be found in the Levant, and the medieval structures of the whole region were investigated. Nonetheless, this research serves as an initial step in the investigation of a relatively understudied aspect of medieval architecture, specifically the practices related to doors and windows in the Crusader Near East. The findings of this research contribute to the development of accurate reconstructions of medieval doors and windows, as well as a deeper understanding of their evolution in the region.

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