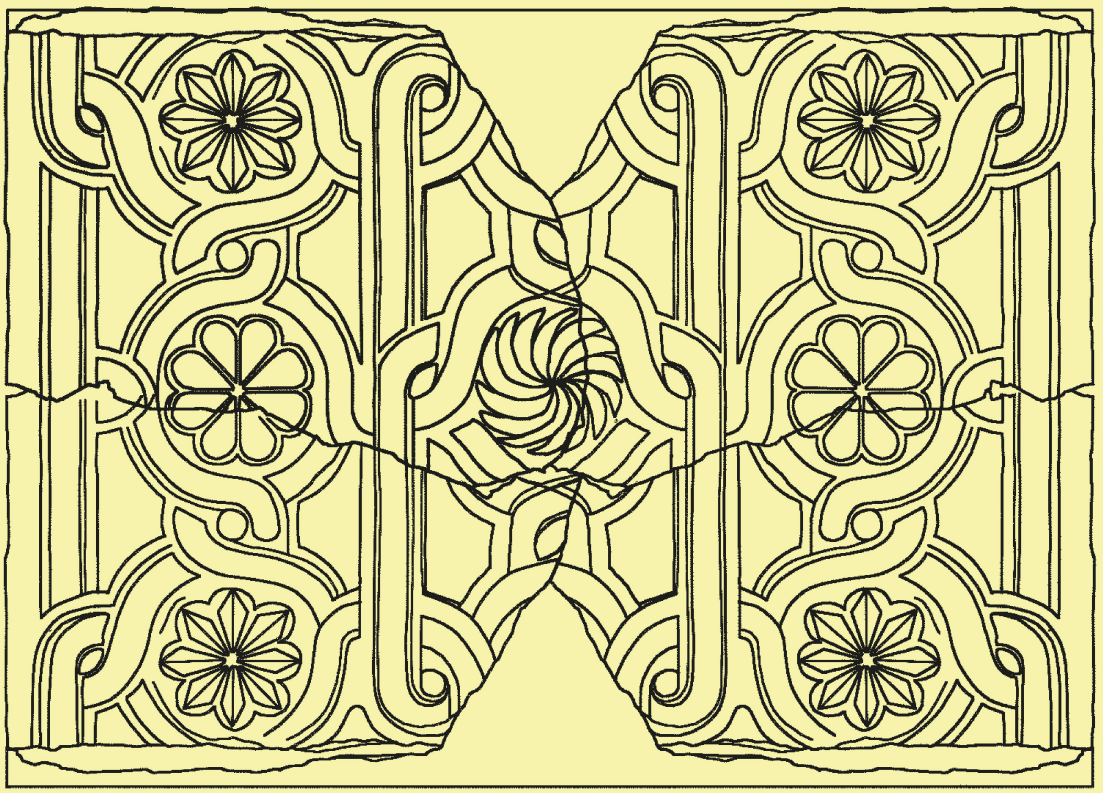
архитектурная археология

ISSN 2686-6900

architectural archeology

№ 6



Институт археологии
Российской академии наук

ISSN 2686-6900

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Главный редактор
Вл. В. Седов

№ 6

МОСКВА

2024

УДК 72.025.4:902/904(051)
ББК 85.11я5+85.118я5
А87

Учредитель: Институт археологии РАН

ISSN 2686-6900 DOI: 10.25681/IARAS.2024.978-5-94375-455-5
ISBN 978-5-94375-455-5

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On the use of spaces in the Hospitaller castle of Margat

B. Major

HTTPS://DOI.ORG/10.25681/IARAS.2024.978-5-94375-455-5.27-43

Abstract. The nearly two centuries of European presence in the Levant resulted in the erecting of some of the finest examples of 12th and 13th century military architecture in the contemporary world. Due to the lack of medieval sources and fieldwork the function of the spaces in these magnificent structures has been rarely researched in depth. Margat is one of the most important castles built by the Order of St. John and it has been the subject of a joint research program of the Syro-Hungarian Archaeological Mission since 2007. The archaeological works combined with various interdisciplinary research resulted in identifying the functions of a large proportion of the spaces in the castle and proposed hypotheses for most of the rest. The following article is summarizing the most important results.

Keywords: Margat, Crusader, Hospitaller, fortification, function of spaces, archaeology.

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FORTIFICATIONS defending the Crusader states were amongst the largest and most refined ones European architecture produced in the 12th and 13th centuries. Some of them survived in a very good state of preservation with various individual spaces that offer the possibility of an analysis about their original functions. However, this is not an easy task as medieval sources are usually scarce and often completely silent on this special aspect. Fortifications were also occasionally subject to remodelling and extension, which could result in the changing or relocation of different functions from one building to the other. Margat (Arabic Qal'at al-Marqab), one of the largest Crusader fortifications in the Holy Land, is a good example of a well-preserved site with almost no written sources on the use of its spaces. The architectural analyses and excavation work of the Syro-Hungarian Archaeological Mission since 2007 resulted in a vast amount of data with which attempts can be made to clarify the functions of the spaces inside the castle.

Overlooking the Via Maris, the main trunkroad of the Syrian coast from a volcanic spur rising above 360 m, Margat is the largest medieval fortification controlling this strategic communication line (fig. 1). During the Crusader times it was also the southernmost castle of the Principality of Antioch bordering the County of Tripoli and from after 1188 it was the main Crusader bulwark against the newly conquered Muslim territories to its north. Hisn al-Marqab, the "fortress of the lookout post" was established by a local tribe in 1062 (*Yāqūt al-Ḥamawī*, nd. V. P. 127) and was briefly taken by the Byzantines in 1104 (*Anna Comnena*, 2003. P. 365). The castle was already back in the hands of the local chieftains by 1109, when the Crusaders took the neighbouring town of Buluniyās (today Bānyās) which

• **Fig. 1. The map of the Crusader states in the 13th century indicating the position of Margat. By B. Major with the use of Google Earth**

• **Fig. 2. Aerial picture of Margat from the south. The plateau is occupied by the castle (*1*) and the inner suburb (*2*). The outer suburb (*3*) spread out on the western slope and the open cistern (*4*) is seen in the foreground of the castle. By B. Takáts**

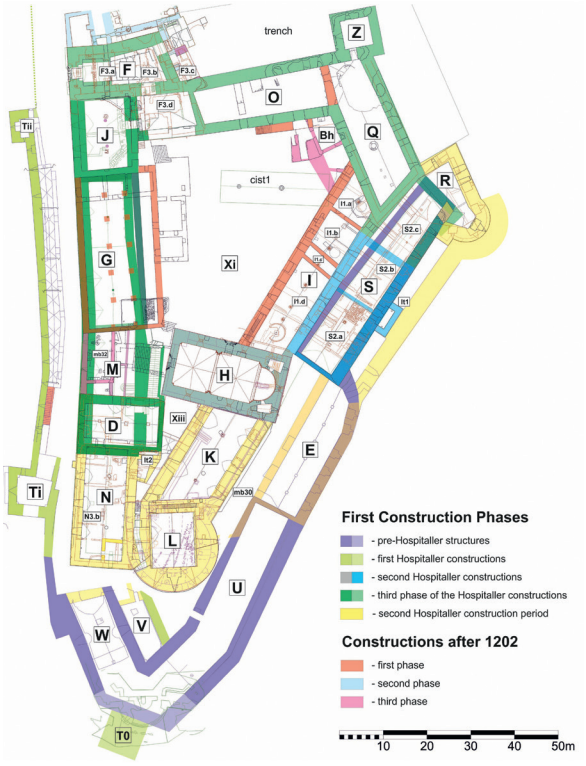
became the seat of a bishopric under the name Valenia. Roger, the prince of Antioch took al-Marqab in 1117/18 and according to the Arabic source had it garrisoned with Franks and Armenians (*Ibn ʻAbd al-Ẓāhir*, 1961. P. 85–86). Margat, as it was called by the Europeans, must have been retaken by the locals sometime in the 1130s as in 1140 it was taken by Renaud de Mazoir, the lord of Valenia (*Caffaro de Caschifellone*, 1895. P. 66–67). The Order of St. John bought all the Mazoir properties including Margat and Valenia at the beginning of 1187 (*Mayer*, 1993. P. 176) and developed it immediately into the headquarters of its northern possessions. After the campaign of Saladin the next year, Margat also became the most important Crusader border fortress against the Ayyubids and later the Mamluks on the northern Syrian coastal area. Muslim pressure had been mounting on the remaining Crusader territories during the second half of the 13th century and after the fall of the other large Hospitaller fortress of the Crac des Chevaliers in 1271, and the parallel loss of several outlying possessions, Margat remained the only considerable Hospitaller possession in northern Syria for another decade and half. The castle was taken by the army of Sultan Qalawun in 1285 *(Ibn ʻAbd al-Ẓāhir*, 1961. P. 77–81) after which the importance of the site slowly eroded, although its military use is sporadically attested to in the later sources.

As a result of the numerous fieldwork seasons it is clear that although Margat had developed into a considerable fortified site by the second half of the 12th century, the construction program following the Hospitaller takeover in 1187 erased almost all previous structures from the mountain plateau. The new Hospitaller fortress finally comprised three main areas. The castle of the Order covering an area of 1 hectare, the 5 hectare large inner suburb to its northern side and surrounded with the same ring of outer walls that encircled the castle, and the outer suburb on the western slopes of the mountain, which stretched on an area of approximately 10 hectares (fig. 2). The periodization study of the castle shows a clear construction sequence with all the main elements planned from the very beginning (*Major*, 2019) (fig. 3). It is not surprising that due to the grave situation of the Crusader territories after 1187, the newly acquired site of the Hospitallers had to be developed with special regards to two main points. The site always had to be defensible even through the construction process and financial limits had to be counted with too. In 1202 one of the most serious earthquakes in Crusader history struck the Syrian coast (*Mayer*, 1972. P. 303). The thorough documentation and analyses of the wall textures supplemented with the results of the excavations and the geological studies show that most of the Hospitaller castle was completed in two main construction periods before the great earthquake of 1202 (*Major*, 2019. P. 17). The first construction period saw the strengthening and extension of the outer walls of the former Mazoir fortifications. After the outer defensive ring was completed, the destruction of the outdated buildings of the Mazoir citadel began in the interior, which was followed by the construction of the new

Hospitaller castle in a third phase. This new inner ring comprised of large rectangular vaulted structures on the inner side of the enceinte. The second construction phase completed this new castle with the addition of a number of robust structures, at this time mostly by rounded outer facades, mainly on the southern side, which was the most exposed section to siege operations. This well-planned and fast construction activity took less than 15 years to complete as can be observed from the traces left by the earthquake of 1202 on its key element, the donjon (*Kázmér, Major*, 2010). Later constructions in the 13th century were done on a much lesser scale, but some textual and archaeological evidence indicates that the development of the site did not cease until the end of the Crusader rule. Margat had two large suburbs too, from which the inner one was sharing the same mountain plateau with the castle. While the Hospitaller castle occupied to the south one-hectare area of the triangular mountain top, the rest of the plateau to the north had a five-hectare large area encircled with the same outer ring of walls. To this an outer suburb was attached from the end of the 12th century at least on the western slopes of the mountain (*Major*, 2016). Its walls were connected to the fortifications above.

After 1285, the Mamluk owners kept using the fortifications on the mountain top and contributed with some additions and functions of individual spaces were changed occasionally (*Major*, 2023), but these did not result in serious alterations on the previous constructions. This means that despite some fluctuations, Margat is an appropriate site for the preliminary study of the use of spaces in the Hospitaller period.

The spaces and the functions. Although Margat is briefly mentioned in a number of historical accounts and several charters, practically no information is given on the individual buildings themselves, not to mention their functions. The most detailed description on the site was given by a Christian pilgrim Wilbrand of Oldenburg in 1212 with the following words: "This (Margat) is a large and very strong castle, fortified with a double wall, displaying in itself many towers, which seem more apt for sustaining heaven than for defence. For the mountain on which the castle is sited is extremely high, such that it holds up the high heaven on its shoulders like Atlas. Very broad at the base and rising gradually on high, it liberally furnishes to its masters each year five hundred and nine waggon-loads of render, which the efforts of its enemies cannot prevent, however often they have tried. This castle belongs to the Hospitallers and is the greatest support of all that land. For it is opposed by many strong castles of the Old Man of the Mountains and the sultan



• **Fig. 3. Plan of the castle showing the main construction periods and the codification of the buildings. By B. Major**

of Aleppo, whose tyranny it restrains and assaults it has held in check to such an extent that it receives from them each year for keeping the peace the equivalent of the value of two thousand marks. And because it is on guard lest any treason should occur, as can happen, each night it is guarded by four knights, who are brothers of the Hospital, and by another twenty-eight watchmen. For in time of peace in their outlay for defending the castle the Hospitallers maintain a thousand people over and above the other citizens of the castle, in such a way that they provide them with every convenience and necessity, [sufficient to supply] the castle with the necessities of life for five years. At the foot of that mountain is a city called Valenie, which although it was at one time larger — so it is said and as may be seen — through divine punishment is now desolate and destroyed. Its episcopal seat has been translated into the castle of Margat, this being on account of fear of the Saracens" (*Wilbrand of Oldenburg*, 2012. P. 69–70).

Margat was one of the most important fortifications of the Order of St. John and as such there were a number of standard buildings to be expected at a centre of one of the most powerful Military Orders of the Middle Ages.

• **Fig. 4. Digital reconstruction of the interior of the chapel looking east. By G. Buzás & Zs. Vasáros**

Such was the church, the chapter house and the main refectory with the necessary infrastructure for storing and cooking the food. Besides the residential quarters of both the commanders and the dormitories of the knights, the clergy and other staff, there must have had been a residence for the bishop of Valenia too, who relocated his seat from the town destroyed by the troops of Saladin to Margat, where he stayed until the fall of the site (*Rey*, 1883. P. 335). As Margat was also the largest settlement in the neighbouring region, the Hospitallers are expected to have had some kind of infirmary or hospital for at least the wounded members of their personnel. Storage facilities of the various weapons from crossbows to the trebuchets and stables for the horses were all essential in a fortification of such dimensions just to mention a few other basic requirements. Whether the actual number of the personnel supplied by the Hospitallers was really around 1000 as mentioned by Wilbrand the inhabitants of the castle and its suburbs had to be supplied by a highly developed water management system too. These can mostly be deciphered from the structural and archaeological analyses of the buildings in Margat.

The chapels. Every site of the Military Orders with such importance had to possess at least one sizeable chapel where the members of the Order could have fulfilled their religious duties. One of the earliest buildings of the Hospitaller castle was the main chapel building (H) that stands in the centre of the site (fig. 4). As most of the castle chapels it is a single-nave structure ending in a wide semi-circular apse that had a rectangular shape from the outside. On the two sides of the apse small individual chambers opened. The southern one that had a sizeable cupboard niche on its western end was the sacristy. The northern one was apparently a private oratory as it had a little window opening into the nave from where one could have a direct view over the mass. The oratory had its own wall painting program that was executed later than the murals in the main nave and the apse. The huge hall of the nave covering 18.9 × 10 m and ending in a 7.8 m wide semi-circular apse offered ample space for the religious practice of the knights and was adjusted accordingly. The main, neatly carved and decorated entrances of the chapel opened on the western front from the courtyard in front of the chapter house and on the middle of the northern wall into the main courtyard of the castle. The early church had a lesser, southern door too, opening from the eastern bay of the nave into what must have been a small courtyard in the early enceinte of the inner castle erected in the first construction period. It would be tempting to see this small courtyard as one reserved for the priests serving in the church. They might have had only temporary timber buildings here as during the second period this whole area was dismantled to give space for the extension and completion of the castle. This included a two-storeyed vaulted range, where the

upper storey seems to have been the dormitory of the knights. While the now non-functioning southern door of the eastern bay was walled up, a new one was cut further west in the same eastern bay. This was the entrance of a staircase leading directly into the dormitory. The northern wall of the eastern bay of the chapel also had a large niche covered by a pointed arch and opening at a height of roughly 1 m above the pavement of the chapel. This in all probability was a niche constructed for a sarcophagus which was more likely holding a relic than intended for a recent burial. The reliquary version is further strengthened by the fact that the wall surface between the niche and the triumphal arch of the apse preserved the remains of a drapery painting with palmettes composed into circles. Given the elevated position of this place emphasized by the extra decorative painting on its wall, it is not impossible that the bishop of Valenia had its seat here during the mass. It was bishop Anterius who had to relocate his seat to Margat in 1188. We also know from the documents that a discord developed between Anterius and the Order (*Burgtorf*, 2007. P. 37–38) which might explain why the centre of the large mural depicting hell on the southern wall of the eastern bay is occupied by the almost life-size depiction of a person wearing a Latin mitre. Being seated in front of the drapery painting Anterius would face the hell-mural with a Latin bishop in the middle of it (*Major, Galambos*, 2012. P. 28).

Geophysical survey of the chapel's floor and the excavations in some areas did not result in finding any burials in the chapel itself and the enormous medieval flagstones fixed by a thick layer of very strong mortar make it very unlikely that the chapel floor was ever intended to serve as such. However, it is not impossible that in the early Hospitaller period the area to the east of the northern gate served as the graveyard of the knights. Here, a medieval burial was discovered in 2011 adjacent to the northern wall of the chapel, now covered by the vaulted hall I1.d (*Major*, 2014b. P. 1–4). Excavations in the other main Hospitaller castle, the Crac des Chevaliers by the Syro-Hungarian Archaeological Mission in 2017 discovered a number of Crusader period burials carved into the bedrock in the foreground of the chapel too (*Rétfalvi*, 2019. P. 80–84). Later construction works in the northern foreground of Margat chapel might have resulted in the removal of these early burials into an ossuary and thus only those, not noticed during the "repositioning process" were left here.

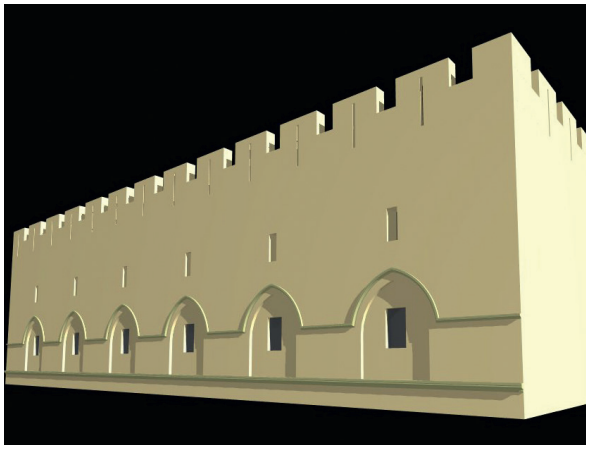
There was at least another chapel inside the Hospitaller castle, the traces of which are found in the area of the southern first floor hall of the western gate house complex (F3.d) (fig. 5). This, today almost

• **Fig. 5. Aerial picture of the castle from the north with the code of the main buildings indicated. By B. Takáts**

completely dilapidated area measured 10.8×9 m and from the scanty remains of the two capitals, evenly dividing up the length of the western wall and once being the bases for the springing of cross vaults, it is obvious that the space was covered by a cross-vault system of nine bays resting on four central pillars (*Buzás, Major*, 2014. P. 555). Refined buildings with such a delicate vaulting were rather rare even in the castles of the Military Orders and the existence of such a structure above the gate tower can give further support to its function as a chapel.

Excavations of the Mission in the northwestern area of the inner suburb in 2023 revealed several Crusader period graves with persons of various ages which might indicate the existence of a medieval chapel in the area heavily overbuilt by dry-stone houses in the Ottoman period. At the moment it is impossible to define with certainty whether this supposed church was a parish church of the early castle or possibly belonged to the Hospitaller period inhabitants of the inner suburb. It is also uncertain whether the three construction stones covered by mural fragments belonged to it, or to another chapel. In the outer suburb on the western slopes of the mountain of Margat (fig. 2) two small churches were excavated by the Mission, being adorned with murals. Both lay amongst civilian houses and the one to the north was encircled by a cemetery with tombs of both sexes, while the southern church was a double-apse structure. Given these facts it is most likely that they were parish churches serving the inhabitants of the outer suburb and none was directly serving the Hospitaller garrison of the castle above.

An area that must have served as the apse of a chapel and was constructed by the Order itself was identified in one of the eastern loopholes of the first-floor room of the coastal guard tower that overlooked the port of Margat. The mural fragment preserved on the vault of the loophole was deciphered as the upper part of a deesis scene, which was painted with very high-quality pigments, including lapis lazuli (*Márk*, 2019. P. 254–255). As it was looking east, it must have served as an apse for the garrison detached from the main castle and the frequent services in its main chapel.



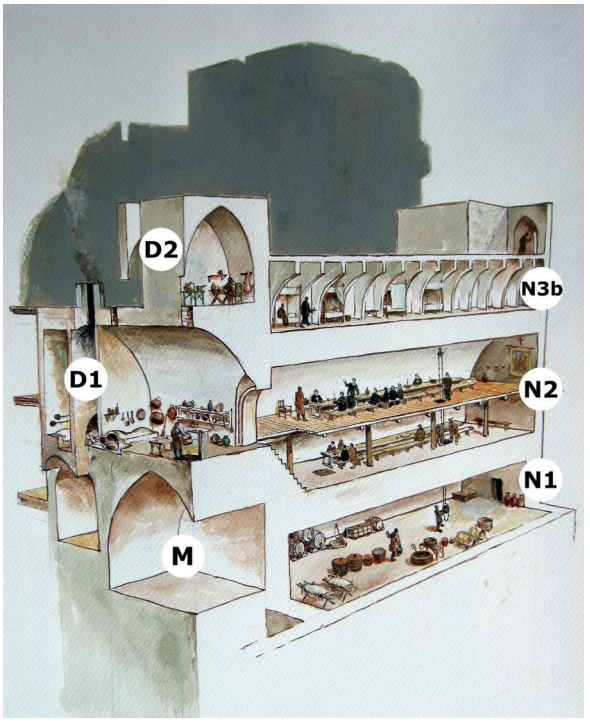
• **Fig. 6. Digital reconstruction of the chapter house as it might have looked like from the southwest. By G. Buzás**

The chapter house(s). The existence of a chapter house was also a basic requirement in a central site of a Military Order where dozens of knights following the monastic rule were expected to live. Margat must also have been equipped with a fairly big one as sometime between 1204 and 1206 even the chapter general was held in the castle (*Lutrell*, 2014. P. 206), where delegates from all the provinces of the Order were expected to be present. The largest building of Margat suitable for such a function was identified in the remains of a 37.2×18.6 m large rectangular hall on the western side of the castle (G) (fig. 6). Although most of the structure has been erased, there are three important elements still visible besides the outline of the building. The northern wall has been preserved almost to its full height, one original window remains from the row of windows decorating its western façade and the lower part of a recessed door frame can be observed on its almost completely destroyed southern façade too. Excavations and architectural studies of the Mission revealed that this building was covered with an imposing cross vault system resting on two rows of rectangular pillars each consisting of seven pillars. The interior was thus divided into three aisles and 18 bays and is estimated to have had an inner height of 12 m. The excavation trench opened in the southeast corner of the hall found the lower courses of a 70 cm wide stone bench base running along the eastern wall of the hall. Benches and seats along the interiors are characteristic of monastic chapter houses just like the location of this huge building in the immediate vicinity of the chapel.

The excavations also unearthed the foundations of an earlier and somewhat smaller rectangular hall under the supposed chapter house. This measured about 34.3×12.5 m and based on the calculations of a number of rib and console fragments found scattered in the castle it seems to have been covered by two parallel wooden wagon ceilings supported by a row of four graceful arches resting on pillars. Fragments of a pointed arched twin window, without the place for shutters, which is typical for cloisters and chapter houses might also have belonged to this early construction. As one element of it was later reused in a still Crusader constructed

building above the gate tower, it was obviously out of use sometime during the beginning of the 13th century. Given this data it would be tempting to suppose that the carefully decorated, slightly smaller and statically weak structure on the site of the later chapter house was also a chapter house of the earliest Hospitaller castle, which was destroyed by the devastating earthquake of 1202. By this time planning of the chapter general in Margat might already have been under way and this is the reason why the new chapter house was constructed on an even larger scale, this time with a more solid roofing structure (*Buzás*, 2012. P. 49–64).

Refectory and the connected facilities. Communal life of the Military Orders needed a central refectory too, which is usually in the vicinity of the kitchen area. This close combination of buildings is clearly visible in Margat (fig. 7), where the two were attached to the western wall of the castle and to the south of the little square onto which the gates of both the chapel and the chapter house opened. While the kitchen (D1) was built as early as the first period of construction, the present refectory (N2) measuring 25.5 × 9.9 m was built in the second. Its 7.8 m internal height was divided horizontally into two spaces of roughly equal height by a large wooden mezzanine floor held by a series of stone corbels which are still preserved in the walls. While the lower floor had only one entrance and that on its eastern wall, the upper floor had two. The main entrance to the upper floor of the refectory opened on the northern end of the eastern wall, while the door of the adjacent kitchen area to the south had its own direct access in the southern wall, which facilitated the serving of the food directly in the upper floor first. From here a staircase led down to the ground floor dining area too. The upper floor is likely to have been the refectory of the knights and the lower one might have been serving the sergeant brothers. Both were lit by a row of windows in the western wall of the refectory that overlooked the coast. Another structure that seems to have been directly linked to the refectory was the huge barrel-vaulted hall under it (N1). It was clearly built to serve as a cool storage area with a narrow door and only one window providing some light and ventilation. While all the Crusader halls in the castle have rectangular ventilation shafts, with around 40–50 cm diameter at the apex of their vaults, the two openings in this storage area are almost one meter wide with a circular shape. As they open directly into the refectory hall, it is rather logical to suppose that they had been designed to enable the direct elevation of wine barrels onto both floors of the refectory with the help of wooden lifting worms fixed into the vault of the refectory. The cold cellar area beneath, that opened into the outer



• **Fig. 7. Reconstruction painting of the western vaulted ranges of the castle. By M. Incze**

castle, would have been an ideal place for storing such commodity and was also easy to approach from outside the castle through the southwestern main gate tower. However, getting the barrels up into the inner castle and then the refectory at its southern end would have been challenging through the narrow doors and tunnel-like corridors that otherwise provided the closest approach. The importance of ample quantities of wine stored is clearly reflected in the Statutes of the chapter general of 1288: "…it is decreed that any Bailiff, who shall come to the Chapter, should leave his bailiwick furnished with wine wheat and barley up to the New Year" (The Rule, Statutes … , 1934. P. 91). The chapter of Margat decreed that the same wine of the convent had to be distributed in the hospital, except if its quality was "not good enough to strengthen the sick brethren", as in this case it had to be improved upon. (Ibid. P. 42)

The kitchen hall (D1) had a 17 × 7.8 m large interior area which was covered with a heavy barrel-vault that had two rectangular ventilation shafts. The eastern one served as the chimney of the four ovens that were excavated by the Mission in 2009. The smoke exiting from the mouths of the ovens was diverted to the vent by a 0.38 m wide flue formed by double diaphragm wall, the mortar imprints of which are still visible on the vault.

As no built structures were found beneath the western ventilation shaft, it could have been the chimney vent of a large open cooking area. The three large windows on the windy western front of the room would have certainly helped the ventilation. The excavations unearthed a stone-framed channel that brought the "grey" water from the direction of the courtyard towards the latrines and thus could only have been used to get rid of the used water of the kitchen. As Margat was growing dynamically in the first decades of Hospitaller rule, it is most probable that the elongated building (mb 32) with an interior area of 14.6 × 5.4 m was constructed as an extension to the kitchen (fig. 3). It was inserted between the northern wall of the kitchen and the southern wall of the new chapter house that is supposed to have been constructed for the chapter general between 1204 and 1206. This would be all the more possible as this meeting meant a sudden and considerable increase of personnel whose catering had to be solved for a rather long timespan.

A similar expansion can be observed in the area dedicated to the baking facilities of Margat castle. The earliest bread oven of the castle excavated hitherto was found in the southern end of vaulted hall Q (fig. 5). Originally this hall seems to have been an L shaped space, but probably after the earthquake of 1202 its collapsed northern cross-vault was narrowed, and the western arm of the L shaped hall was walled off forming hall O. This was the time when the northern end of hall Q received a second oven. Because of statical reasons the area between these two ovens in hall Q can not be excavated, but some architectural features like the positioning of the ventilation shaft on the apex of the vault and the remains of the mouth of a wide steeply inclining shaft in the eastern wall indicate the presence of a third oven, too. This would have formed a huge capacity bakery which is likely to have served not only the garrison and servants of the castle, but also at least part of the population of the suburb (*Youssef*, 2019. P. 137–138). The adjacent halls to the south (I1.a and I1.b) were in direct connection to the hall of the ovens and seem to have been used to prepare the bread dough.

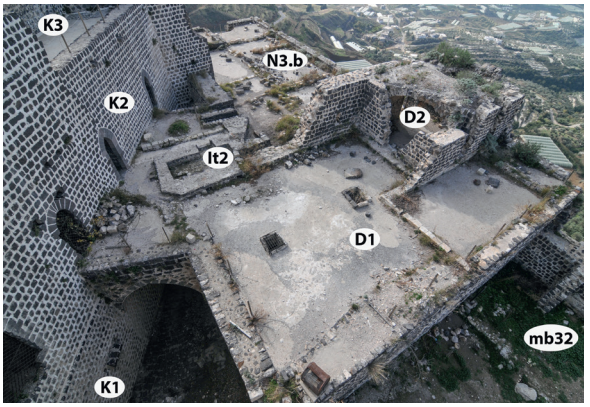
Dormitories. The core of the large dormitory hall of the eastern side of the castle was amongst the first structures constructed in the inner castle of the Hospitallers (S2.a-b) (fig. 5). It was attached to the north corner of the chapel and thus fulfilled the basic requirement of being in close proximity to the main scene of the religious practices that were performed several times a day according to the monastic hours (*Riley-Smith*, 1967. P. 250–251). The two main doors of the dormitory opened into the main square of the castle on its western wall close to the northern doorway of the chapel. The early dormitory building was a rectangular barrel-vaulted structure with an interior covering 35 × 9.5 m. The hall was evidently intended to serve as a residential quarter as it had a huge latrine tower attached to it from the east, with an area of 7.7 × 3.3 m. It is also obvious that the early dormitory hall was divided into two parts from the very beginning as can be seen not only from the foundation of the division wall excavated by the Mission, but also from the two adjacent doors opening into the latrine tower and the equal number of the windows and doors on both the eastern and western longitudinal walls of the hall. It is very likely that the 17.9 m long southern part of the hall (S2.a) was reserved for the knights and the shorter, 10 m long one (S2.b) was the dormitory of the brother sergeants-at-arms, who are assumed to have been lesser in number (*Riley-Smith*, 2012. P. 104–105). As construction activity continued, the dormitory was extended towards the north by another 18.1 m (S2.c) in the second phase of the first construction period, by the end of which vaulted structures were supporting all the walls of the inner castle from the interior side. The development of this dormitory range was completed in the second construction period but still before 1202, when the northern end of the vaulted hall was extended with and a large horseshoe shaped tower (R) that added further 6.5 m to the interior area of the hall at its northern end. How the internal divisions of this new vaulted range now reaching an impressive 54.4 m in length looked like is hard to decipher, partly because internal divisions might have been made of wood just like in the Auberge, the great dormitory of the hospital in Acre (*Templar of Tyre*, 2003. P. 86–87, 115; *Pringle*, 2009. P. 116) and also because by this time the knights seem to have been moved to another area of the new constructions executed during the second period.

This second construction period saw the establishment of the new dormitory of the knights between the chapel and the also newly erected donjon (fig. 8). This hall (K2) with internal dimensions of 24 × 10 m was in an even closer connection with the chapel than the previous dormitory. The northern end of it was actually the southern wall of the chapel with a large gothic lancet window opening into the nave from the new hall. The dormitory received a staircase in the same southern wall of the chapel that led directly into the sacred space. The dormitory also had a door opening into the first floor of the donjon that might have been the residence of the castellan. On its western façade hall K had several windows plus a door which opened onto the roof of

the kitchen and the refectory. In this same construction period, a new latrine tower (lt2) was added to the corner formed by the new refectory and the kitchen. It had four latrine shafts operating from two levels, two shafts on each. As the two latrine levels were most easily approachable from the doorway of the new dormitory, they were evidently constructed to serve this space. The 7.7 m high dormitory room has no clear remains of any major interior installations fixed onto the walls and it is very unlikely that it had a wooden mezzanine floor. In case the beds were arranged beside the walls and the window niches were free of them, around 15 beds might have been inside the room. In case there was a third row inserted in the middle, this number could be increased up to around 25 if they were normal beds and not bunk beds.

As the number of the knights is reported to have been at 60 in the sister castle of the Crac in 1255 (Cartulaire … , 1897. P. 777–778, no. 2727), it is not surprising that within a relatively short time, the space of accommodation available for the ordinary knights in common dormitories had to be increased in the first half of the 13th century, when the both the size of the castle and its importance expanded rapidly. A new hall (N3.a) was added to the castle on top of the refectory itself, covering an internal area of 22.4 × 6.1 m which in all possibility was another dormitory. That it was certainly built well after the second construction period is clearly attested by the facts that it was closing the former crenelated parapet of the refectory built before 1202. It was also constructed with a wall made of a single line of well-cut limestone ashlars, like the other similar post-second construction period buildings. Just like these latter buildings, the light roofing of hall N3.b was supported by a number of transverse arches of the similar single ashlar thickness. Given its close proximity to the dormitory of the knights (K2) and its privileged position, it must have also been intended for the brother knights.

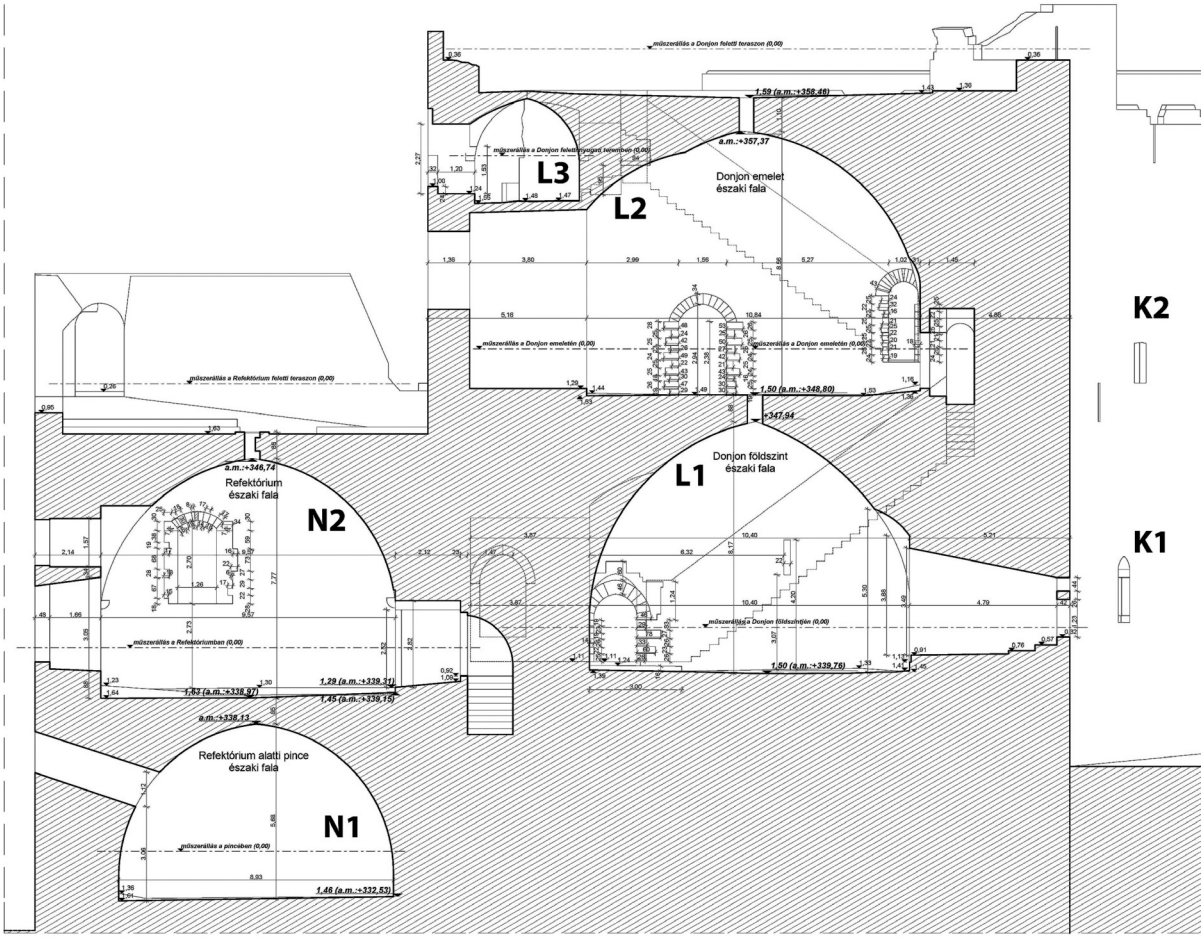
There is at least another vaulted structure that was very likely used as a dormitory. It was a 31 m long and 8 m wide hall E attached to the outer wall of the fortifications on the eastern side (fig. 3), parallel to dormitory K2 of the inner castle. In spite of all the defensive considerations, this hall had no less than four large windows opening onto the trench in the foreground of the castle, which clearly attests that it was a living quarter. Its northern end also had a wooden mezzanine floor supported on corbels jutting out from the eastern and western walls. As it has a ceramic pipe inserted into its vault that must have been built to carry a rope



• **Fig. 8. Buildings on the southern tip of the castle. By B. Major**

that operated a bell above, it seems to have been the dormitory of a part of the garrison. The use of bells by the Hospitaller convents is also mentioned in the sources (The Rule, Statutes … , 1934. P. 62). As the hall is in the outer ward, it is tempting to see it as the dormitory of the turcopoles. These mostly native soldiers in all likeliness had their own refectory in Margat. This latter would have had an ideal place in the building to the south of the dormitory and on top of vault U. It was covered by a light timber roof. It is evident that the area of the covered spaces in Margat was explicitly raised during the second construction phase which saw the erection of hall E too. The roughly 43 m long and 4.5 m wide elongated area (mb 30) between hall E and buildings K was covered with a timber roof. This area had four wide pointed-arched niches inserted into the western wall of E, which all had their own cupboard niches and were evidently intended to serve as sleeping alcoves. What the function of the rest of this covered space was is hard to ascertain, just like that of its continuation, the barrel-vaulted ground floor hall S1. This was the almost only complete relic of the old Mazoir castle but was completely built around with new structures during the second construction period, so all its former openings (the six arrow slits on its eastern wall, its gate to the south and the ventilation holes at the apex of its vault) were all opening into other covered spaces or walled up for good. Still, it could have been used both as sleeping quarters or rather as a storage area.

Besides the large communal dormitories there were a number of spaces with considerably smaller areas mainly used for sleeping. Such were the rooms in the flanking towers for the garrison and the spacious rooftop of tower Txi which had its own doorway and must have had a timber roof of some kind with space for at



• **Fig. 9. Section drawing of the donjon and its immediate vicinity. By E. Mindszenti-Varga**

least half a dozen of beds under. A considerable part of the garrison was not member of the Order, but they were paid soldiers or knights belonging to the palatinate of the Hospitallers. Most of these latter ones however must have retired to their houses in the suburbs after service.

Residences of the officers. Monastic life in theory meant sleeping in common dormitories, but the grand master had his own living quarter as early as 1160 and not only the leading officers but also part of the brothers seem to have had their own cell-like compartments during the 13th century (*Riley-Smith*, 2012. P. 116). Most of these were likely wooden division walls in the same vaulted structure. The castellan of Margat and the chief officers certainly had their own living quarters from at least the second construction period, when most of the castle buildings were completed. The residence of the castellan was in all probability on the first-floor room of the great rounded donjon (fig. 9). This hall measured 12.6 × 10.7 m. In spite of the striking thickness of the walls of the donjon (close to 6 m on the southern and eastern sides), effort was made to provide as much natural lighting as possible. Beside the large arrow slit on the southern wall, it had two window niches with relatively large windows, one in the east and another on the southwest side. The sleeping alcove of the room and the north wall also had a window opening. This all points clearly to a residential function, just like the numerous cupboard niches in the walls. As the chapter general of 1262 decreed: "…every prior beyond the sea should have a register, which he should keep in his private cabinet (segrete); in this register should be entered all the rents, lands, vines and meadows; this register every bailiff (i.e. commander) should have and receive

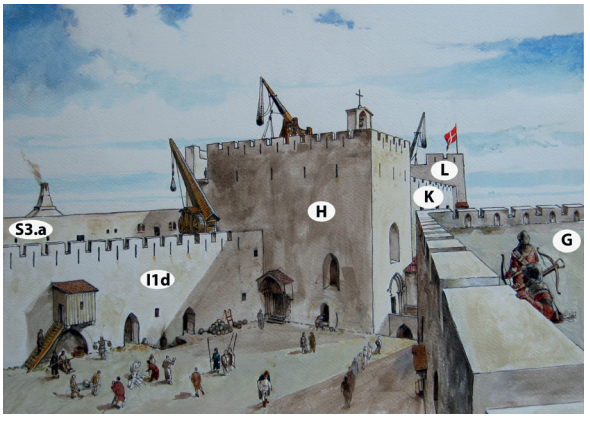
from his prior, that is to say of everything that relates to his bailiwick" (The Rule, Statutes … , 1934. P. 59). The 8.8 m high interior space of the hall had wooden galleries if not a complete wooden mezzanine floor. On the western side of the hall an additional 5 × 3.7 m large niche is found with corbels for the wooden compartment elements that divided it from the main room and also formed a wooden mezzanine floor. This must have been the sleeping alcove of the person living in the hall as it also had a separate latrine room on its southern end measuring 2 × 2 m and having a double latrine chute. As the privy was reserved for the use of one person only, the construction of the two chutes might have been done in preparation for the case if one was clogged. The windowless latrine could be closed from inside, so the little niche in its southern wall was evidently used for holding an oil lamp. This possible hall of the castellan was directly connected with the adjacent dormitory K2 through a large doorway on its northern wall.

It is quite interesting that according to the wall texture research the entrance to the hall from the sole staircase from the ground floor had no trace of closing system or door, however all the imprints point to the strange fact that there was a wooden corridor leading from this door to the neighbouring door on the north wall. This in turn led to another upper room (L3) that was sunk into the western haunch of the vault above the hall. Thus, the main entry to the castellan's room was at the same time serving the room above it and the two were separated by the wooden walls of the corridor linking the doors. This small room upstairs measuring 10.2 × 3.4 m was another private residence of a person who had two large windows overlooking the sea, a neatly executed sleeping alcove with a cupboard niche and a little room that apparently had a urinal chute in its western wall. Margat was one of the few Hospitaller castles that had its own chancellery and treasury (*Burgtorf*, 2006. P. 222–223; The Rule, Statutes … , 1934. P. 72, 79), and it would be tempting to see the head of the writing office living in this room. As Margat was the centre of the enormous northern Hospitaller palatinate and had to manage both internal and foreign affairs, the chancellery and its clerks had to be at hand during day and night which would explain the close proximity of the castellan's residence to that of the chancellor's. An additional fact that might strengthen this theory is that this upper room L3 has his own door on the northern end, from where the neighbouring room (K3) (fig. 8) in the haunch of the vault K2 could be reached via a wooden bridge. This narrow, elongated room measuring 17.2 × 2.9 m had three large windows and a number of cupboard niches inserted into its wall which would create a perfect and bright area for the clerks.

There was at least one other high-ranking officer who had his residence in the donjon, this time on the ground floor hall that was comparable in area and general design to the first floor one. The lighting was also very similar to the first-floor hall, but the number of the cupboard niches was visibly lower. This ground-floor hall also had a similar large sleeping niche and a double chuted privy on the western side and would have made an ideal residence of the military commander of the large garrison, who was second in importance to the castellan.

There were a number of other officials that might have had an individual living quarter. One might have been the commander of the stables, who is supposed to have lived right beside the stable buildings that were identified beside the main western gate of the site. The semi-circular flanking tower at the southern end of the stable ranges had a mezzanine wooden floor in its vaulted first-floor room with a rather large rectangular window lighting the upper floor. Accessible from inside the stable close to its main entrance, it would have been an ideal place as the residence of the overseer of the stables.

The three large alcoves sunken into the façade of the eastern vaulted ranges bordering the main courtyard of the castle might have been intended for the directors of the individual activities that took place in the vaults themselves (fig. 10). The pointed-arched alcoves had an area of 2.5 × 2.6 m which was extended towards the courtyard with a wooden box-like screen wall adding at least another 2.5 m². Each of them had their own cupboard niches and were approachable by a wooden staircase that very was very likely positioned on their northern sides.



• **Fig. 10. Reconstruction painting of the buildings around the main courtyard looking south. By M. Incze**

Residence of the bishop? As the episcopal seat of Valenia was moved to Margat after 1188, not only the bishop, but his local chapter also needed suitable accommodation (*Riley-Smith*, 2012. P. 112). A possible candidate would be the building complex over the top of the western gate tower of the inner castle. This consisted of four main halls with some additions towards the east (fig. 5). Immediately over the gate itself and overlooking the sea through an elegant twin window was hall F.2a of 6.1 × 6 m dimensions plus its own latrine tower added to it on the northern side. The adjacent 16.3 × 12.1 m hall to the south (J2) was originally a timber roofed structure with a wooden mezzanine floor, but later the roof was reconstructed with a ribbed vault of six bays supported by two central pillars and springing from neatly decorated pilasters. This can be dated on stylistic grounds to the 1220s and 1230s (*Buzás, Major*, 2014. P. 555–556). A separate staircase led up to the upper floor with two main areas. One was the already mentioned second chapel (F.3d) that was bordered on the north by a 19 × 8.8 m large hall (F.3a-b) which was divided into two separate rooms with a partitioning wall in a ratio of 1:2. Both were covered by a timber roof that originally had a number of stone pillars supporting it and from which the basement of only one remained in situ in the western part. In this western room F.3a covering an area of 8.8 × 7.3 m there were two elegant window niches and at least one cupboard niche, while the eastern one had a series of latrines in its northern wall and at least two cupboard niches. To further elaborate the highly elevated status of this residence, a hypocaust heated bath was added to its eastern side that overlooked the inner trench separating the castle from the inner suburb (F.3c). This construction seems to have been contemporary with the changing of the original timber roofing of hall J2 and was the most refined bath structure evidently intended for the use of an important person.

Residence of the clergy? As the excavations of the Mission revealed a set of timber roofed buildings started to be developed (S3.a-b) from an early time on top of the large vault of the early dormitory range S2 (fig. 5, 10) (*Major*, 2014a. P. 93–109). The main expansion reached its last phases after the second great construction phase, when the earliest rooms with basalt walls were supplemented by a number of rooms with thin walls formed from a single thickness of cretaceous limestone blocks. The final area covered was 37.5 × 13.5 m and many of the spaces created can be connected with residential functions, like the entrance into the latrine tower lat1, the existence of a bathtub with a neighbouring room that could be identified as a small kitchen and another postulated kitchen further to the north. It also had a 5.3 × 5 m large room with a double row of benches of limestone blocks around its interior walls which must have been a small chapter house. During the excavation objects that were identified as the holder of a thurible, the covering of an inkpot and the remains of a metal decoration of a book were also found, it is tempting to connect the area to the clergy serving the adjacent chapel. The huge size of the chapel, the many and continuous duties that were prescribed to be performed there almost constantly and the statutes of the chapter general of 1263 (The Rule, Statutes … , 1934. P. 67–68) make it clear that there was a considerable number of clergymen serving in Margat. This residential quarter of mostly light constructed buildings right beside the chapel, to whose northern door there was a staircase leading directly, would have been an ideal place for them.

Spaces with other functions. As the central castle of the Order defending the northern borders of the County of Tripoli in the 13th century, Margat had to have large stable facilities that served its numerous cavalry units. During the raid of the garrison of Margat on the Crac of the Mamluks in 1280, the horsemen of the Hospitaller forces is reported to have counted 200 (*Templar of Tyre*, 2003. P. 75–76). The main building of the stables was identified by the Mission as one that ran on the inner side of the outer walls from the main western gate almost the northern end of the plateau of Margat. It might have been as long as 165 m with an average width of 6 m on its excavated southern half. Besides finding rock-carved tethering holes we could identify a large rectangular opening on the outer wall between two sections of the stables that was in all probability used to discharge the animal dung into the trench outside the castle. The long range of stable building was not vaulted but had a lighter roofing of some kind. The area it provided was certainly not enough for all the horses and pack animals assumed to be used by the garrison and it is not unlikely that during the long peace times many of these were housed outside the castle in the suburb or other areas nearby in stables of light construction.

Margat was the home to one of the largest concentrations of Crusader forces and equipment on the Syrian coast which needed a huge amount of storage spaces. The storing of "five hundred and nine waggon-loads of render" income annually and maintaining "a thousand people over and above the other citizens of the castle, in such a way that they provide them with every convenience and necessity, [sufficient to supply] the castle with the necessities of life for five years" mentioned

• **Fig. 11. The possible laundry area excavated in vault I1.d. By B. Major**

by Wilbrand in 1212 necessitated considerable storage capacities. We can be certain that some of the largest ground-floor vaults like vault M stretching beneath the kitchen and the whole chapter house was one of them (fig. 7). However, it is very hard at the moment to decide which ones were serving as the armouries of various weapons or as the storage spaces for other equipment and garments. For example, it can only be guessed that vault O overlooking the inner trench of the castle (fig. 5) might have been used as the storage place of the elements of the trebuchets defending the castle. The description of the final Mamluk siege makes explicit mention on the effective use of mangonels set up by the Hospitallers after the arrival of the Mamluks (*Ibn ʿAbd al-Ẓāhir*, 1961. P. 78). This also points to the fact that during the timespan between two sieges, which in the case of Margat sometimes lasted for decades, the precious machines were disassembled and stored in a safe place. As vault O has the widest doorway amongst the vaults bordering the main courtyard of the castle, it would be logical to see it as an optimal place for manoeuvring with long beams. At least some of the trebuchets were certainly operating from the highest points of the castle, like the donjon or the chapel, which would enlarge their range considerably. Excavations of the Mission found the in-situ remains of a treadwheel platform over vault I.1.d. that must have been installed to facilitate the lifting of machine parts and projectiles to these final destinations from the courtyard (fig. 10). That this treadwheel crane was not the only such structure in the castle is proven by finding the element of another platform over vault Q (*Major*, 2012).

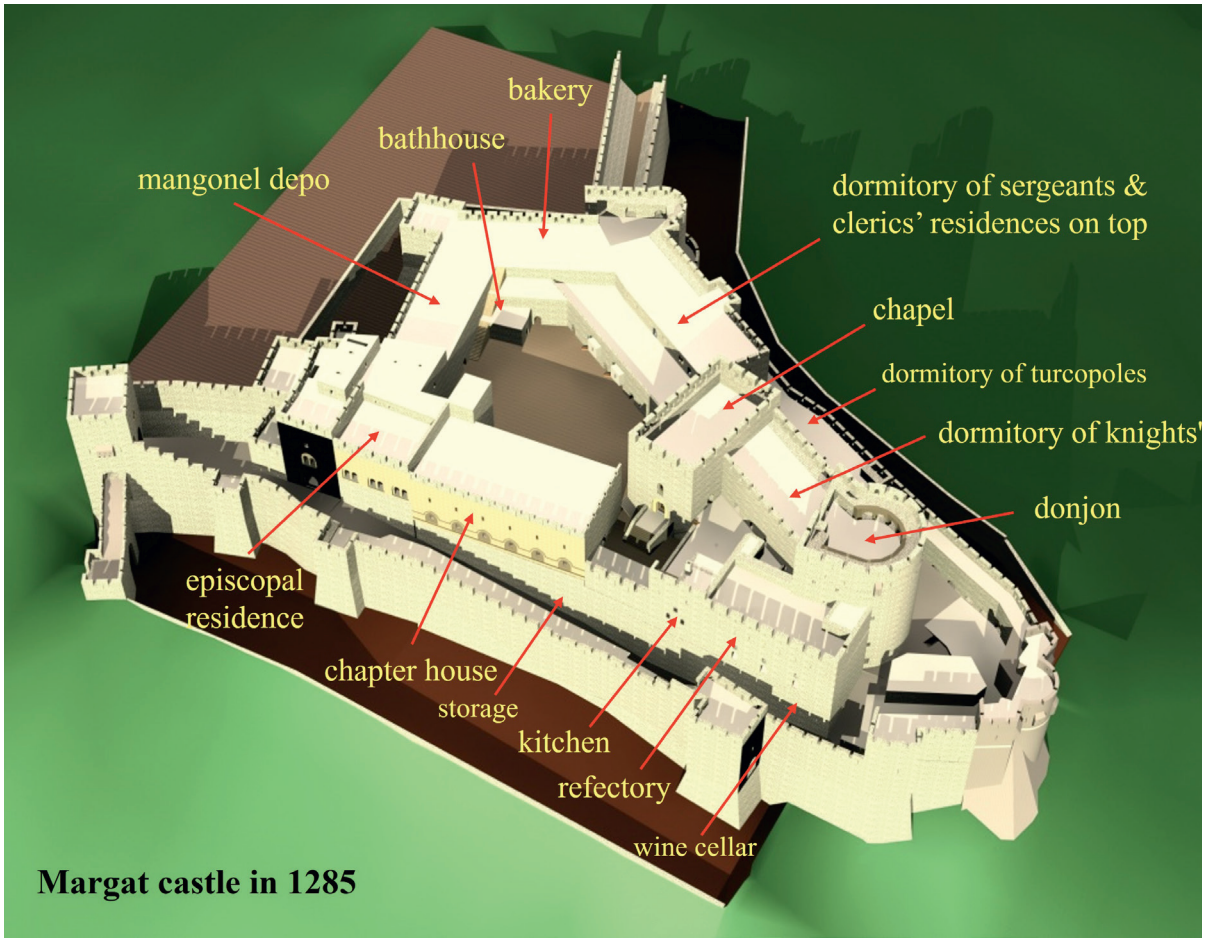
Excavations of the Mission in 2010 and 2011 in the 22.1 × 7.9 m large hall I1.d. unearthed a set of well-designed structures under the thick debris covering the medieval floor level (fig. 11). It consisted of a huge furnace operated through a tunnel from the main courtyard of the castle, 16 rectangular basins of stone and mortar construction many of which were plastered 3–4 times, and three large but shallow rectangular basins that were evidently collecting water as their ground floors were sloping to one point where small

circular basins were the final collecting points. The most probable function of this room might have been the laundry of the castle. The large garrison needed some central cleaning service for its garments which could have been soaked in the 16 basins of uniform design together with the detergent which was very likely ash based. Some of these basins still had a thick ash layer in their bottom. Hot water was boiled in a large metal cauldron over the furnace, while the ash created in it was collected in the rectangular basin at its opening. The large shallow rectangular pool-like basins might have been the areas where the wet clothes were wringed out and the rather small amount of water was collected in their circular basins then discharged of. An evidently identical, but smaller structure (only six basins) that had all the main elements that were excavated in Margat (furnace, washing-basins, ash collecting basin and a lesser area for wringing out the clothes) was excavated by the Syro-Hungarian Archaeological Mission in 2017 in the Crac des Chevaliers, too. This area that had its own cistern was also positioned in the inner castle and was evidently dating to its Hospitaller period.

The basic elements of the water management system. Margat was constructed on the top of a more than 350 m high volcanic mountain, where water to supply the thousands of inhabitants and their animals could only be obtained from the winter rains. There was a very highly refined water management system constructed by the Hospitallers that perfectly fulfilled the four basic duties: collecting the rainwater, storing it safely, distributing the water to the various places needed and discharging of the dirty water. As the field surveys and excavations proved, water was collected on every surface, not only on the clean rooftops but also on the paved courtyards. The former were usually channelled into large cisterns, while the grey water of the latter was used to flush the latrine towers. While most of the canals were constructed of mortared stones and were rectangular in cross section, clean drinking water was often transported by circular ceramic pipes. In some cases, lead pipes were also employed, and they always operated from storage tanks positioned on the rooftops or high grounds and thus had considerable pressure to transport the water. There were two huge rectangular water collecting cisterns in the castle, one under the main courtyard Xi (cist1) (fig. 3) and the other under the vaulted ranges of building K. Both were partially cut into the bedrock and covered by a pointed barrel vault. The area of the former measured 25.3 × 7.8 m while the latter 13.2 × 6.3 m and both had smaller cisterns constructed before their main inflow channel that filtered the water coming from the roofs. Because of the thick layer of debris accumulated in them it was impossible to verify their precise depth, but given their visible structure, the cistern under the main courtyard was able to store more than 1100 m^3 water and that under K1 more than 540 m^3. This latter was evidently the most valued drinking water collecting point as it was filled with the water from the highest rooftops, that of the chapel, the K and the donjon. Its water was not drawn directly from the two openings on the apex of its vault, but from a neighbouring well-shaft that was constructed for this very reason beside the cistern and was connected to it by a channel at its bottom. There were dozens of other lesser cisterns detected both in the castle and the suburbs of Margat, most of them with a bottle shape cut into the bedrock and plastered.

Most of the water that fell on Margat was collected and after being used left the castle through the latrine shafts. This was true for the overflow channels too, that were attached to the main cisterns. Having surveyed the water management systems of both Margat and its sister castle of the Crac des Chevaliers it is evident that more water fell on the two sites during the rainy winter seasons that their water installations were able to store. So, after the cisterns were filled at the beginning of the rainy season, their overflow channels were diverting all the excess water which left the castle after flushing the latrines. During the rainless summer months water was reserved for drinking and washing and the waste accumulated in the deep latrine shafts to be completely flushed out again only in the next winter season.

As part of the water management, Hospitaller Margat had a highly developed infrastructure for bathing too. The main bathhouse (Bh) covering about 185 m^2 on its ground floor was excavated in the northeast corner of the main courtyard (fig. 3) (*Major*, 2013). It must have been the main community bath for the garrison, while the small, hypocaust heated bath over the inner gate house was the private bath of the high-ranking person (possibly the bishop) living there, and the bath over the vault S might have served the clergy supposed to have lived on this rooftop. The only building that survived above ground and almost intact of the outer suburb on the western slopes of the mountain of Margat was thought until recently to have been constructed by the Mamluks. Recent surveys of the Mission however make it much more likely that this bath was constructed by and



• **Fig. 12. Digital reconstruction of Margat castle with the various functions indicated. By G. Buzás & B. Major**

for the Crusader period population of the outer suburb and might have been used and re-plastered during the post-Crusader period too. The huge quantity of water needed for its operation was very likely channelled down from the huge open cistern that was constructed before the southern corner of the castle (fig. 2). This now partly filled *berquilla* was covering an approximately 67×16 m large area and its depth was more than 10 m. It had multiple tasks in the foreground of the castle. It was collecting and storing vast amounts of water from the neighbouring slopes, which must have been elevated by some kind of machines in peace times then used for at least two main purposes: to supply the outer suburb and to water the horses and pack animals outside the castle. As it occupied the narrow neck connecting the mountain of Margat to the mountain range to the south it blocked the road of the attackers and their siege engines of the enemy from the only direction the castle was approachable.

Conclusion. Medieval castles in the Levant are rarely analysed in depth with regard to their functions which is in large part due to the general lack of detailed medieval sources or descriptions and the lack of on-site research. This was also the case with Margat, one of the largest and best-preserved medieval sites. Recent fieldwork of the Syro-Hungarian Archaeological Mission combining on-site research with the examination of the scanty surviving written sources has identified a large number of certain infrastructural elements in the castle and identified the function of a number of spaces (fig. 12), amongst them, sacred spaces and dormitories, with certainty. There is still a considerable number of rooms where their use can only be hypothesised with more or less certainty, which is also due to the fact that although the medieval site was built in only a few main construction periods, functions of certain spaces shifted parallel to the expansion of the site.

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Б. Майор. Об использовании пространств в замке госпитальеров Маргат

Аннотация. Почти два столетия присутствия европейцев в Леванте привели к созданию выдающихся образцов военной архитектуры XII–XIII вв. Однако из-за нехватки средневековых письменных источников и недостатка полевых исследований функциональное назначение пространств этих уникальных сооружений редко становилось предметом детального анализа. Замок Маргат, один из ключевых объектов, построенных Орденом Святого Иоанна, с 2007 г. находится в центре внимания совместной исследовательской программы Сирийско-Венгерской археологической миссии. Проведение археологических работ в сочетании с междисциплинарным подходом позволило определить функциональное назначение существенной части помещений замка и выдвинуть обоснованные гипотезы относительно остальных. В данной статье представлены основные результаты этих исследований.

Ключевые слова: замок Маргат, крестоносцы, госпитальеры, фортификация, функции пространств, археология.

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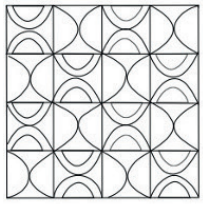

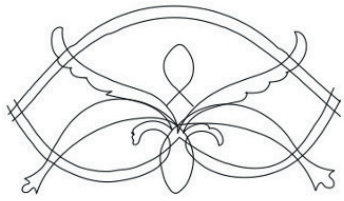

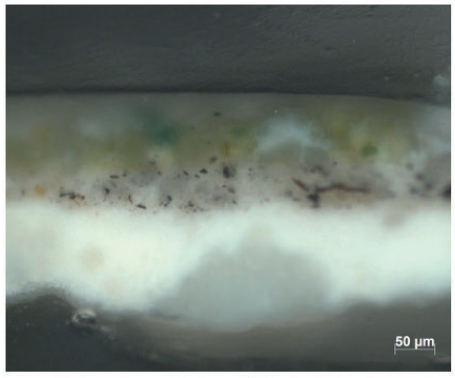

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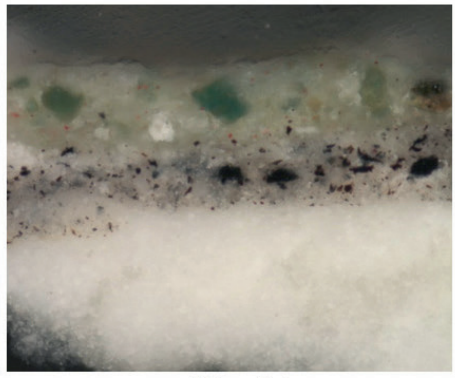

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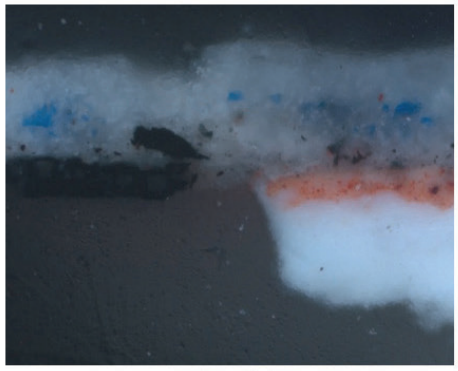

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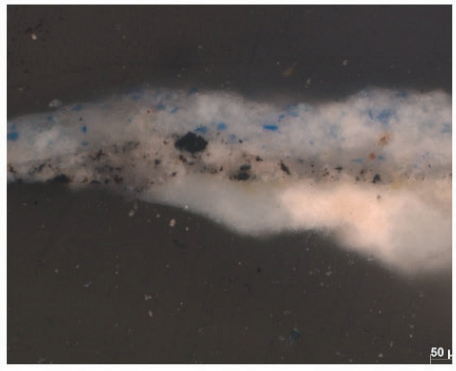

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12th century wall-paintings in comparison: Novgorod and Aquileia

A. Giumlia-Mair, E. Ya. Zubavichus

HTTPS://DOI.ORG/10.25681/IARAS.2024.978-5-94375-455-5.60-72

Abstract. This paper presents part of the analysis results of fresco fragments from different periods recovered from the excavations by the Institute of Archaeology in the years 2013–2022 in and around the Cathedral of St. George in the Yuriev Monastery at Novgorod. The 12th century pigments, and technology are compared with the materials of the Veneto-Byzantine wall-paintings of the Basilica of Santa Maria Assunta at Aquileia, province of Udine in Italy, recently collected by our team as part of our project with the aim of confronting chronologically parallel wall-paintings in different parts of Europe. Painting habits and preparation layers are also presented and discussed here.

Keywords: XRF, SEM-EDS, XRD, Raman, pigments, plaster, mural paintings, Middle Ages, St. George's Cathedral, Yuriev Monastery, Basilica Santa Maria Assunta in Aquileia.

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Introduction. This paper presents the analytical data collected during a stage at Aquileia by the same team working on the wall-paintings of the Cathedral of St. George at Novgorod. The research was carried out within the state assignment of Ministry of Science and Higher Education of the Russian Federation (theme "Pre-Mongol frescoes in Novgorod: archaeological context and scientific research: The frescoes of St. George's Cathedral, Yuriev monastery from the 2013/2020 excavations"), agreement № 075-15-2021-576. The paintings in the crypta of Aquileia have been chosen as comparison for the paintings in the St. George's Cathedral (fig. 1), because they both are dated to the 12th century CE, but also because both churches are believed to have been painted, entirely or partly, by Byzantine artists. It is also thought that the Byzantine Greek artists, who painted the murals in the St. George's Cathedral, possibly obtained their pigments from Italy, therefore it is interesting to see if the pigments employed in the crypta of Aquileia can be compared with those in use at Novgorod.

Since Roman times, the importance of Aquileia as town was due to its role first as military post and then as trading center, because of its strategical location in Northern Italy and the excellent roads connecting it to Central Europe, the Baltic, and the Balkans up to the Black Sea. Being a major port, it was also connected to the main commercial centers of the Mediterranean. Even after the destruction by the Hunnic king Attila in the summer of the year 452 CE, numerous wars and sieges, for example by Alaric in 401 and 408, the occupations by the Langobards in 568 and the Francs in 774, and the multiple raids by the Hungarians in the 9th and 10th century, the town of Aquileia was an important point of

• **Fig. 1. The Cathedral of St. George at Novgorod, seen from the Volkhov river**[1]

• **Fig. 2. Basilica of Santa Maria Assunta at Aquileia**

convergence: a Christian center, seat of the Patriarchs, as established in the second Council of Constantinople (553 CE), when the bishops of Aquileia were officially legitimated as being directly nominated by St. Mark and St. Hermagoras and, as such, as having the right of bearing the title of Patriarch. The Patriarch of Aquileia was at this time, after the Pope, the most important Catholic power in the Italian peninsula.

The basilica of Santa Maria Assunta at Aquileia (fig. 2) has a very complex structure with buildings and rooms on different levels dated to various periods (*Dorigo*,1992; *Luca*, 1992; *Jacobsen*, 2010). The arched portal supported by two late-Romanesque lions in the basement of the presbyterium is the entrance to the crypta with the wall-paintings, analyzed for this project. As commented by Tavano (1977. P. 133–134), the paintings in the crypta represent an almost foreign and separate architectural element in the complex of Aquileia.

The crypta. The actual room of the crypta was added to the basilica during the construction works ordered by the Patriarchs Johannes IV or Poppo (*Cozzi*, 2010. P. 491) in the 9th century. There have been some attempts to date the adaptation of the room to much earlier phases (*Zanetto*, 2013), however, in general scholars agree that this happened in the 9th century. The wish of the Patriarch was that of integrating in the basilica the lower structures of the early Christian Basilica that had already been reconstructed after the destruction by Attila in 452 CE, and later during the Byzantine occupation of the region in 552 CE. During the works and the adaptations carried out in the 9th century, most of the old perimeter walls were kept, except on the East side, where a semicircular apsis was built inside the internal space, while the outside maintained the rectangular shape. Because of this, two small, roughly triangular rooms without paintings, accessible through two small doors, exist at the back of the crypta. The graffiti in the small rooms belong to the beginnings of the 20th century.

The 9th century pillars were also mostly preserved, however, while previously the double row of pillars went through the entire room, after the renovation it was reduced by one third, leaving free the space next to the *fenestella confessionis*, placed between the two stairs to the presbyterium. The still recognizable Carolingian elements are the capitals of the pillars, which look all similar with leaves at the top and arches underneath and belong to a type known from the 8th and 9th centuries (*Trevisan*, 2013. P. 58), and the typical red lines, which are in some places still visible under the 12th century paintings. The shaft of the pillars is roughly rounded and was covered by painted plaster, like the capitals, most probably in Carolingian time and later in the 12th century, albeit with some repair and conservation intervention in later periods as well.

The crypta had been planned as the place in which the relics of the martyrs St. Hermagoras and St. Fortunatus, the saints who brought the Christian religion to Aquileia, were kept and venerated. There are two schools of thought about the dating of the paintings in the crypta, one asserts that they should be dated to the first half of the 12th century, the second to the second half of the 12th century. Most scholars agree that they should be dated after the "pace veneziana", i.e. to around 1180 (*Tavano*, 1977. P. 135; *Cozzi*, 2010. P. 489–491).

The wall-paintings represent four different themes: scenes of the Passion of Christ in the lunettes on the

1 All photos by the authors.

• **Fig. 3. One of the scenes of the Passion of Christus in the crypta: the Deposition from the Cross**

• **Fig. 4. 9th century pillars with 12th century representations of saints in the corbels. On the vaults are the stories from the life of St. Hermagoras. The damage caused by the installation of the cage for the Treasure chamber can be recognized on three of the corbels**

walls, the figures of saints in the corbels of the pillars that support the vaults, scenes of the life of St. Hermagoras and St. Fortunatus on the vaults, and the monochrome "velario" at the lowest level of the walls with various scenes, some of which are not well preserved.

The murals in the lunettes represent the Dormitio Virginis, the Crucifixion, the Deposition (fig. 3) and the Entombment of Christ. Two further Christological scenes have been destroyed in the 15th century.

The 24 figures of saints and the 6 bishops (on the half pillars) are considered qualitatively the best in the crypta, however some of them were damaged in the 15th century, when a "treasure chamber" consisting of a kind of iron cage was installed between the pillars (fig. 4).

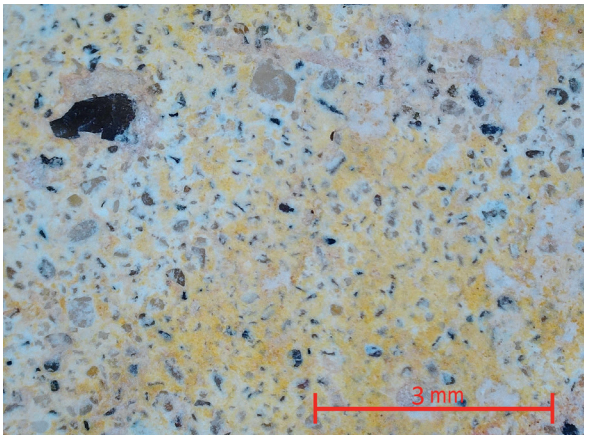
• **Fig. 5. The "velario" with the representation of a warrior chasing a Saracen**

Certainly, the most famous parts of the velario are the representation of a warrior chasing a Saracen (fig. 5), and so-called pilgrims offering some non-recognizable object to a man seated on a faldstool, with a bird at his back, perhaps an ibis with a fish in its beak.

The decorative friezes are rather striking, as they repeat late Roman or early Christian motives such as the two peacocks facing each other, feeding from a basket with fruits, symbol of the Eucharist or the decorative band with masks. Of interest are also the many graffiti with dates, the earliest of which is 1217 (*Giové Marchioli*, 2000. P. 245–246).

Methods of analysis. In the case of the Cathedral of St. George we possess a huge number of detached fragments of wall-paintings from different periods, which we can now distinguish and date (*Giumlia-Mair et al.*, 2023a), therefore we could employ different methods of analysis. For the very first screening all samples were examined with optical microscopes and analyzed by X-ray fluorescence spectrometry (henceforth XRF) (*Giumlia-Mair et al.*, 2022). For the textural observation and the determination of the micro-chemical composition, so as to carry out a detailed study of the pigments, the plaster and especially the stratigraphy of the various fragments, we employed the scanning electron microscope in the laboratory of our Institute with energy dispersive analyzer (henceforth SEM-EDS) with 20 kV accelerating voltage, 10 mA beam current, 15 mm working distance, counts of 500000 impulses per analysis, dead time of approximately 25 %. The measurements were processed using the AZtecOne EDS Software. As standards we used pure pigments, bought from specialized workshops (*Giumlia-Mair et al.*, 2023b). These data were then confirmed by Raman (*Giumlia-Mair et al.*,

• **Fig. 6. Microscope image showing the 12th century plaster consisting of lime mixed with quartz sand and straw**



• **Fig. 7. Microscope image showing the angular sand grains now visible under the damaged yellow pigment**

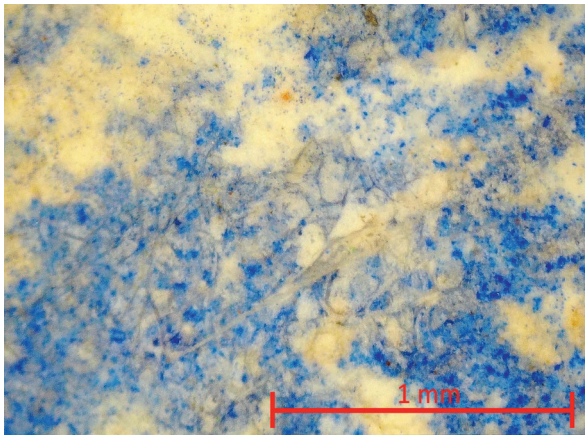
2024) and X-ray diffraction spectrometry (henceforth XRD) analyses, while, for the special research on the provenance of the lazurite employed for the blue parts of the wall-paintings, isotope mass spectrometry in a constant flow of helium (henceforth CF IRMS) with FlashHT element analyzer was used to determine the isotopic pattern of the sulphur present in the mineral (*Giumlia-Mair et al.*, 2024).

The wall-paintings in the basilica of Aquileia are *in situ* and cannot be sampled, therefore we had to limit our study to microscopy (i.e. a Proscope with 50, 100, 200 x magnification and a portable Levenhuk with variable magnification) and analyses carried out by XRF, by using an Assing transportable device consisting of various parts: the head of the system with X rays source, a support containing various devices to control the position and stability, a transformer, a stabilizer and a computer with dedicated software. The X-rays are emitted by a miniaturised X-ray tube. The spectrometer has a Si(Li) detector, and it operates at a maximum voltage of 50 kV and a maximum current of 0.35 mA. The exact area to be measured is shown by a laser beam and an audio signal controls the distance from the sample: the focal point is ± 0.1 mm. This device was especially developed for the study of cultural heritage materials and can be transported and assembled wherever needed, for instance in museums, institutes and even excavations. The measurements carried out in the crypta on the various scenes, details, decorations, colors, nuances and possible alterations and later retouching or additions were in total 141. Having a large number of data, we can compare the pigments employed on the diverse areas and judge more easily which were the unaltered original colors. The data we present in this paper are therefore the result of many analyses and observations and can be considered quite objective.

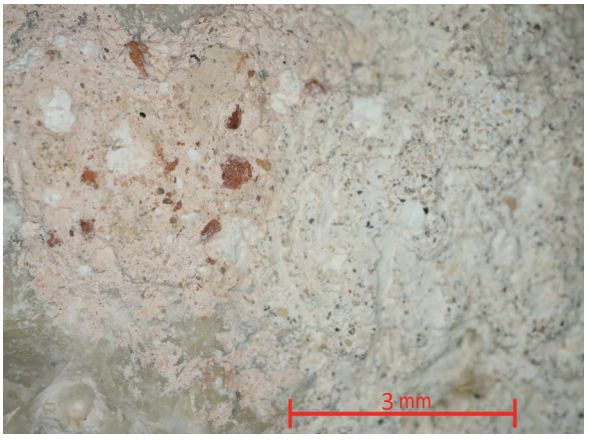
After having studied the pigments from the Cathedral of St. George for years with different methods, we are very much aware of the problems that can arise when using only XRF to recognize a pigment, however, as at Aquileia this was the only possible option we decided to try and see if we could at least collect some interesting data. We believe that the results we obtained can be useful and they are exposed here below.

Plasters and additives. The plaster employed in the 12th century in the Cathedral of St. George at Novgorod, consists of a very white and compact lime intonaco containing some straw and few grains of sand as additives, as well as some flax, placed immediately under the uppermost layers of plaster or intonachino. This allows to immediately attribute the correct date to the fragments, because the later plasters contain a larger amount of rougher sand and brick fragments (see *Giumlia-Mair et al.*, 2022. P. 114).

Establishing what kind of plaster was used at Aquileia is a bit more difficult, because we can only observe it on a few spots, where the wall is slightly damaged or evaluate what is visible through the layer of pigment, especially on areas where it is slightly abraded. Nevertheless, the microscopic examination of the walls showed important details that help us to understand how the plaster was prepared. Some micrograph with ca. 50 X magnification shows for instance that short cuts of straw were mixed into the plaster together with sand (fig. 6), while other details reveal that the sand grains look like quartz particles and that they are not rounded like river or sea sand, but quite angular, like sand from a quarry (fig. 7). In one case also a few strands of flax or



• **Fig. 8. Microscope image showing some strands of oakum of linen or flax under a damaged lazurite pigment**



• **Fig. 9. Microscope image showing on the left the 9th century plaster consisting of lime and brick fragments and on the right the 12th century plaster containing sand and straw**

oakum of linen added to the plaster could be observed under the pigment (fig. 8).

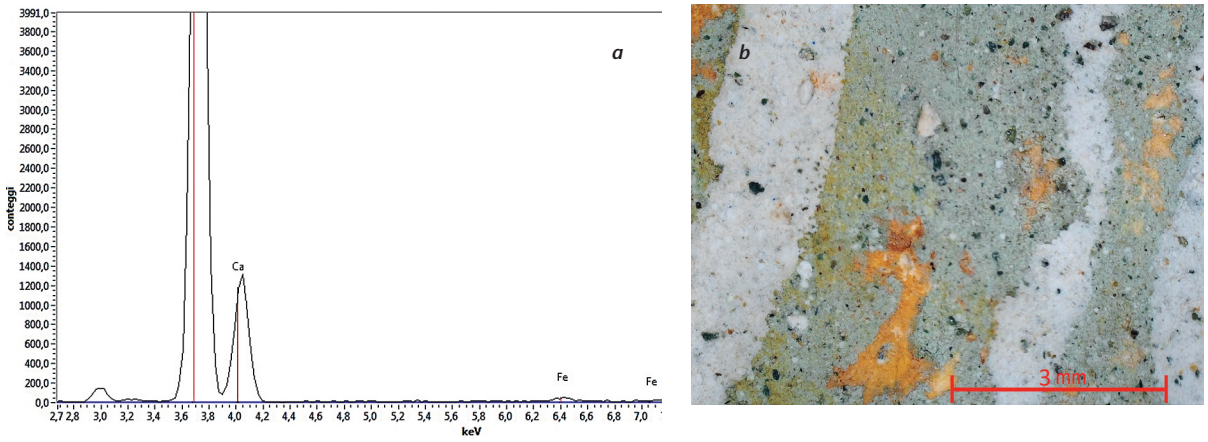
The microscopic examination of the plaster layers on the pillars allows us to distinguish between later and earlier layers. The lowest visible layer of plaster contains an admixture of brick fragments and may be related to the first decoration of the crypta, possibly to be dated to the Carolingian phase in the 9th century. This early plaster was later covered with the plaster containing sand that has the same composition of the intonaco on the walls (fig. 9). In various areas of the crypta several layers have been applied on top of each other, possibly at different times, and should be attributed to some conservation or restoration interventions in various periods.

Pigments. Optical microscopy was the first method we employed in the crypta of the basilica in Aquileia. The idea was that of comparing the texture and the color of the pigments at various magnifications and see if any parallels could be observed. The XRF analysis followed immediately after the microscopic examination.

White pigment. The white fields on the wall-paintings of Aquileia and of the St. George's Cathedral were created by applying calcium carbonate white ($CaCO_3$) on the plaster, i.e. it was lime-based with a prevalence of calcium. The white pigments in use in the St. George's Cathedral were mostly lime-based, but there were some exceptions. An example of this is fragment n. 3478, most probably belonging to a later phase. In this case the analyses conducted on this sample showed that the pigment had been produced by mixing cerussite, gypsum and kaolinite.

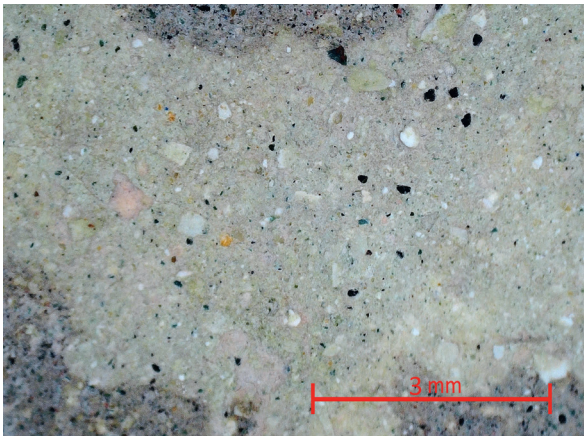
At Aquileia the white layer is often stained with yellowish spots, that might be salt efflorescence from the altered plaster, however the coloring can also depend on the pigment used on nearby areas or on the substrate. For example, on the white sleeve of Johan on the Crucifixion scene some cream-colored shadings were added, while on the white cloth of the first figure on the right of the Deposition from the Cross, representing Nicodemus, the shading on white was done with red ochre mixed with white. The white hair and beards of several figures are painted with a mixture of green earth with a few grains of powdered carbon and highlighted with calcium carbonate white. This is for instance the case with the figure of St. Nicholas in the corbel of the pillar to the right of the peacocks panel (fig. 10: *a, b*)

Grey or black pigments. In general, the black or grey colors were achieved by mixing powdered carbon or, in some cases soot (see below under blue pigments). The XRF method cannot distinguish between charcoal, soot, lamp black, wine black or burnt animal bones, but in some of the samples from Novgorod and also on the microscopy photos of the paint layers in the Basilica of Aquileia fragments of carbon can be easily recognized. Among the analyzed fragments from the St. George's Cathedral there was one instance of black, achieved with a manganese mixture, however, this being a single occurrence at least up to now, it probably does not belong to the 12th century fragments, but is very likely a later addition. Nevertheless, in the Classical antiquity black manganese mixtures of lime, manganese and iron salts were used in the eastern Mediterranean, for example in Cyprus and in general in Eastern Europe, and this pigment was still used in Byzantine churches (*Kakoulli*, 1995; *Hradil et al.*, 2003; *Iordanidis et al.*, 2014),



• **Fig. 10.** *a* **— the XRF measurement carried out on white pigment shows unmixed calcium carbonate white with only some impurities of iron from the red ochre pigment used next to the white;** *b* **— microscope image showing a detail of the "white" beard of St. Nicholas, painted with green earth and highlighted with calcium carbonate white. The yellow pigment showing through scratches was used for the nimbus that was painted before the face**

• **Fig. 11. Detail of the cyclus of the life of St. Hermagoras: the black carbon-based paint employed for the irises and pupils are now completely lost and the eyes are white**

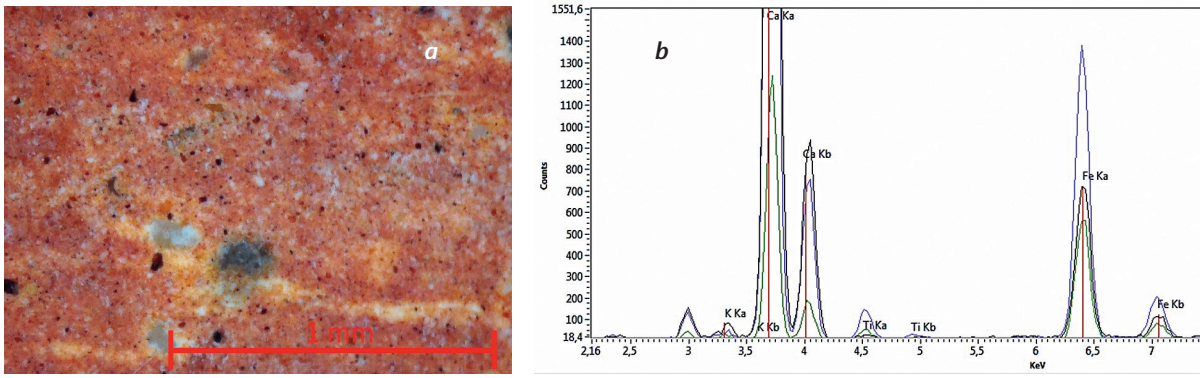


• **Fig. 12. Microscope image with detail of the leg of the peacock on the left. The lighter grey pigment consists of lime mixed with a few grains of powdered carbon and green earth, while the darker one is mixed with a larger amount of carbon and some green earth and lazurite grains**

so perhaps some import of this black pigment or at least the knowledge about it, possibly brought by Byzantine artists, is not impossible in Russia.

On the wall-paintings in the crypta of the Basilica there is no real black color, except for a few dark lines (that might have been originally dark blue) on some of the figures. However, it is quite important to note that many details that would normally be black or at least very dark are missing from the paintings and are clearly lost. As an example, we can mention the eyes of several figures, which are now completely white (fig. 11). The black pigment was not very stable as it was applied by mixing powdered charcoal od soot with some kind of organic glue, as mentioned by Vitruvius (de Architectura, 7, 10).

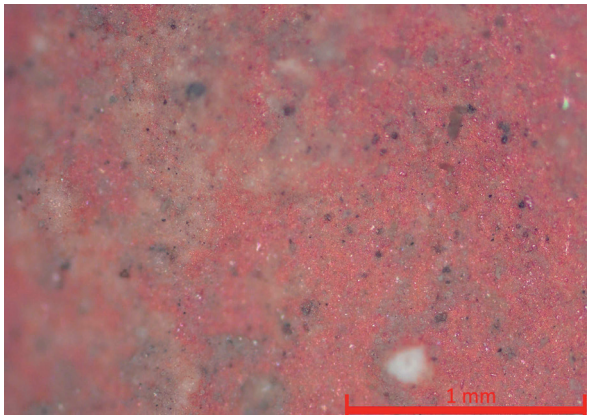
A grey color has been employed for many details, for example for the light and darker grey bands on the legs of the peacocks (fig. 12) for which calcium carbonate white was mixed with carbon for the lighter nuance, and with carbon, with a small amount of blue and green, for the darker bands. Carbon was abundantly employed both in Aquileia and in Novgorod as a substrate when darker hues were required (fig. 16: *a, b*; 17: *a, b*). In the Russian literature this material is called reft, elsewhere it is



• **Fig. 13.** *a* **— microscope image with detail of red band with masks. Red earth (ochre-based) pigments were used for all red fields;** *b* **— XRF measurements carried out on red, yellow and brown pigments on multiple plot, showing that all are-ochre based minerals containing more or less hematite, depending on the color**

known as veneda and in Byzantine times it was widely used in all Mediterranean countries, for instance in the church of Christ Antiphonitis's monastery near Kalogrea, district of Kyrenia (*Daniilia et al.,* 2008. P. 1697–1700) or in that of Santa Maria delle Cerrate near Lecce in Southern Italy (*De Benedetto et al.*, 2013. P. 59, fig. 1).

Red pigments. In both churches red ochre-based pigments are lavishly employed. The XRF analyses carried out on various red fields on the wall-paintings of the Basilica of Aquileia amply confirmed that ochre-based red earths, but also yellow and brown (fig. 13) were used for all red nuances, while at Novgorod also cinnabar was employed. The presence of this expensive pigment was for instance determined on sample 2376: XRF determined clear mercury peaks and microscopy shows the small crystals of cinnabar (fig. 14). The XRF analyses carried out on red fields and red details did not identify any cinnabar on the wall-paintings of Aquileia. The various red nuances were obtained by mixing red earth with calcium carbonate white to obtain a lighter color both in Aquileia and Novgorod, while the darker hues were obtained by mixing the pigment with brown earth or some form of carbon or soot.



• **Fig. 14. In the St. George's cathedral at Novgorod also the expensive cinnabar was in use. The microscope image shows tiny crystals of cinnabar. In the crypta of Aquileia no cinnabar was detected**

Brown pigments. Most of the brown areas and details have been painted in both churches by using brown ochre-based earth with many impurities. Interestingly, in one case, i.e. on the brown cloth of the first figure on the right of the lunette with the representation of the Deposition from the cross, the XRF analysis showed that here the brown earth was mixed with minium, however, as this was the only instance of the use of this pigment in the entire crypta it can be quite safely assumed that this must be a later retouching of the painting.

Yellow pigments. The main yellow pigment employed both at Novgorod and at Aquileia is yellow ochre (goethite, limonite or yellow earth $FeO(OH) \cdot n\,H_2O$). It consists mainly of goethite and clay, but can also contain organic substances, such as bitumen and humus derived particles. When darker hues were desired, it was mixed with red or brown ochre or with carbon. When lighter hues were planned it was mixed with calcite or kaolinite.

In the Cathedral of St. George at Novgorod most faces belonging to fragments dating from the 12th century were painted with yellow ochre, and only occasionally mixed with some white and possibly some minium, depending on the represented person. It has to be noted that minimum was employed during the renovation in the 17–18th centuries, while the use of minium in the 12th century remains questionable. In the Cathedral of St. George, in some cases, also cinnabar was employed to represent the pink on the cheeks. This was the case, for example, on the image of a mature lady

• **Fig. 15. The pigment used for the faces in the crypta of Aquileia has a pinkish tinge, while at Novgorod yellow ochre was employed as base color for faces. Detail of St. Nicholas' face in one of the corbels of the crypta**

characterized with a nimbus and wearing a *maphorium*, most probably the Mother of God: a small amount of cinnabar was identified on her cheek (*Giumlia-Mair et al.*, 2023a. P. 141, fig. 2).

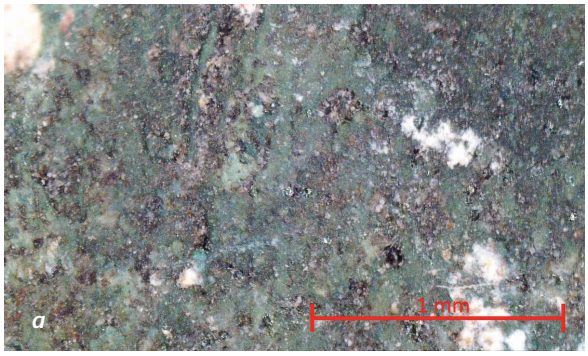
The pigment used for the faces in the wall-paintings of the Basilica of Aquileia has generally a more pinkish tinge and was obtained by mixing white with red ochre, as for instance on the face of St. Nicholas in the corbel of the pillar next to the peacocks panel (fig. 15). This is a major difference between the two churches.

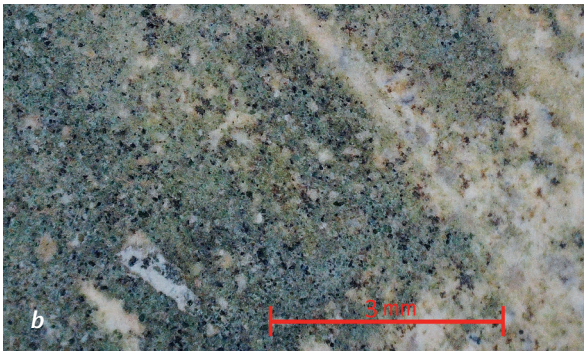
Green pigments. As all XRF analyses on the paintings of Aquileia and XRF, SEM-EDS and Raman carried out on the fragments from Novgorod have shown, all green nuances on the wall-paintings in both churches were obtained by using green earth, mixed with calcium carbonate white or with yellow ochre to obtain lighter hues and with carbon or sooth when a darker shade was desired. As already mentioned the ancient *creta viridis*, green earth, consisted of celadonite (approx. K[(Al, Fe_3+), (Fe_2+, Mg)]($AlSi_3$, Si_3)O_{10}($OH)_2$ with low Al content, and glauconite, with a large content of Al (approx. (K,Na) (Fe_3+,Al,Mg)$_3$ (Si,Al)$_4$ O10 ($OH)_2$). Philippova et al. relatively recently analyzed by XRD one green fragment from the St. George's Cathedral and identified green earth, with the prevalence of celadonite over glauconite, and some calcite (*Philippova et al.*, 2022. P. 5–6). Up to now we only have a few XRD analyses on green fragments from the Cathedral, and more are needed for a better understanding of the local techniques and pigments employed, but the few data we possess at the moment seem to confirm that the green earth employed at Novgorod consist of celadonite only as in the results of Philippova et al. (2022). Celadonite is the better-quality component of green earth as it gives a darker green hue than the rather pale glauconite.

Among the pigments from the Cathedral of St. George there were two exceptions: the XRF analyses showed that the pigment green earth was mixed with manganese and iron salts to darken it. Up to now these data have not been confirmed, so we suppose that this exception is due to some late retouching of the wall-painting.

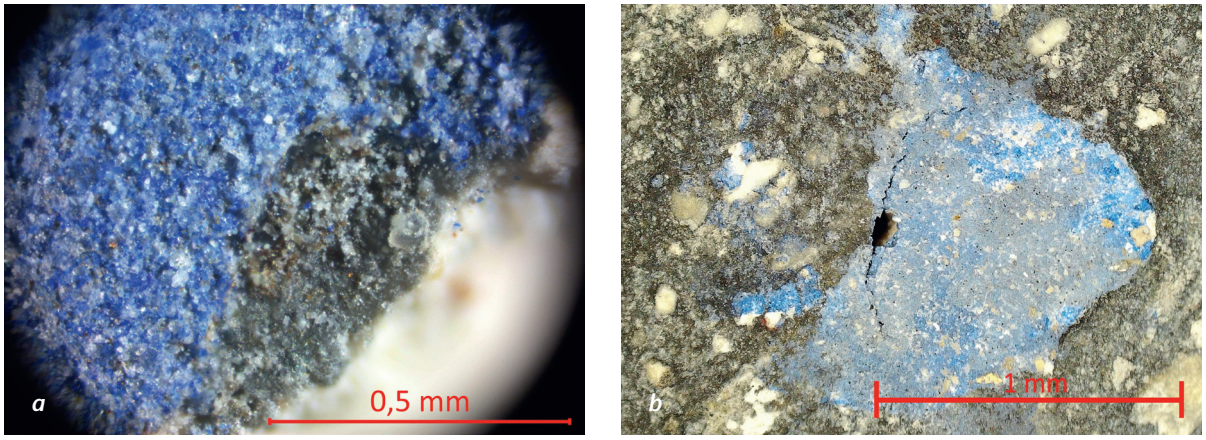
Good examples of the green earth mixtures are fragment 3406 from Novgorod, which shows a layer of green earth applied on reft, and the microscopy picture of the dark green grass background of the Crucifixion scene at Aquileia, on which carbon particles can be seen on the green earth pigment (fig. 16: *a, b*).

Blue pigments. We analyzed a large number of blue fragments from Novgorod (*Giumlia-Mair et al.*, 2022) and from the results we can assert that all of them contain lazurite ($(Na,Ca)_8(AlSiO_4)_6(S,SO_4,Cl)$), obtained from ground lapis lazuli. Being this a natural stone it is





• **Fig. 16. *a* — microscope image of fragment n. 3406 from Novgorod showing a green earth pigment with a carbon-based substrate; *b* — microscope image of green earth pigment in the crypta of the Basilica of Aquileia, green grass background on Crucifixion scene: the pigment is mixed with powdered carbon and some lazurite grains to darken the tinge**



• **Fig. 17.** *a* **— microscope detail of fragment n. 3481, showing lazurite applied on a layer of blackish reft, with all probability obtained by mixing lime with soot;** *b* **— microscope detail of lazurite applied on carbon-based black in the crypta of Aquileia**

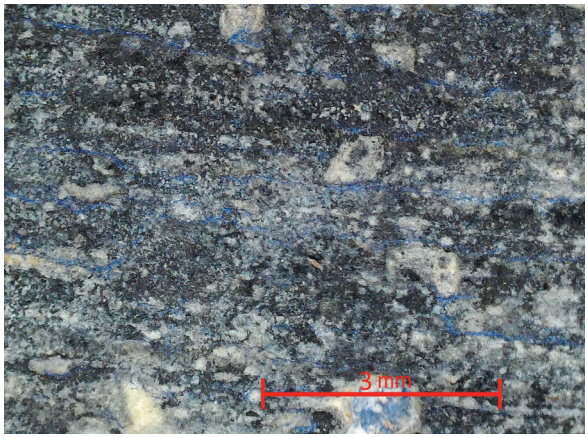
mixed with various other minerals, such as for instance nepheline (Na,K)$AlSiO_4$), sodalite ($Na_8(Al_6Si6O_{24})Cl_2$), quartz, sanidine/albite (Na,K)($AlSi_3O_8$), diopside $CaMgSi_2O_6$ and phlogopite ($K_2(MgFe)_6[Si_6Al_2O_{20}](OH)_4$) and traces of calcite and pyrites. Lazurite was the most expensive pigment since antiquity and through the Middle Ages and later until the third decade of the 19th century when artificial lazurite was produced (*Plesters*, 1993. P. 55). At Novgorod most blue samples had a substrate of blue clay (*Giumlia-Mair et al.*, 2022. Fig. 8–12), a kind of earth belonging to the smectite group, found in the oblast of St. Petersburg at Nikolskoye, but also in some places in Estonia and in Finland (*Eastaugh et al.*, 2008. P. 168). When a darker color was needed, a layer of reft was placed under the lazurite both at Novgorod and at Aquileia (fig. 17: *a, b*). It has to be noted, that the SEM-EDS examination of the section on samples from the St. George's Cathedral did not evidence grains of charcoal in the reft layer, so that we suppose that in this case soot, i.e. amorphous carbon, was employed.

The blue pigment in use in the crypta of Aquileia is also lazurite that, like the pigment in use at Novgorod, seems to have been refined. It is certain that it was imported from far away, almost certainly from the region Badakhshan in Afghanistan. On the lazurite of Novgorod we performed isotopic studies on the sulfur present in the samples with CF IRMS technique with FlashHT element analyzer and the results clearly indicate that the source of the blue pigment was Afghanistan (*Giumlia-Mair et al.*, 2024). Obviously, this kind of analysis cannot be performed on the blue pigments at Aquileia as the paintings are *in situ* and cannot be sampled.

Nevertheless, the results of the XRF analyses indicates that the blue pigment used at Aquileia was lazurite, as most of the elements that are diagnostic for this mineral have been determined, and no copper could be detected. However, the dark blue pigment applied on the frieze with masks on the wall above the velario with the representation of a non-identified man seated on a faldstool with offering pilgrims, is clearly a later addition or restoration. In this case the analyses showed that in the substance employed as a pigment only a small amount of lazurite is present, and it seems to be mixed with carbon black, to give the impression of dark blue (fig. 18). On an even later repair some iron and manganese salts have also been recognized, while the high peak of phosphor suggests that the carbon was obtained by burning animal bones. This method of giving the impression of a blue hue by using carbon black is known from several Byzantine churches. Such a pigment was for instance used in the Basilica of Guran, near Vodnjan in Istria (*Mazzocchin et al.*, 2007. P. 659), but also at Kastoria in several Byzantine churches (*Iordanidis et al.*, 2014. P. 2717). The church of Guran and those of Kastoria are dated between the 14th and the 17th century.

Painting process. Some features of the intonaco in the St. George's Cathedral indicate the usage of the *fresco* technique. The partition lines of the *pontata* that we identified in the crypta of Aquileia also show that the fresco technique was employed. The meeting edges of the single *pontate* are hidden under the red lines delimiting the scene composition in both, the St. George's Cathedral and the crypta of the Basilica of Aquileia.

The main pigments for the backgrounds are green earth and lazurite in both cases, but in the Cathedral



• **Fig. 18. Microscope detail: late "restoration" of the masks band for which "false blue" was employed: the pigment consists mainly of carbon-black with a small amount of lazurite**

of St. George the areas covered with lazurite seem to be much larger. The methods of painting the draperies are also quite similar. The folds of clothing in both the St. George's Cathedral and the crypta of Aquileia were highlighted with calcium white. In Aquileia a later retouching employed unmixed calcium white, while in Novgorod calcium white with the addition of the pigment employed for the clothing was used. There are more noticeable differences in the representation of faces. In Aquileia the faces are drawn by using the same procedure in all cases. The first step was a light background of the face, then the shadows were outlined with green earth. After this, the lines of the drawing were emphasized with unmixed red ochre and red ochre mixed with calcium white, however, in numerous cases the underlying painting is hidden by the later retouches, done mainly with darker ochre red and unmixed calcium white. In the St. George's Cathedral, various techniques were in use. The process began with a light background on the face. Then the shadows were outlined with a mixture of red and yellow ochre and green earth for the deeper shadows. The ratio of the components varied, giving different expressions to the faces. For the outlines a dark red ochre, sometimes with the addition of carbon-based pigment, was employed and the lines are finer, however this might be more a matter of style than technology. In rather rare cases in Novgorod cinnabar was used to create a soft blush for the cheeks, while in Aquileia pinkish contrasting blush and lines are found on almost all faces. Finally, in the Cathedral of St. George the highlights consist of calcium carbonate white mixed with yellow ochre that gives a softer light effect, while in Aquileia the unmixed white, which comes mostly from later retouches, creates a much greater contrast.

Conclusions. The comparison of the wall-painting technology in Novgorod and Aquileia illustrates the many nuances of the Byzantine painting tradition in the 12th century. In the paintings of the crypta of Aquileia one can certainly see local peculiarities, such as the cycle of images on the life of St. Hermagoras, the battle scene with the Saracens, bright blood in the crucifixion scene, which is not typical for the Orthodox iconography, however, our research on technology shows that these works of art certainly belong to the Byzantine wall-painting tradition.

Comparing the pigments and painting techniques of two churches that have been studied by using such different methods of analysis is not so easy, but after analyzing by XRF as many details of the wall-paintings of Aquileia as possible we can reach interesting conclusions and establish similarities and differences between the Russian-Byzantine and the Venetian-Byzantine 12th century wall-paintings. The first observation is that in both cases the artists generally employed "classical" Byzantine pigments and techniques, with earth pigments, such as red, yellow, and brown ochres, green earth, white earth, as well as carbon mixtures and lazurite. However, while in the Cathedral of St. George at Novgorod some cinnabar was also employed, no traces of this expensive pigment have been identified at Aquileia. Further, it seems that on several areas of the Novgorodian paintings some minium was mixed with yellow ochre and calcium carbonate white to obtain a color for the faces of saints. In the crypta of Aquileia instead minium has been identified on only one spot in a reddish-brown pigment used for the clothes of one single figure, suggesting thus that this addition is only a late retouching or restoration. It is however quite striking that in both churches the most expensive pigment lazurite was employed for the blue color without any addition of a copper-based pigment like azurite, as it was widely done in Roman times. Also, in both cases, when a dark blue color was needed, the lazurite was applied on a layer of reft (or veneda) obtained with carbon or soot. At Aquileia we detect a tendency of darkening green earth by mixing it with carbon, while at Novgorod the main method was that of applying it on top of a reft layer.

A major difference between the two is found in the use of pigments when representing the flesh color on faces and bodies. The artists who painted the saints figure in the St. George's Cathedral in the 12th century

used yellow ochre, only occasionally mixed with a small amount of cinnabar or minium. The color employed for representing human flesh at Aquileia seems to be more pinkish and it was obtained by mixing calcium carbonate white with red ochre and perhaps only a small amount of yellow ochre. Finally, at Novgorod the shading, the details of faces, body and hair are mostly given with brown ochre and green earth. At Aquileia in numerous cases the paintings were faded and the faces have been repainted in later times with red ochre and calcium carbonate white on top of the almost gone green earth, therefore it is rather difficult to distinguish the original shading technique.

A further major difference is found in the plasters: at Novgorod it is very white, and the only additives are straw or wood shavings, oakum of linen (or flax) and very few small grains of sand, while the plaster at Aquileia contains straw, oakum of linen and a noticeable amount of sand. The production of intonaco and the additives (or aggregates) very much depend on what was locally available, so that the diverse texture of the plasters does not represent a big surprise.

The analytical results of the wall-paintings in the crypta of Aquileia can be compared with those of the architectural elements in the so-called Veneto-Byzantine style in the National Archaeological Museum of Cividale, dated to the second half of the 12th century (*Roascio et al.*, 2002). At this time Cividale was an important town belonging to the territory of the Patriarchs of Aquileia and the architectural parts must have belonged to the Palace of the Patriarchs of Aquileia that was the seat of the Patriarch when at Cividale. This palace was demolished in 1553. The remains of pigments on the sculpted architectural parts in the Cividale Museum have been analyzed by SEM-EDS and PIXE by Roascio et al. (2002). They took six samples of different color (white, red, yellow, green, vivid blue and dark blue) for the investigation. The results showed that the white pigment was calcium carbonate, possibly slightly altered, because of the traces of sulfur they detected. Allegedly, the yellow pigment consisted of litharge mixed with calcium carbonate or of minium mixed with calcium carbonate white. Litharge was not present in the Cathedral of St. George nor in the Basilica of Aquileia. Further, at Cividale the red pigment was red ochre, and the green one was green earth. The bright blue pigment was lazurite, while the dark blue color was the so-called "Paris blue" pigment ($Fe_4[Fe(CN)_6]_3$). This was certainly a much later "restoration" that possibly happened in the 18th century, before the sculptured pieces came to the museum in 1818, and certainly after 1750, when the "Paris blue" pigment became available (*Roascio et al.*, 2002. P. 294). Litharge was used by the Romans as a pigment, but it is quite surprising in this period, perhaps minium would be a better interpretation of the data.

The most interesting result is again the quite abundant use of lazurite at Cividale, but also at Aquileia that suggests a direct import from Venice. At the time, the town of Venice seems to have had the monopoly of the trade with lazurite from Afghanistan through its ports of trade around the Mediterranean and an amazing economic power, being the entrepôt between the Ottomans (who received lapis lazuli from Afghanistan through Iran) and Europe (*Plesters*, 1993. P. 38). It is certain that the Venetian merchants were the ones who delivered the precious lazurite and possibly also other pigments to Aquileia. We do not know the 12th century trading routes from Afghanistan to Russia, but the lavish usage of lazurite at Novgorod suggests that receiving this pigment did not represent a problem for the Russian-Byzantine painters.

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Иллюстрации

Ил. 1. Собор Св. Георгия в Новгороде, вид с р. Волхов

Ил. 2. Базилика Санта-Мария Ассунта в Аквилее

Ил. 3. Одна из сцен Страстей Христовых в крипте: «Снятие с креста»

Ил. 4. Колонны IX в. с относящимися к XII в. изображениями святых на капителях. На сводах представлены сцены из жизни св. Ермагора. Повреждения, нанесенные установкой решетки для Сокровищницы, видны на трех капителях

Ил. 5. «Веларий» с изображением воина, преследующего сарацина

Ил. 6. Полученное с помощью микроскопа изображение показывает штукатурку XII в., состоящую из извести, смешанной с кварцевым песком и соломой

Ил. 7. Полученное с помощью микроскопа изображение угловатых зерен песка, видимых под поврежденным слоем желтого пигмента

Ил. 8. Полученное с помощью микроскопа изображение волокон пакли изо льна или пеньки под поврежденным слоем лазурита

Ил. 9. Полученное с помощью микроскопа изображение: слева — штукатурка IX в., состоящая из извести и фрагментов кирпича; справа — штукатурка XII в., содержащая песок и солому

Ил. 10. *a* — результаты РФА-анализа белого пигмента показывают чистый карбонат кальция с небольшими примесями железа из красного охристого пигмента, использованного рядом с белым; *b* — полученное с помощью микроскопа изображение детали «белой» бороды Святителя Николая, написанной зеленой землей и выделенной белым карбонатом кальция. Желтый пигмент, видимый сквозь царапины, использовался для нимба, который был нанесен до изображения лица

Ил. 11. Деталь жития св. Ермагора: черная краска на основе углерода, использованная для радужки глаза и зрачков, полностью утрачена, глаза белые

Ил. 12. Полученное с помощью микроскопа изображение детали ноги павлина (слева). Светло-серый пигмент состоит из извести, смешанной с несколькими крупицами

углерода, и зеленой земли. Темный пигмент содержит больше углерода, а также зеленую землю и частицы лазурита

Ил. 13. *a* — полученное с помощью микроскопа изображение детали красной полосы с масками. Для всех красных областей использовались охристые пигменты на основе красной земли; *b* — результаты РФА-анализа красных, желтых и коричневых пигментов показывают, что все они состоят из охристых минералов, содержащих разное количество гематита в зависимости от цвета

Ил. 14. В соборе Св. Георгия в Новгороде использовалась также дорогая киноварь. Полученное с помощью микроскопа изображение показывает крошечные кристаллы киновари. В крипте Аквилеи киноварь не была обнаружена

Ил. 15. Пигмент, использованный для лика в крипте Аквилеи, имеет розоватый оттенок, тогда как в Новгороде в качестве базового цвета для лиц применялся желтый охристый пигмент. Деталь лика св. Николая на одной из капителей крипты

Ил. 16. *a* — полученное с помощью микроскопа изображение фрагмента № 3406 из Новгорода: представлен зеленый пигмент на углеродной основе; *b* — полученное с помощью микроскопа изображение зеленого пигмента в крипте базилики Аквилеи, зеленая трава фона в сцене Распятия: пигмент смешан с углеродным порошком и небольшим количеством зерен лазурита для более темных оттенков

Ил. 17. *a* — полученное с помощью микроскопа изображение фрагмента № 3481, показывающее лазурит, нанесенный на слой черноватой рефти, предположительно полученной путем смешивания извести с сажей; *b* — микрофотография лазурита, нанесенного на углеродное черное основание, в крипте Аквилеи

Ил. 18. Полученное с помощью микроскопа изображение: поздняя «реставрация» полосы с масками, для которой использовался «ложный голубой» пигмент: пигмент состоит преимущественно из углеродно-черного с небольшим количеством лазурита

Все фотографии выполнены авторами.

А. Джиумлиа-Маир, Е. Я. Зубавичус. Сравнение настенных росписей XII в.: Новгород и Аквилея

Аннотация. В статье частично представлены результаты аналитических исследований фрагментов фресок разных исторических периодов из раскопок внутри и вокруг Георгиевского собора Юрьева монастыря в Новгороде. Раскопки проводились Институтом археологии РАН в 2013–2022 гг. Мы сравнили пигменты и технологию XII в. в Новгороде с недавно изученными нашей командой материалами венето-византийских настенных росписей в базилике Санта-Мария-Ассунта в Аквилее, которая находится в провинции Удине в Италии. Целью работы было сопоставление хронологически близких настенных росписей в разных частях Европы. В статье рассмотрены традиции живописи и подготовительные слои.

Ключевые слова: РФА, СЭМ-ЭРМ, Рамановская спектроскопия, пигменты, штукатурка, монументальная живопись, Средние века, Георгиевский собор Юрьева монастыря, Санта-Мария-Ассунта в Аквилее.

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Список сокращений

АА — Архитектурная археология. М.

АИППЗ — Археология и история Пскова и Псковской земли. М.; Псков

АН — Архитектурное наследство. М.

АН СССР — Академия наук СССР

АО — Археологические открытия. М.

БЛДР — Библиотека литературы Древней Руси

Вестник ПСТГУ — Вестник Православного Свято-Тихоновского гуманитарного университета. М.

ВОИДР — Временник Императорского московского общества истории и древностей российских. М.

ГАНО — Государственный архив Новгородской области

ГБУК — государственное бюджетное учреждение культуры

ГВНП — Грамоты Великого Новгорода и Пскова

ГТГ — Государственная Третьяковская галерея

ГУГООКН ТО — Главное управление по государственной охране объектов культурного наследия Тверской области

ГЭ — Государственный Эрмитаж

Д. — дело

ИА РАН — Институт археологии РАН

ИГАИМК — Известия Государственной академии истории материальной культуры. М.; Л.

ИИАК — Известия Императорской Археологической комиссии. СПб.

ИИМК РАН — Институт истории материальной культуры РАН

ИТОИАЭ — Известия Таврического общества истории, археологии и этнографии. Симферополь

КП — книга поступлений

КСИА — Краткие сообщения Института археологии. М.

КСИИМК — Краткие сообщения о докладах и полевых исследованиях Института истории материальной культуры. М.; Л.

Л. — лист

МАИЭТ — Материалы по археологии, истории и этнографии Таврии. Симферополь

МАМЮ — Московский архив Министерства юстиции

НГОМЗ — Новгородский государственный объединенный музей-заповедник

НИС — Новгородский исторический сборник. Новгород

НЛ — Новгородские летописи

ННЗИА — Новгород и Новгородская земля. История и археология. Великий Новгород

ННРУ — Новгородское научно-реставрационное управление

НПЛ — Новгородская первая летопись старшего и младшего изводов

об. — оборот

ОН ГИМ — Отдел нумизматики Государственного исторического музея

Оп. — опись

ПКНО — Памятники культуры. Новые открытия

ПМЗ — Псковский музей-заповедник

ПСРЛ — Полное собрание русских летописей

ПЭ — Православная энциклопедия

РАН — Российская академия наук

РГАДА — Российский государственный архив древних актов

РГНФ — Российский гуманитарный научный фонд

СА — Советская археология. М.

Ф. — фонд

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ФО НА ИИМК РАН — Фотографический отдел Научного архива ИИМК РАН

ЦКП ИА РАН — Центр коллективного пользования ИА РАН

OM — Optic microscopy

SEM EDS — scanning electron microscopy with energy dispersive x-ray fluorescence spectroscopy

SOAS — The School of Oriental and African Studies

XRF — x-ray fluorescence spectroscopy

Авторам

Правила оформления статей

Материалы пересылаются в редакцию сборника по адресу architectural.archeology@yandex.ru (в качестве дублирующих — zakomara@yandex.ru, jin-arx@yandex.ru, elreserva@ya.ru) в электронном виде с соблюдением следующих правил:

1. Текстовый файл под названием «Фамилия_текст» должен содержать следующие материалы, каждый из которых желательно размещать на новой странице:

— основной текст статьи;

— список литературы (см. ниже, п. 5);

— список подрисуночных подписей (см. ниже, п. 4);

— аннотация (не более 700 знаков с пробелами);

— ключевые слова (не более 7–10 слов и словосочетаний);

— сведения об авторе (см. ниже, п. 6);

— список сокращений.

Общий объем всех перечисленных текстовых материалов не должен превышать 40 000 знаков с пробелами.

2. Текст должен быть набран с использованием редактора Word: шрифт Times New Roman, размер шрифта — 12, межстрочный интервал — 1,5; форматирование текста должно быть автоматическим. В заголовке инициалы ставятся перед фамилиями авторов. Название печатается не прописными буквами.

3. Иллюстрации предоставляются в электронном виде, в отдельных файлах формата .tiff или .jpg (они должны называться «Фамилия_автора_1.tiff», «Фамилия_автора_2.jpg» и т. д.), в текст статьи иллюстрации не вставляются. Количество иллюстраций не должно быть больше количества страниц текста статьи, поделенного на 2. Файлы должны быть пронумерованы в соответствии с порядком ссылок на них в тексте статьи. В тексте статьи обязательна разметка (ссылки на номера) иллюстраций. Для иллюстраций дается нумерация арабскими цифрами, в текст вставляются ссылки вида: (ил. 1: *а, б*), (ил. 2). Все черно-белые иллюстрации должны быть сканированы в режиме «градации серого», в масштабе 1:1, при этом фотографии — с разрешением не ниже 300 dpi, а штриховые рисунки — не ниже 600 dpi.

4. В подрисуночной подписи должна содержаться следующая информация: объект, название иллюстрации, автор, дата, для архивных материалов — местонахождение (собрание, город/страна).

Например:

Ил. 1. Знаменская (Пятницкая) церковь во Владимире. Архивная фотография 1958 г. Вид с севера;

Ил. 2. Георгиевский собор Юрьева монастыря. План по уровню промежуточной зачистки пола. Чертеж А. А. Поповой, 2014 г.

В подписи должны быть кратко расшифрованы все условные обозначения на иллюстрации. В графический файл подрисуночные подписи и расшифровки условных обозначений не вставляются.

5. Список литературы дается в алфавитном порядке и состоит из двух частей. Первая часть — издания на кириллице, вторая — на латинице. Названия отчетов о полевых исследованиях включаются в общий список. Список литературы составляется в обычном библиографическом порядке. При ссылке на книгу следует указывать количество страниц; при ссылке на статью или раздел в монографии — диапазон страниц данной публикации в издании. Необходимо указывать ответственного редактора книги, а после места издания — издательство. Труды одного автора располагаются в хронологическом порядке. При ссылке на разные произведения одного автора, вышедшие в одном году, в библиографическом списке и в тексте статьи к году добавляются литеры в порядке алфавита.

Например:

Карасев А. Н. Развитие строительно-каменотесного ремесла в античных городах Северного Причерноморья (VII–I вв. до н. э.) // Проблемы истории Северного Причерноморья в античную эпоху / отв. ред. А. П. Смирнов. М.: изд-во АН СССР, 1959. С. 126–138.

Масленников А. А. Отчет Восточно-Крымской археологической экспедиции ИА РАН за 1994 г. // Научно-отраслевой архив ИА РАН. Р-I. Д. № 19540. 225 с.

Седов Вл. В. Лестничная башня в Боголюбове (по материалам раскопок 2015 года) // КСИА. 2017а. Вып. 249, ч. II. С. 131–150.

Седов Вл. В. Северный портал собора Рождества Богородицы в Боголюбове // КСИА. 2017б. Вып. 246. С. 56–69.

Böhmer J. F. Regesta imperii. Bd. IV, 2. Wien; Köln: Böhlau Verlag, 1991. 305 S.

Coden F. Sguardo d'insieme all'architettura umbra del Duecento // L'Umbria nel XIII secolo. Spoleto: Centro italiano di studi sull'alto Medioevo, 2011. P. 333–420.

Lo Sardo E. E. Kircher's Rome // Athanasius Kircher: The Last Man Who Knew Everything / ed. P. Findlen. New York; London: Routledge, 2004. P. 51–62.

В тексте в круглых скобках указываются фамилия автора (на языке издания) или сокращенное название (если издание автора не имеет), год издания, ссылка на страницу, рисунок, таблицу (*Карасев*, 1959. С. 135). Ссылки на источники — оригинальные работы древних авторов, архивные материалы (кроме полевых отчетов), музейные коллекции — приводятся в скобках в тексте (РГАДА. Ф. 19. Оп. 1. Ед. хр. 379. Л. 105) и в список литературы не включаются.

6. К статье прилагаются сведения об авторе (авторах) с указанием фамилии, имени и отчества, ученой степени, полного почтового адреса и полного названия учреждения — места работы, телефонов (для оперативной связи, не для публикации), адреса электронной почты и даты отправления.

Об издании

Издание включено в систему Российского индекса научного цитирования (РИНЦ) и в перечень рецензируемых научных изданий (перечень ВАК). В нем публикуются основные результаты диссертаций на соискание ученой степени кандидата наук, на соискание ученой степени доктора наук по следующим научным специальностям и соответствующим им отраслям науки:

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Подписка на издание оформляется по Объединенному каталогу «Пресса России», подписной индекс 79663

Утверждено к печати Ученым советом Института археологии Российской академии наук

На обложке — каменная плита с резьбой из новгородского Софийского собора (гипотетическая реконструкция). Чертеж Ю. С. Фомичёвой (к статье Вл. В. Седова и Ю. С. Фомичёвой. С. 136).

Архитектурная археология = Architectural archeology, № 6 / Институт археологии
А87 Российской академии наук.— Москва: Институт археологии РАН, 2024.— 240 с.

ISSN 2686-6900. ISBN 978-5-94375-455-5

Шестой номер ежегодника включает материалы конференции «Архитектурная археология: материальный мир древних памятников», прошедшей в апреле 2023 г. в Великом Новгороде. Её приоритетные темы относились к естественно-научным исследованиям памятников архитектуры и материального мира Средневековья. Был затронут обширный круг проблем, связанных с изучением не только архитектурных конструкций и строительных материалов, но и предметов искусства и ремесла. Вследствие специфики конференции к традиционным рубрикам ежегодника прибавилась новая, «Естественно-научное измерение», отразившая интерес ученых-гуманитариев к взаимодействию со специалистами точных наук. Отдельное направление конференции было посвящено изучению фресок и церковной живописи в памятниках Средневековья и Нового времени — исследованию целых композиций и фресковых фрагментов. Номер содержит статьи о памятниках, расположенных на территории России, Италии, Балкан, Сирии, Турции, и охватывает объекты, датируемые от VI до XVIII в.

УДК 72.025.4:902/904(051)
ББК 85.11я5 + 85.118я5

Архитектурная археология

Выпуск 6

НАУЧНОЕ ИЗДАНИЕ

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Верстка и подготовка иллюстраций: *А. В. Лазарев*

Подписано в печать 24.12.2024.
Формат 60 × 84 1/8. 27,9 усл.-печ. л.
Заказ № Тираж экз.

Подготовлено в Институте археологии РАН.
117292, Москва, ул. Дм. Ульянова, 19.
Тел.: +7 (499) 126-47-98

Отпечатано с готового оригинал-макета
в типографии ООО «Принт».
426035, г. Ижевск, ул. Тимирязева, 5.