INTERNATIONAL JOURNAL OF CONSERVATION SCIENCE
ISSN: 2067-533X Volume 17, Issue 1, 2026: 25-42 www.ijcs.ro
DOI: 10. 36868/IJCS.2026.01.02

ROTUNDA OF THE HOLY VIRGIN MARY AT THE WAWEL HILL IN CRACOW: FROM THE FUNCTIONAL AND SPATIAL ISSUES

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Abstract

The article concerns the rotunda of the Holy Virgin Mary at Wawel Hill, which is one of the oldest preserved stone churches in Poland. Although its walls have been preserved to a height of 1.5 to 6 meters, which is quite a good condition for the analysis of the building, it is still the subject of scientific discussions, and the problem related to its functional and spatial organization has not yet been unequivocally solved. The rotunda has been studied since its discovery, i.e., from the beginning of the 20th century to the present day, but there are no clear answers to the basic bothering questions, such as the lack of external entry to the building, the question of the existence of a crypt in the building, or the connection of the rotunda with the alleged palatial building. The author of this article has taken up a polemic with the views currently established in the literature, based on her own research, including non-invasive methods, and as a result of the research and the analysis of the issues, she presents alternative solutions to the above-mentioned key issues.

***Keywords**: Early medieval architecture; Crypt; Palatial complex; Construction; Non-invasive research methods*

Introduction

The Rotunda of the Holy Virgin Mary at the Wawel Hill is considered to be the best-preserved pre-Romanesque building in Lesser Poland [1] and is dated to the end of the 10^{th} or the beginning of the 11^{th} century.

The walls of the church are built of broken, thin sandstone slabs, layered in the *opus incertum* technique, and bonded with pure-lime mortar. The walls have been preserved to a large extent, especially the southeastern apse, reaching over 6 meters. Both the thread of the external face of the wall and the exposed interior are perfectly legible. The thickness of the wall is relatively small and amounts to about 1 meter. The temple was founded directly on the rock and does not have a foundation part. On a European scale, it is a relatively small facility. The round, central nave has a diameter of 4.8 meters, and the adjacent four apses, giving the projection of the building the form of the so-called *tetraconchos,* have the same diameter of 2.8 meters. On the southwest side, there was an additional fifth apse, connected to the interior by a passage opening with a semicircular vault [2] and a fragment of a straight wall (B) tied to the rotunda, which is the remains of further buildings that have not been clearly identified to this day. From the northwest side, another, later fragment of the wall (A) is added to the apse, with a relatively parallel course

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to the wall (B). The size of the rotunda is the smallest in relation to the early examples of central architecture known to us in Poland, dating back to around the mid-11th century (Fig. 1).

To this day, three basic issues concerning the rotunda are still open for discussion. Two of them concern the spatial disposition of the building, i.e., the existence or absence of the alleged crypt, and the issue of external communication, which, despite the good state of preservation of the building, is still a topic subject of scientific discussion. The third issue concerns the primary function of the object. In this article, the author aims to raise these issues once again, analyzing the existing concepts and results of previous archaeological and architectural research, as well as presenting formal arguments based on her GPR, thermal imaging, and analytical research.

State of Research

The Rotunda of the Holy Virgin Mary was discovered during the restoration works of the Wawel Hill in the area of the so-called Royal Kitchens by Zygmunt Hendel [3]. Architectural and archaeological research was continued in this place by Adolf Szyszko-Bohusz, who was the first to attempt to reconstruct the building [4], [5]. Further archaeological works at the rotunda were carried out in the years 1956-57 by Andrzej Żaki, Józef Niżnik, Krzysztof Szuwarowski, Stanisław Walczy, and Stanisław Kozieł [2]. The result of another research action in the years 1964-66 was the uncovering of relics of two walls, within which a skeletal burial was found. In the 70s and 80s of the previous century, the area of the rotunda was returned again with the research. Archaeological work was carried out by J. Niżnik, S. Kozieł, and K. Żurowska under the supervision of S. Walczy [3], [4], [5], [6]. The research brought further results and shed new light on the architecture of the Wawel *tetraconchos*. Already in the 1960s, the unveiling of a negative of a wooden pillar in the so-called fifth apse prompted K. Żurowska to interpret it as a relic testimony to the existence of a staircase in this place and for the first time suggested the possibility of the existence of a palatial building connected to the rotunda on a common axis. At that time, Żurowska's theory was sharply criticized by A. Żaki, who considered the circular annex, i.e., the so-called fifth apse, to be a kind of porch [7], [8]. In the 1960s and 1980s, two extensive publications by this researcher appeared on studies and research on the rotunda of the Holy Virgin Mary [3]-[6]. The publication from 1983 was accompanied by an article by Tomasz Węcławowicz analyzing and summarizing the collected research materials in detail. In conclusion, T. Węcławowicz presented a version of the reconstruction of the building as a two-level building with a crypt [9]. Czech researchers, led by J. Cibulka, saw the rotunda of St. Vitus in Prague as the prototype for the Wawel *tetraconchos*. This theory was supported by V. Mencel and then by V. Mole, A. Merhautova, K. Żurowska, and Z. Świechowski [10], [11]. However, later research by J. Frolik changed this view when the Czech archaeologist questioned the four-apse layout of the Prague church [12]. Z. Pianowski fully supported both Frolik's research and the concept of reconstruction proposed by T. Węcławowicz, at the same time defining the function of the rotunda as a reliquary chapel and perhaps even a princely treasury [13], [14], [15]. Among the main opponents of this theory were *A. Merhautova* [16] and *Z. Świechowski* [17]. A different position as to the provenance of the rotunda was taken by the Ukrainian researcher *J. Dyba* [18], who, seeing in the rotunda of the Holy Virgin Mary Hungarian architectural patterns transplanted here by Bela I, thus slightly shifted the dating of the rotunda to the mid-11th century. According to him, the rotunda was a one-story building, and the disputed entrance would be located on the axis of the two-level western annex. I also wrote personally about the rotunda of the Holy Virgin Mary in the pages of the Journal of Heritage Conservation, emphasizing the ancient roots of the four-apse plan, and in terms of external communication, I also mentioned the possibility of entering the rotunda by stairs or a ramp modeled on western churches, as in the case of the rotunda in Cuxa [19]. This theory was developed and thoroughly analyzed by T. Rodzińska-Chorąży in her habilitation publication, presenting the author's concept of communication by stairs to a two-story building directly to the level of the western gallery (matroneum). She also presented two variants of the reconstruction of this type of solution [20], [21]. In 2013, in a monograph published by me, I returned, among other things, to considerations on the Wawel rotunda, presenting a completely alternative communication solution and function of the building, referring to the original concept proposed by K. Żurowska, but with a different orientation of the layout [22].

Research objectives and methods

The aim of the article is to demonstrate that the proposal to reconstruct the rotunda of the Holy Virgin Mary at Wawel as a two-story building with a crypt, which is still common and accepted in the scientific community, including the latest concept of T. Rodzińska-Chorąży, has no archaeological and architectural premises. At the same time, the article presents the results of research and analyses carried out by the author, including geophysical surveys (thermal imaging and GPR prospection) and analytical architectural and structural studies. The author's research took into account cultural layers preserved in the form of ”archaeological witnesses” and located in the close vicinity of the rotunda in the interior of the ”Wawel Lost” archaeological and architectural reserve. All of the above-mentioned aspects constitute substantive premises to undermine the theory of the existence of the crypt in the Wawel rotunda. The article also discusses the probable solutions for entering the building from the outside. The arguments were based on the results of the above-mentioned research and analogous solutions used in early Piast and European architecture.

Explanation of the issues and argumentative analysis

The Rotunda of the Holy Virgin Mary, although so well preserved, still arouses emotions and disputes related to the attempt to reconstruct the body of the building, reconstruct its spatial disposition, and define its function. The key to answering the doubts accumulating around the rotunda is to solve the problem of external communication. Awareness of this problem accompanied both the discoverer of the church and its subsequent researchers. The first reconstruction of the rotunda, more intuitive than scientific, was already proposed by A. Szyszko-Bohusz, who believed that the shape of the building should refer to the tradition of Byzantine construction, transferred to the Polish territory, as he believed, through the Great Moravian State [4]. The second reconstruction of this researcher, taking into account architectural measurements and based on archaeological research, was created two years later, when a circular annex known in the literature as the so-called fifth apse was recognized [23], [24]. The form of the church proposed by Szyszko-Bohusz was simple, additive, and massive. The one-story, low (11.0 m) building in the central nave was covered with a dome, and in the apses with semi-domes. The entrance to the temple was to lead through a door opening located by him in the northeastern apse, which is now considered not very reliable as the original entrance, and the temple was not oriented in his opinion. After further research in the 50s and 60s of the 20th century, several concepts for the reconstruction of the building were created at the same time. K. Żurowska, conducting a broad and thorough comparative analysis of the rotunda, saw it in the context of buildings with ancient traditions. In the southwest, she reconstructed the western gallery (matroneum, empore), which was reached by a spiral staircase that was to be located in the fifth apse. The recurring problem of communication from the outside inspired the researcher to present a hypothesis of an alleged palatial building, coupled on the axis with the rotunda. This concept in a natural and uncomplicated way allowed the communication, which took place from the level of the palace floor directly to the gallery of the chapel associated with it, without the need to place a door opening on the ground floor level. Such solutions are known from other palatial complexes in early medieval architecture in Poland and other European countries. The theory was criticized by *A. Żaki* [24], who considered the obstacles in the natural shape of the rock of the Wawel Hill, occurring in the area of the rotunda, as the main counterargument to the concept of the palas. In the vicinity of the church, the rock fell rapidly towards the northwest, creating a kind of fault [25]. Z. *Świechowski* [25] also spoke against Żurowska's concept, followed by *Z. Pianowski* [14], who considered the thickness of the wall (B) tied to the rotunda to be insufficient for the main walls of the palace (the wall tied to the rotunda is 80 cm thick), and *P. Urbańczyk* [26], referring to the counterarguments of his predecessors, Z. *Świechowski* [25], *Rudolf Jamka* [27], *S. Kozieł* [28], and *A. Tomaszewski* [29], commented on the terrain of Wawel Hill, analyzing the issue in detail. *S. Kozieł* [28] proposed the reconstruction of the rotunda as a free-standing building with a westwork with the western gallery (matroneum). *A. Tomaszewski* [29], on the other hand, introduced an ambulatory with an upper, surrounding gallery story inside the church, without communicating individual balconies with each other [30]. As a result of so much criticism, K. Żurowska began to withdraw from the concept of the palatium and considered the option of a free-standing church. As part of her publication, there was an article written by T. Węcławowicz, a scientist cooperating with her, who, analyzing the relics of the preserved walls and the terrain, presented a completely new concept of the rotunda of the Holy Virgin Mary, distinguishing the crypt and the upper storey, equipped with a western gallery in this small building [9]. This concept was supported by Żurowska. In the reconstruction proposed by Węcławowicz, the height of the building was increased by 1/3, which was necessary for the introduction of the crypt. This resulted in a slimming of the squat form proposed by A. Szyszko-Bohusz. It was then suggested that the elongated and distorted proportions of the building created in this way should be corrected in drawing reconstructions by raising the external level. It was also concluded that due to the lack of preserved layers in direct relation to the walls of the rotunda (these were recorded in Szyszko-Bohusz's research, but they were omitted), the external usable level in the early Middle Ages could also have reached such a height at the church walls that the level was slightly below the window sills (Fig. 2).

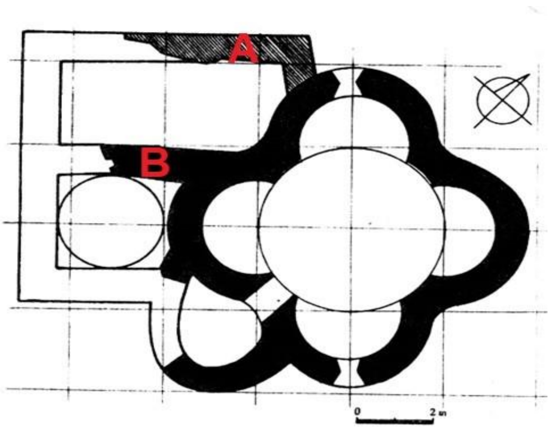

Fig. 1. Plan of the rotunda of the Holy Virgin Mary according to S. Kozieł, wall (A) added and chronologically later, wall (B) connected with the rotunda

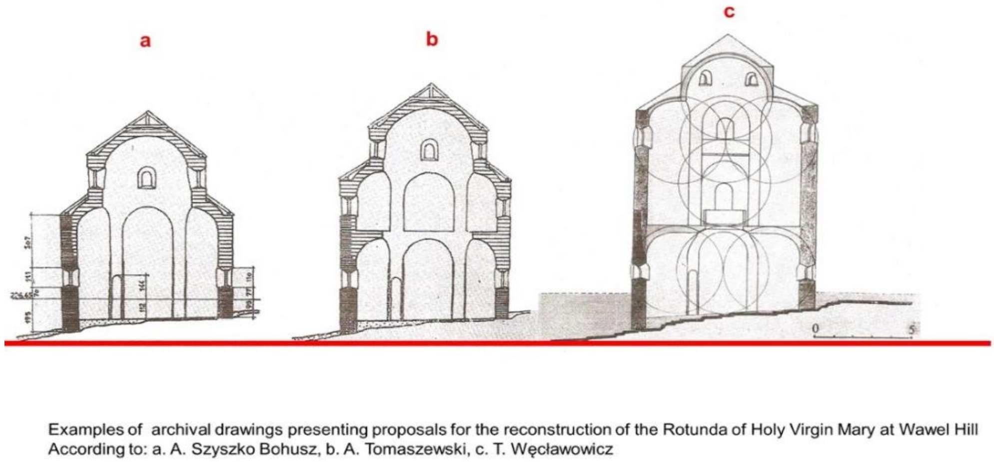

Fig. 2. Proposals of the cross-sections of the rotunda of the Holy Virgin Mary according to three various scientists

Stratigraphy and External Levels

Meanwhile, the analysis of the preserved layers around the rotunda and the researchers' reports show that the external level associated with the rotunda in its initial phase did not exceed 40 cm in thickness, counting from the rock surface. Szyszko-Bohusz reported that at the time of discovery, the rotunda standing directly on the rock was covered with a small layer of earth 15-20 cm thick, which he associated with the creation of the rotunda [4]. Żurowska, responding to the data provided by Szyszko-Bohusz, stated that she had identified an early medieval layer with a thickness of 15-25 cm to the north and northwest of the rotunda, and at the rotunda itself she had captured a layer 40 cm thick from the rock level [6]. The wall added to the walls of the rotunda, called by K. Żurowska (wall A), was placed on a 40 cm layer of the original external level. The wall was made in the stone, thin slab technique in the *incertum* technology, but it differed in the type of stone and mortar used there, and unlike the rotunda and the tied wall (B), made of sandstone, it was built of limestone. This difference between the foundations of both walls proves that during the construction of the wall (A), the layers around the rotunda grew significantly, while during the erection of the rotunda, they were so small that it was necessary to level the terrain to bare rock in order to be able to safely tie the walls to the rock terrain. Within the chamber that was created as a result of the addition of wall (A), a burial was uncovered. Assuming that it would be related to the creation of the room, the dating of the burial may approximate the date of construction of the wall (A). Referring to H. Zoll-Adamikowa, the arrangement of the skeleton's hands does not indicate its origin earlier than the 12th century [31], and the crystal pendant found within the walls of the annex (on the mixed layer) cannot be dated earlier than the end of the 12th century [32], which, in relation to the rotunda dated to the turn of the 10th/11th century, gives a difference of about 150 years. The threshold of the secondarily cut entrance is located at a height of 120 cm from the rock level. The portal communicated the interior of the annex (mausoleum) with the interior of the rotunda and was placed in the northwestern apse. Thus, during these years, the level of the interior of the rotunda could also have been raised, and the entrance located at this level may signal the absence of the alleged crypt. Unless we assume communication between the mausoleum and the crypt, which would require the introduction of stairs again due to the differences in the usable levels of both interiors. The entrance was then closed up with the use of worked stone blocks arranged in layers, in a technique typical of the architecture of the $12^{th}/13^{th}$ century (Fig. 3).

Fig. 3. Walled-up passage from the interior of the mausoleum to the rotunda of the Holy Virgin Mary, cut in the northwest apse of the church, photo: K. Stala

The question also arises whether there was a need to build an annex in the form of a mausoleum in a situation where the church had a crypt that could successfully perform sepulchral functions. It seems unnecessary. Therefore, the erection of the mausoleum is indirect evidence of the lack of a crypt in the rotunda. When analyzing the archaeological layers around the rotunda, it should be remembered that it was Adolf Szyszko Bohusz who was the first to explore this area on a long-term basis and had access to intact stratigraphic systems. As already mentioned, according to his written and drawing documentation, the layer around the rotunda was 15-25 cm thick. There are no traces in the documentation, either from the research of Szyszko-Bohusz or other researchers, testifying to the leveling of the level at the height included in the reconstructions of K. Żurowska and T. Węcławowicz, thus explaining the existence of the crypt and hiding part of the walls in the ground in order to reduce the optically distorted proportions of the rotunda. This proposal is all the more incomprehensible in view of the preserved archaeological witnesses in the "Wawel Lost" reserve, of which the rotunda in question is a part. The preserved cultural layer, lying directly on the rock and identified as early medieval, has a maximum thickness of 40 cm. It is not in direct relation to the rotunda but is located in its surroundings (Fig. 4). Therefore, taking into account the archaeologically documented external early medieval level around the rotunda, the extension of the building by 1/3 of its height in relation to the 11-meter-high reconstruction of Szyszko-Bohusz, with the diameter of the central nave of 4.80 m, disturbs the architectural proportions of the body and does not find an analogy in this form.

Height of windows placement

Another argument, which, according to K. Żurowska and T. Węcławowicz, provides a substantive basis for the reconstruction of the crypt in the rotunda, is the windows preserved in the southeastern apse and the opposite, which, as the researchers mentioned above, were placed relatively low in relation to the external level. However, there is currently no preserved original, early medieval external level directly adjacent to the rotunda because it was explored during Szyszko-Bohusz's research.

Fig. 4. Preserved early medieval archaeological layer located to the west of the rotunda with a height of 40 cm, photo: K. Stala

Therefore, it remains only to use the drawing documentation from these studies, which, according to the author, was made reliably and professionally, as well as the data from Żurowska's publication. So-called "witnesses" preserved in the archaeological reserve, which means the remains of intact sequences of cultural layers located at a distance from the object but giving a reliable view of the stratigraphy of this region, are also helpful in reconstructing the early medieval level around the rotunda of the Holy Virgin Mary. Therefore, analyzing all available data, the maximum thickness of the early medieval layer in this region was no more than 40 cm. It was a layer registered by researchers (Szyszko-Bohusz, Żurowska), which had already grown during the use of the rotunda. However, during the construction of the building, a thin layer of earth was leveled to the rock, and the church was placed directly on it, which did not have a separate foundation part. The discussed preserved window facing southeast, due to the large slope of the terrain in this place, is therefore located at a height of 260 cm from the window sill to the rock, and taking into account the maximum thickness of the layer formed during its use, amounting to 40 cm, the height is 220 cm. There are also no archaeological indications that the slope of the land was leveled. On the other hand, the opposite, northwestern window, where only the sill has been preserved, was set—counting from the rock—at a height of 172 cm [28]. In addition to Moravian, Czech, and Western European analogies, as described above, some researchers have turned to Old Croatian rotundas in their search for influences on the Wawel rotunda, including recently T. *Rodzińska Chorąży* [20], *Z. Świechowski* [33], and *K. Stala* [22]. Analyzing numerous Old Croatian *polyconchos* rotundas, it should be noted that most of them are preserved up to a height of 1 m, only Stomorica in Zadar up to a height of 1.5 m, and the rotunda of St. Michael u Pridragi up to 1.85 m. There are no traces of window openings in these preserved relics of the walls. On the other hand, the best-preserved six-conch rotunda of the Holy Trinity in Poljud, near Split, has preserved window openings at a height of 1.8 m from the early medieval level [34], [35]; the *triconch* of St. Martin near Nin at a height of about 2.0 m; and the Church of the Holy Cross in Nin similarly (Fig. 5). From the group of Italian *tetraconchos,* the examples of the Chapel of the Holy Cross in Bergamo and the Baptistery in Mariano Comense should be cited. Both of the above-mentioned examples have low-set windows, less than 2.0 m high (measured from medieval levels). Although the Chapel of the Holy Cross has a crypt, the crypt was not equipped with window openings and was dug into the earth layers; the historical levels were leveled, and today we can observe the object, including the exposed walls of the underground part of the building. The chapel was also connected to the auditorium of the bishop's palace by a special corridor. Thus, the examples of low-set windows, i.e., at a height of between 2 and 1.7 m, placed in the apses of small pre-Romanesque and Romanesque churches, especially in Southern European *tetraconchos* and Old Croatian *polyconchos*, which do not have a crypt, are documented so well that, in the light of the examples cited, the argument that the windows in the rotunda of the Holy Virgin Mary were placed too low to illuminate the central nave and low enough that they testify to the existence of a crypt I find absolutely unconvincing.

Fig. 5. Low-placed windows in the six-apse rotunda of the Holy Trinity in Poljud near Split, photo: K. Stala

Wall thickness and construction aspects

During a conference in 2013 organized by the Museum of the Beginnings of the Polish State on "Medieval sacred architecture in Poland in the light of the latest research," in my lecture entitled "Structural issues of early medieval architecture in Poland on the example of the rotunda of the Holy Virgin Mary at Wawel," I drew attention to the stylistic and formal similarities between the Wawel rotunda and the *polyconchos* of the Old Croatian period [36]. The Old Croatian buildings I cited at that time, as analogous examples, have walls not exceeding 1.0m thick, like the rotunda of the Holy Virgin Mary at Wawel, and similar sizes, also in height, not exceeding 12.0 m. Such examples include the Church of the Holy Cross in Nin with a span of 8.0 m, similar to the rotunda of the Holy Virgin Mary, which, together with the apses, has a total diameter of 6.80 m on the inside and about 8.80 m on the outside. The thickness of the walls of the church in Nin is between 80 and 100 cm, exactly the same as in the Wawel rotunda, and the height of the church in Nin reaches 10 m (Fig. 6).

In A. Szyszko-Bohusz's version, the Wawel rotunda is 11.0 m high, and according to Kozieł, it is slightly more. Both of the above-mentioned proposals for the Wawel reconstruction have the right proportions, in contrast to the reconstruction from the 1980s proposed by K. Żurowska and T. Węcławowicz. Another example I propose that can be used for comparative analysis is the triconch of St. Nicholas near Nin, which has similar parameters: the width of the church is 7 m, the thickness of the walls is 80.0 cm, and the height is 7 m. And finally, there is the already mentioned *polyconchos* of the Holy Trinity from Poljud near Split, dated to the 10th and the beginning of the 11th century, preserved in very good condition, with a wall thickness of approx. 80 cm and a span and height of 10.0 m. In terms of proportions, wall thickness, and typology, the examples quoted are the most like the rotunda of the Holy Virgin Mary. T. Rodzińska-Chorąży also refers to Old Croatian architecture but also points to Italian examples in her habilitation publication, mentioning, among others, the baptistery in Galliano and the Chapel of the Holy Cross in Bergamo, the baptistery in Biella, and the baptistery in Mariano Comense [37], [38]. The first of them has a scale incomparable to that of the Wawel rotunda, including the thickness of the walls reaching almost 3.0 m, in which the staircase is hidden, while the second of them has a scale similar to the Wawel rotunda and is an object whose spatial disposition and primary function are also the subject of discussion.

Photos: K. Stala, layouts and cross-sections according to W. Strzygowski and W. Mole

Fig. 6. Church of the Holy Cross in Nin on the left and the three-apse church of St. Martin near Nin on the right

All of the Italian examples quoted are founded on a square plan, while in the Old Croatian examples we will find many *polyconchs* that are strictly rotundas, except for the Church of the Holy Cross in Nin. On the other hand, the Prague rotunda of St. Vitus, which for many years was considered the closest analogy, apart from the concept related to the number of apses, because, as mentioned above, the theories of Czech researchers as to the original plan of the church have changed, primarily due to the scale of the building, cannot be treated as a model for the Wawel rotunda. It should be borne in mind that the introduction of the lower story with the function of a crypt in the Wawel building requires constructional solutions, i.e., vaulting the lower part of the church or at least installing a wooden ceiling. In early medieval buildings, the load-bearing element is the wall, which is why the thickness of the main walls is important in this context. In the case of the rotunda of the Holy Virgin Mary, it is 80-100 cm. As mentioned above, the Old Croatian rotundas have the closest analogies in terms of scale and wall thickness; none of them had a crypt. The situation is similar in the examples of Italian *tetraconchos*. Only the chapel in Bergamo had a crypt, and the thickness of the walls, with a total diameter of 9 m, varies very much from 0.9 in the upper parts to 1.2 m in the lower parts of the church. Setting up a vault in an object requires it to be led out of the wall. Therefore, already in the 80s of the previous century, to support his version of the reconstruction of the rotunda, T. Węcławowicz commissioned a structural expert opinion consisting of estimating the verticality of the walls and the strength of the walls from Maria Kudyba, M.Sc., Eng., who stated that such an option was possible [9]. Following an attempt to answer this important question, in 2009 I carried out thermal imaging research inside the rotunda (in cooperation with Wiesław Nawrocki's company) (Fig. 7).

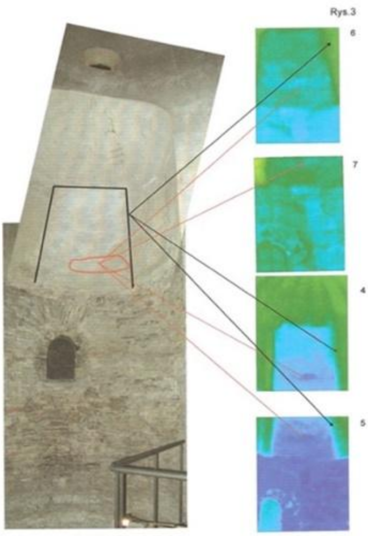

Fig. 7. On the left, the results of thermal imaging tests carried out by the author in cooperation with W. Nawrocki.

In the light of these studies, no thermal changes suggesting the remains of the vault were detected from above the window arch; the only thermal change was recorded so high above the window that leading the vault out of this place would raise the height of the crypt to a size not found in this type of interior, especially in such small buildings. The change was captured within the later conservation interventions carried out by A. Szyszko-Bohusz and, in my opinion, is related to them (Fig. 8).

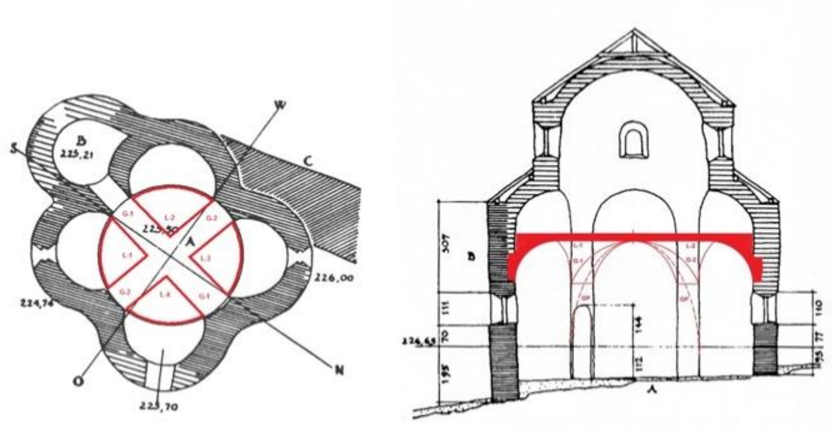

Fig. 8. On the right, an analysis of the minimum necessary height to lead out the vault in the alleged crypt of the rotunda of the Holy Virgin Mary, amounting to 4.5 m, scientific and graphic elaboration: K. Stala

External communication – the Entrance

Therefore, the key question is still the entrance to the rotunda, which was probably not from the external usable level, which is supported by most researchers. Most of the walls of the rotunda are preserved to a height of about 2-3.5 meters, and there is no trace of the door opening in them. Szyszko-Bohusz's suggestions that the entrance could have been in the northeastern apse, due to the recorded, large loss of the wall in this place, were not unequivocally confirmed in later research [39]. In the reconstructions proposed by Walczy, Tomaszewski, and even Węcławowicz, the cross-sections show the entrance currently in use, located between the southwestern and southeastern apses, which has a later origin. Both Kozieł and Żurowska, and above all Węcławowicz, believed that the wall (B) and the so-called fifth apse were the remains of the reduced westwork, and the entrance to the rotunda should take place from this side. The main problem with this entrance to the rotunda is related to the lack of traces of the entrance opening up to a height of 3.5 m in the preserved southwestern apse, which practically excludes the possibility of communication from the outside courtyard level [20].

The concept of stairs leading directly to the western gallery floor was proposed and extensively discussed by the aforementioned T. Rodzińska-Chorąży as a solution to the communication problem in the rotunda. However, in the reconstruction proposed by the researcher, she takes into account the hypothetical crypt as probably existing within the object and at the same time repeats the concept of Żurowska and Węcławowicz about the non-existent and unreconstructable usable level covering the lower-facing parts of the rotunda walls. Again, based on the reconstruction of the above-mentioned researchers, it optically reduces the distorted proportions of the building in an analogous way [20], [9]. Considering the actual recorded usable level, the entrance to the rotunda in the reconstruction proposed by T. Rodzińska Chorąży would have to be at a height of over 5 m. By introducing communication by stairs through the vestibule, the researcher refers to the tradition of Dalmatian architecture, except that in the analogies of Old Croatian architecture she recalls, i.e., rotundas in Zadar, Kolomar, and Stomorica; rotundas in Ošlje; and a number of other numerous rotundas from that period, there are no solutions with a crypt. This is related, among other things, due to the above-mentioned construction conditions, as well as the small scale of the building, the thickness of the walls of approx. 1 m or less and the maintenance of the appropriate proportions of the building. These are common features of Old Croatian rotundas, which I do not include the rotunda of St. Donatus as an example of provincial Carolingian architecture. In these examples cited by T. Rodzińska-Chorąży, communication from the external level to the first floor was recognized in two Old Croatian rotundas: in the rotunda of Stomorica in Zadar and in the rotunda in Ošllje, but this is related to the bell tower added to these churches and not to the direct entrance to the interior of the buildings. In the Old Croatian rotundas studied, the vestibule leads directly to the interior of the church at the zero usable level, as in the eight-leaf rotunda in Bribir [34], [40] (Fig. 9). The Basilica of the Holy Salvatore in Četina, according to the reconstruction of T. Marasović [41], cited by the researcher [20] as an example of this type of solution, is a longitudinal church that is not an analogy to the Wawel rotunda.

Mausoleum—in search of analogous solutions

An important element in the comparative analysis of the Old Croatian *polyconchos* with the rotunda of the Holy Virgin Mary at Wawel is the existence of mostly Dalmatian cases of vestibules called "narthex" by Croatian researchers. In the Wawel rotunda on the west, or rather southwest, side of the Wawel Rotunda, the wall B was discovered, which is tied with the walls of the rotunda, which indisputably proves that the wall was built together with the walls of the church at the same time and that the building concept was homogeneous. The wall is residual, built in the same technique, but with a lower thickness of 80 cm. It was the small thickness of the fragment of the wall that was a counter-argument for Z. Pianowski to K. Żurowska's concept of connecting the rotunda with the palatial building. The issue of the functional and spatial solution of this part of the rotunda was also raised by T. Węcławowicz, who was later joined by K. Żurowska, who, after abandoning the original concept of the palace, agreed to the researcher's proposal that part of the wall could be a remnant of the westwork, and vertical communication would take place within the so-called fifth apse.

a.

b.

Fig. 9. on the left, point a. model depicting the rotunda of Stomorica in Zadar with stairs leading to the tower photo: K. Stala, point b. visualization of the rotunda in Bribir according to V. Ghić, A. Milošević and D. Džino with an annex and an entrance leading from the external usable level

Aneta Bukowska [42] advocated for T. Węcławowicz's concept, and the aforementioned T. Rodzińska-Chorąży [20] later wrote on this subject. It is an indisputable fact that many preserved Old Croatian rotundas have narthexes; therefore, the analysis of this phenomenon is important in these considerations. However, these are not the remains of the westwork on the Carolingian-Ottonian model. First of all, unlike the Wawel rotunda, most of the Old Croatian narthexes are an added element, made chronologically later than the rotundas themselves. Croatian researchers date these additions between the 11^{th} and 12^{th} centuries, while the rotundas themselves mostly date back to the 9^{th}-10^{th} centuries, sometimes even earlier to the 8^{th} century [35]. Most narthexes were burial places, so they served as mausoleums for private families that owned a given area. Sometimes a bell tower appeared in the complex of the annex, and then vertical communication was introduced by means of stairs leading directly to the tower [35]. The only tied annexes are in the Stomorica Church in Zadar and in the rotunda in Bribir, but this is a completely different architectural solution than in the Wawel rotunda. Both Dalmatian examples are the so-called *hexaconchos*, with a rectangular interior appearing in the place of the western apse, a short one in the rotunda in Bribir, and an elongated plan in Stomorica in Zadar. Both are the entrances to buildings with preserved traces in the walls after door openings cut at the ground floor level. Probably in the 11th century, narthexes were added to the above-mentioned rotundas, and they were also added to rotundas, which had a full range of six apses. In this case, the added narthexes enclose the western apses. These include the rotundas of St. Michael in Pridraga, St. Thomas in Kasič, the rotunda in Bribir, St. Mary in Trogir, the rotunda in Brnaze, and the rotunda in Ošlje (Fig. 10).

An exception is the rotunda of the Holy Trinity in Poljud near Split, which remained a free-standing building, without the later architectural interventions in the form of an additional building so typical of this region. The wall (B) of the Wawel rotunda is simultaneous with the church, so it is not an analogous phenomenon. On the other hand, it cannot be overlooked that the later wall (A), added to the Wawel rotunda, dated to the 11^{th}/12^{th} century, despite the thin slab technique (opus incertum-petit appareil allonge) used here, which may be the result of reused demolition material [22], [43], [44]. It is a remnant of the mausoleum, as evidenced by the preserved burial inside the room, and refers to the architectural transformations characteristic of the Dalmatian rotundas; the similarity of dating and sepulchral function is noteworthy.

The mausoleum, as S. Kozieł writes, probably had a burial hidden under the floor, and the passage to the rotunda led through a cut door in the northwest apse, while the entrance to the mausoleum was from the external usable level [45] (Fig. 11). Therefore, in my opinion, the second phase of the Wawel Rotunda has some connotations with Old Croatian narthexes dating back to the 11^{th}-12^{th} centuries [34], [35].

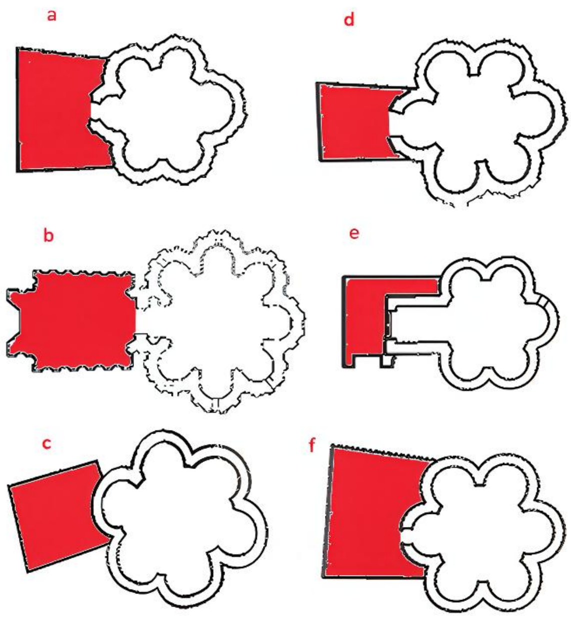

Fig. 10. On the right, a list of examples of Old Croatian rotundas with added annexes according to P. Vežić: a. in Pridraga; b. in Ošlje; c. in Brnaze; d. in Kašić; e. Stomorica in Zadar; f. in Trogir

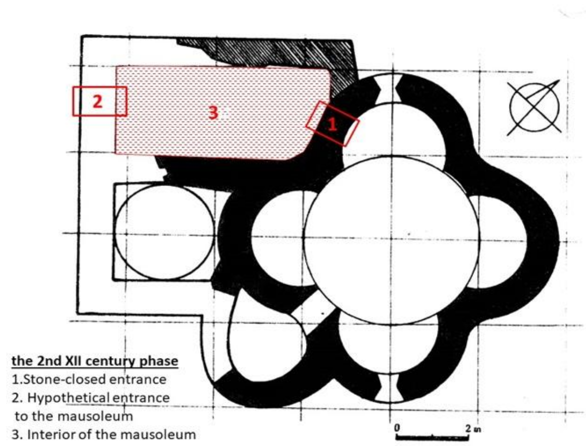

Fig. 11. Plan of the rotunda of the Holy Virgin Mary with added annex as a mausoleum according to S. Kozieł, graphical additions in red K. Stala

Applications

The only solution that responds to direct vertical and horizontal communication in the Wawel rotunda is the existence of a palatial building, which K. Żurowska wrote about in the first phase of her considerations. The arguments for this type of concept are the lack of an entrance from the outside, characteristic of palace chapels coupled with the palace building, and the existence of a western gallery. A. Żaki's counterarguments seem to become outdated in the face of discoveries on Ostrów Tumski in Poznań, where H. Kocka-Krenz [46], [47] unveiled the first Piast palace in a transverse position to the palatial chapel. GPR surveys carried out on my initiative in 2009 [48] in cooperation with the Department of Non-Destructive Testing of the Wiesław Nawrocki KPG, which were part of the above-mentioned non-invasive research within the rotunda and in the area of the Wawel Lost archaeological and architectural reserve, showed characteristic echogram disturbances. The disturbances inform about the occurrence of changes in the ground in the close vicinity of the rotunda, with the outline of an open rectangle arranged transversely to the square annex. Disturbances, probably indicating the existence of underground relics of the walls, run along the top of the rock, bypassing the rock fault, which in the axial system of the palace was a geomorphological obstacle (Fig. 12).

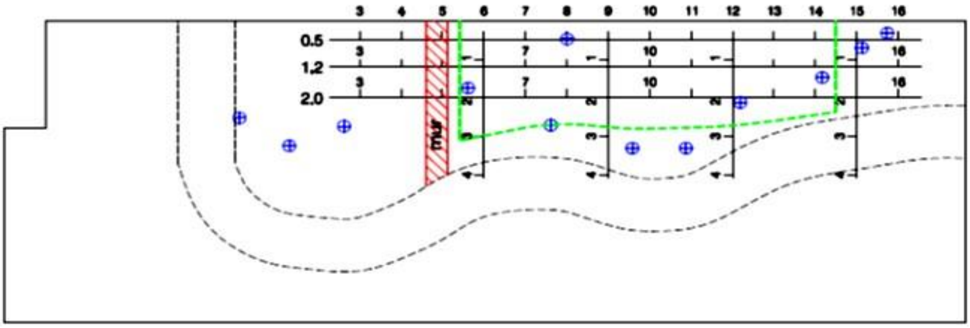

Fig. 12. The result of GPR research carried out as part of the research conducted by the author; the outline of a rectangular building is marked in green

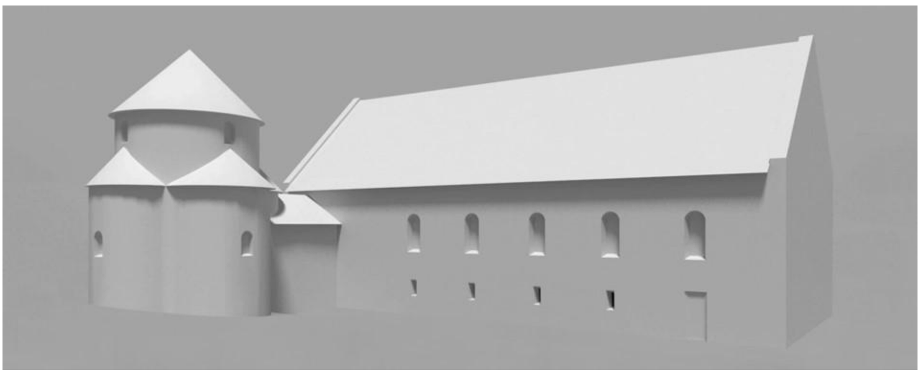

Fig. 13. Model of the rotunda of the Holy Virgin Mary as a palace chapel according to K. Stala. The rotunda is connected to the hypothetical palatial building on the level of the gallery and the palace hall located on the first floor (piano nobile). The staircase located in the fifth apse allows the priest to descend to the main nave with the altar stone.

The issue of the thickness of the annex walls (approx. 80 cm) was raised by Z. Pianowski also does not stand the test of time, because the annex itself does not have to be the perimeter walls of the palace but rather constitutes a connection between the two main buildings of the complex, being an element of communication or a place of honor for the ruler (an extensive emporium). I propose this type of solution in the reconstruction of the rotunda as a palace chapel with an accompanying residence building located transversely. At the moment and with the current state of research, as well as considering the analogy in terms of layout and time horizon of the palace from Poznań, this theory seems to have a strong foundation in science (Figs. 13 and 14).

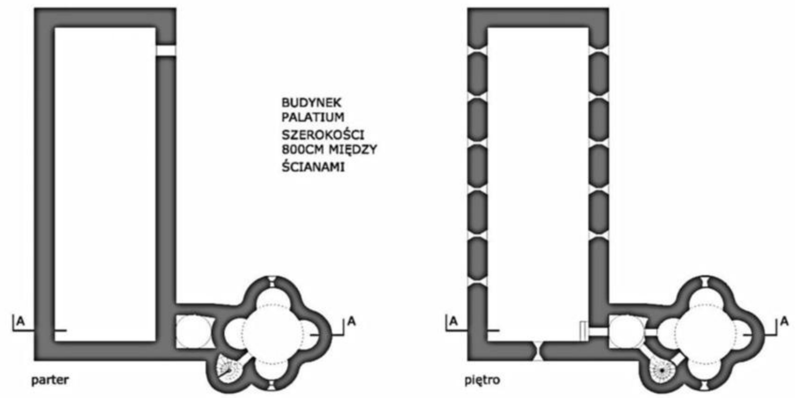

Fig. 14. Plan of the ground floor and first floor of the Rotunda of the Holy Virgin Mary as a palace chapel transversely connected with the hypothetical palatial building. According to K. Stala

Conclusions

Unfortunately, to this day there is no possibility to verify the results of the georadar research obtained by me through excavations, which would give the possibility of authenticating the presented concept by obtaining material evidence in the form of relics. This is related to the arrangement of the Wawel Lost archaeological reserve with an exhibition. However, taking into account my personal experience with this type of non-invasive screening test, including the results of my own research that I obtained at the castle in Sobótka-Górka near Wrocław, which, after verification by archaeological research, confirmed both the accuracy and high sensitivity of the GPR, capturing even marginally preserved relics, as well as the development of technology and increasingly modern, sensitive, and accurate equipment, the results from GPR surveys of the Wawel rotunda should not be marginalized.

The non-invasive research I carried out in the Wawel rotunda contributed to the initial verification of the concept of the body and the spatial disposition of the building. In my opinion, the staircase could have led to the western gallery without the need to divide it into two stories—the crypt and the ground floor with the nave—and the lack of communication from the outside is justified in the case of the connection between the rotunda and the residential building. Therefore, I do not see the possibility of the existence of this building in its original form as a free-standing structure due to very strong architectural premises, such as the lack of an entrance from the outside and the lack of analogies in Polish of external communication solutions by stairs directly to such a high internal level or directly to the western gallery. Such solutions are not registered in early medieval Polish architecture. In the Dalmatian examples cited above, the staircase always leads to the bell tower. In the case of the rotunda of the Holy Virgin Mary at Wawel, the thickness of the walls of the annex tied to the rotunda precludes it from being led out in the form of a tower without the support of the walls of the palatial building. Moreover, in the cited Dalmatian examples, annexes are most often an added, later element, while stairs are introduced only when there is a bell tower next to or above the annex, while in the absence of a tower, communication took place through the annex directly from the external ground floor. Also, the question of the existence of a crypt in the rotunda, as shown in the article, is debatable; this theory is contradicted by the preserved early medieval external levels, and it has also been shown that low-set windows occur in the sacral architecture of that period, both among Old Croatian and Western European examples, as well as the thermal imaging tests carried out that show that there was no crypt in the rotunda, as evidenced by the lack of traces in the walls after the vault was embedded. An important element in the considerations undertaken here is also the later mausoleum created as a result of adding a wall (the so-called wall A) to the northwestern apse. A burial was discovered inside the room created in this way. Its existence can be considered as another architectural premise against the concept of the existence of the crypt, which has been explained above. The annex itself and its mausoleum function refer to this type of solution used in Old Croatian architecture, and some analogies can be found here, both in the fact that it was later added and in the function identical to the Dalmatian annexes. I date the creation of the mausoleum to the late 11^{th} or 12^{th} century, following the researchers Zoll Adamik [31] and Deer [32], as well as K. Radwański [43], to the late 11^{th} or 12th century, and the thin stone slab material from which the wall was built (A) could have been reused; therefore, the construction technology cannot be considered here as the basic dating element, like Kozieł interpreted [49]. So, in turn, it clearly indicates the existence of the second early medieval (Romanesque) phase of the rotunda, when the rotunda probably ceases to be a palace chapel. This is because the princely palace erected by Casimir the Restorer, the so-called Hall with 24 pillars, was already functioning at that time on the Wawel Hill, and the palace at the rotunda became unnecessary [22]. Only then does the rotunda become a free-standing building with a mausoleum and an entrance cut in the northwestern apse, and with an alleged entrance to the mausoleum in the non-preserved part of the walls. The entrance would lead directly from the external usable level through the mausoleum to the rotunda. The external level has risen by circa 80-120 cm from the rock level, as indicated by the height of the threshold of the preserved entrance.

Analyzing the architecture of the rotunda of the Holy Virgin Mary at Wawel, it should be stated that the correct pronouncements referring to the construction of the Balkan horizon were proposed in his reconstruction by Adolf Szyszko-Bohusz, who, like Wojsław Mole [50] and Jan Hawrot [51], saw this direction of influence and provenance of the rotunda. In my opinion, the architectural analysis and the results of non-invasive research exclude the existence of a crypt in the rotunda, while the spatial disposition of the building and the existence of the fifth apse and the tied wall (B) indicate that the rotunda was not a free-standing building but was part of a palatial complex with the function of a palace chapel, which in turn solves the problem of the lack of communication from the outside.

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Received: June 27, 2025
Accepted: January 30, 2026