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MAŁGORZATA MARKIEWICZ, JUSTYNA KOLENDA

3D VISUALIZATION AS A METHOD OF A RESEARCH HYPOTHESES PRESENTATION – THE CASE OF THE MEDIEVAL PALACE IN MILICZ

The bishop's palace in Milicz was probably built in the late thirteenth or early fourteenth century. It was a brick building referring to the type of layout of princely buildings known in Silesia. Erection of the building in Milicz was connected with the creation of the Church castellany in this area. Visualisation of the oldest phase of the bishop's palace in Milicz is part of the project: *Regni custodiam et clavem – Santok and clavis regni Poloniae – Milicz as an example of two border towns*, implemented by the Institute of Archaeology and Ethnology of the Polish Academy of Sciences and financed from the funds of the National Program for the Development of Humanities for the years 2011-2017. Virtual reconstructions were based on the analysis and interpretation of source materials, in accordance with the guidelines contained in the London Charter. The purpose of the visualization is to introduce residents of Milicz and tourists to history of the building and, in the long run, to take steps by local authorities towards preservation and revitalization of the bishop's palace.

KEY WORDS: 3D visualization, reconstruction, the bishop's palace in Milicz

As a result of the intensive development of multimedia 3D visualizations[1] of various kinds of historically, artistically or scientifically valuable objects became standard at the beginning of the 21st century[2]. What triggered the construction of three-dimensional visualizations was the will to protect the cultural heritage[3] – especially historical

[1] The visualization was developed as part of a bigger project titled *Regni custodiam et clavem – Santok i clavis regni Poloniae – Milicz as an example of two borderland towns. The preparation of a source base to conduct a comparative archeological and historical study* directed by Professor Z. Kurnatowska in 2011-2013 and by K. Zamelska-Monczak, Ph.D. since 2013. Scientific research financed by the Minister of Science and Higher Education "The National Program for the Development of Humanities" in 2012-2017. 

[2] Wieliczka – Saltworks Castle (Museum of Cracow Saltworks in Wieliczka) http://muzeum.wieliczka.pl/niezwykle-animacje-3d-zamku-zupnego [access: 02.07.2015]. Reconstruction of the castle in Wleń (Chorowska et al. 2009, 244).

[3] UNESCO indicates assets which are developed and operate in the virtual environment as a significant element of cultural heritage and formulates postulates to protect them in the document *Charter on the Preservation of Digital Heritage* from October 15, 2003 http://portal.unesco.org/en/ev.php URL_ID=17721&URL_DO=DO_TOPIC&URL_SECTION=201.html [access: 10.07.2015]

monuments which are in ruins and exposed to further destruction – as well as the need to disseminate the information about such objects not only among the small group of specialists (Barceló et al. 2000; Forte 1997). Another reason of that is to verify the existing proposals of reconstructions or research hypotheses (Siewczyński 2004).

This situation results from a different way of perceiving the information about the surrounding world by modern society whose perception of reality has been developed by television and the Internet. Consequently, the traditional description of historical monuments with words, that is universally used in the history of architecture, art or archeology, is more and more often replaced with a descriptive narration with the use of pictorial equivalents of referents. The digital visualization of objects has also a pragmatic aspect, increases the group of potential recipients to the whole society and especially to the groups which are not interested in the past that is presented with the use of descriptive narration which requires some specific knowledge of specialist terminology and imagination, especially so called historical imagination.

The selection of the palace in Milicz as an object of visualization was not accidental. It resulted from the interest in the settlement and cultural processes taking place in the north-east area of Silesia, including the region where Milicz played the most prominent role in the Middle Ages. The history of the very design, its origin as a bishop's palace as well as its remodeling and the construction of a duke's castle and finally the existence of a residence of noblemen is not insignificant either. The decision to select that object was also greatly influenced by the fact that the historical object was seriously damaged and its poor condition is getting worse and worse. We hope that providing the local community with the virtual pictures of the palace will result in its preservation against further damage in the future. The 3D visualization of the oldest stage of that design – bishop's palace – is the first stage of the development of the iconosphere of the medieval reality of Milicz.

HISTORICAL OUTLINE

Before the presentation of the visualization as a form of presenting an existing research hypothesis it is necessary to provide some general information about the history of medieval Milicz (Kolenda 2008). The oldest remains of the early-medieval settlement were found on the north banks of the Barycz river which is the right tributary of the Odra river (Fig. 1). In the light of the latest findings it is not known when the first settlements in this area in the early Middle Ages were established. Most probably it was at the end of the 9th century or at the beginning of the 10th century when an open settlement was created (Site 10) in the Valley of Barycz near the river ford. Its structure was significantly changed in the second half of the 10th century when a stronghold was built south of the existing settlement (Site 1), and the older open village was turned into an unfortified borough. The transformations which followed took place in the middle of the 12th century, and they resulted in setting up a cemetery (Site 9). This way the center of Milicz castellany – the seat of the duke – was formed. Its further spatial development took place in the 1st half of the 13th century, and its immediate result was the settlement located on the left bank of the Barycz river. This is where M. Młynarska locates *burgus* – a kind of town settlement (1960). The development of a compact territory by the Church marked the beginning of dualism in Milicz castellany and it resulted in a conflict between the duke and the Church at the end of the first half of the 13th century. The dispute reached its culmination in 1248 and it was solved next year when a document known as *Milicz Agreement* was signed; it regulated the legal and ownership status of the Church in the area of the castellany (Paroń 2008). The resolution of the conflict was the key moment in the history of that center. According to that researcher this is when the Church legalized the transfer of rights, which actually took place earlier *via facti*, to administer criminal justice over its subjects and those who committed offences within the area of the market settlement and the area around it, described in detail in the document (Paroń 2008, 117). In the light of this interpretation the position of the Church in the 2nd half of the 13th century in this area was rather stable. Additionally, it grew after 1290 when the bishop Tomasz II gained for the church in Wrocław the total release from the servitudes, levies and court fees provided for the benefit of the duke. A question arises here when the

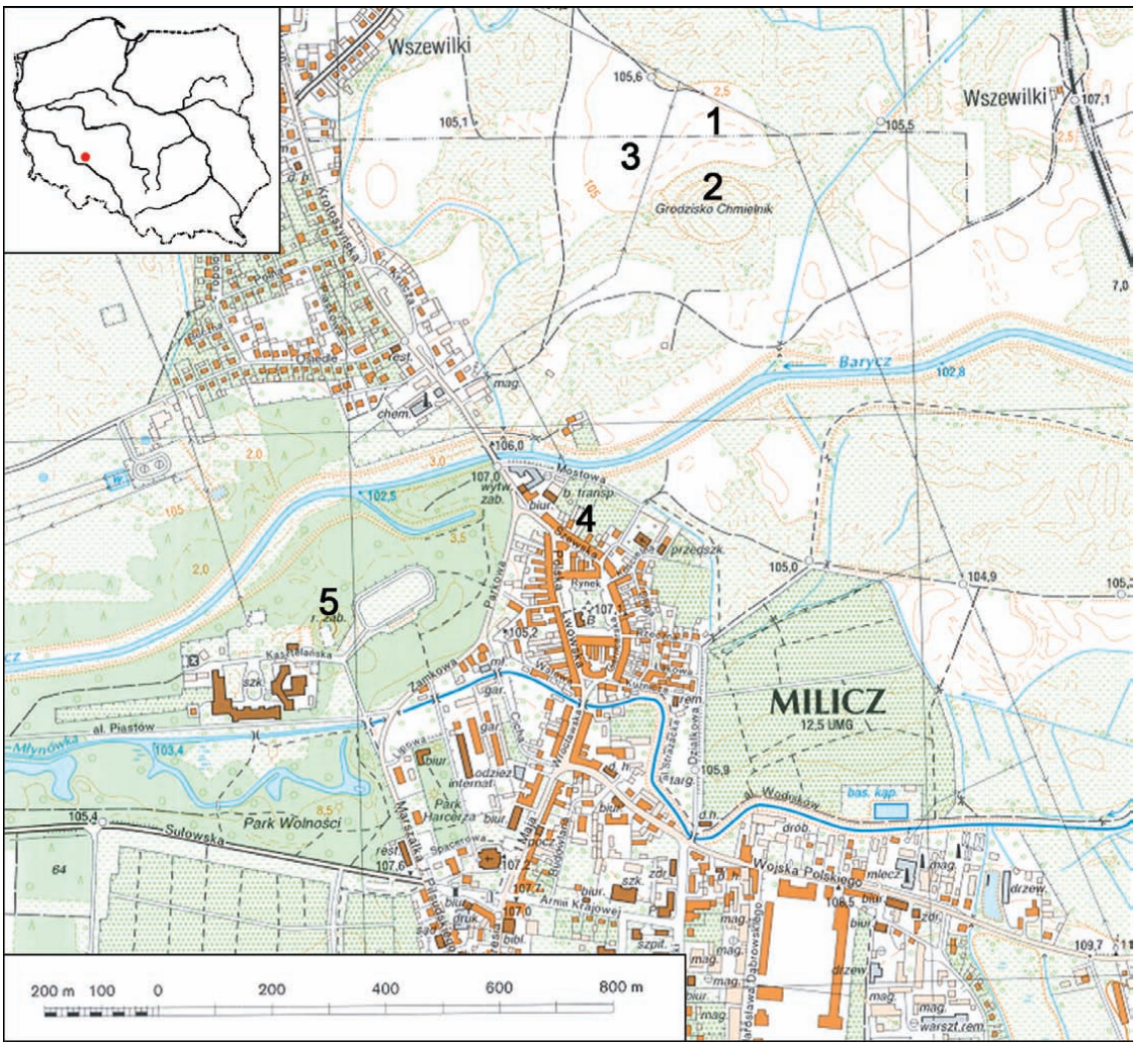

Fig. 1. An early medieval settlement complex in Milicz: 1 – open settlement; 2 – stronghold; 3 – cemetery; 4 – burgus; 5 – palace

construction of the bishop's residence began; was it right after the terms and conditions of the settlement came into effect in the 2nd half of the 13th century, or maybe later at the end of the century? As the power of the church in this area grew the bishop built a palace in Milicz which became a clear symbol of high position of the bishop and evidently dominated the wood houses which were in those times the main element of the cultural landscape of Milicz. Apart from the bishop's seat the palace could also have been used as a venue for court trials and as a place where convicts served time. The high prestige of the center in Milicz in the Middle Ages is confirmed by the fact that it was sieged and conquered by the Bohemian king John of Luxemburg (John the Blind). The king took over the palace in 1339 when the canon from the cathedral chapter in Wrocław, archdeacon Henry of Wierzbna was the bishop's castellan in Milicz. The palace is described in old written accounts as located at the border between Silesia and Greater Poland by the floodlands of the Barycz river with the words *Milich clavis Regni Poloniae* – Milicz is the key to the Kingdom of Poland (Leciejewicz 2008). Taking the residence away from the Wrocław bishop Nanker resulted in the king being excommunicated. The property recovered by bishop Przecław of Pogorzela in 1358 was sold with the town to duke Konrad I of Oleśnica who remodeled the palace and turned it into a fortified castle. The north part of the palace was demolished then and turned into a bailey. It was surrounded by a wall most probably erected on the older wood embankment. The duke built an entry gate in the east section. When the castle was taken over by the Kurzbach family at the end of the 15th century it became the family seat.

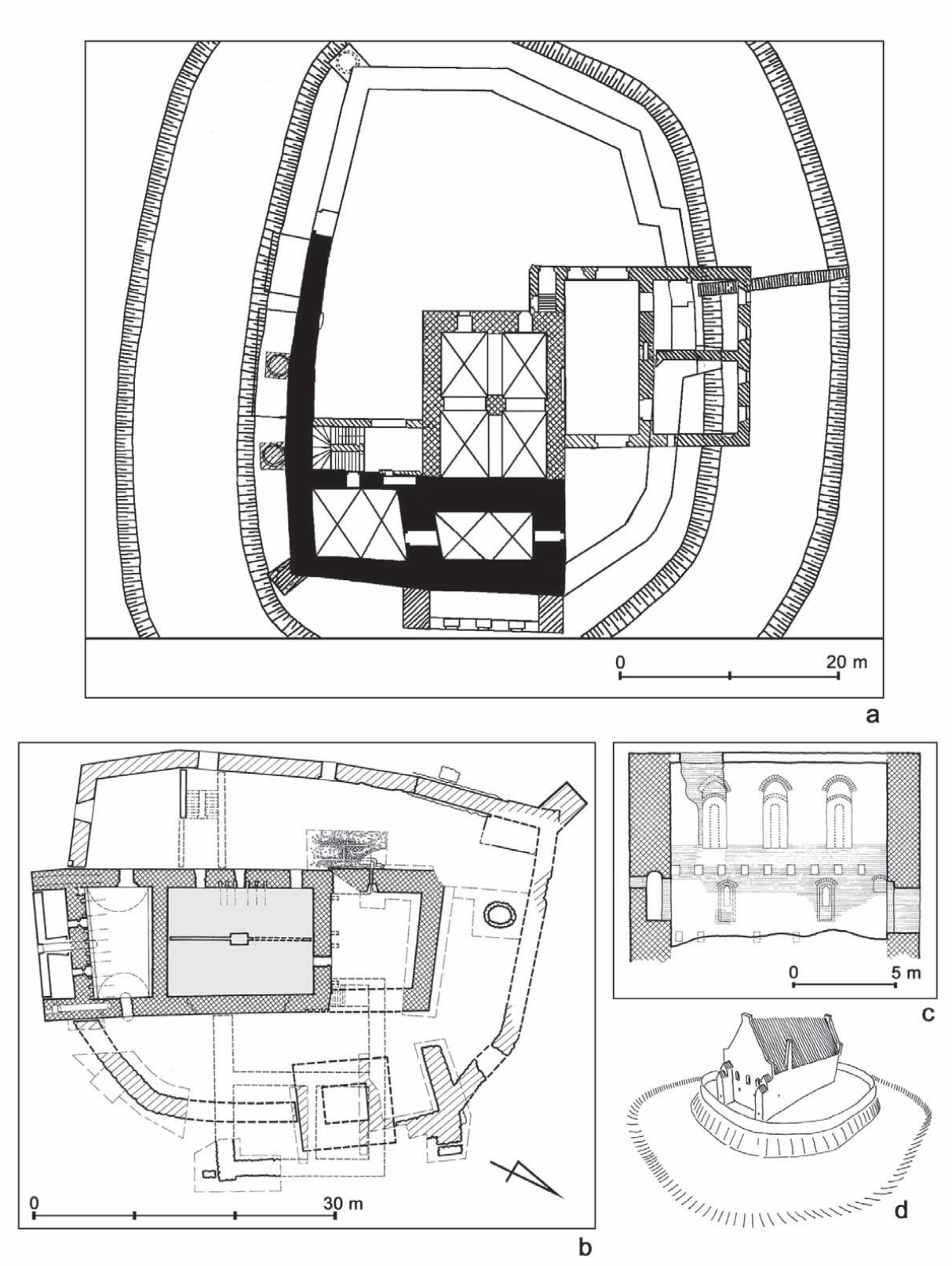

Fig. 2. A Plan and reconstruction of the first stage of the bishop's palace in Milicz: a – after Bimler 1942, p. 62, Fig. 36; b – plan, after Chorowska, Kudła 2005; c – south wall, after Chorowska, Kudła 2005; d – reconstruction of the first stage a palace, after Chorowska, Kudła 2005

In older literature on the subject German and Polish scholars presented different information on the form, size, and chronology of the castle. For instance J. Gottschalk claimed that the masonry castle was built by the dukes of Oleśnica after the attack of the Hussites in 1432 (1930, 43), whereas B. Guerquin claimed it was in the middle of the 14th century when the castle was built on an irregular plan with residential buildings located in the south part of the yard and the enclosure wall with an entry from the east side (Fig. 2:a). The building with the great hall was supposedly built after the fire in 1536 (Guerquin 1957, 59). It was only twenty years later when the scholar reconstructed the oldest design as a residential tower on a rectangular plan with two outside sloping embankments from the south and with three open-space floors (Guerquin 1974, 198). The layout described above is also consistent with the proposal put forward by J. Pilch. In his opinion there was a castle there on an irregular plan surrounded by a wall with an entry on the east side and a residential building in the south part. Just like his predecessors, he claims that a new building with a great hall whose vault was supported by one column was constructed after the fire in 1536 (Pilch 1978, 167). The spatial layout, the size, and the chronology suggested by the scholars mentioned above were verified during the archeological and architectural studies conducted in the 1980s (Rozpędowski, Kudła 1987; Kudła 1988)[4]. The results of the works were discussed in the article by M. Chorowska and A. Kudła (2005) and in another one three years later published by M. Chorowska (2008). In the opinion of the scholars this object was built much earlier in the 13th century or at the beginning of the 14th century (Fig. 2:b-d) as a long, detached house which was used as a palace of the bishop from Wrocław (Chorowska, Kudła 2005, 86-87). This outline demonstrates that the construction of the bishop's palace marks a significant moment in the medieval history of the center and it is closely connected with the legal and property changes which took place in the Milicz castellany at the end of the early Middle Ages.

WORK ON THE VISUALIZATION

The different dating, function, and form of the bishop's palace presented by M. Chorowska and A. Kudła shed some new light on the medieval history of Milicz, and the schematic reconstruction of that oldest stage made by those researchers triggered the works on the visualization of its original form (Fig. 2:d). When developing the visualization, they verified the available data sources by their current analysis and interpretation in compliance with the guidelines of the London Charter[5]. The three-dimensional visualization of the palace was developed with the software used to create 3D graphics – *Autodesk 3ds Max 2011* (Fig. 3) with the rendering engine *V-ray Adv for 3ds max 2011* (*Chaos Group*).

The modeling of the three-dimensional visualization of the palace began with an extensive survey of sources which involved analyzing available findings of archeological and architectural research (Rozpędowski, Kudła 1987; Kudła 1988) and publications (Chorowska, Kudła 2005; Chorowska 2008) which were complemented with additional measurements of the object and the photographic documentation made for the purposes of the model to be developed. At that stage it was also important to consult specialists[6], search for iconographic analogies available in the subject literature and publica-

[4] The studies were conducted by the Institute of History of Architecture, Art and Technology at Wrocław University of Technology in 1986-1988.

[5] The London Charter was conceived in 2009 by the international team of researchers from the *Department of Digital Humanities* at *King's College* in London and *Science and Technology in Archaeology Research Center The Cyprus Institute.* The London Charter was translated into Polish by: Anna Bentkowska-Kafel (King's College London), Agnieszka Seidel-Grzesińska (University of Wrocław), Urszula Wencka (Ossoliński National Institute). The document provides the methods which assure the highest quality of three-dimensional reconstructions and control mechanisms of verifying the historical integrity of 3D models (Bentkowska-Kafel 2008, 43-46); http://www.londoncharter.org/fileadmin/templates/main/docs/london_charter_2_1_pl.pdf [access: 01.07.2015]; http://www.londoncharter.org/fileadmin/templates/main/docs/bentkowska_karta_londynska.pdf [access: 21.06.2015].

[6] We would like to thank M. Dąbrowska, Ph.D. from IAiE PAN in Warsaw for her valuable remarks on the visualization of the heating system.

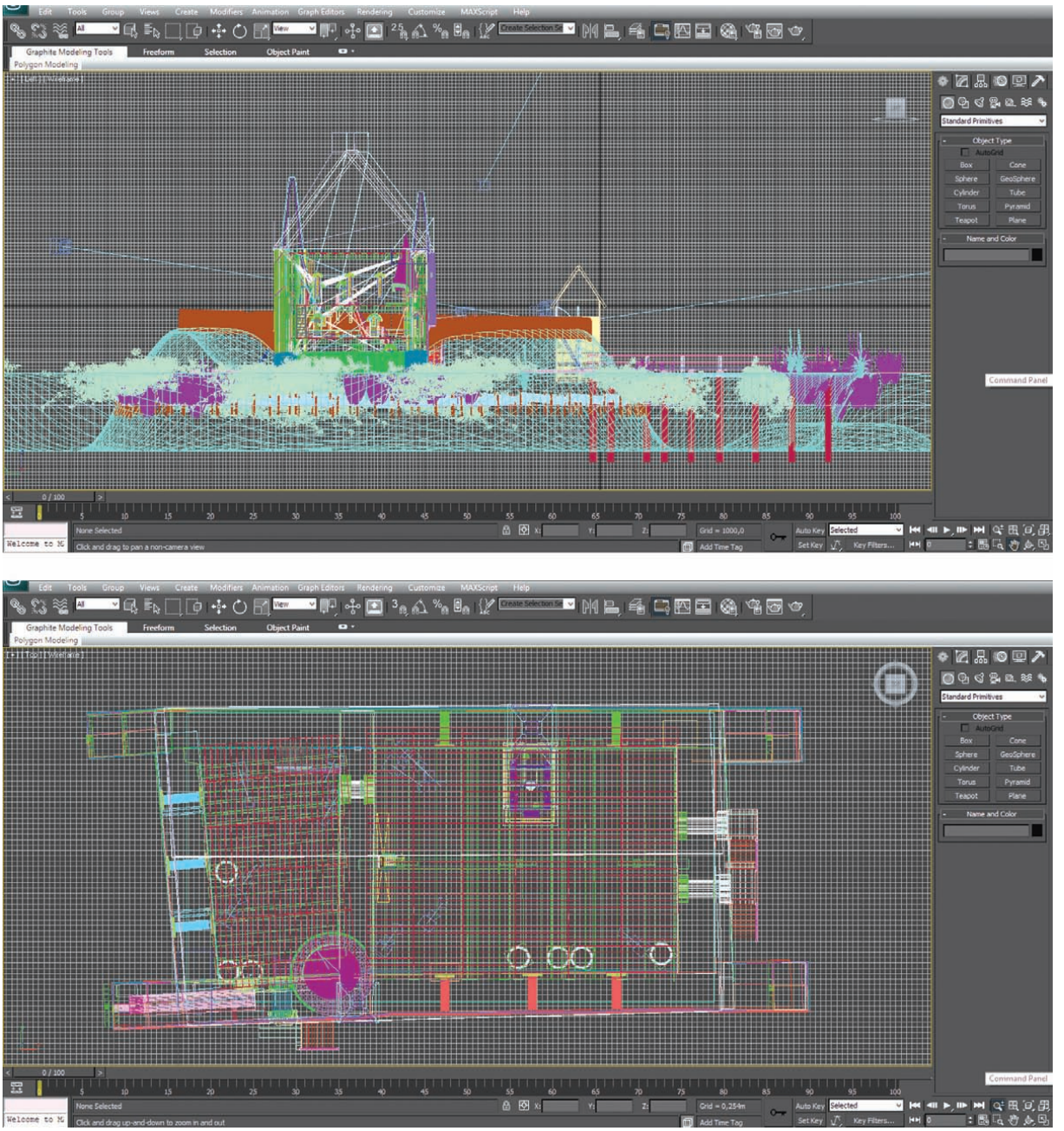

Fig. 3. A three-dimensional model of the palace in Milicz (done by M. Markiewicz)

tions presenting various kinds of reconstructions of medieval structures, both in traditional and digital form – websites. The data collected this way were analyzed at several levels. The first of them regarded the critical analysis of data and it resulted in differentiating their reliability. For this purpose the collected sources were divided into three groups, including original elements of the highest educational value, traces confirming the presence of various types of facilities which were reconstructed on the basis of original traces (50% probability of existence within the object) and the elements whose presence was implied on the basis of general knowledge of such architectural structures which existed in the Middle Ages (10% probability). The division which was applied is substantially justified and it is consistent with the guidelines of the London Charter (Bentkowska-Kafel 2008; Markiewicz 2014). After the qualitative division, it was decided to introduce a "reliability meter" that would enable the recipients to verify the process of modeling a digital image. The use of such a solution was supposed

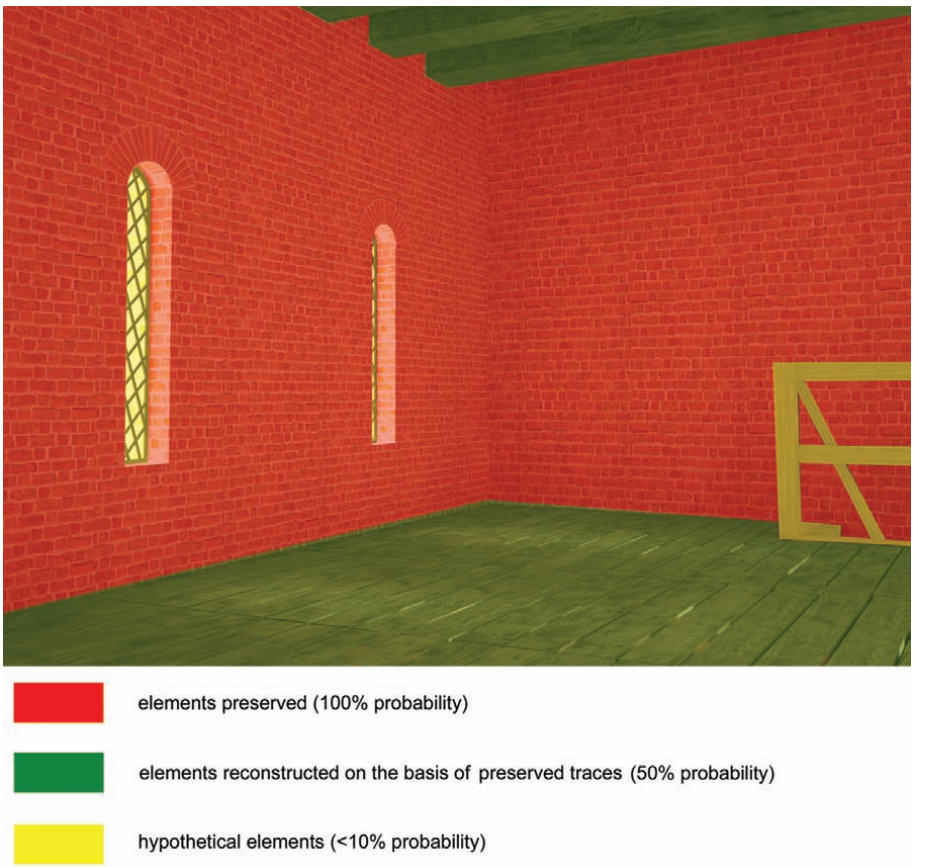

Fig. 4. The bishop's palace in Milicz. "A reliability meter" (done by M. Markiewicz)

to provide information on the method of developing the virtual image from the three types of elements mentioned above. As a result of the review of the solutions employed in such situations[7] the principle of differentiation by color was assumed to demonstrate the degree of authenticity and reliability of individual parts of the visualization (Fig. 4).

The second level of the analysis regarded the search for analogies on the basis of which it is possible to reconstruct the missing or partly damaged elements of the palace. The researchers were first of all interested in the existing remains within the ruins in Milicz. For instance the sloping embankments, which exist today, supporting the south wall have become the source of the reconstruction of the form of original north buttresses whose original remains can be found only at their foundation level. At the same time, a comparative analysis was conducted, taking into account the historical objects from the area of Poland, which allowed for putting forward hypotheses regarding the furnishing of the palace.

The third level of the analysis regarded the chronological issues. The historical objects included in the virtual research can be divided into two main groups: single and multi-stage objects. As a rule, the former ones do not cause any chronological problems and their original architectural elements are considered to have been built at the same time. It is different in the case of multi-stage objects which cause some problems. Not always can an original fragment of the walls or a well preserved structure be unequivocally connected with a specific stage of construction or remodeling of a given historical object. The palace in Milicz, which requires a lot of precision in the chronological interpretation of its original remains, should be included in this very group.

[7] It is a good solution then to apply colors to mark hypothetical elements (just like in the case of digital reconstruction of the Odeon of Agrippa in Athens) or to place reliability meters by the models (a good example is the visualization of the Mausoleum of Augustus in Rome). *The Theatron Project*: <http://kvl.cch.kcl.ac.uk/theatron/> [access: June 29, 2015]; *Mausoleum of Augustus, Rome* <http://3dvisa.cch.kcl.ac.uk/project6.html> [access: June 29, 2015].

The basic part of the visualization was based on the original elements which have been preserved until today. They include mainly the walls and masonry elements of the structures, niches in the walls and some window openings. The other category includes the elements presented on the basis of preserved traces, such as ceilings and vaults reconstructed on the basis of remains of floor joist pockets, indicating their location, size, layout and placement but it does not provide clear information on the ceiling structure itself. The same problem also regards the heating whose existence was inferred on the basis of the original flue inlets in individual rooms and at the same time the absence of the heating facilities themselves. The last group includes the elements whose existence was inferred on the basis of the analogies known from other historical objects or iconographical accounts from the medieval times. They include inside and outside circulation routes (staircases), heating facilities (fireplaces) or window glazing methods. The documentation prepared in this way was the basis of further work connected with the development of 3D models, including both the main body of the palace and its individual rooms. The 3D models were covered with the textures developed on the basis of photographs. The next stage of work on the visualization regarded the establishing of proper lighting parameters and cameras (points of observation). The final works included rendering and recording of completed digital illustrations.

This visualization is composed of two parts. The first of them illustrates the research hypothesis regarding the form, size and function of the oldest stage of the object considered in the literature on the subject to be a bishop's palace (Chorowska, Kudła 2005, 89, Fig. II.6.). The other shows some well-preserved original elements of the interiors (Chorowska 2003, 297; Chorowska, Kudła 2005, 87, Fig. II.4.). The 3D visualization of the bishop's palace is a new form of perception (composed mainly of the view of the ruins or a scientific description), which means that it is a new way of analyzing and presenting the past. The digital content developed in this way can be one of several possible proposals and as such it should not be considered to be historical proof.

VISUALIZATION OF THE BISHOP'S PALACE

In compliance with the functional and spatial program provided by M. Chorowska and A. Kudła, the oldest stage of the palace[8] is the stone and brick two-winged building which was constructed on a rectangular plan with its longer axis oriented north-south – the long house (Fig. 5 and 6). The lowest level was built of fieldstones; the other two floors were built of brick in Flemish bond, and the wall itself had two colors (red and black), with light joints. The length of the palace along its north-south axis was 32-33 m, whereas its width along its east-west axis was 14 m. At the stone foundation level the wall was over 2.3 m thick and it was about 3.5 m deep. The upper sections of the wall, which were made of brick, are about 1.9 m thick (Kudła 1988, 5). The palace's south part is smaller and it was used for residential and utility purposes, whereas its north part is bigger and on the third level it had a large single space room called the great hall. The building had straight buttresses from the north and south[9]. The whole structure was most likely surrounded by a wood and earth embankment. The area between the embankment and the palace from the west was paved with cobbles. In the north part of the court, under the defensive embankment, there was an oval well made of fieldstones (see Fig. 2).

These data regard the general size parameters of the structure, its geographical orientation and its internal division. Analyzing the main body of the building itself it should be noted that the size of the palace, its division into two parts with different functions and sizes and the placement of some windows in the south section are original elements. There are no original buttresses on the north side, circulation routes and the east wall of the great hall, whereas the opposite, west wall was

[8] Detailed analysis of the oldest stage (Chorowska, Kudła 2005, 86-89).

[9] The second stage of the construction is also marked, where another room was annexed to the oblong building from the north and so the whole structure had three parts typical of palaces. The total dimensions of that whole structure were 35 x 37 x 14.25 m (Chorowska, Kudła 2005, 87).

Fig. 5. The bishop's palace in Milicz (photo by J. Kolenda)

rather seriously remodeled as a result of several extensions.

Straight buttresses attached to the south and north gable walls are the object's characteristic feature. However, today only the south wall has original sloping embankments. Although during the research in the 1980s, only the foundation of one of the buttresses (north-west) was unearthed,

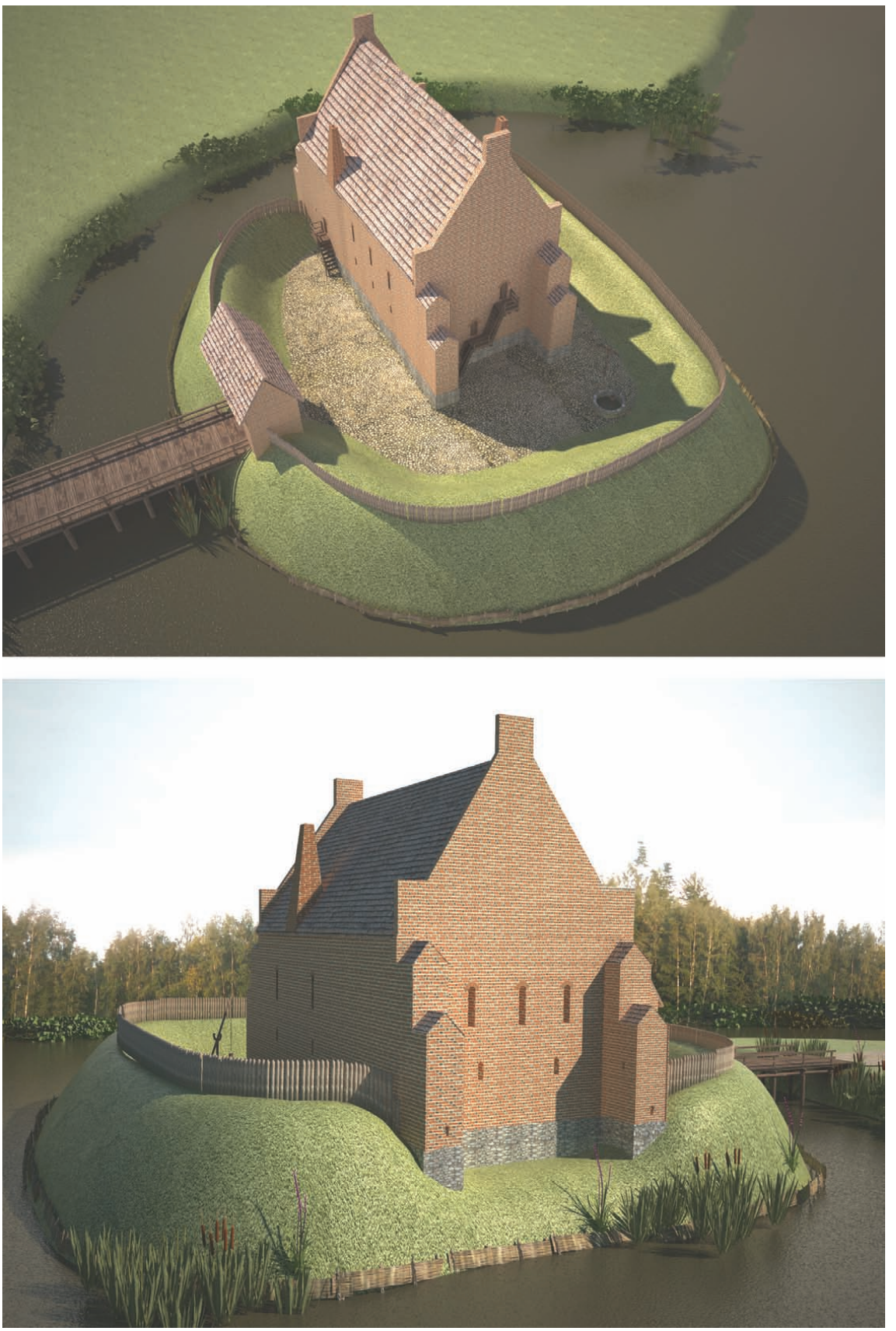

Fig. 6. 3D visualization of the bishop's palace in Milicz (done by M. Markiewicz)

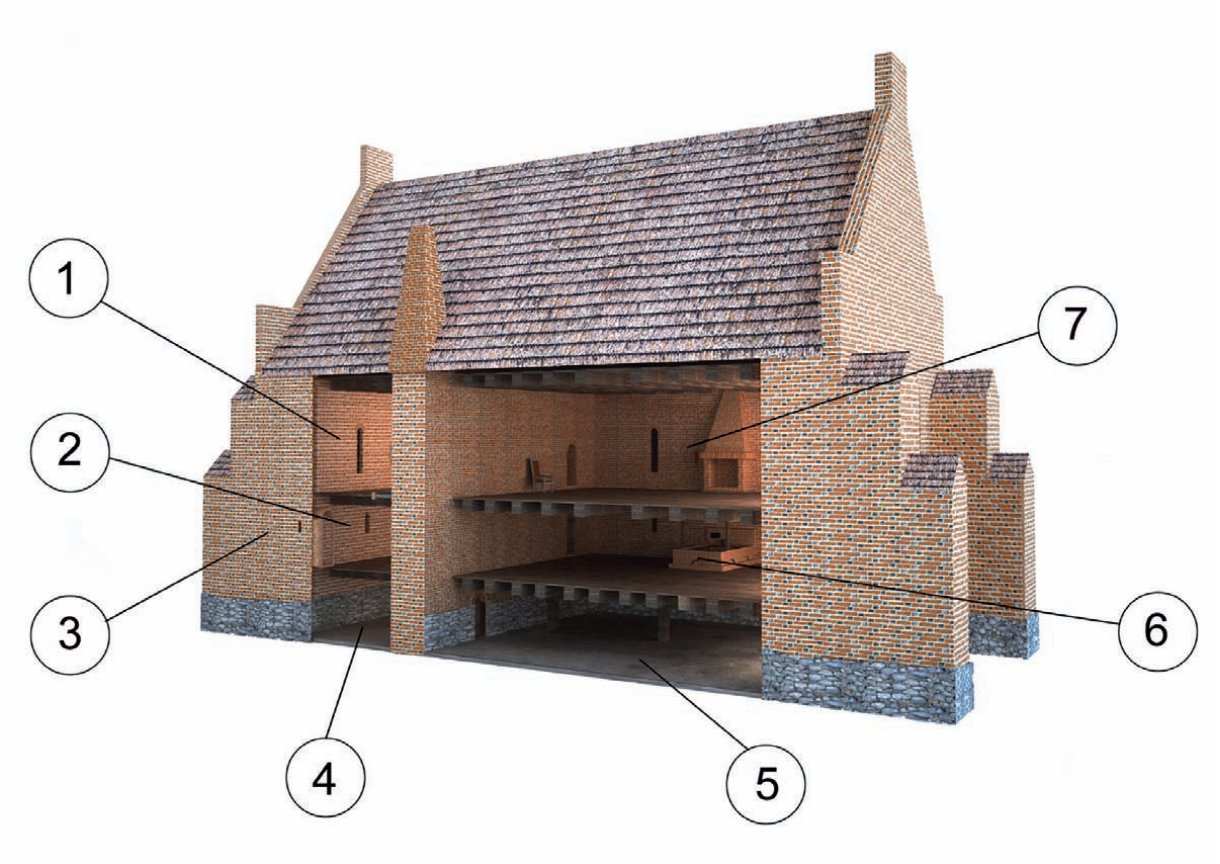

Fig. 7. 3D visualization of the bishop's palace in Milicz: 1 – residential room; 2 – utility room; 3 – latrine; 4 – basement; 5 – basement; 6 – kitchen; 7 – representative room (done by M. Markiewicz)

the reconstruction proposed by M. Chorowska and A. Kudła indicates the presence of two north buttresses (2005, 87, Fig. II.6.) and this is how this part of the object was visualized[10]. As mentioned earlier, the reconstruction of north buttresses was based on well preserved sloping embankment by the opposite wall.

The reconstruction of the west and east walls, and especially the section of the wall which was part of the great hall proved to be a significant problem. The data on the size and placement of windows were insufficient. There are two large windows (190 x 230 cm) in the original west wall on two sides of the remains of a fireplace niche. Most probably they were made during remodeling. Assuming this is possible, with the absence of traces of old, walled-up window openings in the west wall, it was assumed that those two large windows confirm the location of older, smaller windows. The medieval windows known in Silesia had various sizes and forms, however, there was a general rule that smaller windows were placed in utility rooms and different kinds of larger ones in residential and representative rooms. The likely analogies to the windows on the second and third floors in the bigger part included those in the duke's palace in Legnica whose lecture hall had stone biforate windows with shutters (Rozpędowski 1961, 190; 1965) and the original windows from the oldest stage in the palace in Milicz. Ultimately, it was assumed that most windows in the palace looked like those in the south facade. Consequently, level two had 30 x 87 cm narrow windows (Chorowska, Kudła, note 38), whereas level three – the great hall – had bigger, splayed windows[11] (about 40 cm wide). The source material does not provide any remains of

[10] One of the buttresses might have been completely demolished with the foundation during the extension of the palace at the beginning of the 14th century.

[11] There are original splayed windows in the east wall of the south room of the bishop's palace on the Cathedral Island in Wrocław (Chorowska 2003, 66).

window panes so the windows were glazed with rhomboidal, lead framed, transparent glass panes.

The form, size and design of the outside staircase are hypothetical. Its visualization was based on this type of solutions known from other objects in Silesia, such as the duke's palace in Legnica (Chorowska 2003, 51). The outside staircase provided direct access to the representative room and to the kitchen. Neither the guests nor the servants came through the residential quarters which was probably reserved for the bishop or his castellan[12].

During the research conducted in 1987-88 the west side of the palace paved with cobbles was uncovered. It was assumed on the basis of those data that the whole area surrounding the palace was cobblestoned. This is where another problem arises i.e. precise dating because it is not certain if the cobbles correspond chronologically to the oldest stage of the structure or the palace extension stage. The same issue regarding chronology emerges when analyzing the problem of providing the residents of the palace with water. It is assumed that it came from the well made of fieldstones uncovered in the north part of the court near the embankments, but it was not established when it was built.

The palace was surrounded by a wood and earth embankment wall typical of early medieval fortified settlements. Such conclusions were based on research conducted in 2005 when its south-east section was uncovered above the construction solution referred to above. The original remains of the embankment are about 2 m high, however, there is no information about the width of the base of the embankment[13]. An embankment with a wooden palisade on its top was a known solution. As the structures such as the palace in Milicz were remodeled numerous times, which is why it does not have any original analogies, the defensive systems, such as a motte applied in knights' castles, provided some reference.

Another problem to be addressed when developing the model regarded the location and form of the oldest entry gate. It proved impossible to unequivocally establish its original location in the enclosure embankment wall. It was finally located in the east part that is where it was in the 2nd half of the 14th century. Researchers (Chorowska, Kudła 2005, 89) found that at that time Konrad I of Oleśnica built the masonry enclosure wall with a gate located from the east. This investment was supposed to improve the defensive system of the structure located near the border. The placement of the defensive wall within the older embankment can indirectly indicate that a new gate was built in the place of the old one which most probably was to fit the local system of roads in Milicz. Some clues, indicating that it was possible, can be found in the Bimler's plan (1942, 62, Fig. 36), suggesting the existence of an embankment in the area of the moat (Fig. 2:a).

Just like most medieval structures of this type, the bishop's palace was probably surrounded by a moat. Taking into account the direct vicinity of the Barycz river, it can be assumed that one of the river beds was used for that purpose. According to researchers the moat was built by digging across an oxbow (Rozpędowski, Kudła 1987, 21). The moat was 15 m wide and its banks were covered with fascine (Kudła 1988, 8).

VISUALIZATION OF SELECTED ROOMS

The palace in Milicz, just like many original structures of this type which are in ruins, has been stripped of most of its original decoration and furnishing. Most of what's left of the original elements of its oldest stage is in the south part. Probably, there were 5.7-6.7 x 11.2 m open-space rooms on all three floors[14] (Fig. 7). The lowest, basement level might have had ventilation openings instead of windows located near the ceiling. The entrance to this level was located most probably in the east

[12] Such a form of visualization can be supported by the reconstructions of burgher's houses in Wrocław (plot Rynek 6 from the 13th century) where the floors were connected with outside stairs built by the back wall of the building, leading directly to door openings (Piekalski 2004, 198, Fig. 83).

[13] Research was conducted within the grant *Sociotopography of the local center of power in the state by the Piast family – the case of Milicz (Silesia)* directed by Professor L. Leciejewicz.

[14] The inside divisions with walls made of wood or curtains cannot be unequivocally excluded. This situation results from the remodeling of the interiors on the second and third floors (covering the original inside face of the walls) and total filling-in of the lowest floor.

wall, near the south-east corner (Fig. 8). Above it there was an entrance to the second level, with outside wooden stairs leading to it. The room on the second floor has two original narrow windows in the south wall between buttresses.

There are some hints of what furnishing the rooms in the south section had. For instance the use of heating appliances in individual parts of the palace is confirmed by the original chimney inlets. One of them is in the south-west corner on the second floor. A hooded fireplace might have been located in that place**.**

On this level in the east wall there is a door opening leading to a long and narrow corridor located inside the south-east buttress (Fig. 9). The corridor had narrow windows and a small niche for a cresset, oil lamp or a tallow candle. Its function as a latrine is indicated by some original fragment of a toilet seat cover. The waste would flow in a slanting shaft leading to an opening in the buttress wall and further to the moat. Due to a very good condition of the room, which is so unique in the area of medieval Silesia, it is possible to develop its reliable visualization. Furthermore, it should be noted that this type of facilities were much more frequently located in oriels (Chorowska 2004, 149; Chorowska et al. 2009, 59). At present it is difficult to say how the residents moved between the rooms on the second and third floors in the south section. When developing the visualization it was assumed that there was a wooden, inside staircase located in the north-west corner of the second floor, so it is a hypothetical element. The most simple solution was applied, namely ladder-type, closed stringer, single-flight, straight stairs with a handrail and supported by beams on both sides. Such a solution is known from Rakowica Wielka (Chorowska et al. 2009, 169 – Fig. at the top of the page). This is, however, just one possible reconstruction of inside staircases, its alternative being stairs built in the wall. It cannot be unequivocally excluded that there was some outside circulation route connecting these floors or both forms of circulation at the same time.

The next, third floor is assumed to have been residential. This is indirectly indicated by the original fragments of splayed windows in the south wall which is why the room was much lighter than the one underneath it. A heating appliance was located on the third floor in the north-east corner (partition wall between the room and the great hall). Its form and the size were visualized on the basis of iconographic sources. A hooded fireplace might have been located there (Fig. 10) and such heating appliances were known in the area of Germany in the 14th century and Poland (Benker 1987, 105; Pospieszna 2002, 59; Dąbrowska, 2008, 320). It was also assumed that this room, which was used for residential purposes, was connected directly with the great hall. It is debatable, however, if there was a sanitary facility on the third floor. In the south-west buttress there is an original vertical shaft, turning into a slanting drain with its end at the ground floor level (similar to the one in the south-east buttress). However, no corridor leading to the latrine on the third floor was found. Most probably there were various wall niches in the rooms on both floors which were used as a rack – almary, as well as lavabo with basins and water vessels. The latter could have been located right next to the latrine.

Due to the high degree of destruction of the rooms in the north section (in particular completely filled-in basements as a result of collapse of the first and second floors) their visualization is mostly hypothetical. It was assumed that all rooms were open space rooms although it cannot be unequivocally excluded that that there were some internal divisions on the first and second floors. This type of solutions were used in the younger stage and they are marked with a centrally located column supporting the vault (Chorowska, Kudła 2005). The basement, most probably just like the one located in the south part, had no windows. Assuming that court sessions might have been held in the palace for the subjects of the bishop's authority, the functions of the basements could have varied. Apart from the traditional use for storage, they might have been used as a jail.

In the visualization the rooms on the second floor are marked as a kitchen. A large kitchen stove was located in the central section of the west wall by the original chimney inlet which is quite well visible on the third floor. The reconstruction of that facility in the form of an open, rectangular hearth made of brick and clay is totally hypothetical. Usually under this type of facility there were vaulted openings to keep the firewood and a hood used as a smoking chamber above it. Such a solution is known from the castle in Malbork (Pospieszna 2002, 60). A similar reconstruction method was used in the case of the fireplace located in the middle of the west wall of the great hall (Fig. 11), between two rectangular

Fig. 8. The bishop's palace in Milicz. The basement (photo by J. Kolenda, done by M. Markiewicz)

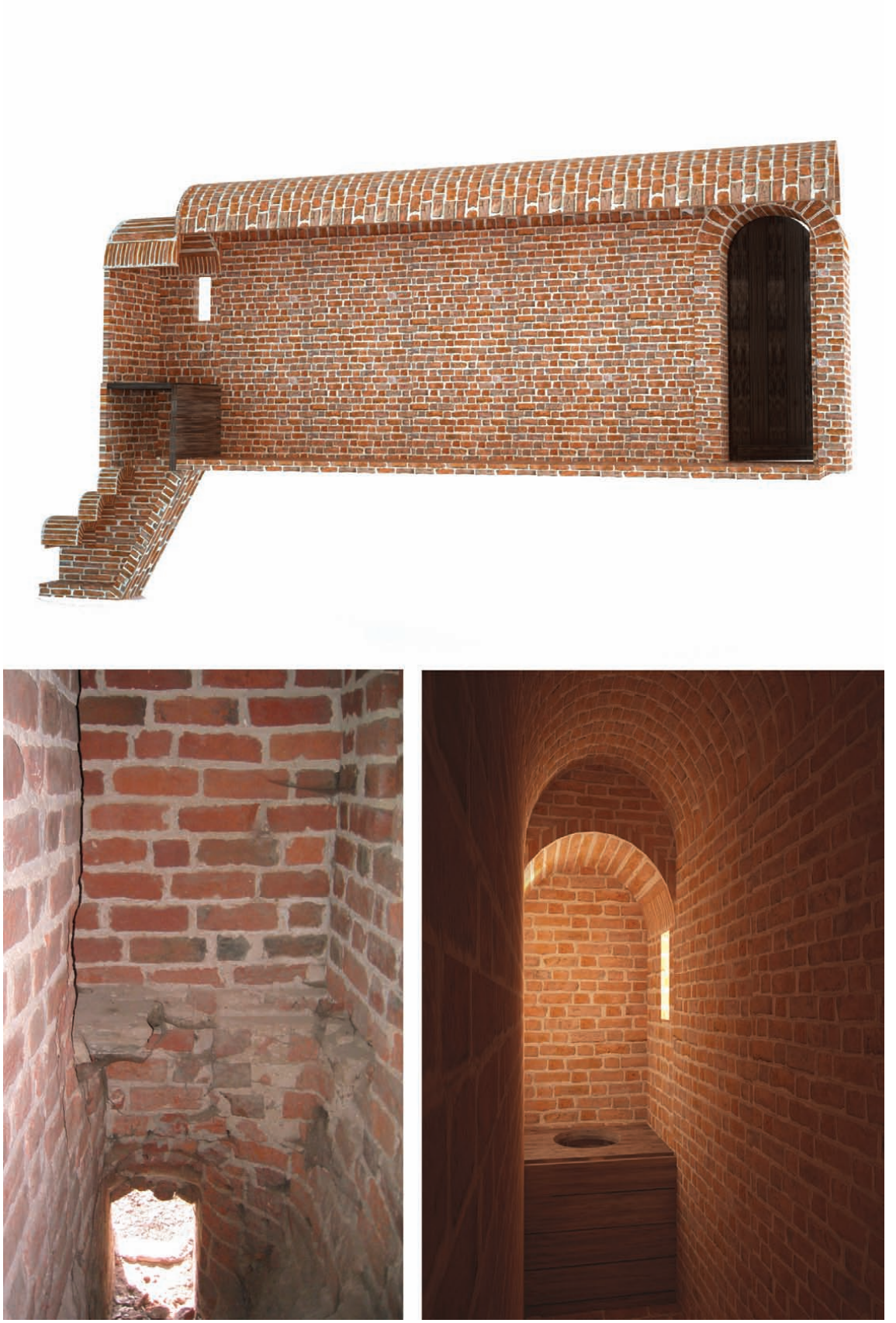

Fig. 9. The bishop's palace in Milicz. The Latrine (photo by J. Kolenda, done by M. Markiewicz)

Fig. 10. The bishop's palace in Milicz. 3D reconstruction of the fireplace on the residential room (photo J. Kolenda, done by M. Markiewicz)

Fig. 11. The bishop's palace in Milicz. 3D reconstruction of the representative room
(photo by J. Kolenda, done by M. Markiewicz)

niches for candles and two windows (Chorowska 2003, 229, Fig. 178). This is where the problem with chronology emerges again. Originally, it might have been a representative room where for instance court sessions could have been held. It cannot be unequivocally determined if the original remains of old decorations come from the oldest stage or were added only at the stage of remodeling after the palace was bought by Konrad I of Oleśnica in the 2nd half of the 14th century.

The reconstruction of the floors and vaults was another big problem. In the oldest stage, the floors of the palace were made of wood. During the following stages of remodeling significant changes were implemented, such as replacement of some wood beam ceilings with brick vaults. The best preserved pockets for rectangular joists are visible in the utility/residential section. The pockets in the south wall indicate the location of a ceiling between the first and second floor, whereas the pockets in the opposite north wall confirm the location of the ceiling separating the second floor from the third one. Most original pockets are only in the west wall by the fireplace (between the first and second floor) and at the chimney inlet level (the ceiling above the third floor). As the rooms in the north part are quite large additional pillars supporting the ceiling were introduced. This type of solution is known from Siedlęcin (Chorowska et al. 2009, 195, 264). Future research should provide the answers to the questions regarding the ceilings in the lowest floor which could have been made of brick from the very beginning.

SUMMARY

The software to develop 3D graphics is today an invaluable and more and more popular tool of visualization of cultural heritage. To see means also to know, so the digital image is designed for a large group of viewers and it provides added value to the analysis of the past. It also significantly improves the process of remembering new pictorial information and associating it with known information which already exists in the viewer's memory.

Another advantage is that with this type of solutions the developed model can get critical feedback and it can be corrected accordingly on the basis of newly gathered data or technical possibilities. In Poland that research method has been applied to verify numerous reconstructions proposed for the architectural design in Ostrów Lednicki (Siewczyński 2004). The analysis of the existing reconstructions of the palace with the use of three-dimensional modeling resulted in the exclusion of spatial solutions which could not have existed for technical reasons. The visualization presented above is different. The digital image of the palace, selected rooms, and facilities presents the original form of the historical object which is at the moment significantly damaged and consequently difficult to see among the ruins. The objective of its publication is to reach more viewers, provoke a discussion about the historical object and about the way to conserve it for future generations.

The presented visualization of the oldest stage of the palace in Milicz can be interpreted at several levels. Firstly, this is a self-contained message, with no narrative information, which is addressed to the viewers for whom the past and its presentation is of little interest and those who need only some general information about the historical object, its form, size and location in the cultural landscape of the medieval Milicz. Consequently, this is a proposal with no additional information about how the data were collected and verified. This is obviously not about emphasizing the dominance or more significance of other than verbal content or the insignificance of contact with the past through text. It should be kept in mind that the correct interpretation of the information contained in the image depends primarily on the viewers' knowledge and it determines the correct interpretation of the message conveyed in the visualization.

Another level includes narration. Individual virtual images can be matched with the description of original elements and the ones which were reconstructed on the basis of the researcher's knowledge or through reference to other famous objects from medieval times – hypothetical. Depending on the degree of the viewers' interest this image can be completed with additional information (narration) regarding the visualization development stages, source data verification, and the existing research hypothesis. This level can also include the visualizations presenting the project of transformation of this historical object into permanent ruins, which would result in the conservation of the original

fragments of the past for future generations. These two levels are addressed to the general public in order to draw attention to the problem of heritage protection and especially historical objects which are in ruins.

The paradata gathered during the works (knowledge gained during the virtual reconstruction through analysis and interpretation of source material as well as through the analysis of missing data; Bentkowska-Kafel 2008, 44) prove the necessity of conducting comprehensive architectural and archeological studies in order to answer numerous questions regarding the form of the whole design or specific facilities as well as to determine more specifically the chronology of some parts of the building.

The presentation of the functional and spatial program of the oldest stage of the palace to the residents of Milicz and tourists should make them reflect over the cultural heritage, and ultimately change the way how they perceive this object in the medieval history of the north-east of Silesia. The images (the cognitive and emotional plane) present the past glory of the historical object and the need to reflect on its present, poor condition, as well as taking further steps by the local authorities to preserve the bishop's palace and save it from a total destruction.

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WIZUALIZACJA 3D JAKO METODA PREZENTACJI HIPOTEZ BADAWCZYCH – PRZYKŁAD ŚREDNIOWIECZNEGO PAŁACU W MILICZU

STRESZCZENIE

W początkach XXI wieku intensywny rozwój multimediów spowodował, że wizualizacje 3D różnego rodzaju obiektów zabytkowych o wartości historycznej, artystycznej czy naukowej stały się już pewnego rodzaju standardem. Impulsem do konstruowania trójwymiarowych wizualizacji jest chęć ochrony dziedzictwa kulturowego, potrzeba upowszechnienia informacji o zabytku oraz weryfikacja istniejących propozycji rekonstrukcji czy hipotez badawczych.

Wybór pałacu w Miliczu jako przedmiotu wizualizacji nie był przypadkowy. Wynikał on z zainteresowania problematyką procesów osadniczych i kulturowych zachodzących na obszarze północno-wschodniego Śląska, a w tym regionie w okresie średniowiecza Milicz odgrywał pierwszoplanową rolę. Nie bez znaczenia były dzieje samego założenia, jego geneza jako pałacu biskupiego, następnie przebudowa i powstanie zamku książęcego, a w końcowym etapie istnienie rezydencji szlacheckiej. Istotny wpływ na decyzję o wyborze tego obiektu miał również fakt dość znacznego zniszczenia zabytku, który pozostaje w stanie postępującej ruiny. Mamy nadzieję, że upowszechnianie w lokalnej społeczności wirtualnych obrazów pałacu zaowocuje w przyszłości jego zabezpieczeniem. Wykonanie wizualizacji 3D najstarszej fazy tego założenia – pałacu biskupiego jest pierwszym etapem realizacji ikonosfery średniowiecznej rzeczywistości Milicza.

Geneza Milicza, jako średniowiecznego kompleksu osadniczego, zasługuje na szczególną uwagę. Kompleks ten powstał na północnym brzegu Baryczy, rzeki będącej prawobrzeżnym dopływem Odry. W świetle najnowszych ustaleń początek wczesnośredniowiecznego osadnictwa na tym terenie przypada na koniec IX w., być może początek X stulecia. Wówczas powstała osada o charakterze otwartym (stan. 10), usytuowana w Dolinie Baryczy, w sąsiedztwie przeprawy przez rzekę. Istotne zmiany w strukturze zasiedlenia nastąpiły w 2 poł. X stulecia, kiedy na południe od istniejącego osiedla pobudowano gród (stan. 1), a starszą osadę przekształcono w nieobwarowane podgrodzie. Kolejne transformacje miały miejsce w połowie XII w., a ich rezultatem było założenie cmentarzyska (stan. 9). W ten sposób zostało ukształtowane centrum kasztelanii milickiej. Istotne zmiany na terenie kasztelanii miały miejsce w ciągu XIII wieku. Część ziem należących do kasztelana książęcego weszła w skład dóbr kościelnych, którymi zarządzał nowo powołany, biskupi kasztelan. W wyniku tych przemian biskup zbudował w dobrach milickich pałac jako formę manifestacji swojej pozycji na tym terenie.

Zaproponowana przez M. Chorowską i A. Kudłę odmienna datacja, funkcja i forma biskupiego założenia pałacowego postawiła w nowym świetle średniowieczne dzieje Milicza, a wykonana przez tych badaczy schematyczna rekonstrukcja tej najstarszej fazy stała się bezpośrednim impulsem do podjęcia prac nad wizualizacją jej pierwotnej formy. Opracowując wizualizację, weryfikowano dostępne dane źródłowe przez ich bieżącą analizę i interpretację zgodnie z wytycznymi zawartymi w Karcie Londyńskiej. Prace nad trójwymiarową wizualizacją pałacu rozpoczęto od szeroko zakrojonej kwerendy źródeł. Polegała ona na analizie dostępnych wyników badań archeologiczno-architektonicznych i publikacji, które uzupełniono dodat-

kowymi pomiarami obiektu i dokumentacją fotograficzną wykonaną dla potrzeb tworzonego modelu. Na tym etapie istotne znaczenie miały także konsultacje ze specjalistami, poszukiwania analogii ikonograficznych, dostępnych w literaturze przedmiotu oraz publikacji prezentujących różnego rodzaju rekonstrukcje średniowiecznych budowli, zarówno te w formie tradycyjnej, jak i cyfrowej – strony internetowe.

Zasadniczą część wizualizacji oparto na autentycznych, zachowanych do naszych czasów elementach. Były to głównie mury i murowane części urządzeń, wnęki w ścianach i niektóre otwory okienne. Druga kategoria to elementy przedstawiane na podstawie zachowanych śladów. Zaliczono do nich stropy i sklepienia zrekonstruowane na podstawie pozostałości gniazd po belkach stropowych, wskazujące na miejsce ich lokalizacji, wielkość, układ i rozstaw, ale w sposób jednoznaczny nie informujące o wyglądzie samego stropu. Ten sam problem dotyczył również systemów grzewczych, o istnieniu których wnioskowano dzięki zachowanym w obrębie poszczególnych pomieszczeń wlotom kanałów kominowych, przy jednoczesnym braku poszczególnych urządzeń. Ostatnia grupa to elementy, których istnienie założono na podstawie analogii znanych z innych zabytków lub przekazów ikonograficznych o średniowiecznej genezie. Zaliczono do nich wewnętrzne i zewnętrzne ciągi komunikacyjne (klatki schodowe), urządzenia grzewcze (kominki) czy sposób szklenia okien. Tak przygotowana dokumentacja stała się punktem wyjścia do dalszych prac związanych z wykonaniem modeli trójwymiarowych, zarówno samej bryły pałacu, jak i poszczególnych pomieszczeń.

Proponowana wizualizacja najstarszej fazy milickiego pałacu może być odczytywana na kilku poziomach. Po pierwsze, jest to samodzielny przekaz istniejący niezależnie od informacji narracyjnych. W tej postaci kierowany jest do odbiorców tylko w nieznacznym stopniu zainteresowanych przeszłością i sposobami jej prezentacji, ograniczających się do pozyskania ogólnych informacji o zabytku, jego formie, parametrach wielkościowych i lokalizacji w krajobrazie kulturowym średniowiecznego Milicza. Tym samym jest to propozycja bez dodatkowych informacji o procesie pozyskiwania i weryfikacji danych. Oczywiście nie chodzi tu o podkreślenie dominacji czy wyższości obrazu pozawerbalnego na rzecz ograniczenia czy niższości tekstowego kontaktu z przeszłością. Należy bowiem zdawać sobie sprawę z tego, że prawidłowe odczytanie zawartych w obrazie informacji zależy przede wszystkim od posiadanej przez odbiorcę wiedzy i tylko dzięki niej można liczyć na poprawny odbiór przekazywanych treści.

Kolejny poziom jest poszerzony o narrację. Poszczególne wirtualne obrazy mogą zostać zestawione z informacjami, opisującymi elementy zachowane (autentyczne) oraz te, które powstały na podstawie wiedzy badacza lub analogii znanych z innych obiektów o średniowiecznej chronologii – hipotetyczne. W zależności od stopnia zainteresowania odbiorcy obraz ten może zostać uzupełniony o dodatkowe informacje (narracje) dotyczące etapów powstawania wizualizacji i sposobów weryfikacji danych źródłowych oraz istniejącej hipotezy badawczej. Do tego poziomu można również dołączyć wizualizacje przedstawiające projekt przekształcenia tego zabytku w trwałą ruinę, dzięki której nastąpi zabezpieczenie zachowanych, autentycznych fragmentów przeszłości dla przyszłych pokoleń. Te dwa poziomy kierowane są do ogółu społeczności, w celu zwrócenia uwagi na problem ochrony dziedzictwa, a w szczególności zabytków znajdujących się w stanie postępującej ruiny.

Pozyskane w trakcie prac paradane uświadamiają konieczność przeprowadzenia kompleksowych badań architektoniczno-archeologicznych, których celem będzie odpowiedź na liczne pytania dotyczące formy całego założenia czy poszczególnych urządzeń oraz uściślenie chronologii niektórych części założenia.

Przybliżenie mieszkańcom Milicza i turystom programu funkcjonalno-przestrzennego najstarszej fazy pałacu ma spowodować ich refleksję nad dziedzictwem kulturowym, a w końcowym rezultacie zmianę sposobu postrzegania tego obiektu na tle średniowiecznych dziejów północno-wschodniego terenu Śląska. Oddziaływanie poprzez obraz ukazuje minioną świetność zabytku i potrzebę refleksji nad obecnym, złym stanem zachowania, a w dalszej perspektywie podjęcie przez lokalne władze kroków w kierunku zabezpieczenia pałacu biskupiego, co zapobiegłoby jego całkowitemu zniszczeniu.

Adresy Autorek:

Mgr Małgorzata Markiewicz
Zespół Archeologicznych Badań Ratowniczych
przy Ośrodku Badań nad Kulturą Późnego Antyku
i Wczesnego Średniowiecza IAiE PAN
ul. Więzienna 6
50-118 Wrocław
e-mail: mma@arch.pan.wroc.pl

Dr Justyna Kolenda
Ośrodek Badań nad Kulturą Późnego Antyku
i Wczesnego Średniowiecza IAiE PAN
ul. Więzienna 6
50-118 Wrocław
e-mail: jko@arch.pan.wroc.pl