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Monumental castle architecture in Teutonic's Prussia. Development and Building Techniques

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Monumentální hradní architektura v teutonském Prusku – vývoj a stavební techniky

Abstrakt: *Článek se zabývá vývojem hradní architektury v Prusku (především správních hradů) v období od roku 1280, kdy politická stabilizace řádového státu vytvořila základ pro rozvoj monumentální architektury. Základním modelem hradu se stal pravidelný kastel, ale jak ukazují nedávné výzkumy, pokračovalo se i v budování starších nepravidelných hradů uzpůsobeným dispozičně dle nových vzorů. Toto období lze obecně charakterizovat jako dobu kvalitativního a kvantitativního nárůstu staveb. Špičková architektura šla společně s vývojem stavebních technik v kombinaci s promyšleným plánováním staveb. Model správního hradu vytvořený v poslední čtvrtině 14. století se používal až do počátku 15. století.*

Abstract: *The article characterizes castle building development in Prussia (primarily commanders' castles) from about 1280, when political stabilization and state development created the grounds for advancements in monumental architecture. The model of a typical castell was modified in the Teutonic state, but as recent research demonstrates, the construction of older irregular castles that followed these new patterns continued. The period is characterized by a qualitative and quantitative boom in construction. High-quality architecture went hand in hand with the development of building techniques in completing sophisticated structures, masonry and earthworks. The model of commander castle created in the last quarter of 14th century was still in use until the beginning of the 15th century.*

Klíčová slova: *hrady Řádu německých rytířů – Prusko – Německý řádový stát – kastely –stavební techniky*

Despite the fact that the first information concerning a brickyard comes from the 1240s (Arszyński 1970, 18)[1], the large-scale development of brick architecture was not possible at the time due to the situation in the country. The Teutonic Knights arrived around 1230 to lands that were basically lacking any tradition of masonry building and urban settlement. The area was also impoverished by wars and invasions (Chrzanowski – Kornecki 1984, 6; Jasiński 1993, 95–97). Corresponding infrastructure and a developed economy, which was vital for the development of masonry architecture, did not exist locally. A new type of building emerged and formed slowly, as all the Order's efforts in the first decades were concentrated and determined by military

actions. Teutonic fortresses erected in this period were primarily of a wooden-earthen type, and the first masonry structures (irregular castles) had very simple forms (Wasik 2016a, 315–317; 2016b). The lack of adequately developed local structures caused the Knights mainly to rely on the resources of their bailiwicks in the Reich territories and from papal, knightly and clergy donations as a form of payment for participation in the Crusades (Biskup – Labuda 1988, 189). The stabilized situation, which was indispensable for the country's development, was constantly disrupted by wars, which were not always successful for the Teutonic Knights. During the 1st Prussian Uprising in the 1240s, the Order kept control of only a few strongholds: Toruń/Thorn, Starogród/Althaus Culm, Radzyń/Rheden, Elbląg/Elbing and Balga. A number of early urban location attempts in Prussia (Braniewo/Braunsberg, Kaliningrad/Königsberg) failed as well as a result of the 2nd Prussian Uprising (Biskup 1980, 408; Dygo 2009a, 184; 2009b, 69).

1283 is a date that symbolizes the final conquering of pagan Prussian tribes by the Teutonic Knights (Biskup – Labuda 1988, 183; Dygo 2009a, 88). However, it did not spell an end to all wars, as the main theatre of war moved eastward. For this reason, Chełmno Land and Upper Prussia were able to live in peace for a time. The Knights quickly began a new dynamic and the intentional colonization process of their properties. New urban centers were already located in Chełmno Land from the turn of the 1270s, 10 of which had been functioning successfully. The same process was also intensified in Prussia's main territory, primarily leading to the restoration of destroyed centers in Braniewo (1284) and Königsberg (1286) and the construction of new towns (e.g. Pasłęk/Preußisch Holland, Tolkmicko/Tolkemit, Iława/Deitsch Eylau). In the beginning of the 14th century, 17 towns were functioning in the northwestern part of Prussia (including 7 towns of the Church) (Biskup 1980, 403, 408–409; Czaja 2009, 180–182, 184; Jasiński 1993, 105, 110). The location's basic purpose changed, as new town functions became crucial at the start of the 1280s– they were designed to be economic centers and trade-production bases for rural settlement with limited privileges compared to the previous period (Biskup – Labuda 1988, 191; Czaja 2009, 178, 184; Jasiński 1993, 110–111). Simultaneously, rural colonization began anew, reaching farther into the realm (Długołęcki 2009, 200–205). The balanced political situation and settlement development provided a foundation for the economic improvement of Prussia, which lasted continuously until the turn of the 14th century (Gancewski 2001).The general administrative structure of the Order was also completed (Jóźwiak 1997, 239; 2001, 60–64). All these changes contributed to creating favorable conditions for brick architecture development on a large scale, providing it with an advanced and stable political-administrative and demographic structure, infrastructure and significant financial means (Arszyński 2010, 11, 14).

Beginning with the descriptions of castle architecture, it should be noted that in comparison with the first decades of the Teutonic Order's presence and operation in Prussia (2nd–3rd quarter of the 13th century), a clear difference of a qualitative and quantitative character is observed in both architectonic form and building techniques. Choosing a *castell* type which would become the most popular form of a commander castle in the Teutonic state was a crucial decision that shaped homogenous castle architecture in Prussia for long to come.

A group of castles from the area of the Vistula Lagoon are regarded as the first regular convent houses, specifically the castles Malbork/Marienburg (Fig. 1), Brandenburg (Rus. Ushakovo), Lochstedt and Königsberg (Torbus 1998, 88–124; 2014, 93–141). The construction of the Malbork convent house began in the 1270s, or perhaps more probably at the turn of the 1270s–80s[2]. The beginning of Brandenburg castle's construction had been dated until recently to the end of the 1260s (Torbus 1998, 372). However, new research has proven that the commandery was established there between 1283–1284, which was the period when construction of the brick convent house must have been begun (Jóźwiak 2001, 61–64). These sites were designed on a plan of an elongated rectangle with three wings[3]. In the beginning of the 14th century they possessed four

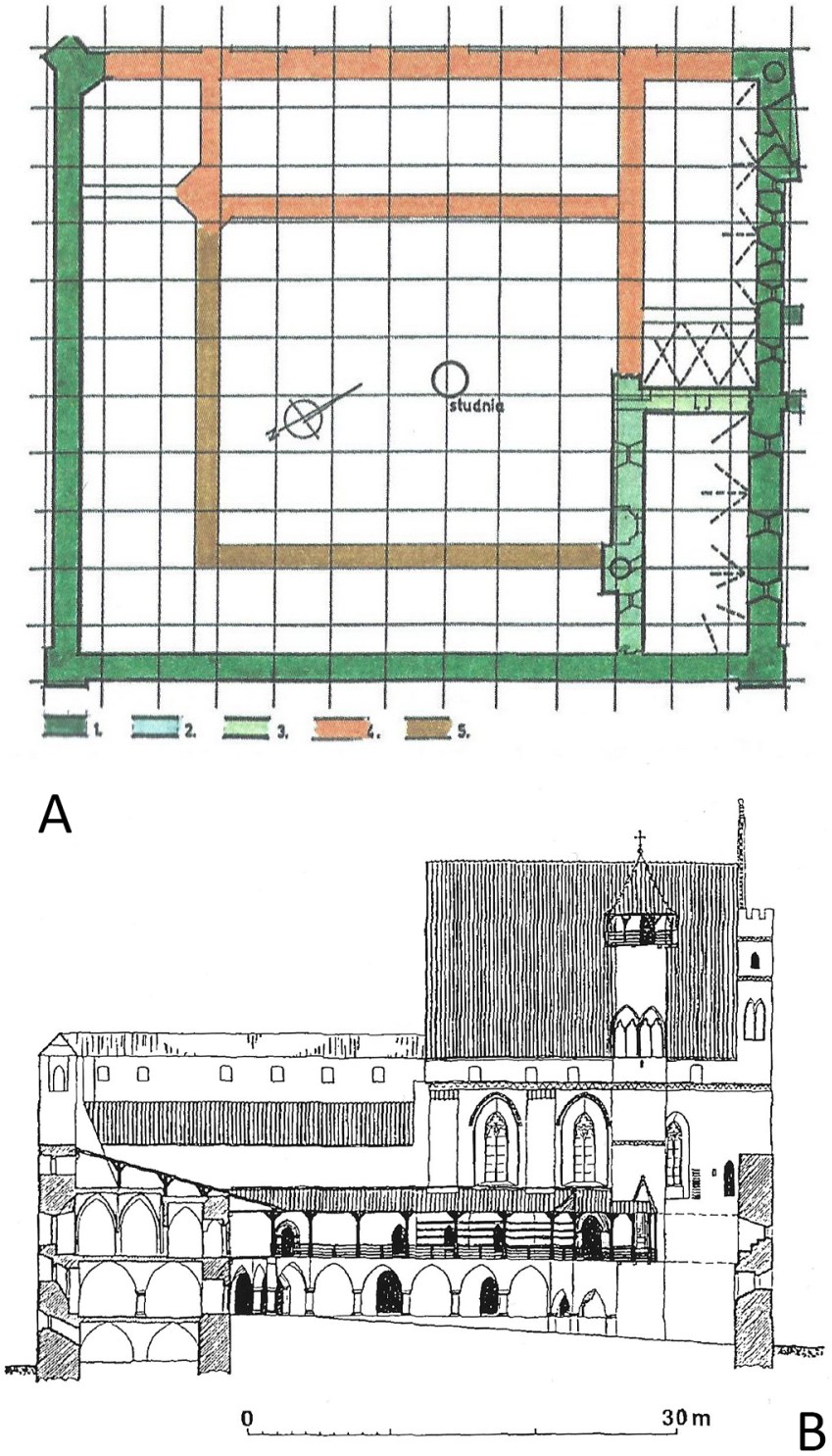

Fig. 1. Malbork, a convent house at the turn of 13th century: A – projection of the 1st floor with building stages marked and a grid with a module of the 1st floor of the old Chełmno measurement unit (after Kąsinowski 2010), B – reconstruction of the central wing's state after finishing works in the chapel (after Pospieszny 2014). – ***Abb. 1.*** *Marienburg, das Konventhaus um die Wende des 13. Jahrhunderts: A – Grundriss des 1. Stockwerkes mit den markierten Bauphasen und einem Raster des Moduls der alten Kulmer Maßeinheit (nach Kąsinowski 2010), B – die Rekonstruktion des Zentralflügels nach der Beendigung der Bauarbeiten in der Kapelle (nach Pospieszny 2014).*

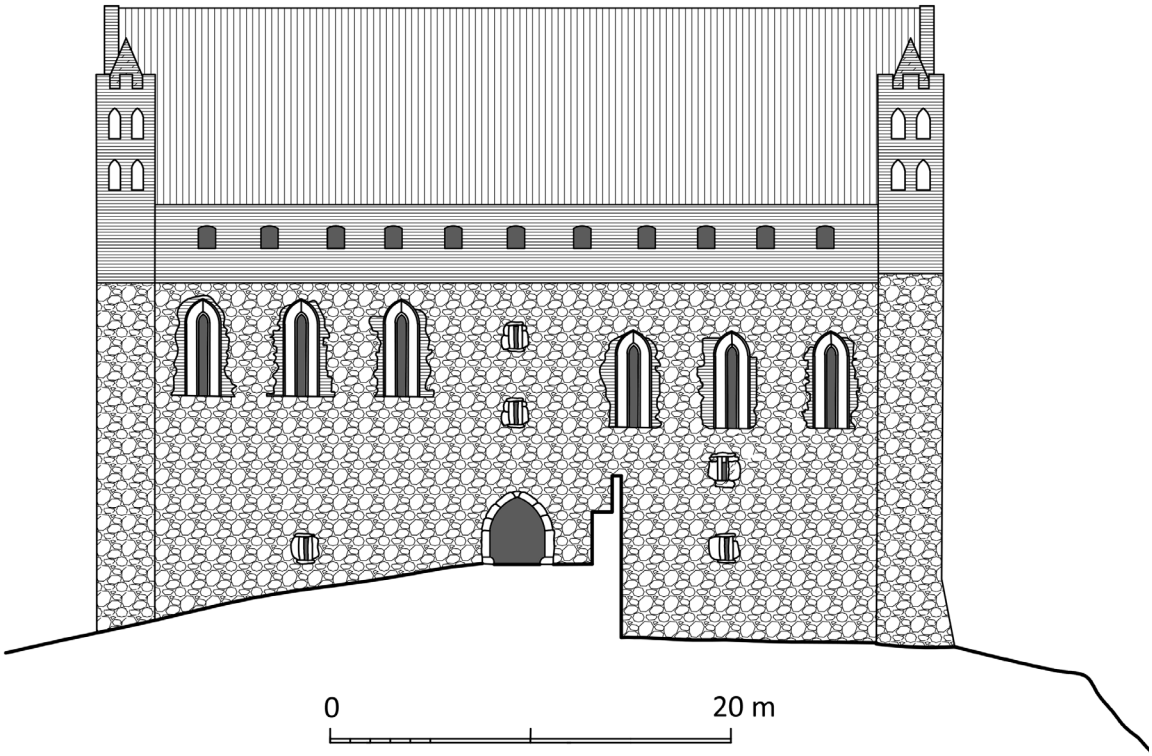

Fig. 2. Papowo Biskupie – reconstruction of the northern façade (central wing) at the beginning of the 14th century. Drawing B. Wasik. – ***Abb. 2.*** *Papowo Biskupie – die Rekonstruktion der Nordfassade (Zentralflügel) am Anfang des 14. Jahrhunderts. Zeichnung B. Wasik.*

wings. Their sizes balanced between about 54–65×46–52 m (Torbus 1998, 370, 478, 449, 492). A convent house in Elbląg is regarded by some researchers as a prototype, and its construction is dated very early, i. e. to the 1250s–60s (Kutzner 1997, 76; Pospieszny 2014, 120–122; Torbus 2014, 95–96). Determining the chronology of this very poorly recognizable object, which is *de facto* rather irregular in design, is very difficult and not reliable at the present state of research[4].

The first construction of *castells* in Chełmno Land started more or less at the same time as in the Vistula Lagoon, or slightly later (Torbus 2014, 141–144), with the oldest structures in Papowo Biskupie/Papau (Fig. 2) and Rogóźno/Roggenhausen – the beginning of construction is dated to the 1270s–80s or the 1280s. The latest projects belonging to that group (Kowalewo Pomorskie/Schönseeand, Golub/Gollub) were erected during the first three decades of the 14th century. These castles differed from the Vistula Lagoon strongholds in the modesty of their architecture and simple form. Only chapels and refectories situated on the first floors of main wings were equipped with larger windows; the other interiors usually had small narrow ones. They were among the first four-winged structures on a square or a short rectangular plan. Corners were marked by turrets, which were set on the walls from the top (Golub), or as avant-corps of the whole body (Papowo Biskupie, Rogóźno). Side lengths of these early Chełmno Land castles varied from 38 to 45 m. Cloisters, which were frequently wooden, enabled movement along the interiors (Torbus 1998, 124–144; Wasik 2016a, 240–241, 271–292, 318–320; Wasik –Wiewióra 2016, 62).

Fig. 3. Grudziądz – projection of a castle from 14th –15th century. Drawing B. Wasik. – ***Abb. 3.*** *Grudziądz – die Rekonstruktionszeichnung des Aussehens der Burg im 14. und 15. Jahrhundert. Zeichnung B. Wasik.*

Apart from *castell* construction from the 13th–14th centuries, Teutonic architecture introduced other characteristic elements such as *parchams*, *danskers* and *bergfrieds* (main towers), although they were not necessarily built everywhere. The main tower in the Vistula Lagoon was built at Lochstedt castle, and presumably at Brandenburg. Observation of early *castells* of Chełmno Land shows that only Lipienek/Leipe possessed a *bergfried*; the fortress in Golub had that structure in its plans, but it was never finalized. *Parchams* were also erected only in a few early *castells*[5] with irregular multilateral lines, e.g. Lipienek castle (Torbus 1998, 301–302; Wasik 2015, 269–271; 2016a, 319–320).

The acceptance of the new *castell* model in Prussia was revolutionary and influential on all castle architecture transformations. Therefore, simple irregular structures of the previous period which had not been completed until then were further constructed and expanded and their forms were adjusted, if possible, to new requirements and patterns (Wasik 2014; 2016a, 319; 2018, 223–235). They were given 2–3 analogous wings joined together by galleries, and for the first time were frequently given elements such as: *bergfieds*, *parchams* and large *danskers*. Irregular convent houses at the time took on elementary forms. In Grudziądz/Graudenz (Fig. 3), based on an incomplete house, a new spacious southern (main) wing was added, and a chapel and

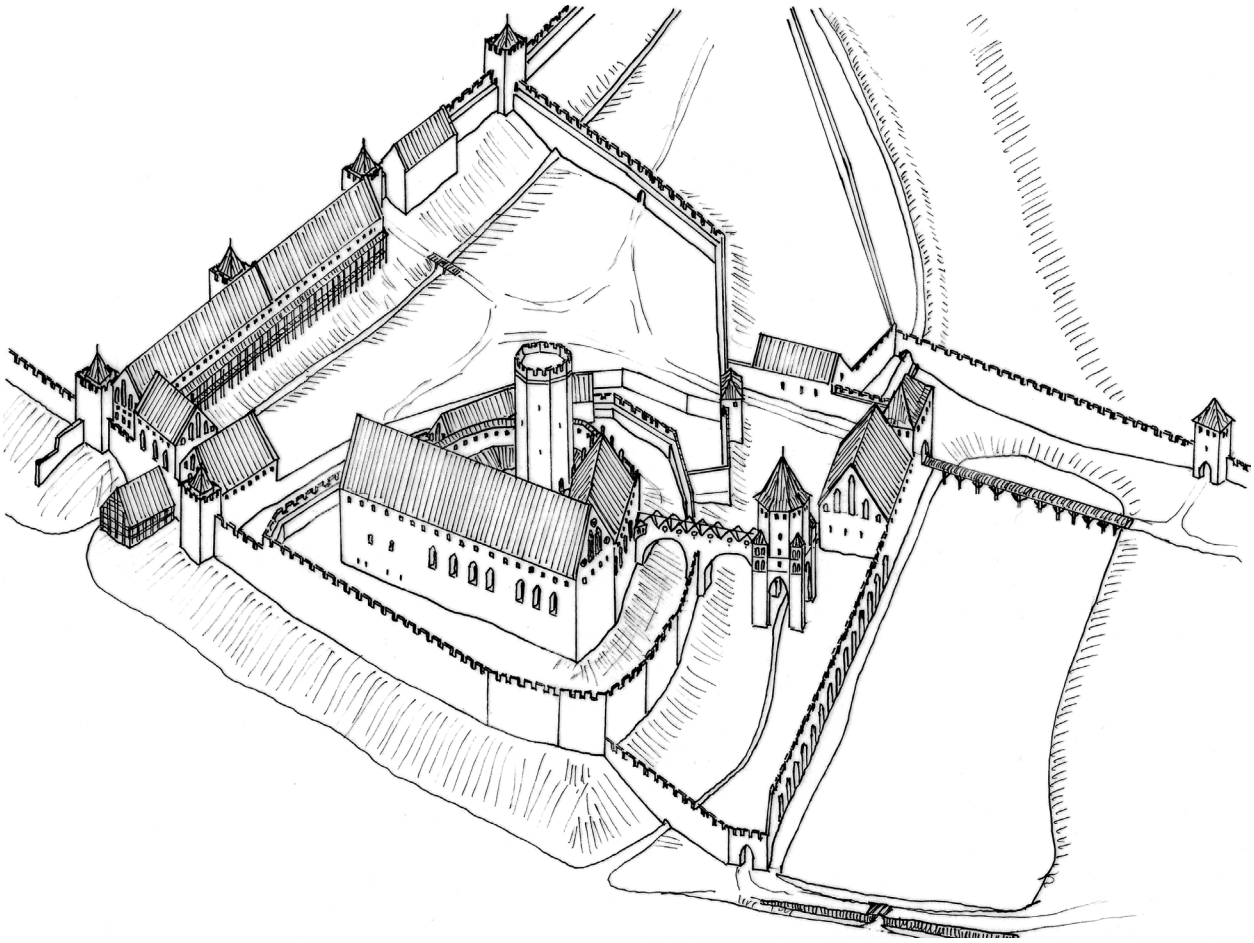

Fig. 4. Toruń – reconstruction of a castle from the beginning of the 15th century. Drawing B. Wasik. – ***Abb. 4.*** *Toruń – die Rekonstruktionszeichnung des Aussehens der Burg am Anfang des 15. Jahrhunderts. Zeichnung. B. Wasik.*

refectory was situated there; another wing was erected from the west, and both were connected with a mortared cloister. Simultaneously, a cylindrical *bergfied*, a *dansker* and a *parcham* were built there (the structure can be dated to the end of 13th century and beginning of the 14th). Identical elements were erected in Toruń – the southern (main) wing was completed, followed by the construction of an octagonal *bergfied*; an eastern wing with a cloister, *dansker* and *parcham* were also added (Fig. 4). The completion of the southern wing housing a chapel can be dated to the 1280s–90s. Finalizing construction of the main wing was the first stage of the extension plan, and, like in Grudziądz, other buildings were the elements of one compact investment and seen as the work of one architect. By situating a tower towards the eastern wing, it became possible to build a bridge from a defensive porch over the diagonally formed (parallel to the side of the *bergfried*) cloister side. The structure is associated with the same workshop that erected the St. James Church in Toruń and is dated to the beginning or first decades of the 14th century (Wasik 2014, 102–112; 2016a, 249–253, 255–258; Jóźwiak – Trupinda 2016, 11). Pokrzywno/Engelsburg castle was extended to include a several-winged convent house which was started at the end of the 13th century and completed at the turn of that century; however, neither a *bergfried* nor a *parcham* were erected (Wasik 2016a, 263–264). In Balga, the construction of three wings forming the convent house body, possibly with a tower, is also dated to the end of 13th century (Torbus 2014, 69, 139). Bierzgłowo (Zamek Bierzgłowski)/Birgelau and Starogród convent houses also lacked towers and their central wings were erected between the 13th and 14th

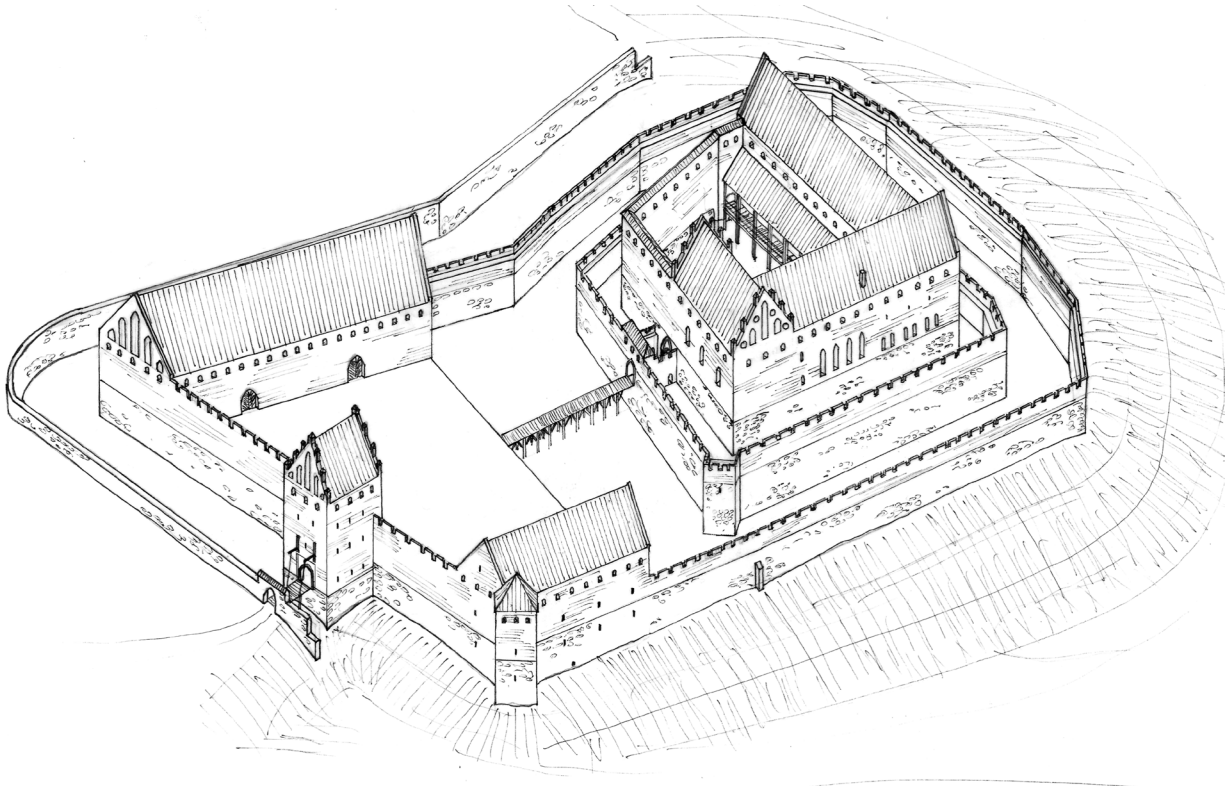

Fig. 5. Bierzgłowo (Bierzgłowo castle) – reconstruction of a castle from the 1st half of the 15th century. Drawing B. Wasik. – ***Abb. 5.*** *Bierzgłowo – die Rekonstruktionszeichnung des Aussehens der Burg in der 1. Hälfte des 15. Jahrhunderts. Zeichnung B. Wasik.*

century. Bierzgłowo castle (Fig. 5) had three wings with a cloister, including one shorter wing with a chapel (the last wing originating from the first castle building stage). The whole complex was surrounded by a *parcham*. In Starogród fortress, as recent research has shown[6], a short wing housing a chapel was completed first, and then a vertical western section with a refectory was added to it. Both buildings were joined together with a cloister. From the bailey side, the convent house was protected by a *parcham* (Wasik 2017b, 52–54; 2017c, 5–14; 2018c, 230). Modifications from the discussed period in the case of the poorly recognizable Dzierzgoń/Christburg fortress are unreadable, although the presence of characteristic rib fittings with trapezoid heads (also applied in Bierzgłowo, Toruń and Grudziądz) and information concerning sculptured details (Pawłowski 2003, 298; 2005, 220) indicate structures that are typical for the period of changes.

When some modification works were still in progress in selected early castles and developed irregular fortresses in the 1st half of the 14th century, Teutonic castle architecture reached its highest form in so-called classical convent houses, such as Gniew/Mewe, Radzyń Chełmiński (Fig. 6) and Brodnica/Strasburg (Fig. 7). Construction of the first building may have begun at the end of the 13th century, and was finished during the first decades of the 14th century. Construction of two others was begun in the 2nd or 3rd decade of the 14th century and completed roughly mid-century. They differed from the previous sites in their lighter style, characteristic larger windows and the construction of *bergfrieds*, corner turrets of an avant-corps type, and regular *parchams* became a rule. These classical four-winged *castells* were also bigger – with a span of about 45–50 m (Torbus 1998, 144–176; 2014, 167–168; Wasik 2016a, 299, 303–304, 320–321). The construction of a *castell* in Człuchów/Schlochau, which is similar to classical forms although without corner turrets, probably began in the 1320s, but it lasted for a rather long time, i.e.

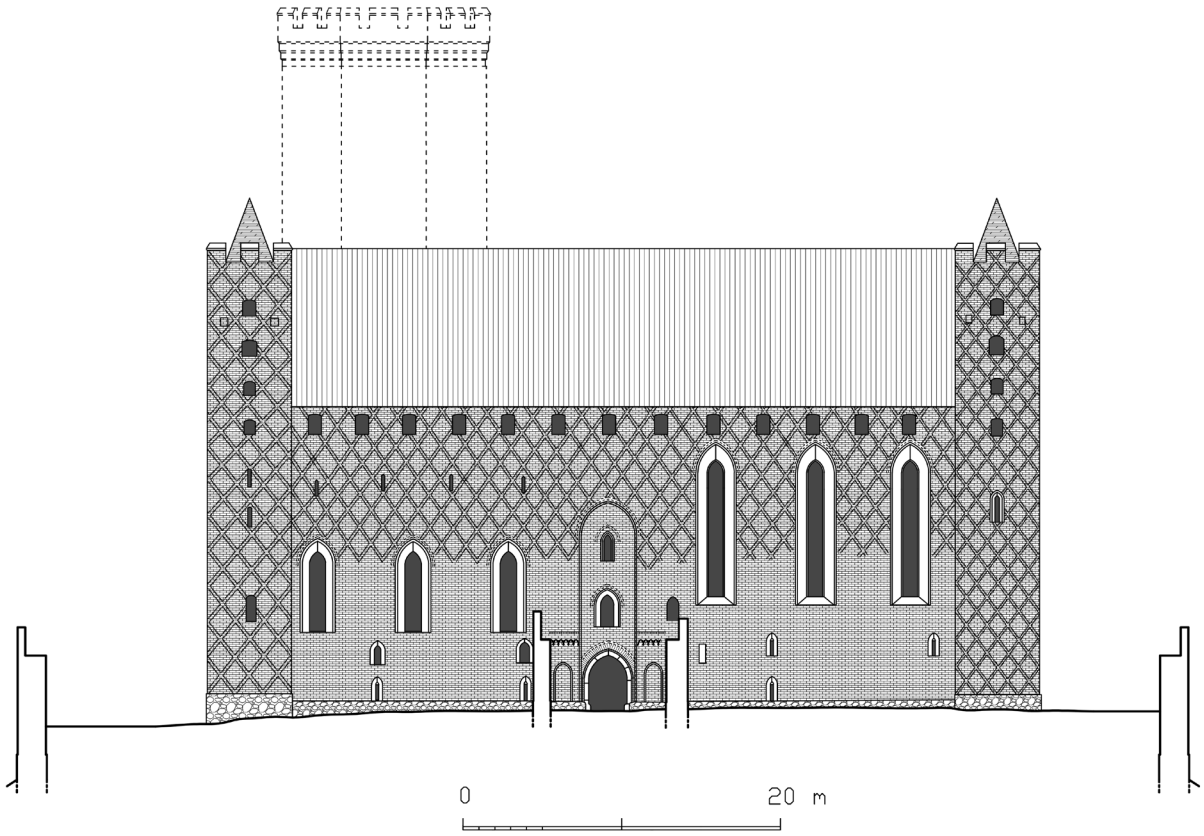

Fig. 6. Radzyń Chełmiński – reconstruction of the southern façade (central wing), mid-14th century. Drawing B. Wasik. – ***Abb. 6.*** *Radzyń Chełmiński – die Rekonstruktion der Südfassade (Zentralflügel) in der Hälfte des 14. Jahrhunderts. Zeichnung B. Wasik.*

until the 2nd half of the century (Starski 2016, 10–11). Another fortress in Świecie/Schwetz, the construction of which began in the 1330s, was equipped with cylindrical corner towers, which was clearly due to the influence of French and Rhine architecture (Torbus 1998, 185–194). The castle never had fully developed wings, a fact which may have been planned. The castle in Nieszawa/Nessau was also not completed according to the original design (Mała Nieszawka at present; Domagała 2002, 98–101). The last castles built in the 2nd half of the 14th century and the beginning of the 15th were characterized by a significant reduction of certain architectonic elements – towers and *parchams* were no longer erected, although the castle architecture still remained monumental, with side sizes from 43 to 45 m (Chernyakhovsk/Insterburg, Ostróda/Osterode) and even 59 m (Nieman/Ragnit) (Torbus 1998, 210–247, 441, 566, 583). The symbolic character of *castells* during this whole period was so fundamental that the pattern also served for designing bishops' residences (Wąbrzeźno/Briesen, Lubawa/Löbau, Lidzbark Warmiński/Heilsberg, Primorsk/Fischausen) and chapters (Kwidzyn/Marienwerder) (Herrmann 2007, 251–259; Jarzebowski 2007, 23–31, 89–107, 140–154: Wasik 2016a, 329)

Recent explorations mainly in Chełmno Land have shed new light on building techniques used for Teutonic castle construction. Contrary to irregular castles from earlier times, the location of regular *castells* was most often chosen on a new site, not in the location of earlier fortresses made of wood and earth (e.g. in Papowo Biskupie, Człuchów; Starski 2016, 14; Wasik 2016a, 271; 2018b, 175–185). Even if there was a wooden-earthen construction (sometimes a continuation of early mediaeval Slavic or Prussian strongholds) existing before a mortared complex, the location

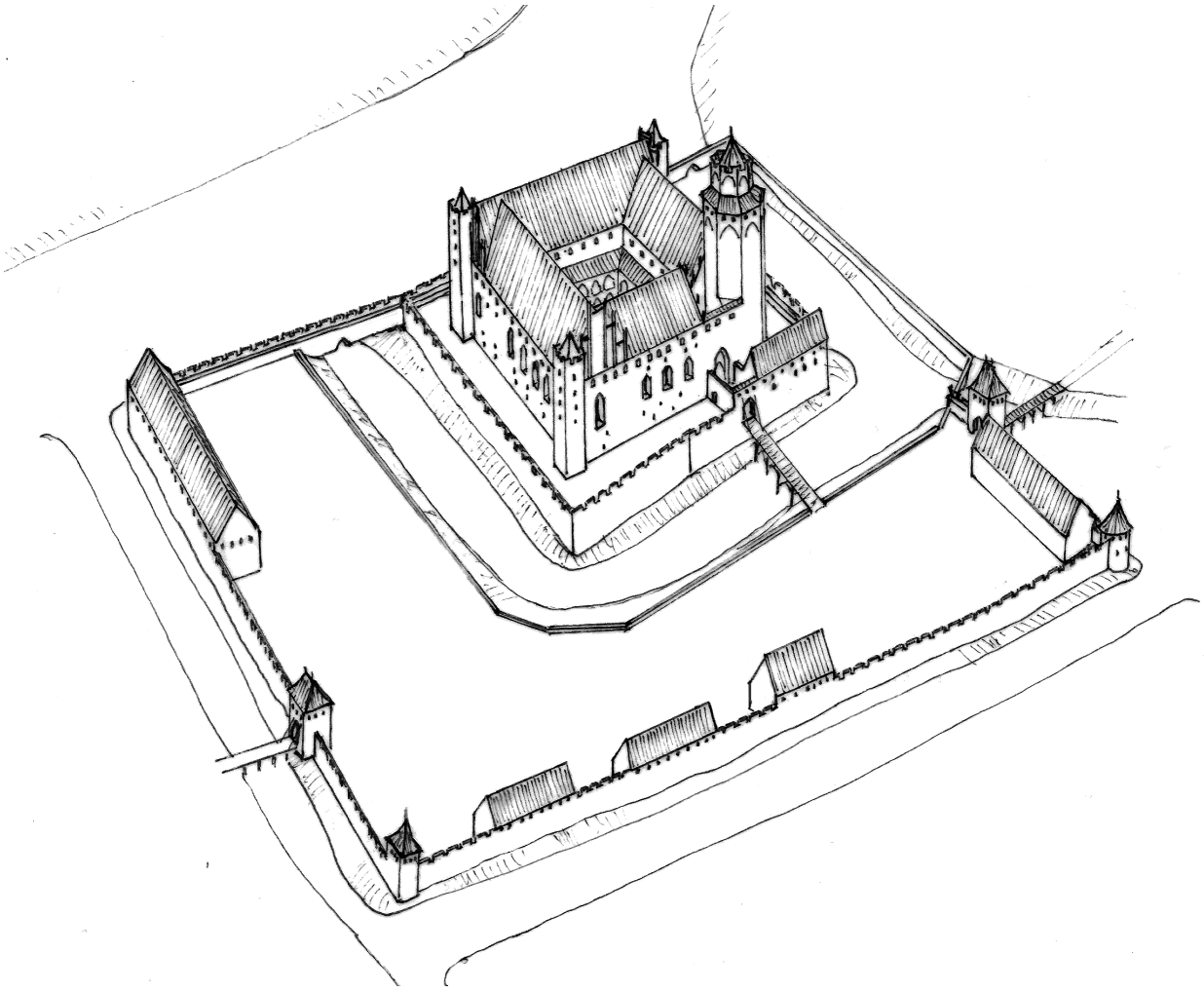

Fig. 7. Brodnica – castle reconstruction from the beginning of the 15th century. Drawing B. Wasik. – ***Abb. 7.*** *Brodnica – die Rekonstruktionszeichnung des Aussehens der Burg im 15. Jahrhundert. Zeichnung B. Wasik.*

was changed. Therefore, the residence of a commander and a convent was moved from Zantyr to Malbork (Pospieszny 2014, 26; Torbus 2014, 109–110). In Kowalewo Pomorskie, which is known for a wooden-earthen fortification evidenced in 13th century sources, the *castell* was built 'in cruda radice'. Also in Radzyń Chełmiński, the researchers did not report any signs of 13th century wooden-earthen fortifications located under the castle. The old Teutonic stronghold must have been located based on an early mediaeval gord at a distance of 250 m from the castle. Brodnica *castell* was not located on the foundations of the first Teutonic fortress evidenced in the 1260s either. It may have been located in some of the neighboring settlements, a few kilometers from the present town (Powierski 1993, 52–54; Wasik 2016a, 27–28). An analogous situation was registered in Gniew, Świecie, Nieszawa (Mała Nieszawka), Ostróda and Ragnit (Domagała 2002, 107; Jóźwiak – Trupinda 2009, 341, 351; Torbus 2014, 171–172, 244; Wilke 1972, 131). Bishops' *castells* in Wąbrzeźno and Lubawa were also erected in entirely new locations, which were distanced from early simple fortresses, although there were some exceptions as well. The situation in Golub is not clear; researchers assume the existence of a wooden-earthen fortress functioning for a short time in the last years of the 13th century, where in the beginning of the next century the construction of a new castle structure began. On the other hand, a ditch and relics of a rampart excavated in the site could have been the original defensive framings of a new

brick castle (they had the function of a bailey protection until about the middle of the 14th century). The case of Rogóźno is even less certain, as excavated relics were interpreted as the signs of an older stronghold situated under the castle, although the collected evidence is not clear (Wasik 2016a, 28–29). Slavic gords was certainly the base for the construction of the castles in Gdańsk and Lipienek (Torbus 2014, 225–227; Wasik 2018a, 41)[7]. Building *castells* in new locations may have been dictated by practical reasons, as the small and irregular early strongholds were not suitable locations for erecting a regular castle in their place. Simultaneously, the old settlement could still function without disturbances during the building works.

Metrical analysis shows that an old Chełmno measurement unit was used first[8]. Later, it was replaced by a new one[9], which became the only one in use in the 14th century (Fig. 1, 8). The unit was used to measure castle dimensions (e. g. in Malbork, the *castell* had 11 × 13 rods[10] of an old unit; in Papowo Biskupie a quadrangle side was 9 rods of an old unit; in Radzyń Chełmiński and Świecie– 11,5 rods of a new unit; in Brodnica – 10,5 rods of a new unit; in Człuchów – 11 rods of a new unit; and in Nieszawa – 8 rods of a new unit), but it was also used to measure the window span on a wall (Kąsinowski 2010, 40–41; Starski 2016, 12; Wasik 2016a, 41–48).

Prussian records do not provide univocal information confirming the drawing of building projects[11], but we must suppose they were made, as their existence is evidenced in Western Europe (Harvey 1972, 110–113). Mediaeval builders frequently made sketches of façades, architectonic details and projections of objects' fragments. These drawings were useful in defining objects' proportions (Wyrobisz 1963, 87). Various geometrical methods were used, in particular the ones based on square dimensions (*ad quadratum*) and triangles (*ad triangulum*) (Harvey 1972, 121–127; Łodyńska-Kosińska 1964, 89–114). Analysis of Prussian *castells* clearly depict that their proportions were defined using the *ad quadratum* method, the pattern known in Western Europe (Fig. 9–10), and this is clearly evidenced by analyses of plans and proportions of objects in better condition. The method was based on subdivisions made of squares, drawn within a larger one, where the first created the convent house's general outline; the additional squares created the wings and yard width. Using this method, proportions of the horizontal projection, and in some cases also building height, were measured (Papowo Biskupie, Radzyń Chełmiński), with the exception of a castle in Golub, where the main wing's façade has proportions of 1:2; however, the size does not come from drawing *ad quadratum* for its outline. The *ad quadratum* method was used for designing both early Chełmno *castells* (e.g. Papowo Biskupie), classical ones (Gniew, Radzyń Chełmiński, Brodnica), later Teutonic fortresses (e.g. Nieszawa – Mała Nieszawka, Ostróda, Barciany/Barten), and also bishops' residences (Lubawa, Lidzbark Warmiński) (Wasik 2012; 2016a, 49–61; 2018a). It should be noted, however, that in reference to the Vistula Lagoon castles (Malbork in particular), a form of *ad quadratum* design different from the one described above was suggested (Pospieszny 2014, 248–254).

According to the research, *castell* building was carried out in stages, but followed original projects (Fig. 11). Therefore, the mortaring of subsequent walls (not only the window and door openings) was carried out simultaneously, as well as vault supports and wall toothings, to which walls were added in the following phases (Fig. 12). Corrections were, of course, introduced in the construction process, e.g. bricking off windows and building vaults in places other than the original buttresses. In Golub, the construction of a *bergfried* was abandoned during the complex works. Wall analyses of particular *castells* demonstrate that construction processes were similar and in accordance with a general pattern. This is additionally confirmed by castles that were never completed in a previously planned form (Barciany, Nieszawa – Mała Nieszawka) and were left in a kind of petrified stage of construction (Wasik 2016a, 322).

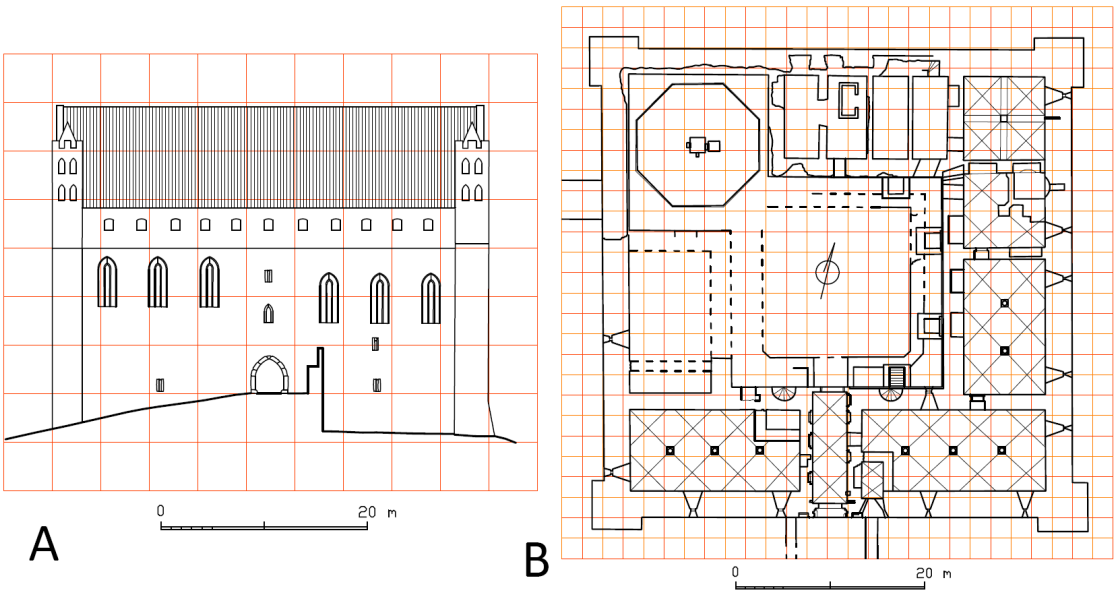

Fig. 8. Castles projection on Chełmno measurement unit grid: A – Papowo Biskupie castle façade on a grid with a module of 1 rod of the old Chełmno unit, B – castle plan in Radzyń Chełmiński Biskupi on a grid with a module of 0,5 rod of the new Chełmno unit. Drawing B. Wasik. – ***Abb. 8.*** *Grundriss der Burg in Chełmno mit einem Raster des Moduls der alten Kulmer Maßeinheit: A – Aussenfassade von Papowo Biskupie (1 Einheit), B – Grundriss der Burg in Radzyń Chełmiński Biskupi (0,5 Einheit).*

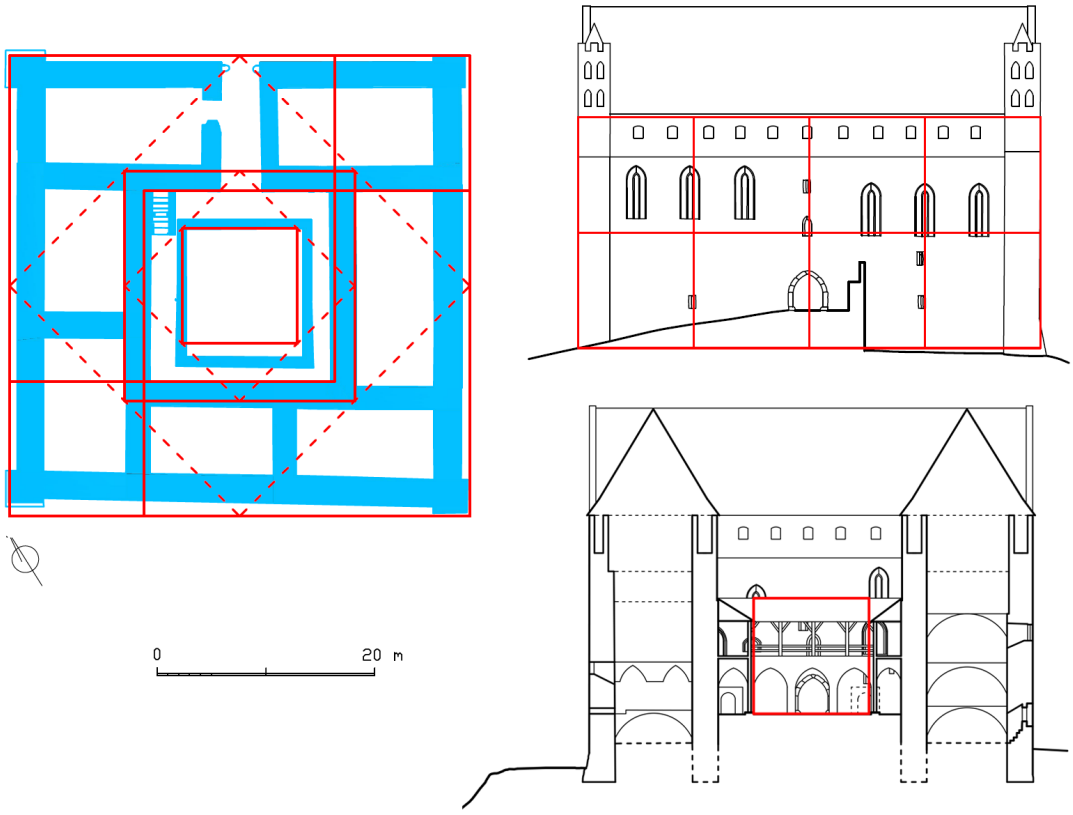

Fig. 9. Papowo Biskupie – drawing *ad quadratum* of a plan and a façade, estimation of cloister proportions using a square, definition of internal yard space. Drawing B. Wasik. – ***Abb. 9.*** *Papowo Biskupie – Zeichnung ad quadratum auf dem Grundriss der Burg, Außenfassade und Aufzeichnung auf der Fassade des Innenhöfes. Zeichnung B. Wasik.*

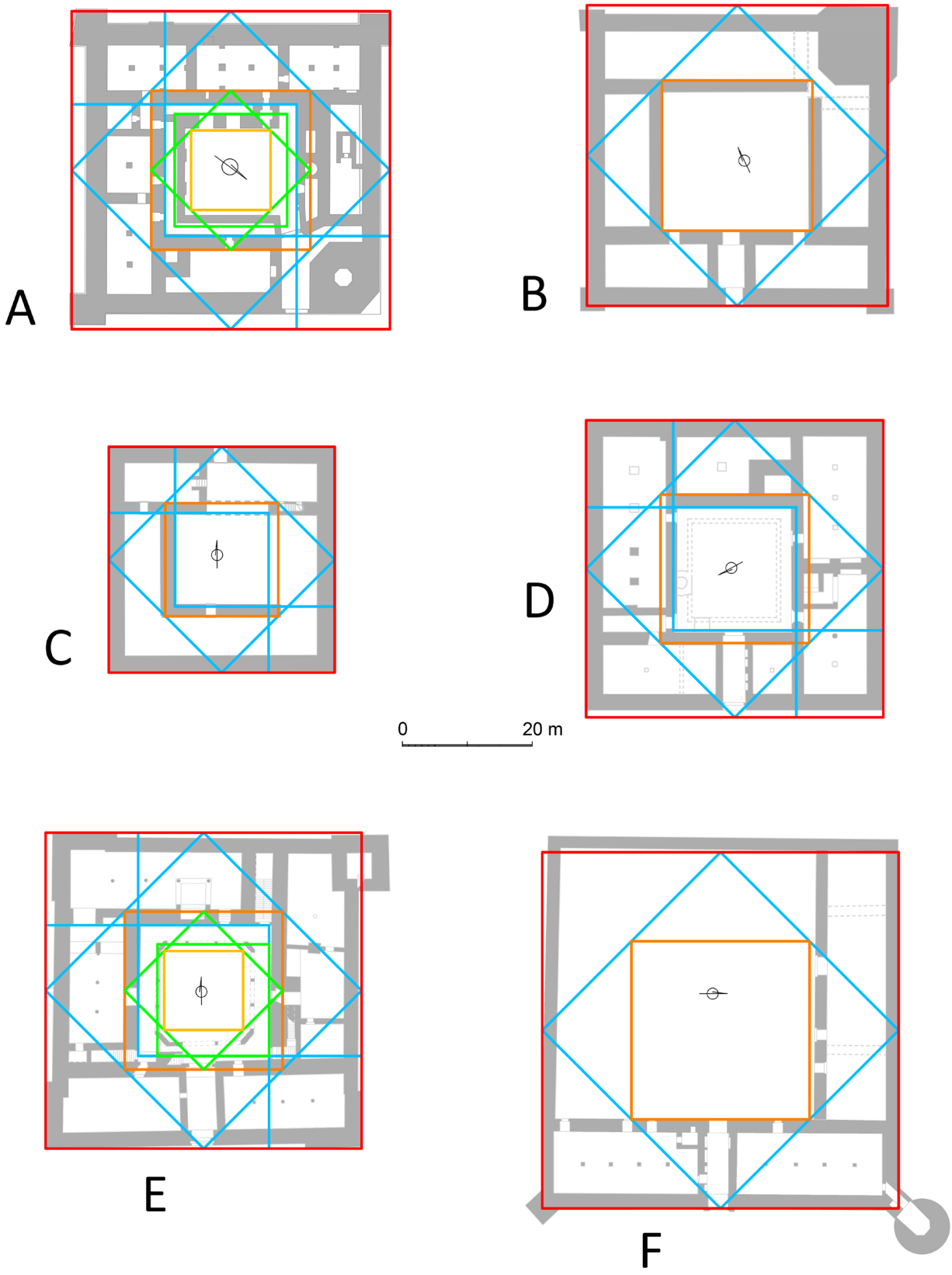

Fig. 10. Drawings *ad qudratum* of selected castles plans: A – Brodnica, B – Gniew, C – Nieszawa (Mała Nieszawka), D – Ostróda, E – Lidzbark Warmiński, F – Barciany. Drawing B. Wasik. – ***Abb. 10.*** *Aufzeichnung des Grundschemas in den Grundrissen der ausgewählten Objekte: A – Brodnica, B – Gniew, C – Nieszawa (Mała Nieszawka), D – Ostróda, E – Lidzbark Warmiński, F – Barciany. Zeichnung B. Wasik.*

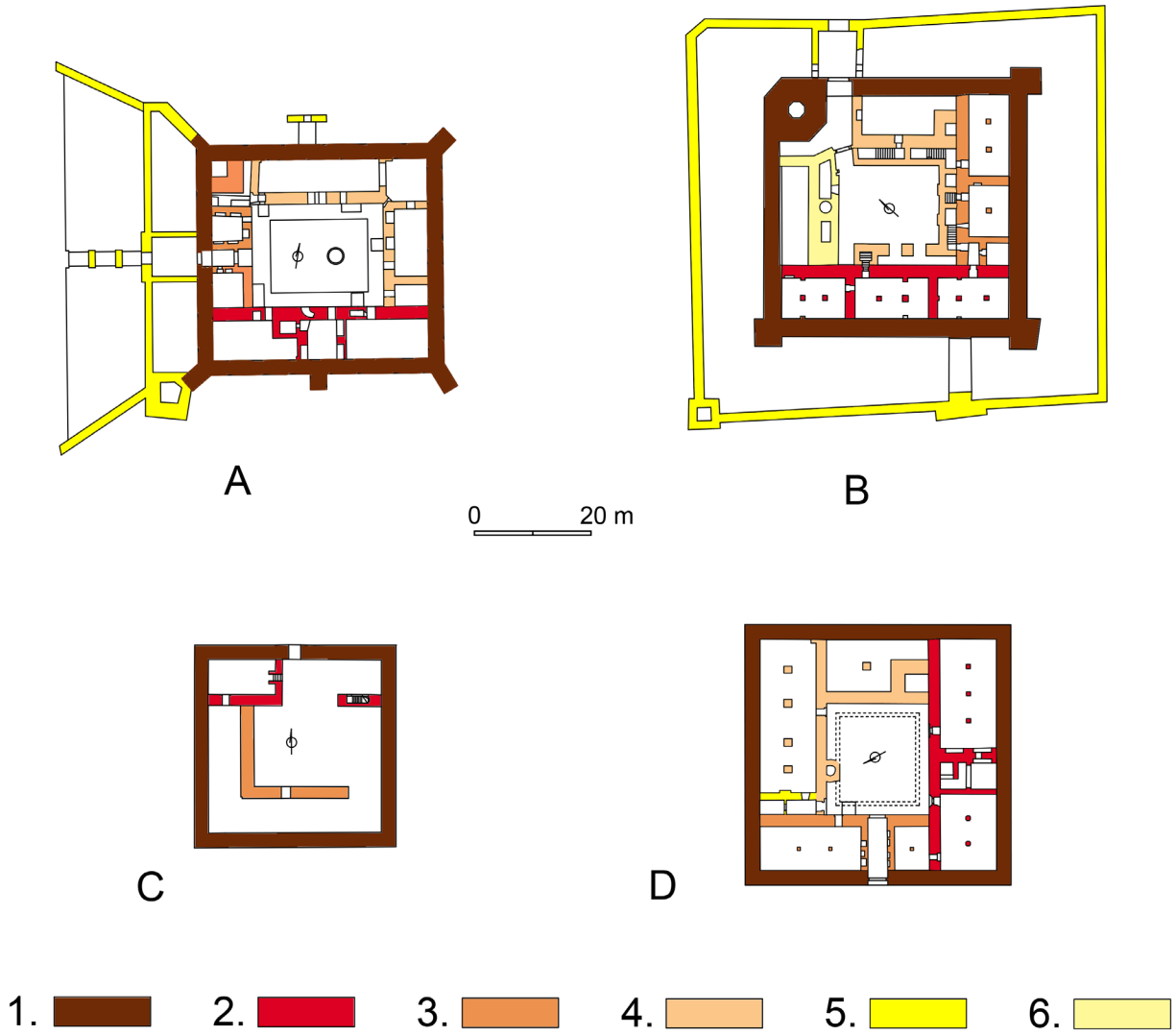

Fig. 11. Building stages of selected *castells*: A – Golub, B – Brodnica, C – Nieszawa (Mała Nieszawka), D – Ostróda. Drawing B. Wasik. – ***Abb. 11.*** *Die Bauphasen der ausgewählten Kastell-Burgen: A – Golub, B – Brodnica, C – Nieszawa (Mała Nieszawka), D – Ostróda. Zeichnung B. Wasik.*

Foundation ditches were made first. Building was preferably planned on stable clay natural soil. It was standard procedure to dig narrow trenches for the convent house's curtains, usually about 1–1,5 m deep, which is confirmed by Chełmno Land castles and others, e.g. Świecie. The Ostróda structure also had much more shallow trenches, about 0,4 m deep, and its bottom was smoothed with a gravel layer and timber, a result of the damp soil character. The implementation of different forms of foundation trenches was due to poor ground conditions, as was the case in Kowalewo Pomorskie, where the curtains were grounded in wide excavations. Cellars were not usually placed deep down – shallow wide excavations were made as a rule, situating the cellar level nearly on the original ground level or a little below it (Gula 1994, 2–3; Wasik 2016a, 67, 70–72; Wilke 1972, 128–129) (Fig. 13). Within trenches, foundations were made of stones combined only with clay up to the ground level (Fig. 14). Above it, they were made more carefully with stones in a layer bond with lime mortar. Contrary to older irregular castles, all foundations of *castells* were made on a similar level (Fig. 15), with one registered exception in Człuchów, which was a result of the ground slanting. The foundations had no plinths and were sometimes

Fig. 12. Examples of toothings excavated after dismantling walls: A – stone toothings prepared for adding a partition wall in Papowo Biskupie, B – brick toothings for a wall of a gate neck in Radzyń Chełmiński. Photo B. Wasik. – ***Abb. 12.*** *Die Beispiele der Schmorzen nach der vergangenen Mauern: A – steinerne Schmorzen an den Wand in Papowo Biskupie, B – Ziegelschmorzen in Radzyń Chełmiński. Foto B. Wasik.*

only slightly marked. A stone socle usually stuck out slightly above the ground level. A brick wall was erected above. In addition to the Wendic bond, the gothic bond began to be used from 1300 and slowly replaced the older one. An exception was the convent house in Papowo Biskupie, which was built of stone up to the height of the sentry porch (Fig. 2). The works were usually done from single-pole scaffolds, leaving putlog holes that are visible today (Starski 2016, 15; Wasik 2016a, 184–210).

In the first stage, a circumferential curtain was erected (Fig. 1, 11). Sometimes the originally erected curtain wall was temporarily crowned with battlements (Golub, Barciany). The second stage was devoted to building the main wing, which housed the most important convent rooms – a refectory and, most importantly, a chapel. It should be noted that in the light of recent studies by historians, chapters did not function in Teutonic castles, and their reconstructions were artificial historiosophic creations. Refectories were rather central convent house interiors with representative functions. They were situated in the main wing with a chapel and heated using *hypocaustum* furnaces (Jóźwiak – Trupinda 2012, 310–342). As the chapel was a crucial room required by the Order's regulations, it was completed as the first object. This can be observed in Malbork at the end of 13th century, in the castles of Chełmno Land (Papowo Biskupie, Golub, Radzyń Chełmiński), and also in *castell* examples from the 14th and 15th centuries such as

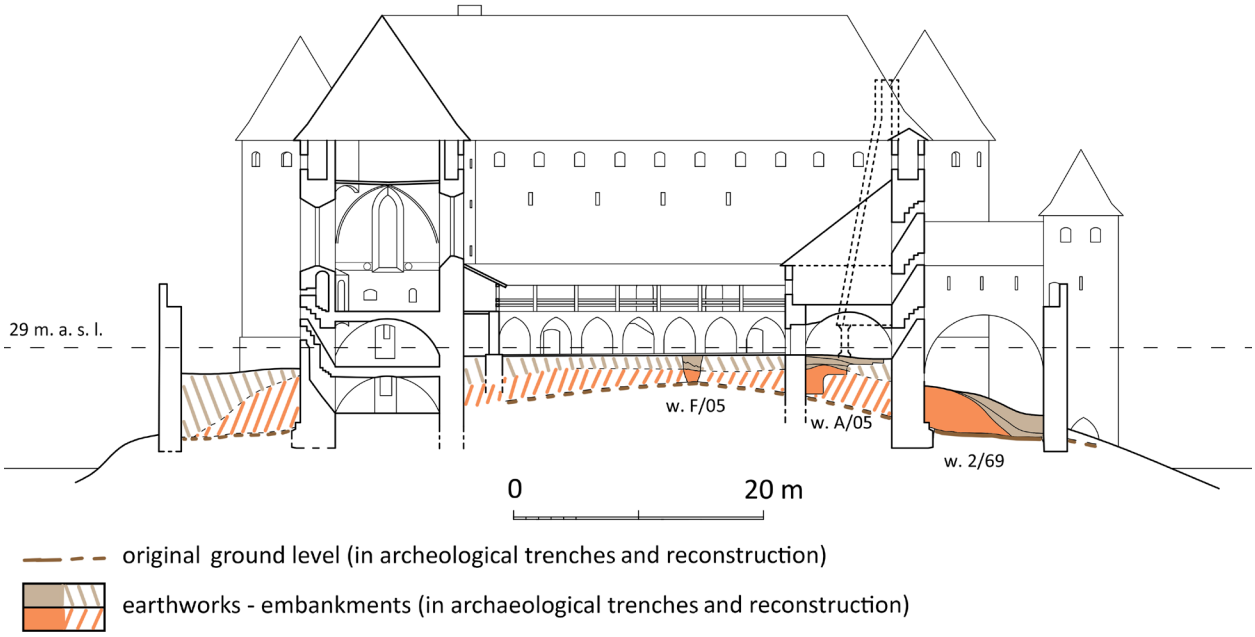

Fig. 13. Świecie – North-South cross-section (view towards the East) of a convent house with building embankments (marked), identified during exploration. Drawing B. Wasik. – ***Abb. 13****. Świecie – der südnördliche Schnitt durch das Konventhaus mit der Aufzeichnung der ursprünglichen Terrainsniveaus. Zeichnung B. Wasik.*

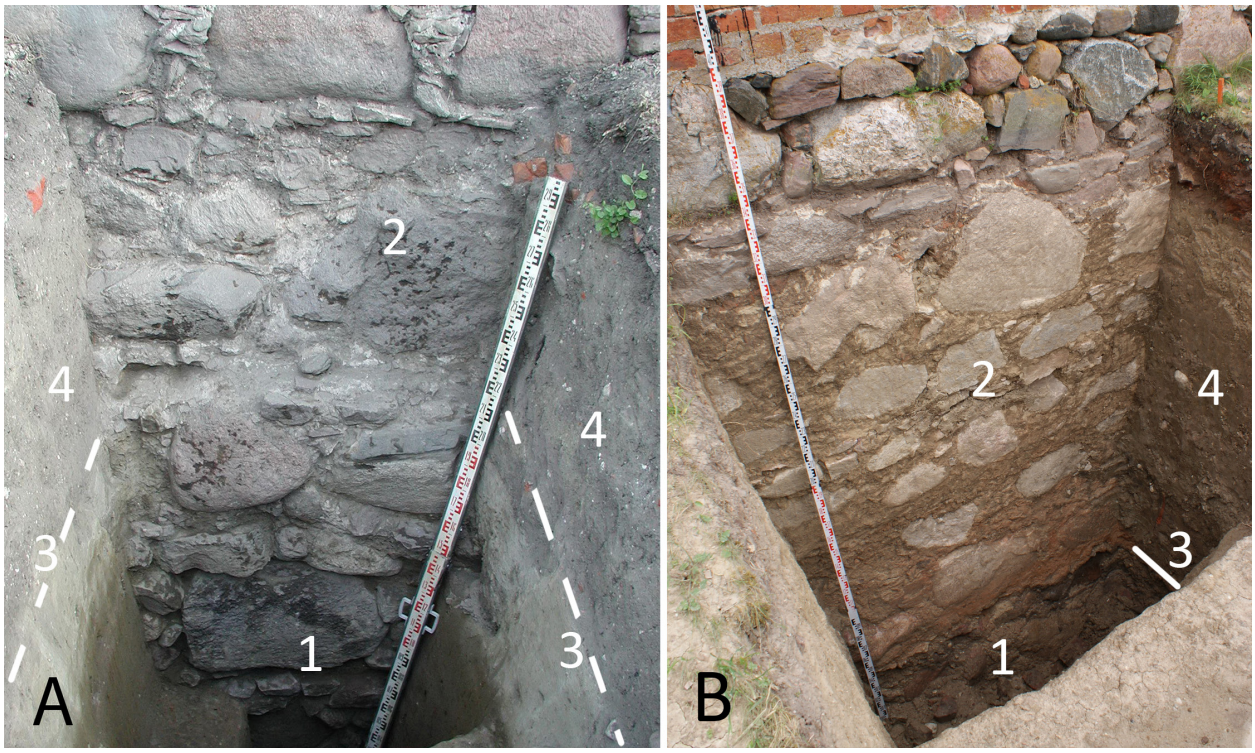

Fig. 14. *Castell* foundation examples: A – Papowo Biskupie, B – Radzyń Chełmiński. 1 – foundation built in a narrow ditch without use of mortar, 2 – wall built above original ground level and then covered with an embankment, 3 – ground level from the period of building, 4 – building embankment. Photo M. Wiewióra. – ***Abb. 14.*** *Die Beispiele der Bauwerkenfundamenten: A – Papowo Biskupie, B – Radzyń Chełmiński. 1 – Fundament in einem engen Graben ohne Verwendung von Mörtel, 2 – Mauer über dem ursprünglichen Boden gebaut und dann mit einer Aufschüttung bedeckt, 3 – Terrainniveau aus der Bauzeit, 4 – Aufschüttung. Foto M. Wiewióra.*

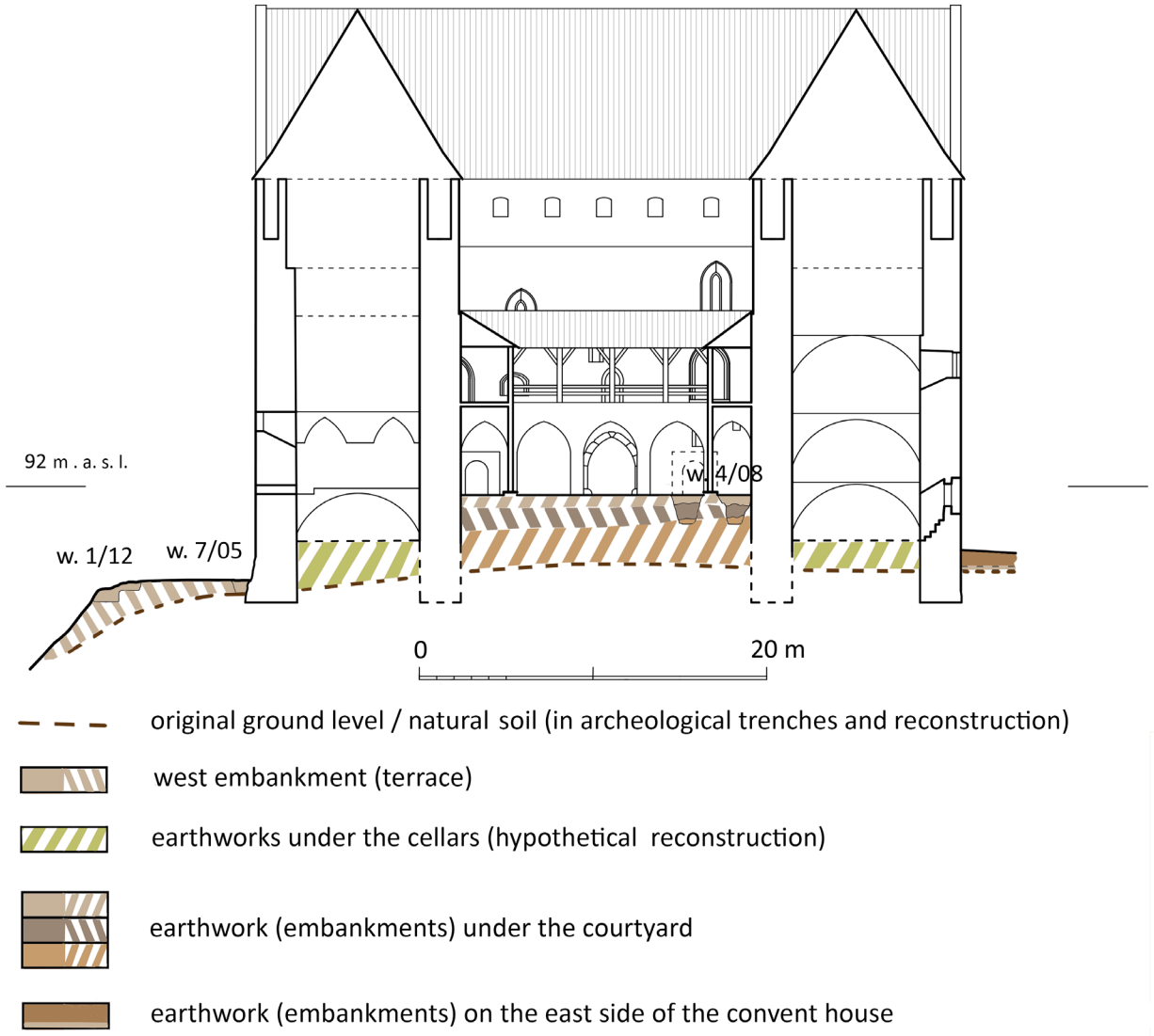

Fig. 15. Papowo Biskupie – West-East cross-section (view to the North) of a convent house with marked building embankments. Drawing B. Wasik. – ***Abb. 15.*** *Papowo Biskupie – der westöstliche Schnitt durch das Konventahus mit der Aufzeichnung der Erdarbeiten (Blick nach Norden).*

Barciany and Ragnit. Other castle wings were built gradually after this. Ragnit castle, which was mentioned above, has not been architectonically and archeologically explored like other structures; however, its building process is particularly carefully evidenced in written sources, which have recently been thoroughly studied anew by historians (Jóźwiak – Trupinda 2009; 2011b). The comparison of their suggestions with analyses of other castle architecture shows analogical building stages as in other *castells*. Its construction began in 1397 (Jóźwiak – Trupinda 2011b, 208–209), and although written sources do not state whether the circumferential curtain was initiated in the first stage, we can conclude that the construction of wings was performed in subsequent stages. This is confirmed by several periods of intensification in various works[12], such as interior decorations in particular wings completed in a different time. The southern wing was completed first, as a chapel situated there was built as early as 1403. This was the main complex wing, which according to historians housed a refectory as well (Jóźwiak – Trupinda 2009, 345–346, 349–350). Various works were still in progress in the northern and eastern wings (not

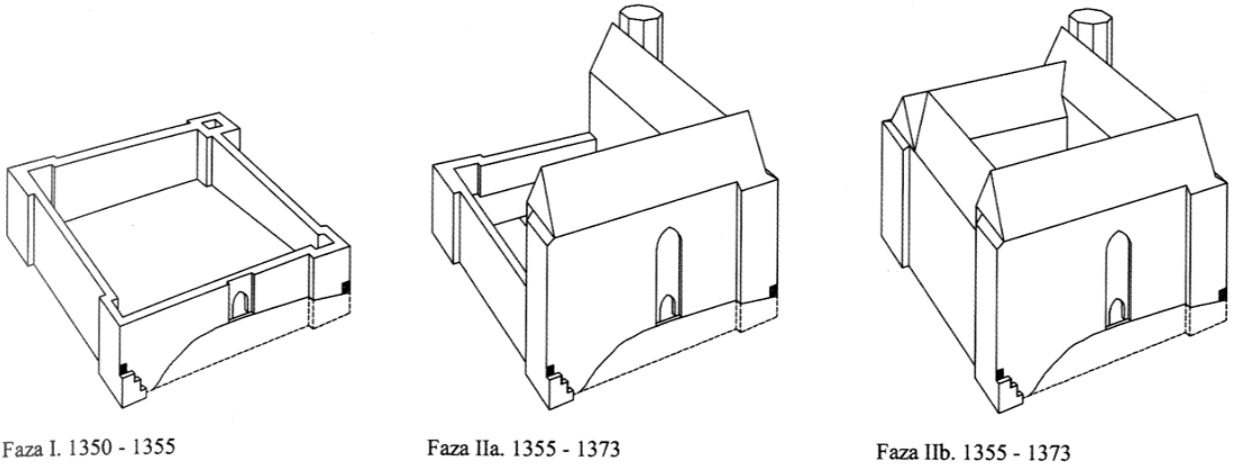

Fig. 16. Lidzbark Warmiński – building stages of a bishop's *castell* (after Wółkowski 2016). – ***Abb. 16****. Lidzbark Warmiński – die Bauphasen der bischöflichen Kastell-Burg (nach* Wółkowski 2016).

yet habitable) in the time of departure from the old settlement and the move to the new castle. Apart from the southern (main) wing, the western part was probably only partially completed (Jóźwiak – Trupinda 2009, 352). Buildings not fully completed were protected by a truss with planks covering the constructions temporarily, and vaults were erected gradually. Planks were replaced by tiles only in the final stage, and the last wing was probably roofed in 1405 (Jóźwiak – Trupinda 2009, 347, 356).

The building process of a bishop's castell in Lidzbark Warmiński from the 3rd quarter of the 14th century (Fig. 16) was conducted analogically according to recent architectonic studies (Wółkowski 2016, 31–35). It should be noted, however, that there were also differences in the order of wing construction, e. g. Brodnica (Fig. 11), where the southern wing with a chapel was started after the western one. The eastern wing was erected in the next stage and was finally followed by the northern one. In Człuchów, the southern wing (with a kitchen) may have been built first and the eastern part later. Nieszawa castle (Mała Nieszawka), which was never completed in its original design, reveals that the northern wing with a passage was the first to be added to the curtain (Fig. 11). It was not finished, and only its western section and a part of the wall from the east were completed. Next, a wall of the southern wing with a chapel and the western wing were built (Domagała 2002, 98–101; Kurdwanowski – Starski 2011, 300; Starski – Kurdwanowski 2008, 5; Wasik 2016a, 271–304, 322; 2018a, 44–45). In the bishop's castle in Wąbrzeźno, the curtain with a tower was probably built first; the wings were then built at the same time (Wasik 2016a, 307–308).

After the castell walls were lifted at least to a certain height, spatial earthworks began by raising and leveling the yard surface and forming terrace embankments around the complex (Fig. 13, 15). To achieve this, about 1 to 3–4 m of earth was brought and leveled (even several thousand of m^3). Such huge and impressive earthworks were observed in Chełmno Land castles and other territories of the Teutonic state, e. g. Świecie, Gniew, Człuchów, Nieszawa – Mała Nieszawka, but also in the bishop's Lidzbark Warmiński (Franczuk 1985, 2; Hołowińska – Massalski 1987, 110–135; Starski 2016, 14–16; Wasik 2016a, 95–114; Wasik – Wiewióra 2015, 82, 84; Wilke 1972, 128–129, Wółkowski 2016, 35). These works caused a 'deepening' of the foundations, and the cellars were erected close to the original ground level. In early *castells* which lacked *parchams*, the terraces around a house were made with slopes of about 45°, e.g. Papowo Biskupie and Golub. When a *castell* possessed a *parcham*, an external wall was bricked later (after the construction of

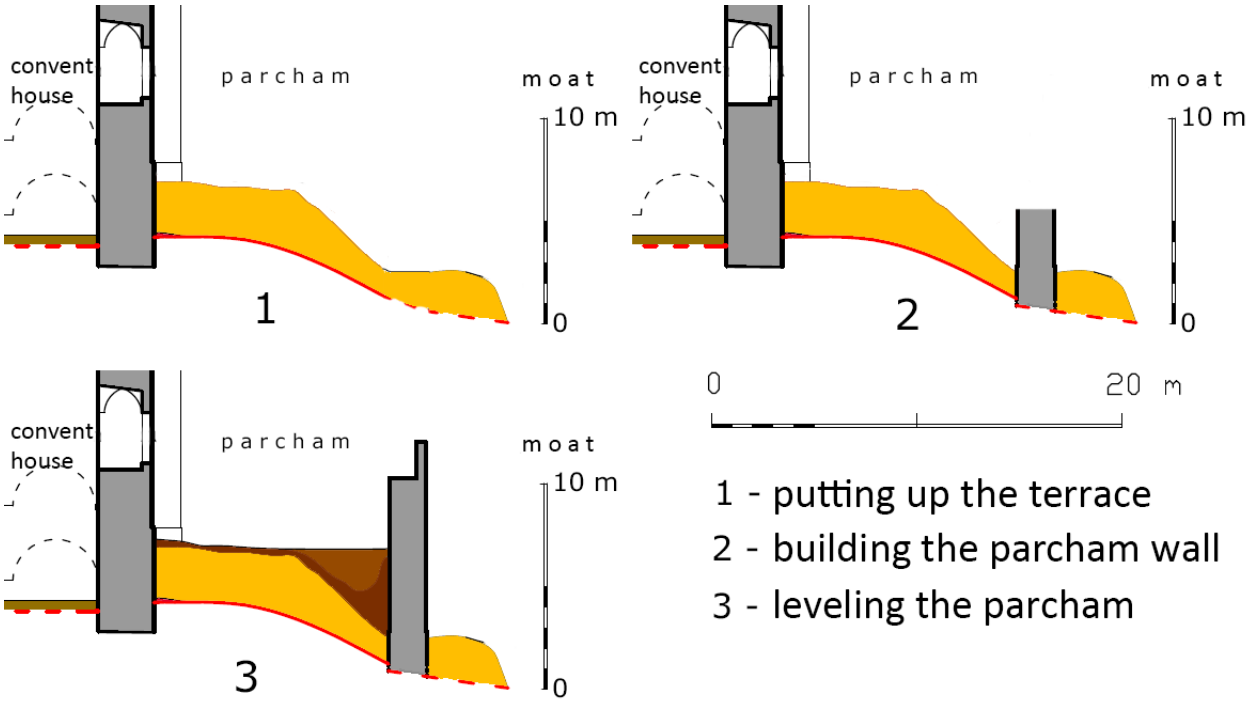

Fig. 17. Radzyń Chełmiński – building stages of western *parcham*. Drawing B. Wasik. – ***Abb. 17.*** *Radzyń Chełmiński – die Bauphasen des westlichen Zwingers. Zeichnung B. Wasik.*

a circumferential curtain and wings) – examples of which can be seen in Radzyń Chełmiński, Brodnica (Wasik 2016a, 295, 301), Świecie[13], or Gdańsk[14]. Sometimes, however, *parcham* and *castell* walls could be put up simultaneously, like in Człuchów (Starski 2016, 16). A wall was usually made only of stones, reaching the level of the later prepared *parcham* terrace, and sometimes stones were placed from the *parcham* side and covered with a brick façade from the side of the moat. The walls above were made of brick. Such construction protected brick parts from humidity from the ground. Simultaneously, the external wall façade was bent slightly inside, so the wall broadened downwards, strengthening construction keeping soil mass (Wasik 2015, 273; 2016a, 179–183). Two methods of *parcham* embankment construction can be observed. First (e. g. Radzyń Chełmiński, Świecie) a terrace and a slope were formed, next a *parcham* wall was built at the foot of the embankment, and the space between it and the slope was filled with earth (Fig. 13, 17). Another method, used more rarely, was filling all the *parcham* space regularly with earth only when a curtain of a convent house and a *parcham* wall were completed (Człuchów, Lubawa). Earth (clay) for these embankments may have been obtained from dug out ditches (moats). In later *castells* from the 2nd half of 14th century, which did not have *parchams* built, the embankment range from the castles outside was minimal, which can be observed in the example of Ostróda (only an embankment 0,2–0,5 m thick was registered there). A bigger leveling embankment was made in the inner yard, lifting it about 1 m (Gula 1975, 375–377). A bishop's castle in Wąbrzeźno differs from the rules above, as practically no embankment earthworks were made there and the yard surface is slightly inclined. Another conclusion resulting from the analysis of castle relics presents less skilled master masons and the workshop employed for the building (Wasik 2016a, 111–113, 329; Wasik – Wiewióra 2015, 86–88). Earthworks which were characteristic for the period and conducted even in older irregular castles, the building of which was continued in the turn of 13th century, were not neglected. In irregular castle building, which began in the first period of the construction of Prussian fortresses (3rd–4th quarter of the 13th century), this kind

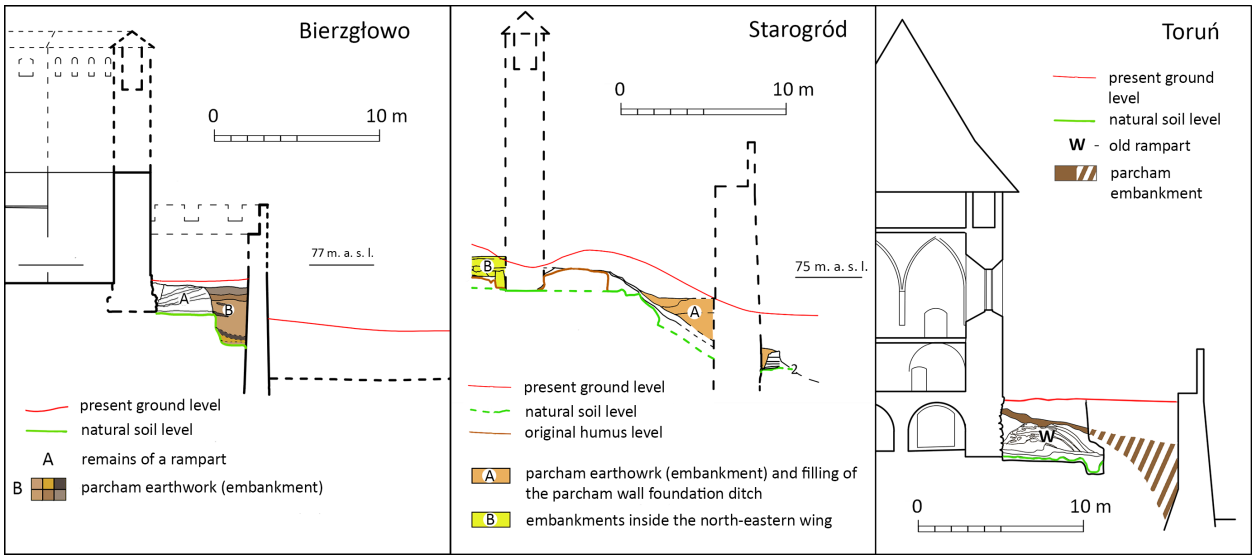

Fig. 18. *Parchams* of irregular castles in Bierzgłowo, Starogród and Toruń, with marked building embankments from the 13th and 14th century. Drawing B. Wasik. – ***Abb. 18.*** *Zwinger auf den unregelmäßigen Burgen in Bierzgłowo, Starogród und Toruń mit der Aufzeichnung der nachfolgenden Terrainsgestaltungen. Zeichnung B. Wasik.*

of work had a smaller range and concentrated generally on *parchams* built in the characterized period (Fig. 18). Firstly, a *parcham* wall was created at the foot of an original slope next to the empty space between the embankment and the wall was filled up, resulting in the raising of the *parcham's* surface and leaving a slight slope, which is evidenced in Toruń and Starogród (Wasik 2016a, 85–90; 2017a, 45–46). In Bierzgłowo, the technique was similar from the east side, although not identical, because originally the slope (together with layers of a rampart that were older than the castle) was cut by a ditch about 3,5 m deep. Next, a *parcham* wall was built in the narrow trench, filling the ditch systematically when the wall was raised (Wasik 2017c, 12).

The construction of embankments caused castle buildings to dominate over the area and held a symbolic and defensive significance. At the same time, making thick clay embankments around *castells* extended a *plateau* and strengthened the whole construction. These types of terraces were also made around *castells* situated on hills, such as Golub.

The final building works included the roofing of standard wings (first only temporary, like in Ragnit) and the construction of vaults and gable ends (Arszyński 1995, 165, 167).

Apart from high castles described above (convent houses), the castles also consisted of wards – from one to as many as three (Fig. 3–5, 7). They were surrounded by walls and mainly contained household and dwelling houses. When a castle had more than one bailey, one of them was not brick, i. e. it was made only of wood and earth (e. g. in Radzyń Chełmiński, Lipienek, Starogród). During the construction of baileys, some earthworks were also carried out to expand the area, but in a relatively smaller range than treatments during the building of convent houses (Wasik 2016a, 115–126, 326).

This flourishing of architecture also caused a significant increase in the manufacturing of architectonic details, which was absolutely incomparable to the period before 1280. New building challenges required the development of brick shapes and terracota forms (Wasik 2016a, 159–164; 2018b, 175–185). Castles of the Vistula Lagoon are particularly surprising in their rich architectonic forms (Fig. 19), with typical terracotta tile friezes with arcade motifs, letter friezes and ceramic building materials, which were glazed black, green, yellow and brown (Torbus 2014,

139–140, 372–374). As described before, early Chełmno Land castles were characterized by their distinctively stark architecture, although a castle in Kowalewo Pomorskie, where recent explorations revealed several brick shapes including rib, casing and other forms, differs only slightly. A variety of details were also registered in extended constructions of irregular castles of Toruń and Grudziądz from the end of the 13th century and the beginning of the next (*Aneksy* Wasik 2016a, 19–79). Glazed brick and tiles were novelties that transformed old structures of irregular fortresses in Chełmno Land. Black or green glazed bricks served for designing the *bergfried* strips of Grudziądz castle and *bergfried* corners in Toruń. In Toruń, we can also observe decorated cloister arcades and a *dansker* with glazed green and yellow bricks (Fig. 19). Colored glazed elements were also used in traceries (Grudziądz, Starogród). Sites in Toruń and Grudziądz also show roof tiles glazed green, which confirms that even roofs were decorated in patterns not identified at present. In castells in Chełmno Land, this type of architectonic detail was applied rarely, although its presence can be identified in portals of Radzyń Chełmiński castle. Another motif appeared on façades here more often – geometrical patterns made of burr bricks that were baked black (Herrmann 2007, 96–97, 100; Torbus 1998, 324–326; Wasik 2016a, 223–228; 2017a, 47). Many convent houses were equipped with numerous sculptures and figurative decorations that were placed in portals leading to chapels – examples can be found in Malbork, Golub and Brodnica (Jurkowlaniec 1989, 39–41).

The development of architecture required specialists such as architect-builders and craftsmen skilled in brick manufacturing. In the first decades of the Teutonic Knights' presence in Prussia, the area lacked brick building traditions, and these specialists and master masons simply did not exist, hence the necessity of importing them from abroad (in the last quarter of the 13th century, they were mostly workshops of Northern Germany – Mecklenburg, Brandenburg, the Duchy of Pomerania and Lübeck).The workshops produced various forms of details, frieze decorations of terracotta, and glazed building ceramics. Many of these style features disappeared during one or two generations, the last of which lasted until the 1330s (Herrmann 2007, 175–180, 290–291). The brick production boom at the turn of the 13th century was caused by the appearance of the gothic bond in architecture, which required more intense brick manufacturing than in the case of the older Wendic bond (Herrmann 2007, 112; Torbus 1998, 149; Wyrobisz 1963, 94). A number of the imported craftsmen may have stayed on in this new country, continuing to work at other building sites. Simultaneously, between the 13th and 14th century, an indigenous group of specialists was educated, although the existence of such settled architects and their organizations in urban centers is evidenced in sources as late as in the 2nd half of the 14th century (Arszyński 1995, 154). A group of experienced builders was probably created by taking up the new tasks of erecting these objects in Chełmno Land, repeating the *ad quadratum* method from subsequent projects (Wasik 2012, 90). Craftsmen were employed by contracts for performing particular tasks. The same situation was in the case of employing general builder-architects. Master masons arrived with their apprentices. Other helpers were employed by investors. A mason, according to the contract, received his pay based on the volume of the erected wall, which was measured in the amount of bricks used (Arszyński 1970, 109–117; 1995, 162–166). The building site employed specialists and journeymen for some specific works in some defined stage of a castle's construction, e. g. for the building of vaults, etc. (Jóźwiak – Trupinda 2009, 346; 2011b, 209–211). They were random groups, not professional teams. Experienced and reliable craftsmen were probably employed by the Knights on other sites. This work system was flexible, cheaper and could be easily controlled by a contractor (Arszyński 1970, 101–102; Herrmann 2007, 121, 139). In accordance with obligatory legal regulations called *scharwark* and *baude*, the local rural population was forced to work as an unqualified workforce in the digging of ditches and transport. In addition to the free workforce, special diggers were contracted for making

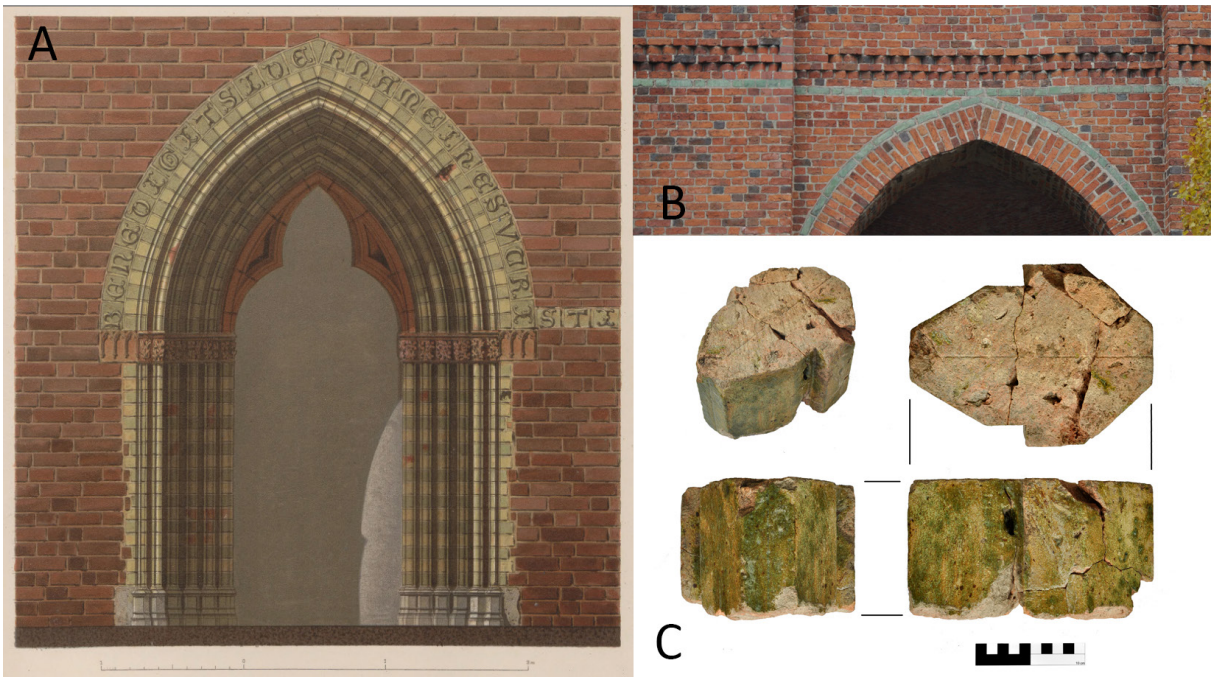

Fig. 19. Examples of the use of glazed building ceramics: A – a chapel portal of Lochstedt castle (drawing C. Steinbrecht), B – dansker details of a castle in Toruń, C – brick shape of the tracery in Starogród castle. Photo B. Wasik. – ***Abb. 19.*** *Die Beispiele für die Verwendung von glasierter Baukeramik: A – Das Portal der Kapelle in Lochstedt (Zeichnung C. Steinbrecht), B – Details aus der Danskerfassade aus Toruń, C – Ziegel aus der Burg in Starogród. Foto B. Wasik.*

earthworks (contracts defined a ditch size and form of payment) (Arszyński 1970, 92–93, 109; 1995, 153–152, 162). According to the recent research of historians (Jóźwiak – Trupinda 2015), the Order's arrangement of building works was the duty of an especially appointed Teutonic official – a mason supervisor (*magister lapidum, magister laterum, steinmeister, czygelmeister, muwermeister*). Although he did not manage any project or building issues, his duty was to supervise all finances and expenses and to manage the whole enterprise. He was also responsible for *Steinhof*, which was a habitable workshop/storage space situated in the closest vicinity of a building site for housing craftsmen. It had thatched roofs, workshops and probably furnaces for lime and bricks.

In conclusion, it should be stated that every decision for erecting a castell model as a convent residence had to be considered. Common use of this type of architectonic fortress at the end of 13th century and the modification of older structures to this new project could have been a trend of standardization of castle architecture. A *castell* model in 13th century Europe was associated with the activities of strong rulers (Philip II Augustus, Frederick II, Ottokar II of Bohemia) and attributed to symbols of strong, centralized authority. Therefore, the model could have been accepted by the Teutonic Order in Prussia due to this significance, magnifying and strengthening the ruling aspect in its exceptional homogeneity of castle architecture. The pattern may have been taken from the Czechs, as the Order's Prussian branch had strong organizational bonds with them in the 13th century and long traditions of contact (Durdík 1993; Jóźwiak 2001, 22–23; Kutzner 1995, 26–31; Skibiński 1994, 32–36; Wasik 2016a, 322–323). This was also a crucial time for the Order, as the Crusaders were being ejected from the Holy Land. In 1271 they lost Montfort, and in 1291 Akka, the last capital of the Latin Kingdom of Jerusalem, fell. As a result, the seat of the Grand Master was moved to Venice. All these events contributed to an increase in the significance of the Prussian Order's domain (Arszyński 2010, 14; Skibiński 1994, 34).

Prussian dignitaries' aspirations grew as well, and they not only concerned the subjected lands, but the whole corporation as well (Jóźwiak 2001, 38–39, 85). These facts led to the shift of the main Order's seat from Venice to Malbork, an act that faced many obstacles. The Grand Master Zygfryd von Feuchtwangen, who arrived to Prussia in 1309, remained in the shadow of local dignitaries, while his successor Karl von Trier conflicted with them and left Prussia. As a result of these perturbations, Malbork did not become a permanent Grand Masters' residence until 1324 (Jóźwiak 2001, 86; Jóźwiak – Trupinda 2011a, 157–159). Therefore, castle building development in Prussia after 1280 and the acceptance of their *castell* model should also be considered in the context of the growing significance and aspirations of 'emancipating' the Prussian branch of the Teutonic Order in that period, and not only as a sign of the Order's efforts towards unity.

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[1] It belonged to the Dominican Order in Elbląg. Another brickyard (in Chełmno), which was first dated to that time, turned out to be a more modern structure, as the document used to date it was written later, i.e. in the 1290s (Jasiński 1980, 44–45).

[2] In Kazimierz Pospieszny's opinion, building started around 1274, although Sławomir Jóźwiak and Janusz Trupinda indicate the period to be after 1279. This later dating is also suggested by Tomasz Torbus (Jóźwiak – Trupinda 2011a, 53; Pospieszny 2014, 25–33; Torbus 2014, 109–110).

[3] There is no evidence of how many wings (three or four) were erected in Królewiec castle, which has not been thoroughly identified, while it is likely that the three-winged body of Malbork castle was never completed, as the works of the next investment stage started, i.e. the construction of a four-winged convent house as a seat of the grand masters (Pospieszny 2014, 51–72, 176–192; Torbus 2014, 93–94).

[4] Tomasz Torbus associates Elbląg castle's second building stage with a group of fortresses from the Vistula Lagoon (2014, 94).

[5] For instance – Malbork's *parcham* was made in the next building stage, i.e. the beginning of the 14th century (Jóźwiak – Trupinda 2011a, 64).

[6] Works performed within the research project *Castra terrae culmensis – na rubieży chrześcijańskiego świata, (at the borderland of the Christian world),* managed by Marcin Wieiwóra from the Institute of Archaeology of NCU.

7) Another exception to the rule can be mentioned in the case of Lipienek Castle – see the article in this issue of the journal.

[8] 1 foot = 31,3 cm

[9] 1 foot = 28,8 cm

[10] 1 rod = 15 feet

[11] To confirm the existence of these drawings in the Teutonic state, the researchers quoted the source from the beginning of the 15th century, where two terms can be found that define the sketches made: situational – *gelegenheit*, and one presenting the general shape of the object – *gestalt*. This interpretation has been questioned recently by Sławomir Jóźwiak and Janusz Trupinda, indicating misinterpretation of the source (Arszyński 1970, 103; Herrmann 2007, 141; Jóźwiak – Trupinda 2011b, 202–208).

[12] Some of the sections of the building were advanced in 1400–1401. In 1402, the sources report intensive masonry works and completion of all the main walls. Between 1402–1403, the next works on roofs were conducted and window glass was collected. In 1403, a contract for the construction of vaults was signed (Jóźwiak – Trupinda 2009, 343–344).

[13] This has been confirmed by analysis of the layers' composition, which was carried out in the 1960s during archaeological exploration in Swiecie castle (Wilke 1972).

[14] A convent house in Gdańsk was incorporated into the ramparts of an early mediaeval gord to make use of the bulwark during the castle's operation before a parcham was erected (Jarzęcka-Stemporek – Kocińska 2013, 543).

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Bogusz Wasik: Die monumentale Burgarchitektur im Preußen der Deutschen Ritter. Entwicklung und Bautechnik

Die Deutschen Ritter kamen um 1230 in die Gebiete, in denen es keine Ziegelbaukunst mehr gab. Die Entwicklung monumentaler Architektur war in den ersten Jahrzehnten praktisch unmöglich – nicht nur wegen der mangelhaften Infrastruktur, aber auch wegen der dauerhaften Aufstände, die die Eroberung der preußischen Gebiete begleiteten. Die Situation änderte sich um 1280, als die Eroberung der preußischen Länder beendet war und die Ritter gewannen die hiesigen Gebiete. Die Ritter starteten eine neue Kolonisierung und gründeten zahlreiche Städte und Dörfer. Die Zeit des Friedens schützte die stetige Entwicklung neuer Siedlungen und die Ritter konnten sich auf die Verbesserung der Infrastruktur und der Landesverwaltung konzentrieren, was wiederum wirtschaftlichen Wohlstand verursachte und bildete die günstige Bedingungen für die Entwicklung der monumentalen Architektur.

Als das Beste wurde ein Modell von dem Kastell-Typ angenommen. Die älteste (noch nicht vierflügelige) Objektgruppe umfasste die Burgen, die im letzten Viertel des 13. Jahrhunderts in der Weichsellagune errichtet wurden. Das Kulmer Land registriert zwei Arten von den Burgen, die in den letzten beiden Jahrzehnten des 13. bis Mitte des 14. Jahrhunderts erbaut wurden. Gleichzeitig wurden die alten unregelmäßigen Burgen nach neuen Trends umgebaut und erhielten zwei oder drei Flügel mit den Galerien. Die letzten Burgen, die zu Beginn des 15. Jahrhunderts erbaut wurden, hatten wieder stark vereinfachte Formen. Trotz stilistischer Unterschiede wurden alle Burgen nach analogischem Zeitplan errichtet: an einem neuen Standort, in der Regel ohne Verwendung der alten Erdhochburg, wurde die Projektion mit der typischen hiesigen Kulmer Maßeinheit und den Proportionen *ad quadratum* erstellt. Der Bauprozess wurde in mehreren Schritten durchgeführt – die Schritte zum Vervollständigen des ursprünglichen Plans: I – Errichtung der Ringmauer, II – Zentralflügel, III – andere Flügel, IV – Zwinger, wenn überhaupt. Die Varianten der Flügelreihenfolge wurden in Strasburg beobachtet und in Löbauer Bischofssitz, so die Forscher, zusammen mit einer Zwingermauer und einer Ringmauer gleichzeitig errichtet. Parallel dazu wurden Erdarbeiten durchgeführt, bei denen Höhen und Tiefen von 1 bis 4 m angehoben wurden. Fertigstellung von Arbeiten in den unregelmäßigen Burgen, Bau von Zwinger; aufwändige Erdarbeiten wurden auch durchgeführt.

Alle diese Arbeiten erforderte qualifiziertes Personal, das zunächst aus Norddeutschland mit zeitlich begrenzten Fachkräften nachgeholt wurde. Handwerker wurden unter der Aufsicht eines teutonischen Beamten unter Vertrag genommen.

Die Erschließung monumentaler Burgen findet in der für die Geschichte des Deutschen Ordens kritischen Zeit statt – der Verlust des Reiches im Heiligen Land und die Verlegung des Großmeisterssitzes nach Venedig sowie in die Nähe von Marienburg, was das Prestige des Ordens in Preußen hervorhob.