

Grzegorz Bukal

ON RELATIONS BETWEEN MEDIEVAL
AND MODERN DEFENSIVE ARCHITECTURE

The fundamental connexion joining a medieval castle to an eighteenth-century fortress (Figs. 1, 2) is the realizing of defence by means of fortification. However, this relation is evident, so it should be asked a question whether there are any other connexions going beyond limits of the largest comprehended function of defensive architecture. It will be very helpful for

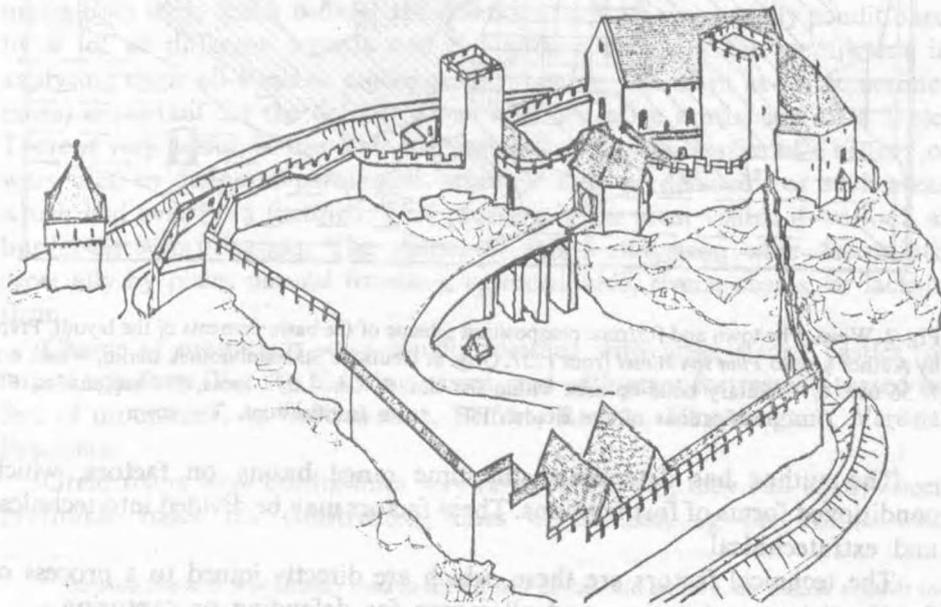


Fig. 1. Choustnik Castle, South Bohemia, about 1250. Acc. to:
D. Menclova, *České Hrady*, Praha 1972

answering this question to define a territorial and time sphere of activity. Thus, let us accept the territory of Europe, or more exactly the West-European cultural range considered in two periods: from the beginning of the 11th to the end of the 15th century, and from the beginning of the 16th to the end of the 1st half of the 19th century.

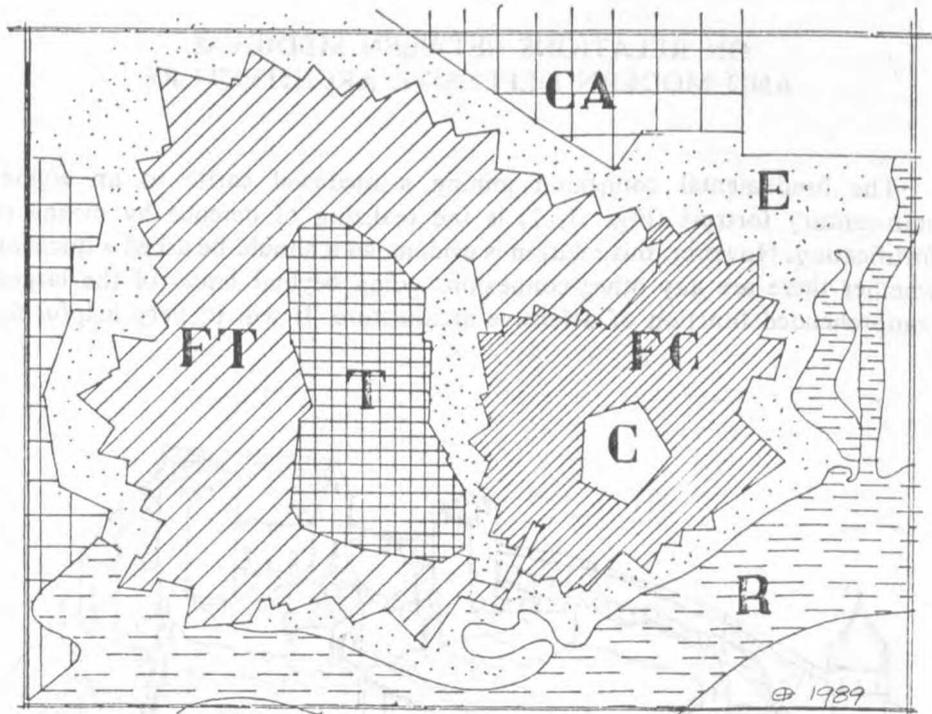


Fig. 2. Wesel. The town and fortress; composition scheme of the basic elements of the layout. Prep. by Author acc. to *Plan von Wesel* from 1727. Orig. at Deutsche Staatsbibliothek Berlin, Wesel, no. X 36 067. C - military build-up area within the citadel, CA - civil areas, E - esplanades, FC - fortifications of the citadel, FT - town fortifications, T - town

The author has determined the time range basing on factors, which conditioned forms of fortifications. These factors may be divided into technical and extratechnical.

The technical factors are these, which are directly joined to a process of fortifications construction, and all means for defending or capturing.

The extratechnical factors, ie natural conditions, political situation of a country, its economy, a degree of civilizing development, etc. This group of factors may be left out of consideration for exceeding limits of purely architectural subjects.

If we have a good look at the technical factors, it appears that there were no differences between the Middle Ages and the modern times in the sphere of feasibilities and availability of building materials. Both of these epochs built of the same materials, ie stone, clay, earth and wood; they used the same sources of energy, ie water, wind, human and animals muscles and simple, well-known mechanisms. Even the art of constructing was similar.

The period from the 11th to the 15th century was the age of projectile engines¹. The next centuries brought on domination of smooth-barrel fire-arms, which imposed changes of fortifications forms. This epoch finished after 1850.

Now we may take up an investigation of relations between shapes of medieval and modern fortifications. The word „shape” has been used intentionally because the author, as an architect is interested in the whys and wherefores of shape of an object. The author considers three types of relations: spatial, functional and formal.

I. The spatial relations concern spatial arrangement of elements of fortifications. They may be referred to few scales of fortifying: territorial, regional and a single fortress one.

I.1. The scales of the territory and the region of a country. The author unites both these scales because the defence of a State was usually conditioned by a lot of different regards and the author does not feel competent in analysing them of. Besides, a geographical region was often as (or sometimes more) important for the defence as an administrative border-line of a State. There is very useful, in this scale to apply this, what the classics of a history of wars used to define as permanent, strategic lines of defence², or such areas which had ever been fortified. This problem is the most visible if we look at border-lines fortification. The shapes of this fortification were determined especially by plain, natural frontiers, eg mountains, rivers, coasts, or lack of them.

Chains of mountains were usually fortified with little, strong castles, or later single forts (Fig. 3), blocking passes, and with great fortresses situated on feet of mountains, eg Carcassonne, Belfort, Rastatt, Ulm, Lugano, Verona, Peschiera.

Great rivers were border-lines very rarely only. Yet, they had always been profitable bases for constructing lines of defence, eg the Rhine with

¹ Because fire-arm was already used in the 1st half of the 14th century, the author regards the break of the 15th century as a conventional boundary. However, the dominating influence upon a way of fight it attained – particularly in siege operations – just in the end of the 15th century (e.g. siege of Rhodes in 1480, Italian wars of Charles VIII etc.). So the 15th century may be called a transition period and architectural forms characteristic of modern fortifications were commonly introduced in the 16th century only.

² E.g. H. Jomini, *Précis de l'art de la guerre*, Paris 1830.

Neuf-Brisach, Strasbourg, Mannheim, Mainz, Koblenz, Bonn, Köln and Wesel.

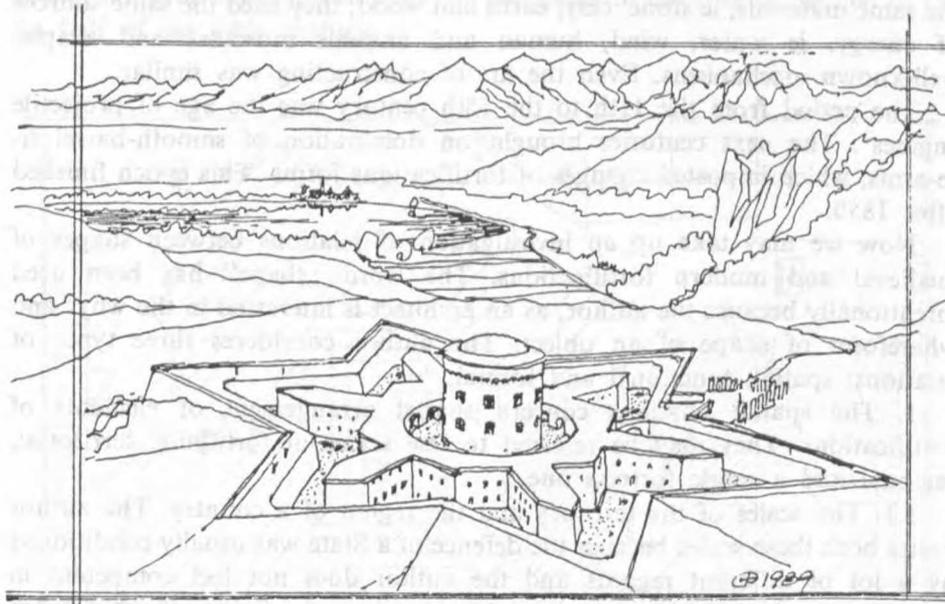


Fig. 3. Separate Fort; the 1st half of the 19th century (?). Acc. to: *Vertheidigung der Festungen...*, übersetzt von J. Ritter von Xylander, München 1820

Coasts were usually fortified with smallish, but well-placed castles or forts. Mouths of rivers and ports were protected with special care and often became strong fortresses, eg fortresses in the Netherlands, towns on the south coasts of the Baltic Sea, little coastal fortresses in North France (near Dunkerque, Calais, Boulogne), the system of defensive towers and little castles on the coasts of Sicily etc.

However, natural borders are lacking there in a larger part of Europe, and the problem of fortifying must have been being solved differently, according to demands of an epoch, to a size of a country, a specificity of the ground, a kind of colonization and character of potential enemies, their power and way of fight.

Such a situation took place on the Polish territories and made Polish sovereigns rulers build the strong system of castles all along the west border of the kingdom (Fig. 4). In the same time, on the opposite side of the Polish northern border the Teutonic Order built the perfectly organized network of castles, which covered the whole territory of their State in Prussia. Likewise, there was built (though voluntarily and without any unified idea) the network

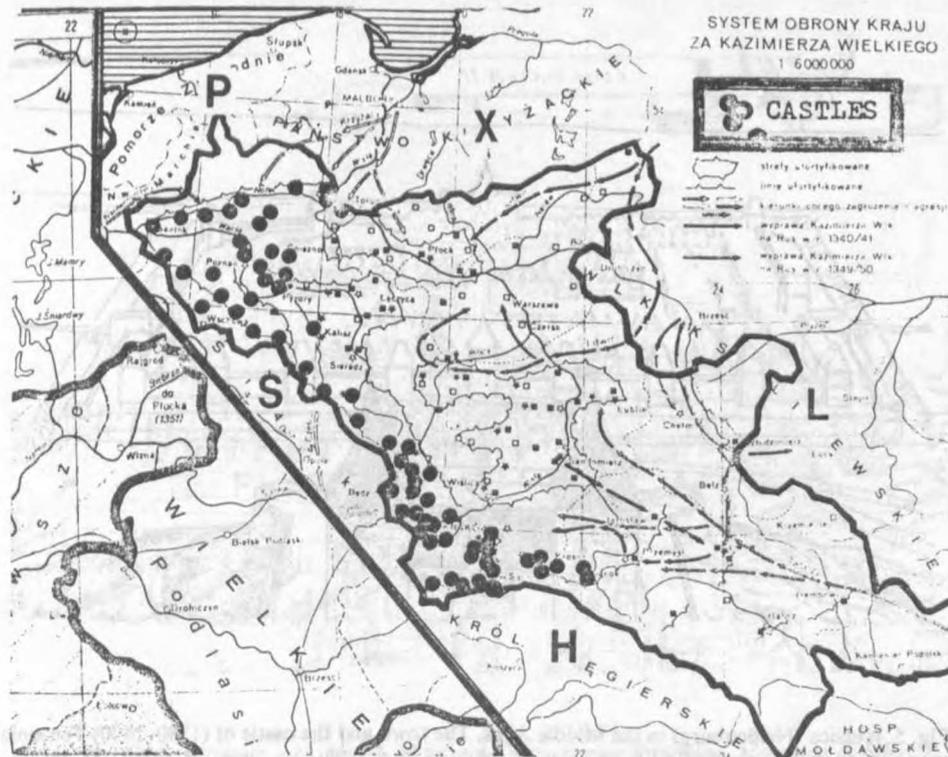


Fig. 4. The Castles on the West Border of Poland in the 14th century. P – the Duchies of West Pomerania, X – the State of the Teutonic Order in Prussia, S – the Duchies of Silesia, H – the Kingdom of Hungary, L – the Great Duchy of Lithuania

of little castles, fortresses, fortified monasteries, and manors in the south-east borderland of the Polish-Lithuanian State. They existed beside main fortresses and being in fact unable to resist any more considerable power, excellently resisted smallish groups of Tartars or Cossacs, being also bases for operating Polish squads. The system acted from the 14th to the first half of the 18th century. In West-European monarchies this problem was sometimes solved too radically. In the late 17th and the 18th century an excessively developed theory of fortification caused coming into being a great number of fortified places. These, frequently needless, must have been being maintained just because they had already been built. This phenomenon was noticed by Jomini or earlier even by Vauban although. Just by Vauban, who himself built some such fortifications...³

³ Jomini, *op. cit.* The author means also Vauban's controversies against the Minister of War, Louvois.

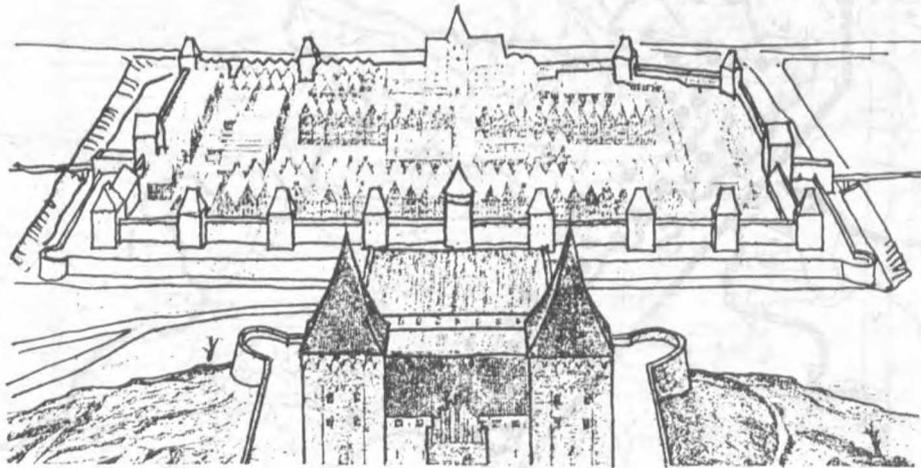


Fig. 5. Nidzica (Neidenburg) in the Middle Ages. The town and the castle of (1380–1400) Teutonic Knights; Galindia, South Prussia. Acc. to: O. Kloeppel, *Siedlung und Stadtplanung im Osten*, Breslau 1926

1.2. The scale of a single fortress one. The spatial shape of either a medieval or a modern fortress was usually conditioned both by a site and an assignment. In order not to complicate the problem let us have a look at a fortress situated on an unfortified naturally plain.

In the Middle Ages on the area of Europe fortresses were big, single castles, fortified towns or units assembled of two such elements. The shapes of their circumferences and also fortifications were conditioned by forms of a layout; usually similar to a circle or a rectangle. Newer fortifications of such fortresses were often effects of development of an older scheme, which had been increasing in new elements. This extension was commonly realized with no design.

The methodical or even scientific fortifications planning began in the times of the Renaissance. Contemporary theoreticians as eg Alberti, di Giorgio Martini, Dürer, Castriotto, or others had designed a number of schemes; in fact similar to one another and to those, constructed in the Middle Ages. It was obviously that particular elements had to be changed, eg turrets, towers



Fig. 6. Wrocław (Breslau), Acc. to: M. Merian, *Topographia Bohemiae, Moraviae et Silesiae...*, Frankfurt 1650. E – the medieval defensive wall with turrets, F – the modern (16th century) rampart with bulwarks and bastions

and stone walls were replaced with earthworks. Yet, the fundamental structure left the same: a regular polygon as a draft of circumference connected to a regular and polygonally shaped modern citadel replacing a castle. Even so characteristic for medieval defensive architecture single castles were imitated, where there it was needed by separate forts, very loosely only, or in any way joined to a great fortress (Fig. 3).

The matter of dimensions of fortresses should be also brought in the problems referring to the spatial relations. First of all it concerns modern fortresses. Beside other regards as eg the assignment, the decisive influence upon dimensions of a defensive structure had an efficiency of arms. The dimensions of constituent elements of fortification were conditioned by an arm-range. Thus, the real turn in that field was made only by the artillery. The importance of this kind of weapon consisted not only in the power of fire but just in the range of a shoot. In order not to make possible for besiegers to reach aims within a fortress there were not only fortifications strengthened, but

also a defence must have been brought outside, onto foregrounds, what made an excessive growth of territories of fortresses in the 19th century.

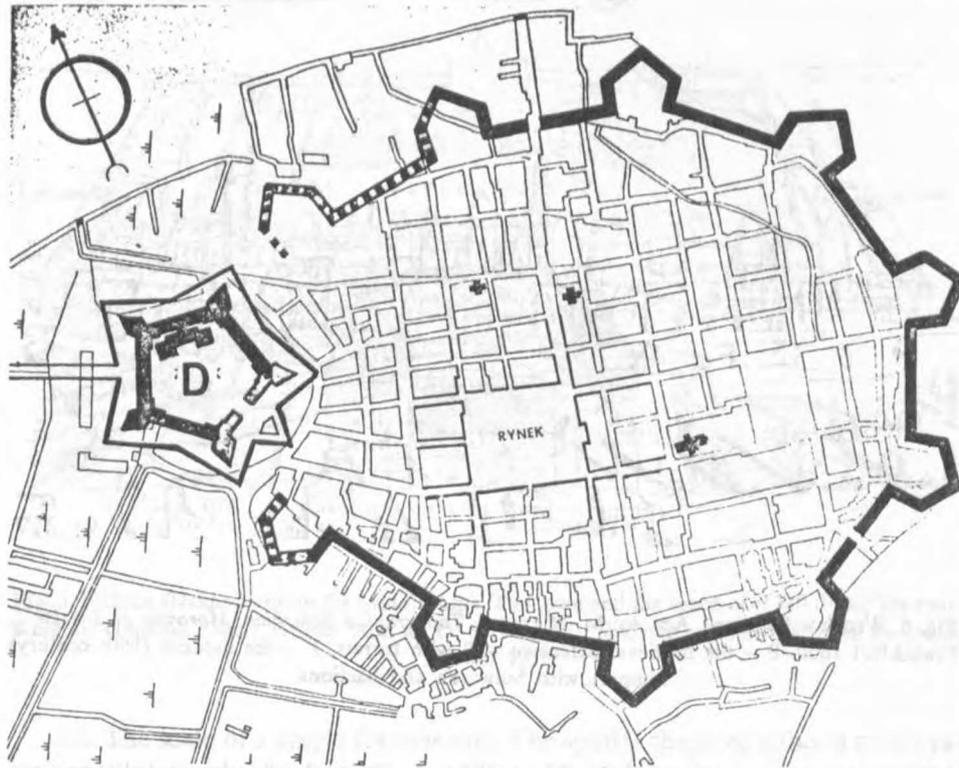


Fig. 7. Brody, South Wołyń; The Fortified Town, the 1st half of the 17th century. Reconstruction by O. Sosnowski. D - the Citadel

After all, the mere dimensions of main works of fortresses from the 18th and the 19th century, called not always rightly „the citadels” were often much bigger than much bigger than medieval units constructed of both a castle and a fortified town, eg Grudziądz (Graudenz), Poznań (Posen) (Fig. 8), Warsaw.

II. The functional relations may be seen as concerning a function of elements of fortifications. The author refers them only to the scale of a single fortress because in higher scales some extraarchitectural regards were always deciding. As the point of departure for next considerations we may accept the

traditional classification of elements into the obstacles, the post (action station, emplacement), and the shelter⁴.

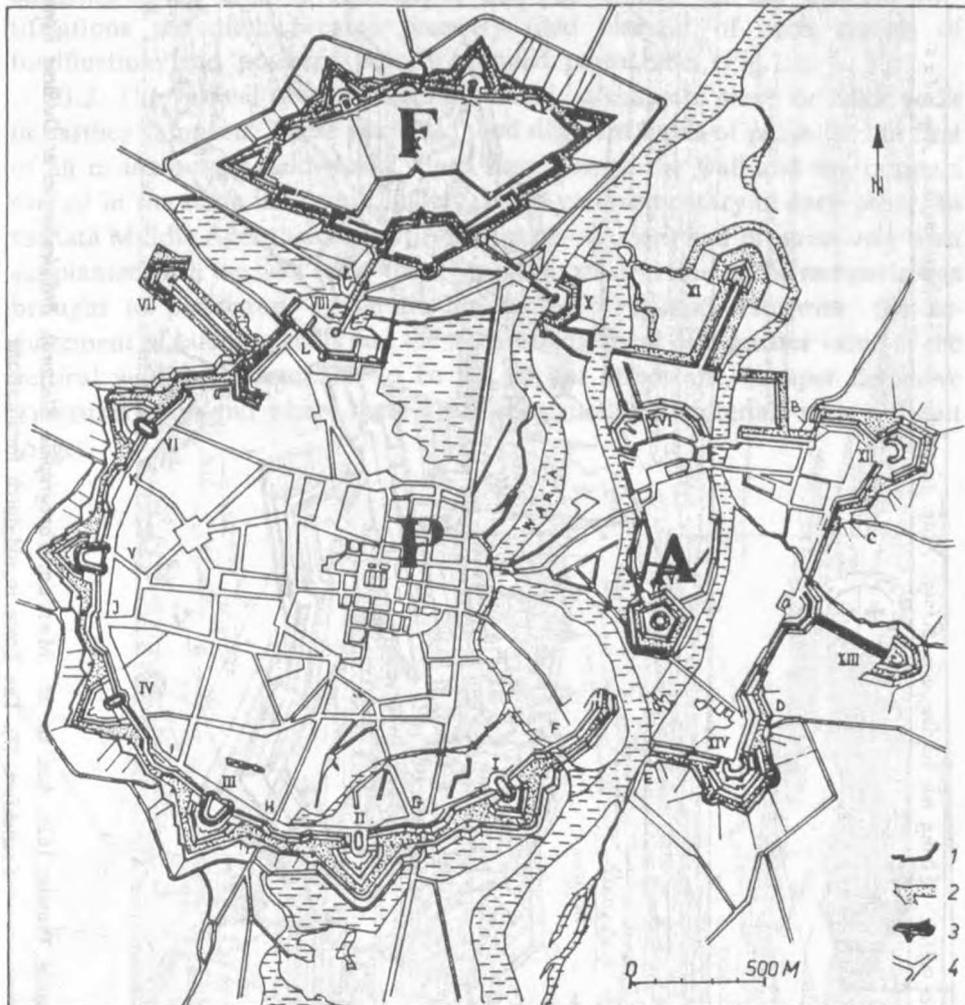


Fig. 8. Poznań (Posen). Plan of the town and fortifications of the New Prussian system. Drawn by P. Wojciechowski. Acc. to P. Wojciechowski, *Zarys rozwoju fortyfikacji miasta Poznania*, (Outline of fortification development of Poznań city), „Zeszyty Naukowe Politechniki Gdańskiej” 1981, no. 321, Architektura, vol. 20. A – Fort Radziwiłł (see Fig. 20), F – Fort Winiary (citadel), P – old town

⁴ Acc. to: *Encyklopedia wojskowa*, (Encyclopedia of the military science), Warszawa, 1936–1938.

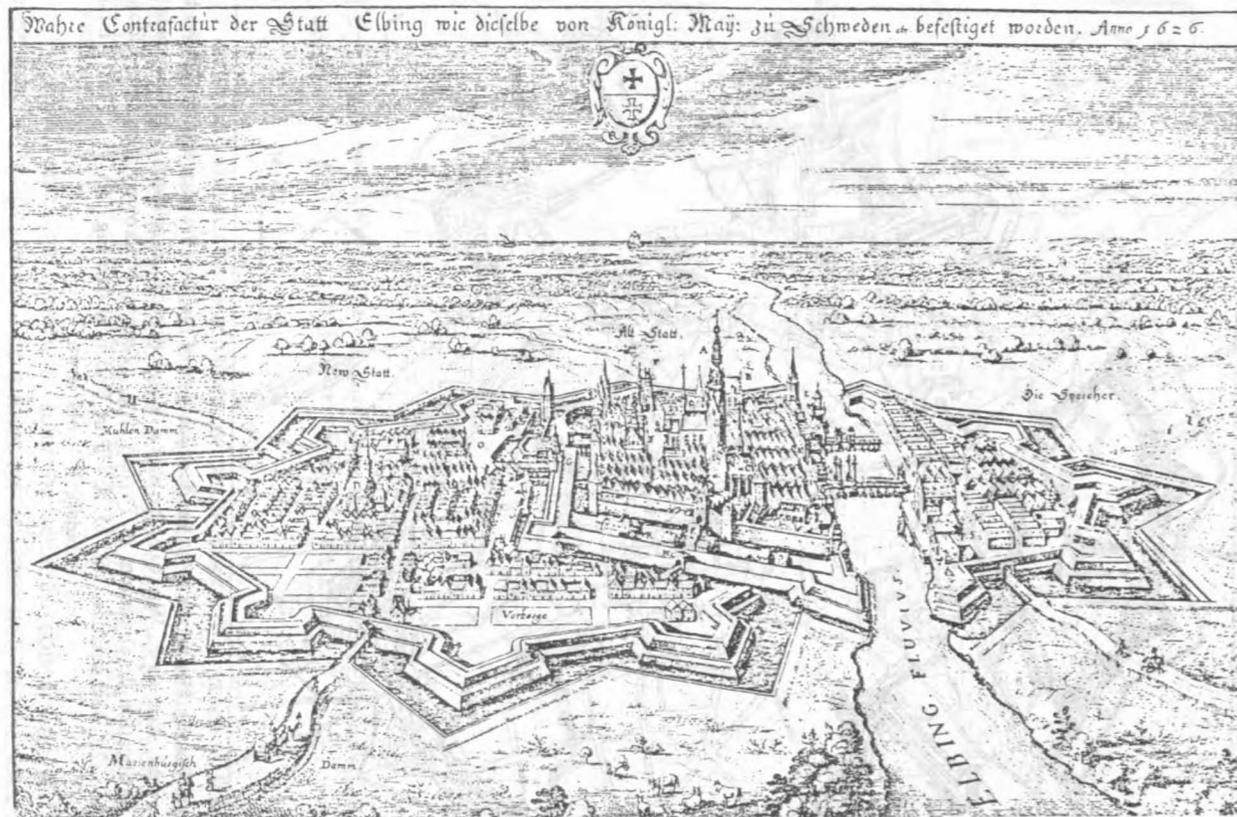


Fig. 9. Elbląg (Elbing), Pogesania, Prussia; 1626. Acc. to: M. Merian, *Topographia Electorat. Brandenburgici et Ducatus Pomeraniae...*,
 Franckfurt, (?). The Town in old-dutch fortifications

II.1. The horizontal obstacle was first of all a ditch; dry or according to possibilities filled with water. In the Middle Ages dimensions of moats were conditioned by a local experiences and feasibilities. In the modern fortifications the ditch became precisely fitted element of each system of fortification, and possessed exactly planned parameters (Fig. 9).

II.2. The vertical obstacle assumed mostly a shape of stone or brick walls or earthen ramparts. There were also used different kinds of palisades but first of all in temporary field-works. Both these forms, the wall and the rampart existed in the same time coordinately, being complementary to each other. In the late Middle Ages the rampart (often earth-wooden) had progressively been supplanted with the wall even where there the construction of the ramparts was brought to perfection, eg on the territories of Poland. However, the acquirement of building skills and the acknowledgement of a greater value of the vertical wall made ramparts to be left in less important, cheaper defensive structures only, and where there other constructional materials were difficult to get.

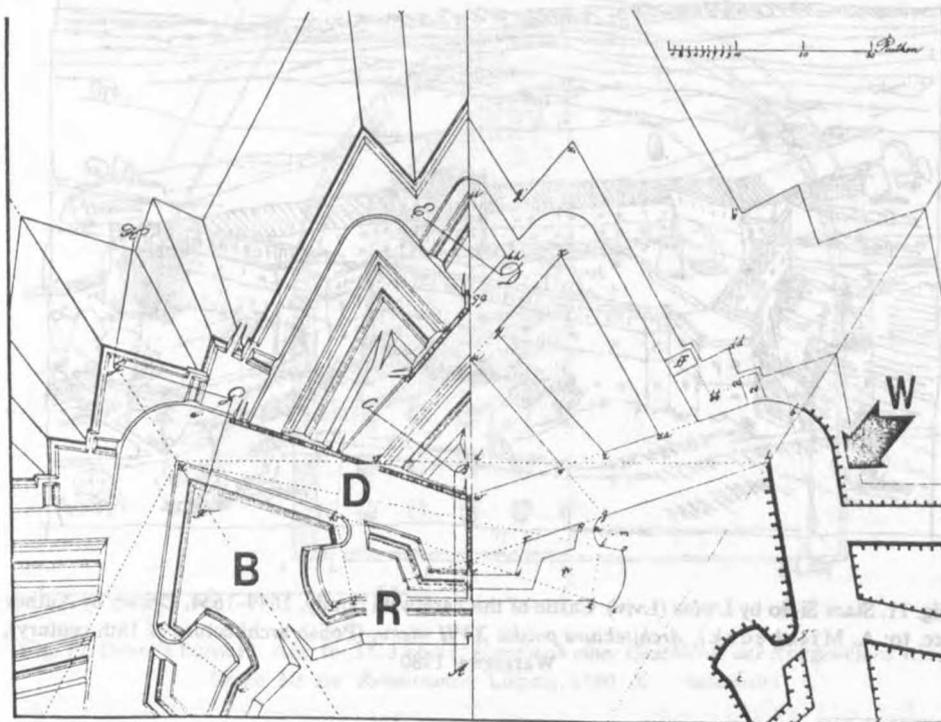


Fig. 10. Vauban's 1st system of fortification. Acc. to: A. Zastrow, *Handbuch der vorzüglichsten Systeme und Manieren der Befestigungs-Kunst*, Berlin 1828. B - bastion, R - main rampart, D - ditch, W - brickwork escarpment

After introduction of the artillery into common use it took place the new increase of the importance of a rampart. Its construction and form was, in fact, different; it must have been proofed against the fire of artillery and it was to be a station for artillery. With time, the stone courtin began to be a frame of a great heaps of earth only (Fig. 10). The extreme example of this tendency was the old-dutch fortification from the end of the 16th and the 17th century, where a brickwork was completely eliminated (Fig. 9). However, it happened at the instance of specific opportunities of its coming into existence⁵. In conclusion, the importance of a wall did not lessen but rather changed. The wall became an important element of the close defence and was hidden from the fire of artillery. Where there building of a rampart was impossible or unnecessary, eg in coastal fortifications, where the wall was often the only obstacle and cover of fire stations.

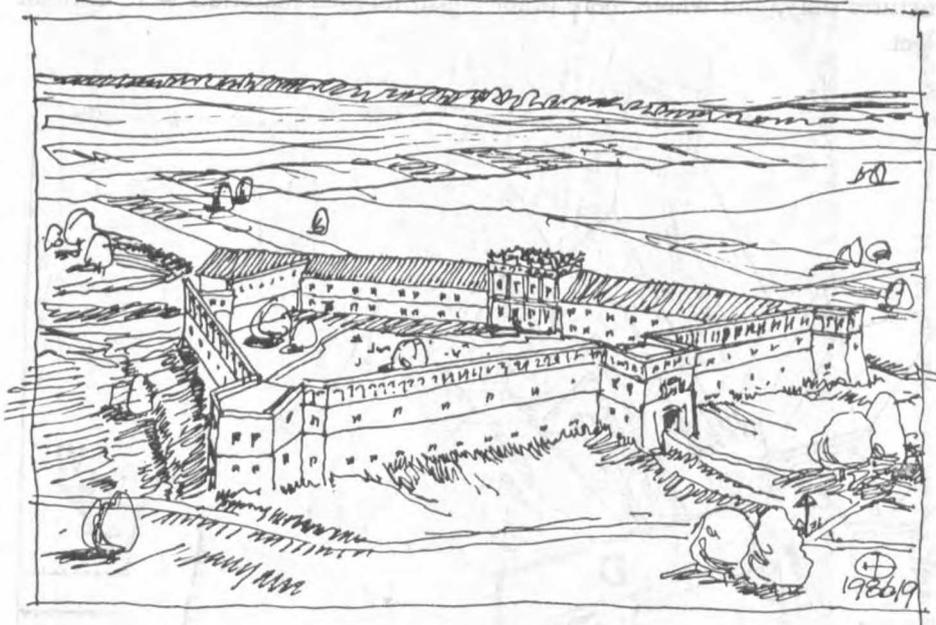


Fig. 11. Stare Siolo by Lwów (Lviv). Castle of the Zasławski family, 1649–1654. Drawn by Author acc. to: A. Miłobędzki, *Architektura polska XVII wieku*, (Polish architecture of 18th century), Warszawa 1980

⁵ The old-dutch fortification was introduced during wars in the Netherlands in the 16th century. It had to be built quickly and of such materials which were possible to get in the spot; so it was constructed of earth and wood mainly; as obstacles there were used wide moats and floods regulated with flood-gates. Works were plain and easily feasible (Fig. 9).

Besides, the walls dominated where there the potential enemy did not have at his disposal any heavy artillery or first of all, used to storm into a fortified position, so that the strong vertical obstacles were necessary. Such a situation took place in the Polish-Lithuanian eastern borderland, so the fastnesses which had been built there were sometimes wrongly told as to be obsolete⁶ (Fig. 11).

II.3. The posts of defenders in medieval fortresses were situated directly on vertical obstacles, ie on walls or turrets. This obvious and logical arrangement was disturbed and broken when the fire-arm was introduced. However, the main reason was neither the growth of the number of defenders nor better distribution of them. The point was the separation of the close and the distant defence, what had been unknown in the Middle Ages. With time it brought

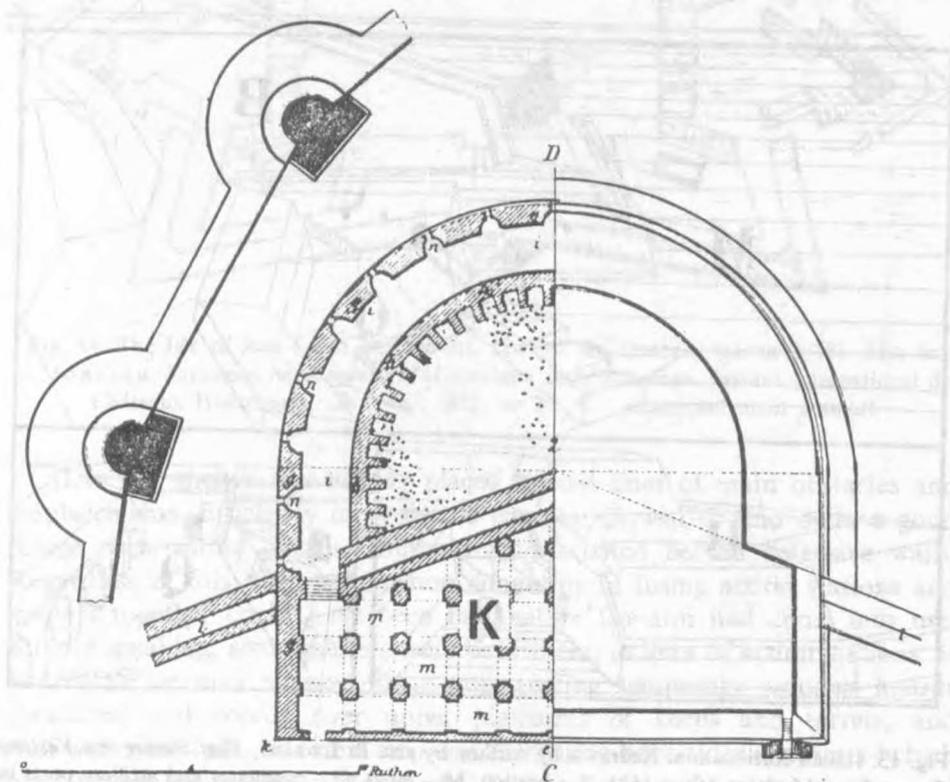


Fig. 12. Dürer's bulwark. Acc. to: M. J ä h n s, *Handbuch einer Geschichte des Kriegswesens von der Urzeit bis zur Renaissance*, Leipzig 1880. K – casemates

⁶ Difficult natural conditions in those areas (e.g. swamps, a lack of roads etc.) caused that transport of artillery was often impossible. In such a situation a high wall could be good as an only obstacle, esp against such a specific enemies as Tartars.

about removing a part of defenders in front of main obstacles: ramparts and moats (Fig. 2). Thus a new solution had to be found.

The application of fire-arm introduced a new kind of emplacements, ie casemates or special rooms for artillery stations. At first casemates were situated inside bulwarks only – both in the Italian and old-German fortifications (Fig. 12), and in flanks of bastions (Fig. 13). Later, eg in eighteenth-century fortifications, the whole main rampart could have been casemated; eg in Ada-Kaleh (Fig. 14), in main forts of such Prussian fortresses as Glatz (Kłodzko, Lower Silesia), Graudenz or later the Ehrenbreitstein by Koblenz. There were combined the three fundamental functions in such constructed works; they were at the same time: an obstacle, an emplacement and a shelter.

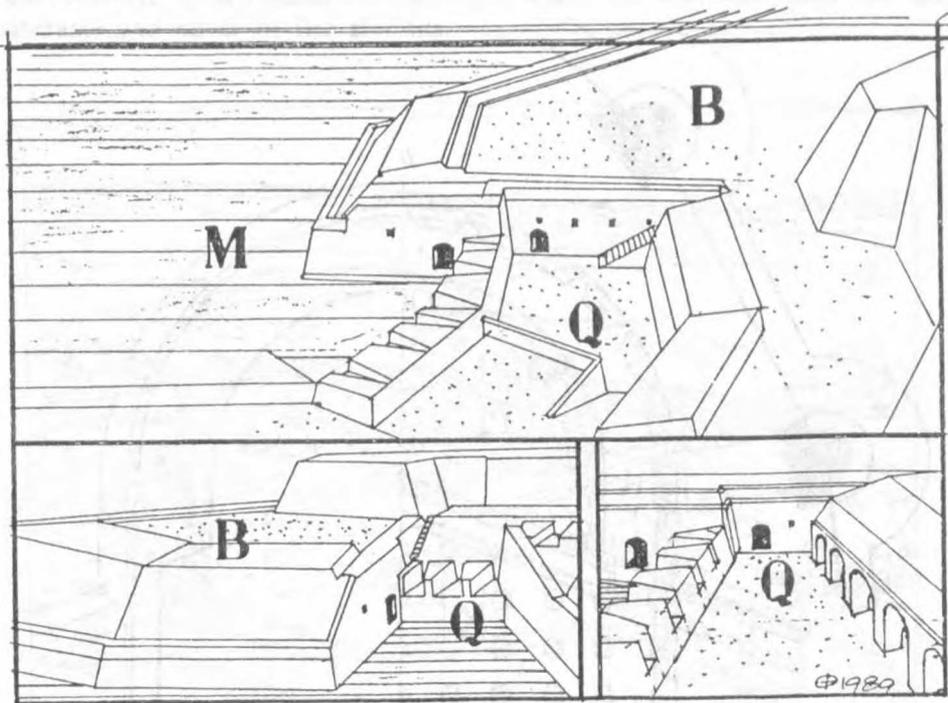


Fig. 13. Italian fortification. Redrawn by Author by acc. B. Lorini, *Fünf Bücher von Vestung Bawen*, Franckfurt am Mayn 1621. B – bastion, M – moat, Q – casemates and artillery posts in bastion shoulder

The way of capturing fortified places with a method of the regular siege (bettered in the 2nd half of the 17th century) made engineers counteract.

The most visible effect of such a counteraction was the extremely complicated spatial arrangement of fortresses. They were divided into a lot of

self-dependent sectors, separated from one another and ready for effective defence.

The next effect was a tendency to elimination defenceless interiors of old fortresses and to build in them with different inner-works, made of earth or stone. Such works were in fact counterparts of medieval donjons (Figs. 15, 16).

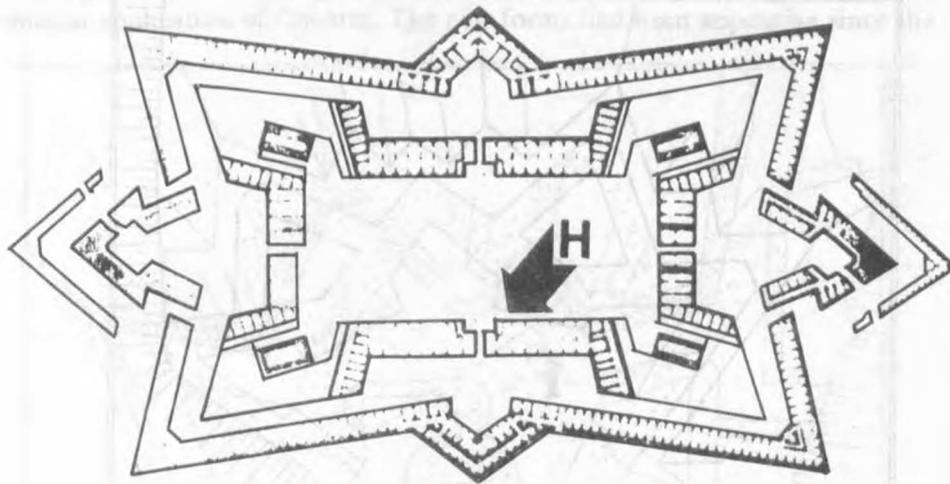


Fig. 14. The Isle of Ada-Kaleh on Danube. Plan of the Fortress, (about 1718). Acc. to: G. Ionescu, *Fortresses bastionnées sur la territoire de la Roumanie*, Institut International des Châteaux Historiques, „Bulletin” 1972, no 30. H – casemated main rampart

II.4. The shelter was usually placed behind lines of main obstacles and emplacements. Efficiency of projectile engines allowed to find quite a good refuge even within houses, churches etc., situated behind defensive walls. Regardless of this, the phenomenon consisting in fusing action stations and shelters together could have been met before fire-arm had come into use. Strictly speaking, some shelters were built there, in lines of action stations. It began, as we may suppose from constructing temporary wooden hoards (brattices) and roofed over upper platforms of keeps and turrets, and wall-walks on walls. The next step was furnishing back sides of turrets (which used to be left opened before). At first, it was made with wooden and brick-wooden and later stone- or brickwork walls. This way constructed turrets were fitted for an independent defence. The development of fire-arm introduced also so called „fire-turrets”; larger, many storeyed, with a lot of fire-stations. The consequence of their development were casemated bulwarks.

Nevertheless, with time shelter was almost completely removed from posts, so that the modern fortification (from about 1550) was assembled of a ring of

obstacles and posts encircling a defenceless interior like a shell of a snail⁷. The ring of fortifications had to be thicker and thicker to remove an enemy from objects inside (Fig. 2). Sometimes the inside of a ring was filled in special inner works, what has already been told of. From the end of the 18th century

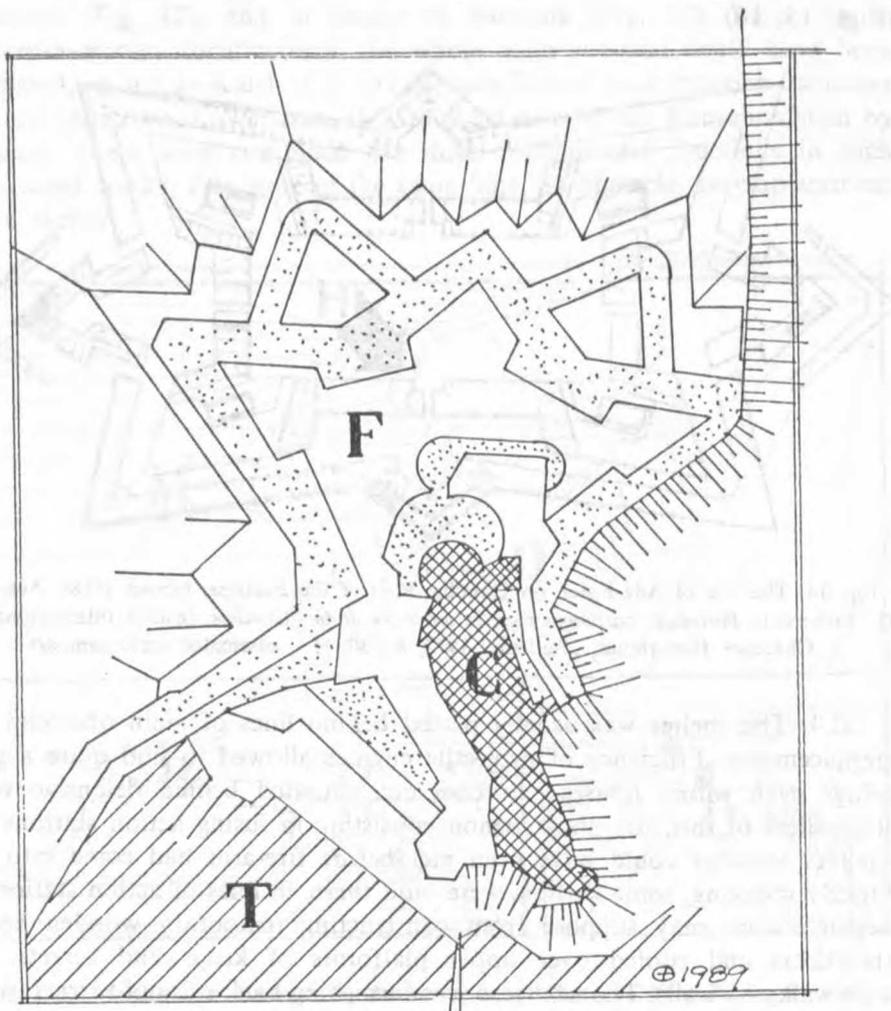


Fig. 15. Kłodzko (Glatz). Schematic plan of the fortress about 1740. Prep. by Author acc. to a plane from 1740. Orig. at Deutsche Staatsbibliothek Berlin – K, no. 25 106 c. C – castle, F – modern fortifications, T – build-up areas of the town

⁷ Casemated objects situated in the line of defence were expensive and endangered. This might have been an important reason that they were abandoned in fortifications.

a fortress girth was often equipped with many different works - bricken and earthen, ie redoubts, batteries, covered galleries etc; they could have served as shelters too.

III. The formal relations concern connexions between architectural forms in fortifications.

The birth of such characteristic for the modern military architecture forms and resignation old, existing were not simultaneous with the beginning of the common application of fire-arm. The new forms had been appearing since the

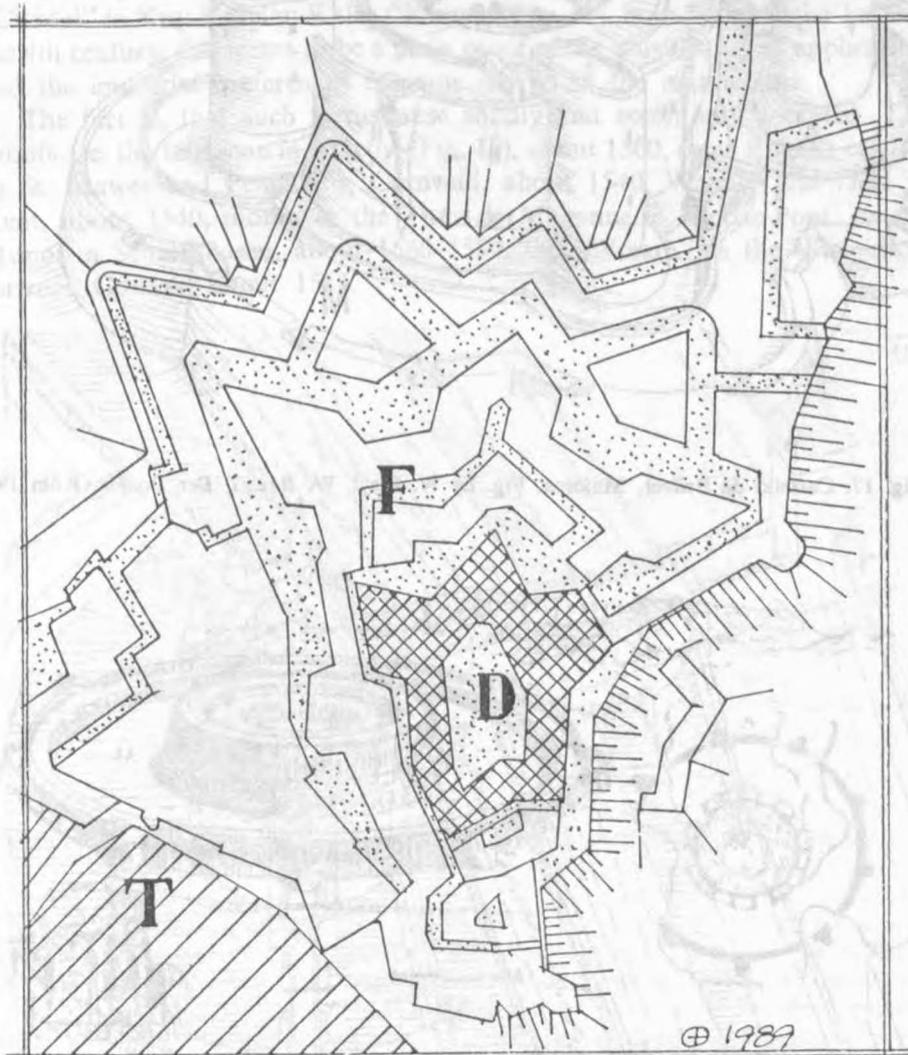


Fig. 16. Kłodzko (Glatz). Schematic plan of the fortress in 1808. Prep. by Author acc. to a plane from 1808. Orig. at Zentralstaatsarchiv Mereseburg, no. III 7649

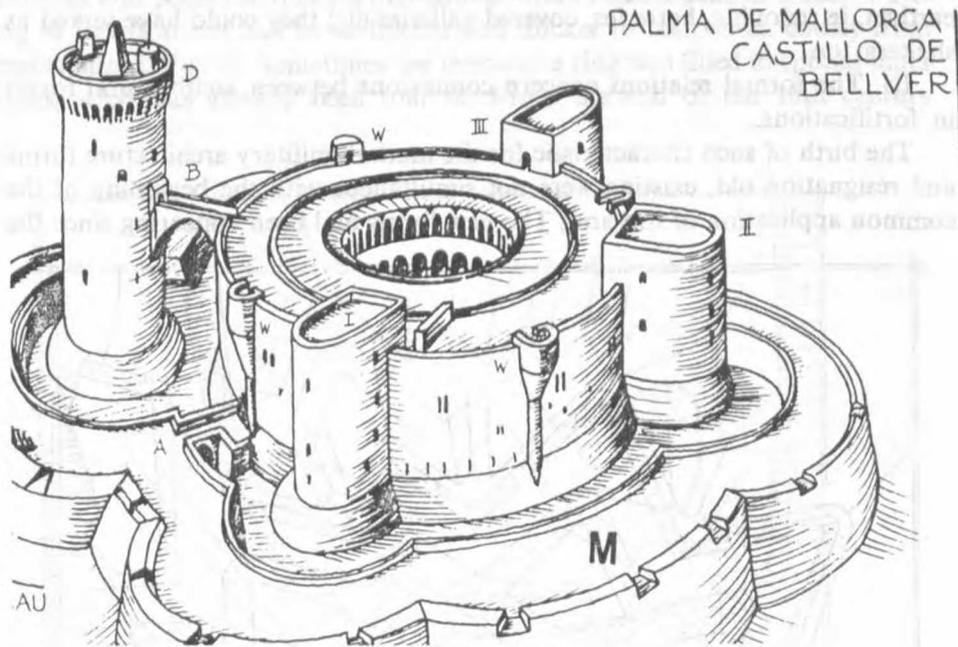


Fig. 17. Castello de Bellver, Majorca. Fig. by W. Bleyl. W. Bleyl, *Der Donjon*, Köln 1980

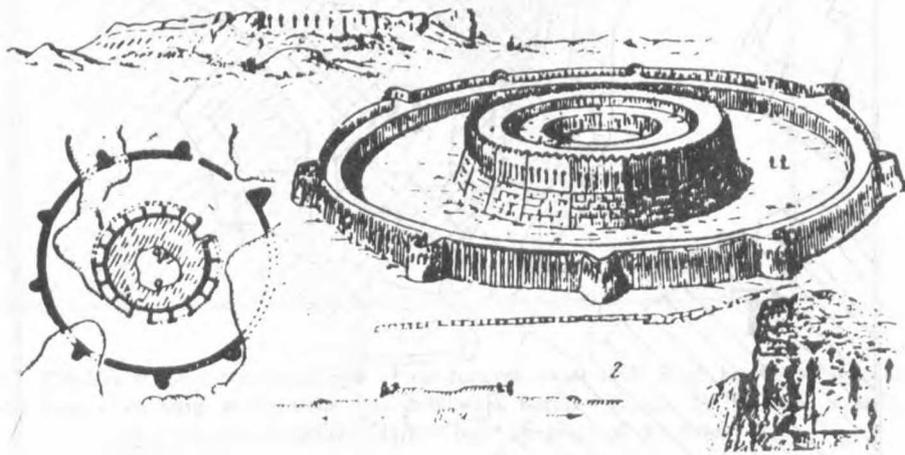


Fig. 18. Koy-Kryglan-Kala, Choresm. „The Citadel”. W. Hensel, *Archeologia żywa*, (Archeology alive), Warszawa 1982

2nd half of the 15th century (or sometimes earlier) in theoretical works of Tetti, di Giorgio Martini, Dürer (Fig. 12) and others. It is difficult to say, how far they were results of contemporary experiences or original creations and how far attractive elaborations of older ideas only. Forms like those, proposed by theoreticians, had been in fact known and used earlier. Let us look at such examples as Castello de Bellver, Majorca, after 1300 (Fig. 17), Queenborough Castle, Kent, about 1360, Le Krak des Chevaliers, Syria, the 1st half of the 12th century; and at last even something such far in the time and area like the „Citadel” in Koy-Kryglan-Kala, Choresm (Fig. 18), built between the 1st and the 4th century; this seems to be a plain proof of the universality of application and the immortal preferences of some shapes in the architecture.

The fact is, that such forms were soonly and commonly accepted. The proofs are: the Barbican in Cracow (Fig. 19), about 1500, some English castles, eg St. Mawes and Pendennis, Cornwall, about 1540, Walmer and Deal in Kent, about 1540, moreover the Tour de Maçonnerie, Roche-Pont, or the Munot in Schaffhausen, about 1560–1580, the „Wreath” in the Wisłoujście fortress, Gdańsk, about 1563.

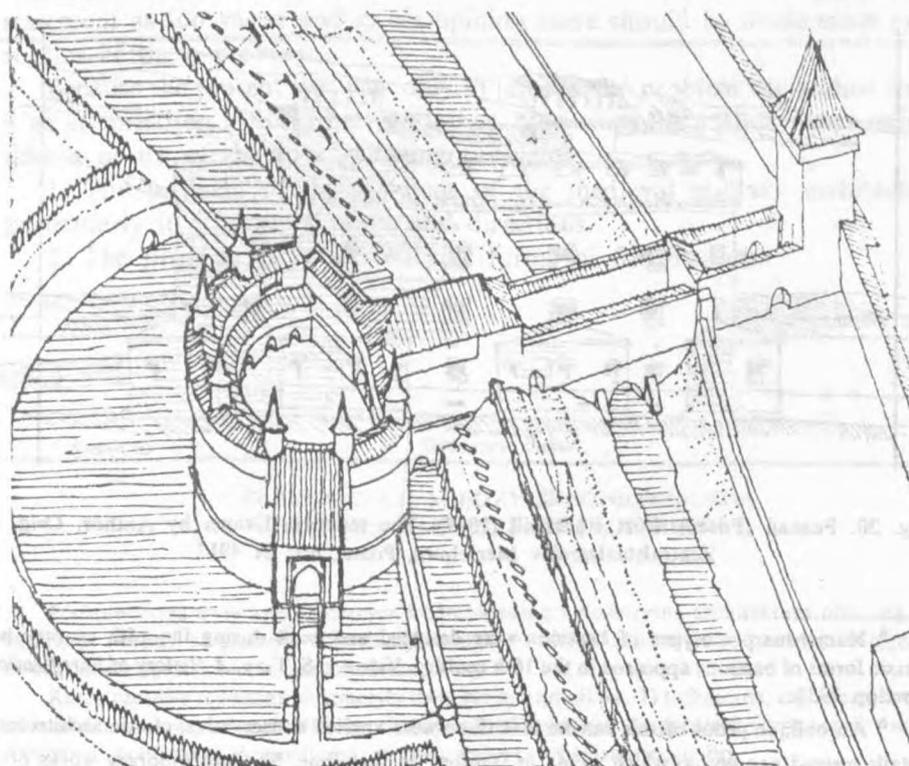


Fig. 19. Cracow. The Barbican; reconstruction by J. Bogdanowski

The bulwark fortifications were soon supplanted by bastion systems (Fig. 9, 10). These, the invention of plainly European origin had nothing to do with forms of medieval fortifications⁸.

The surprising come back of forms close to medieval and early modern was brought by the 18th century. It is a riddle what was the reason, or rather a source of that phenomenon; we can only suppose that it was not any intentional reference to former tendencies but the return caused by quite contemporary necessities⁹. After all, it seems to be necessary to remark that the 2nd half of the 18th century was the period of reaserches which resulted the most visible in the ideas of Montalembert, realizations of Prussian engineers and in the great changes which took place during and after the Napoleonic wars. The effect of these reaserches were massive, self-dependent structures, equipped with a strong artillery, perfectly suitable for inner works, outworks, elements of circumferences of fortified camps or separate forts. They turned out to be serviceable for mountain and coastal fastnesses. We can find some of them at Silberberg (Srebrna Góra) and Cosel (Kozle), Lower Silesia, and in

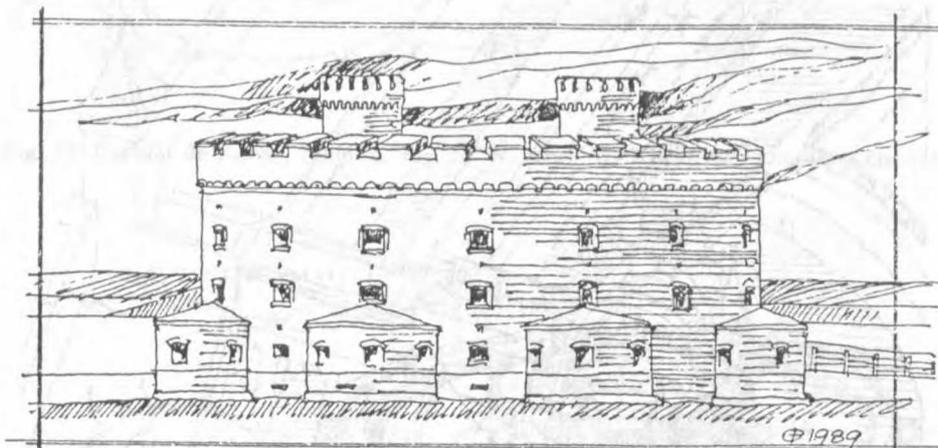


Fig. 20. Poznań (Posen). Fort Radziwiłł (1847). The redoubt. Drawn by Author. Orig. at Zentralstaatsarchiv Merseburg, Posen, no. III 4912

⁸ Numerous prototypes of bastions were designed and built during the 15th century but classic forms of bastions appeared in the 16th century. Vide e.g. S. Toy, *A History of Fortification*, London 1955.

⁹ An oblique proof of this can be that there were applied conservative, classic architectural details instead neo-gothic which were „in fashion” in that time. So, contemporary works often presented themselves as specific architectural „hybrids”, ie almost gothic shape and neo-classic decorations.

forts of Cherbourg (all these works built in the 4th quarter of the 18th century); later, in the 1st half of the 19th century similar objects were built in Linz, Verona, Cracow (Maximilian's Towers) and in Poznań (Fig. 20).

The formal and also the functional resemblance between medieval or early modern and such contemporary works must have been soon noticed. It is expressed in names given to some of them. In two Silesian fortresses: Glatz and Silberberg we can find stone plates built in walls above gates of the inner works of the main forts. On each of such plates there was engraved the name: „DONJON”.

CONCLUSION

The general conclusion which may be drawn from considerations presented above is that there were numerous connexions between military architecture of the Middle Ages and the modern time. The author, however, regards this statement as too vague and in his opinion there should be made more exact studies of these problems.

Because the present text was only to remark the problem the author treats it as an initiation into further researches. Now that, the author wants only to take a notice of the two following problems:

1. The problem of development of the medieval military architecture; particularly in its means, ways and directions.
2. The problem of universality in forms of fortifications.

September 1986.

Grzegorz Bukal

O RELACJACH MIĘDZY ŚREDNIOWIECZNĄ A NOWOŻYTNĄ ARCHITEKTURĄ OBRONNĄ

Podstawowym związkiem łączącym średniowieczną i nowożytną architekturę obronną była realizacja obrony za pomocą fortyfikacji. Autor stawia pytanie o inne, bardziej szczegółowe powiązania między obiema „architekturami”.

Ramy czasowe rozważań wyznaczyły dwie grupy czynników: 1) techniczne, czyli bezpośrednio związane z budową, oraz środki do obrony lub zdobywania, 2) pozatechniczne, czyli warunki naturalne, polityczne, ekonomiczne, stopień rozwoju cywilizacyjnego itp.

Autor bierze pod uwagę tylko pierwszą grupę, jako tę, którą przede wszystkim warunkuje kształt architektoniczny fortyfikacji. Rozważania dotyczą okresów: XI-XV w. i XVI – połowa

XIX w. Podstawowym czynnikiem technicznym odróżniającym te dwa okresy było wprowadzenie broni palnej w XV w. Kolejny przełom spowodowała broń gwintowana oraz nowe źródła energii i materiały budowlane stosowane od około 1850 r. (umownie).

Autor wyróżnia trzy typy relacji:

I. Relacje przestrzenne, dotyczące układu przestrzennego fortyfikacji. Odnoszą się do trzech skal fortyfikowania: terytorium państwa, regionu, pojedynczej twierdzy.

Skale terytorium państwa i regionu zostały tu połączone. Za wyznacznik ułatwiający porównywanie autor uznał tzw. strategiczne linie obrony, czyli obszary, które zawsze podlegały fortyfikowaniu. Jako dobrze ilustrujące zagadnienie wybrane zostały linie umocnień granicznych oparte na łańcuchach górskich, wielkich rzekach, wybrzeżach morskich oraz linie tworzone przy braku granic naturalnych.

Skala twierdzy. Ponieważ kształt przestrzenny twierdzy zawsze determinowany był przeznaczeniem i położeniem, autor pominął przypadki szczególne, biorąc pod uwagę obiekty leżące na równym, nie umocnionym silnie w sposób naturalny terenie. Pod pojęciem twierdzy rozumiane są duże, pojedyncze zamki, silnie umocnione miasta oraz jednostki złożone z obu takich elementów. Za podstawową cechę różnicującą twierdze pod względem organizacji przestrzennej w obu okresach uznaje autor rozmiary założenia. Ujawnia się ona jednak dopiero na przełomie XVIII i XIX w.

II. Relacje funkcjonalne dotyczą roli poszczególnych części składowych umocnień. Zostały odniesione tylko do skali twierdzy, gdyż w skalach wyższych decydowały o nich względy pozaarchitektoniczne. Jako punkt wyjścia przyjęty został tradycyjny podział funkcjonalny elementów fortyfikacji na przeszkodę, stanowisko i schronisko.

Przeszkoda pozioma stosowana była w całym omawianym okresie w postaci rowu suchego lub napelnianego wodą. Zmianie ulegały tylko parametry, a nie charakter.

Przeszkodę pionową stanowiły mur i wał ziemny; początkowo oba rodzaje istniały równolegle, ale w umocnieniach ważniejszych starano się eliminować wały, które zdobyły prymat w drugim okresie. W fortyfikacji górskiej i morskiej mury przeważały również w okresie nowożytnym. Rola muru wzrosła w II połowie XVIII w. i zjawisko to trwało już do końca rozpatrywanego okresu.

Stanowiska umieszczano w średniowieczu na przeszkodzie pionowej. Wzrost skuteczności broni palnej, a zwłaszcza artylerii sprawił, że układ ten został zmieniony; część stanowisk wysunięto na przedpole, część wycofano na zapole przeszkody głównej. Okres nowożytny wprowadził do użytku kazamatę – pomieszczenie stanowisk, zwłaszcza artyleryjskich. Zakres stosowania kazamat był różny, zależał od systemu fortyfikacyjnego, przeznaczenia stanowiska itp. Wycofanie niektórych stanowisk poza główną przeszkodę i wzrost ich liczby wprowadził do fortyfikacji śródszańce, poniekąd odpowiedniki dawnych wież ostatniej obrony.

Schroniska sytuowano w średniowieczu poza linią wyznaczoną przez przeszkody i stanowiska. W końcu tego okresu przybliżyło się do niej obudowywanie baszt, konstruowanie krytych ganków (w następstwie kazamaty); później zrezygnowano ponownie z osłony stanowisk silnymi schronami – chyba z przyczyn ekonomicznych. Dopiero nowocześniejsze systemy fortyfikacyjne z II połowy XVIII i I połowy XIX w. przywróciły fortyfikacji odporne na działanie artylerii schronisko.

III. Relacje formalne, czyli związki zachodzące między formami architektonicznymi fortyfikacji średniowiecznej i nowożytnej. Charakterystyczne dla umocnień nowożytnych kształty, odmienne od tych, które stosowano w średniowieczu, powstały w stosunkowo krótkim czasie (III ćwierć XV – I połowa XVI w.) jako efekt prac teoretyków oraz bieżących doświadczeń. Zupełnym zerwaniem z tradycją średniowieczną było tu wprowadzenie systemów bastionowych. Powrót do form bliskich fortyfikacji bastionowej przyniósł wiek XVIII. Zjawisko to wystąpiło najwyraźniej w fortyfikacji pruskiej, częściowo francuskiej i austriackiej.

Generalnym wnioskiem jest stwierdzenie różnorodnych powiązań łączących obie „architektury”. Jest to jednak stwierdzenie zbyt ogólnikowe i – zdaniem autora – zagadnienie powinno być dalej studiowane. Powyższy tekst miał za zadanie jedynie zasygnalizowanie problemu, będąc jednocześnie punktem wyjścia dla dalszych badań autora, który w chwili obecnej chciałby zwrócić uwagę na dwie sprawy:

1. Problem rozwoju średniowiecznej architektury obronnej, a zwłaszcza środków, dróg i kierunków, w jakich się on dokonywał.
2. Problem uniwersalizmu form w fortyfikacjach.

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