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MORPHOLOGY OF FIELD FORTIFICATIONS OF THE 17TH - 19TH CENTURIES

A contribution to surface research

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The constantly expanding source base, multiplied in the course of surface investigations, confronts us frequently with the question of description, classification and interpretation of features situated, up to now, in a marginal area of specialized interests - temporary field fortifications. Only the fortifications of the period between the 17th and first half of 19th century which may be discussed as a whole in view of the present state of our knowledge have been selected for this paper; they may be said to represent a development stage well discernible both morphologically and functionally with a minimum of traditions of structures of this kind dating to the 15th and 16th centuries.

In the course of the first confrontation of fortified units and firearms in the 15th century, most of the builders reacted by trying to improve earlier fortification systems by protective elements of most diverse kinds, such as cannon bastions, revetment walls, advanced fortifications and the like. These, however, represented no more than a temporary solution of a problem which, in the 16th century, resulted in the so-called first crisis of fortification architecture. A way out of this crisis was found by the builders of Renaissance-period Italy who created the so-called Old Italian bastion system introducing the pentagonal cannon bastions regularly spaced between curtain walls /Bochenek 1972, 67-69/. In this period of time, these new concepts of fortification architecture were not known in Bohemia, situated far from the focal points of conflict. It was the experience of the Thirty Years' war which brought Bohemia flush with the rest of Europe in which a number of schools projecting and building monumental fortification systems and, as is quite natural, concerned also with the methods of their obliteration, were active in 17th century. The military engineers of that period of time did not neglect field fortifications, the significance of which grew considerably in the 17th century and which were employed en masse both in offensive and defensive tactics of fight and as an advanced component of permanent fortification systems. Their importance remained high in the course of the 18th and at least in the first half of the 19th century in which another set of complex transformations of the fortification architecture occurred. In the sphere of field fortifications, these changes were visualized by the introduction of qualitatively new types of features and by the transition to trench systems.

The morphological perfection of field fortification dating from the time of their beginnings is a cause of their morphological stability along the whole period in question. For this reason, I have adopted the morphological classification system in accordance with the approach of contemporary writings of military theo-

reticians. Even if we do feel a lack of real structures and if we resort predominantly to non-archeological sources, we suppose that the source base will be enlarged; for this reason, we have selected an open morphological systemallowing the type- and intertype variants of structures and is based on the contemporary "building-set" understanding of the fortifications.

Contemporary terminology has been adopted for morphological classification of individual types of structures. For the cases when one term included several variants of a single type, an auxiliary terminology set precising the variant in question by classification of morphological changes, again according to contemporary terminology, has been developed. In a case to the contrary, when several terms denote a single variant or type, the selection of the term was done in consideration of its classification quality and quantitative representation in the sources, or it might have again been completed by a morphological precision.

The works of military theoreticians put forward a twofold division of the structure types in question: open fortifications with defence in the form of a segment of a circle and closed fortifications with circular defense enclosing an accurately delimited space / Schwinck 1856, 16, 29/. Extensive complexes, composed of singular types, may be divided in the same manner though the classification into individual groups is not so obvious as the employment of other kinds of fortifications /permanent, natural/ must be taken into consideration and the assignment of complex cases to one of the groups will thus be of a model character.

Open fortifications

Straight line /Fig. 1/1/

This represents morphologically the simplest type of fortification and a basic component of all the following types and variants, existing in an isolated state. This could have served as refuge for infantry or as protection of a battery of cannon.

Redan /Flesche/

The basic redan type is a fortification of a shape of an inverted letter V the wings of which are set at an angle of 60°-120° /Fig. 1/2/. Length of the wings varies and may be in connection with the function of the redan. Artillery redans by the site of Kokrdov /district of Rakovník/ of 1620 have wing lengths of 16 metres at 60° and 18 m at 90° /unpublished/. An infantry redan at Nebesa /district of Cheb/Eger/, dating from 1758 and mentioned in this volume of studies, displays a wing length of some 40 m at an angle of 120° and represents an extraordinary variant of the basic type in which two-thirds of the right wing were transferred behind the basic fortification line in view of an optimum exploitation of the ground line.

Two types of variants are based on the fundamental redan shape. The first one represents an adjustment of the basic type while the second one adds further fortification segments. The first variant type is constituted by a redan with rounded front /Fig. 1/3/ and by a redan with straight front / Fig. 1/4/. The ends of the wings of this second variant could have been provided with flanking devices and its frontage could have been prolonged /Fig. 1/4a/, visibly in a case when it offered protection to a battery of guns as shown on a depiction of the Prussian siege of Prague in 1757 /Kašička - Nechvátal 1985, Fig. 45/.

The other variant type adds to the wing ends the flanks - shorter segments of fortification offering shooting positions for the control of the space in front of the redan tip. A small lateral redan may be formed by the junction of another short flank and the original flank /Fig. 1/2a/. Continuing morphological development will result in a variant with three redans of equal size or with two large lateral ones and one small central one; the latter may be considered a new type for which a term "crown" /Kronwerk, Fig. 1/ /2b, c/ may be used. If the central redan is eliminated, the crown becomes a further type which may be called a bicorn /Hornwerk, Fig. 1/2d/. Both terms have been selected as the most suitable ones, though, in contemporary terminology, they usually denote fortifications composed of bastions /Fig. 3/1a/, half-

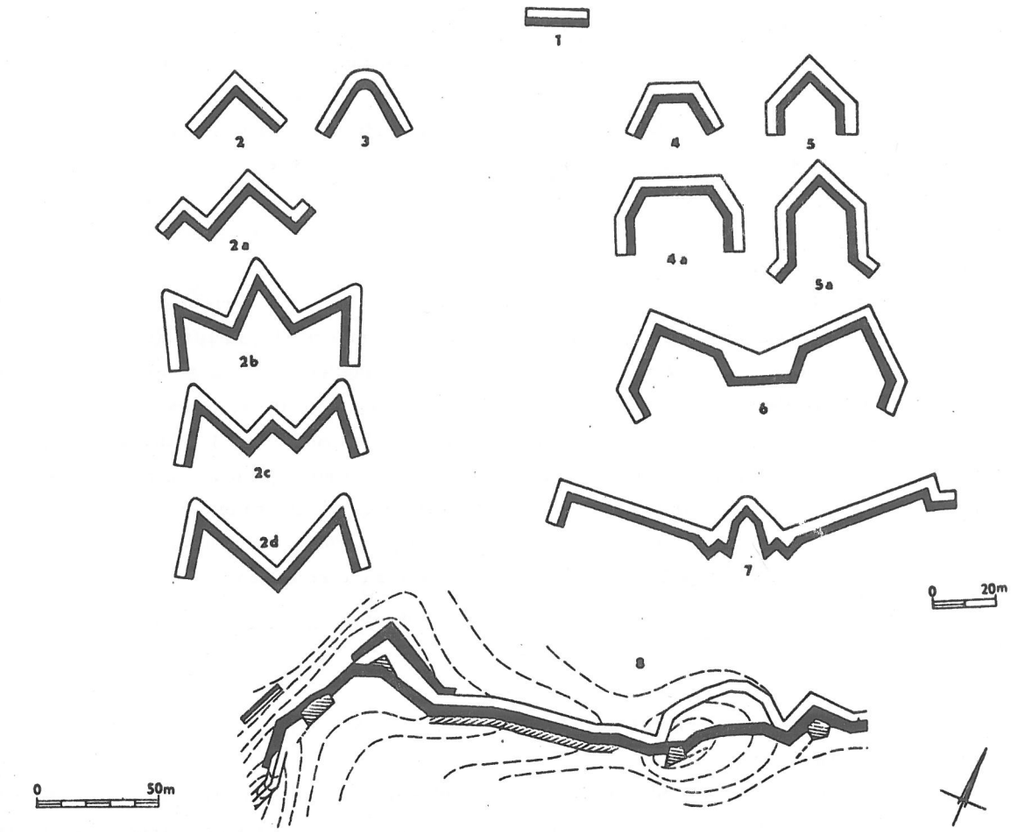

Fig. 1 - Open fortifications. 1 - straight line / Schwinck 1856 Pl. I Fig. 10/, 2 - basic redan type, wings at an angle of 90° /ibid. Pl. I Fig. 14/, 2a - a redan with a flank at the end of the right wing, a pair of flanks making up a lateral redan on the left wing /ibid. Pl. II Fig. 23/, 2b - a crown composed of three equally sized redans /ibid. Pl. II Fig. 24/, 2c - a crown composed of two large lateral redans and a small central one /ibid. Pl. II fig. 27/, 2d - a bicorn composed of two redans /ibid. Pl. II Fig. 26/, 3 - a redan with a round front /ibid. Pl. I Fig. 18/, 4 - a redan with a straight front /ibid. Pl. I Fig. 17/, 4a - redan with an elongated front and with flanks /according to a depiction of the Prussian siege of Prague in 1757, in: Kašička - Nechvátal 1985, Fig. 45/, 5 - a lunette / Schwinck 1856, Pl. II Fig. 22/, 5a - lunette with flanks /according to a variant depiction of the White Mountain battle of 1620 in: Skála ze Zhoře 1984, 357/, 6 - a bicorn composed of bastions / Schwinck 1856, Pl. II Fig. 30, right bastion reconstructed/, 7 - an example of a more complex integration of a bastion into a fortification line /ibid. Pl. II Fig. 31, the break of the line in the right part of the fortification functioning as a flank reconstructed/, 8 - the S part of the N wing of the linear fortification at Dlouhý-vrch /district of Česká-Lípa/ with three battery terraces. Surveyed by the author. Black area - a rampart, white area - a ditch, oblique lines - elevated ground level. Figs. 1-4 drawn by H. Jonášová and P. Meduna. - Otevřené fortifikace. 1 - přímá linie / Schwinck 1856, tab. I, fit. 10/, 2 - základní typ redanu, ramena svírají úhel 90° /tamtéž, tab. I, fig. 14/, 2a - redan s flankem na konci pravého ramene, na levém rameni dvojice flanků, tvořících boční redan /tamtéž, tab. II, fig. 23/, 2b - koruna, tvořená třemi stejně velkými redany /tamtéž, tab. II, fig. 24/, 2c - koruna, tvořená velkými bočními a malým středním redanem /tamtéž, tab. II, fig. 27/, 2d - rohy, tvořené dvěma redany /tamtéž, tab. II, fig. 26/, 3 - redan s oblým čelem /tamtéž, tab. I, fig. 18/, 4 - redan s plochým čelem /tamtéž, tab. I, fig. 17/, 4a - redan s prodlouženým čelem a flanky /dle vyobrazení pruského obležení Prahy 1757, in: Kašička - Nechvátal 1985, obr. 45/, 5 - luneta / Schwinck 1856, tab. II, fig. 22/, 5a - luneta s flanky /dle varianty vyobrazení bitvy na Bílé hoře 1620, in: Skála ze Zhoře 1984, 357/, 6 - rohy tvořené bastiony / Schwinck 1856, tab. II, fig. 30, pravý bastion doplněn/, 7 - příklad složitějšího zapojení bastionu do linie fortifikace /tamtéž, tab. II, fig. 31, doplněno flankovací zalomení linie v pravé části fortifikace/, 8 - jižní část severní větve lineárního opevnění na Dlouhém vrchu /okr. Česká Lípa/ s třemi plošinami pro baterie. Zaměření autor. Černá plocha - val, bílá plocha - příkop, šrafovaně - zvýšená úroveň terénu. Obr. 1-4 kreslila H. Jonášová a P. Meduna.

-bastions /Fig. 3/6a/ or of the combination of both /Fig. 3/1c/.

Another type of an open fortification is a lunette /Fig. 1/5/. Originally, this term was applied to a redan with a rounded front /Bochenek 1972, 172/ and has been transferred subsequently to the type in consideration now and to the redan with straight front /ibid., 172/. Confronted with this terminological chaos, I have adopted the terminology of the Prussian theoretician G. Schwinck who commented on this type of fortification /Schwinck 1856, 20f./. A lunette which is, in fact, a variant of a redan with parallel flanks, might have been provided with further flanks /Fig. 1/5a/ on the wing ends, as is shown on one of the depictions of the White Mountain battle of 1620.

An open type complex is represented by the so-called linear fortification, morphologically combining the straight line with flanking elements /Fig. 1/7/. This is almost identical with fortifications of military encampments /cf. infra/ but it does not enclose a definite area, serving for securing a certain section of the defence and making better use of the ground line. A linear fortification of the second half of the 18th and beginning of the 19th century at Dlouhý-vrch /district of Česká-Lípa/ is more than 1.5 kilometre long and employs, in its central part, a phonolite outcrop /Balatka 1987, 57/; at strategically important spots, the broken line of the rampart fortification is provided with seven terraces for gun batteries /Fig. 1/8/. Linear fortifications composing circumvallation and contravallation rings around besieged fortification systems /Bochenek 1972, 74/ are situated in a border area between open and closed systems.

Closed fortifications

Redoubt

In the sources, this term denotes various types of closed fortifications and must be specified by an appropriate adjective. The basic morphological types are constituted by trapezoidal, square, penta- and hexagonal redoubts /Fig. 2/1-4/. These could have served as independent strong points or be integrated into more extensive complexes. Most frequently, the fortification complexes included square redoubts; on his depiction of the besieged town of České-Budějovice of 1619, Christoph Greutter recorded several variants together /Fig. 3/2/. A more complex variant has been employed in an area of a military encampment at Aire-sur-la-Lys of 1641, known from the painting by Pieter Snayers /Fig. 3/5/. Even a pentagonal redoubt, integrated into a shorter section of a linear fortification depicted by Greutter /Bohatcová 1966, Fig. 13/ is known. All the abovementioned redoubt types served as infantry strong points; artillery batteries were most frequently protected by square redoubts /cf. infra/ and I assume that the other types might have played this role as well. Preserved examples show that the redoubt size varied: of square redoubts, an artillery fortification of 1647 at Třebel, /district of Tachov/ has a side length of c. 10 m /unpublished/, the preserved part of one of the two redoubts representing advanced components of fortification of the town of Litoměřice /of 1639?/ displays a side length of at least 14 m /Ankert 1925, 54/ and the side lengths of a redoubt with bastions of the beginning of 17th century at the Soumarský-most /district of Prachatice/ vary between 25.5 m and 29.5 m /Fröhlich 1986, 294/. A redoubt built by the French army in 1742 as an advanced fortification of the town of Písek - which, in fact, could have represented a re-used redoubt of 1619 - had sides some 30 m long /Fröhlich 1987, 25-26/. One of the eight redoubts, completing the fortifications of a winter camp of the Swedish general Banner by the town of Stará-Boleslav /district of Praha-východ/ and dating from 1639, displayed a side length of 42 m /Irma 1933, 41-44/.

Half-redoubt

This term denotes a type which is morphologically closest to a 90° redan the wing ends of which adhere to the fortification line and which is closed on the rear with the exception of an entrance./Fig. 2/5/. No case in which this type would turn up independently as a simple three-cornered redoubt and it seems that a redan

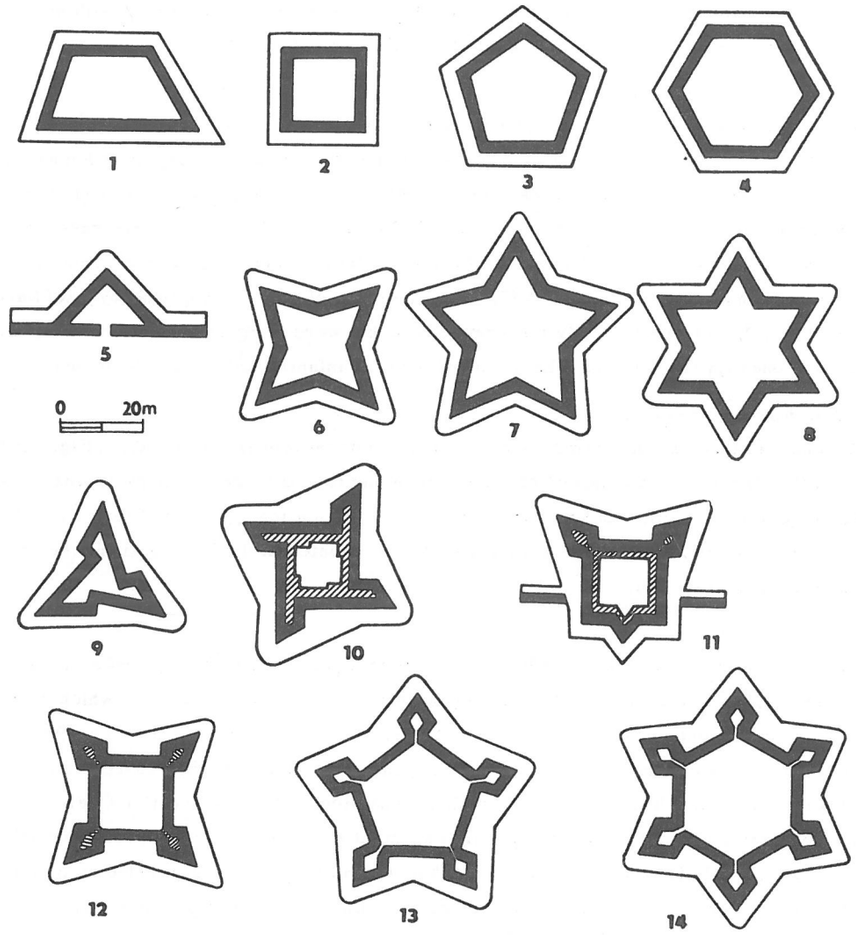

Fig. 2 - closed fortifications. 1 - a trapezoidal redoubt /Schwinck 1856, Pl. III Fig.52/, 2 - a square redoubt /ibid. Pl III Fig. 42/, 3 - a pentagonal redoubt /according to Christoph Greutter, siege of České-Budějovice in 1619, in: Bohatcová 1966, Fig. 13/, 4 - a hexagonal redoubt /ibid./, 5 - a half-redoubt /after Naronowicz-Naroński, in: Nowakowa-Nowak 1957, 150/, 6 - a four-rayed star-shaped redoubt /ibid./, 7 - a five-rayed star-shaped redoubt /Schwinck 1856, Pl. III Fig. 44/, 8 - a six-rayed star-shaped redoubt /after Naronowicz-Naroński, in: Nowakowa - Nowak 1957, 150/, 9 - a three-cornered redoubt with half-bastions /Schwinck 1856, Pl. III, Fig. 49/, 10 - a square redoubt with half-bastions /ibid. Pl. III Fig. 50/, 11 - a bicorn: a square redoubt with bastions in front corners and with a half-redoubt at the rear /after Naronowicz-Naroński, in: Nowakowa - Nowak 1957, 152/, 12 - a square redoubt with bastions /Schwinck 1856, Pl. III Fig. 48/, 13 - a pentagonal redoubt with bastions /after Naronowicz-Naroński, in: Nowakowa - Nowak 1957, 40/, 14 - a hexagonal redoubt with bastions /ibid. 41/. - Zavřené fortifikace. 1 - trapezoidní reduta /Schwinck 1856, tab. III, fit. 52/, 2 - čtvercová reduta /tamtéž, tab. III, fig. 42/, 3 - pětiúhelníková reduta /dle Christopha Greuttera - obležení Českých Budějovic 1619, in: Bohatcová 1966, obr. 13/, 4 - šestiúhelníková reduta /tamtéž, 5 - půlreduta /dle Naronowicze-Naroňského, in: Nowakowa - Nowak 1957, 150/, 6 - čtyřcípá hvězdicovitá reduta /tamtéž, 7 - pěticípá hvězdicovitá reduta /Schwinck 1856, tab. III, fig. 44/, 8 - šesticípá hvězdicovitá reduta /dle Naronowicze-Naroňského, in: Nowakowa - Nowak 1957, 150/, 9 - třírohá reduta s půlbastiony /Schwinck 1856, tab. III, fig. 49/, 10 - čtvercová reduta s půlbastiony /tamtéž, tab. III, fig. 50/, 11 - rohy: čtvercová reduta s bastiony v čelních rozích a půlredutou v týlní straně /dle Naronowicze-Naroňského, in: Nowakowa - Nowak 1957, 152/, 12 - čtvercová reduta s bastiony /Schwinck 1856, tab. III, fig. 48/, 13 - pětiúhelníková reduta s bastiony /dle Naronowicze-Naroňského, in: Nowakowa - Nowak 1957, 40/, 14 - šestiúhelníková reduta s bastiony /tamtéž, 41/.

was used instead of it. There is a question how far this term is applicable to a variant with an opened rear side which appears frequently in iconographical sources /Fig. 3/5, 6, 7, 9/.

Star-shaped redoubt /Sternschanze/

Works of military theoreticians and iconographical sources give evidence of four-, five- and six-rayed star shapes /Fig. 2/6, 7, 8/. These were used as independent strong points. Four-rayed redoubts are known from the depictions of the siege of Budyšín/Bautzen of 1620 by Pieter Isselburg /Bohatcová 1966, Fig. 48/ or of the Prussian siege of Prague of 1757 /Kašička - Nechvátal 1985, Fig. 45/. A six-rayed redoubt - an advanced town fortification - has been documented by Václav Hollar on an image of the conquest of Oppenheim by the Swedish army in 1636 /Richter 1977, 91/. The plans of field encampments by Josef Naronowicz-Naroński /Fig. 3/1, 3/ indicate that only four-rayed redoubts were integrated into fortification complexes. The abovementioned types could again have served both for infantry and for gun batteries.

Redoubt with half-bastions

Only two types are mentioned by the military theoreticians - a three-cornered redoubt /Fig. 2/9/ and a square redoubt /Pl. II/10/. In the cases of redoubts which had five and more corners it was more advantageous to integrate whole bastions into the corners. These fortification types could have served as a combination of an infantry fortification with positioning a battery situated in the half-bastions the inner areas of which were dumped full of earth.

Redoubt with bastions

One of the most popular types is constituted by a square redoubt of an ideal shape, employed as a combined fortification /Fig. 2/12/. The redoubt at Soumarský-most /district of Prachatice/, to which reference has already been made, represents a variant with two bastions in opposite corners /Fröhlich 1986, 294-295/. A redoubt with four bastions seems to have been most popular in the iconographic sources and treatises of the military theoreticians. Much as the redoubts with half-bastions, such fortifications were erected in the vicinity of more extensive complexes at strategically important spots, e.g. for the protection of a double pontoon bridge across the Labe/Elbe river, assembled by the Swedish army commanded by Gustav Adolf by the Werben military encampment in 1631 /Langer 1978, 74/. During the siege of Pasov/Passau in 1626, a bridge across the Danube river was even protected by redoubts at both banks /Langer 1978, 116-117/. Redoubts with bastions having five and more corners are known from military-theory texts only /Fig. 2/13, 14; no evidence from other sources is available up to now.

Bicorn and crown

Much as the open types, the closed types of bicorn and crown may be integrated into extensive complexes; it even seems that this happened much more frequently. The abovementioned bicorn variant in the form of a square redoubt with two bastions in the front and a half-redoubt at the rear /Fig. 2/11/ assumes the position protecting two entrances into a field encampment in the middle of its longer side, and thus in one of the strategically most important segments of the whole complex, on a plan by Naronowicz-Naroński /Fig. 3/1/.

Fortified encampments

I use this popular term for the functional interpretation of closed complexes. The best and most numerous examples of fortified encampments are known from the 17th century and it seems that in the course of the following century, enclosing the encampments by impressive fortification systems gradually fell out of use. Both fortified and open military encampments may be divided - resorting to terms used for medieval structures - into field camps and siege camps, differing in size and inquantitative and qualitative representation of individual types in the fortification complex.

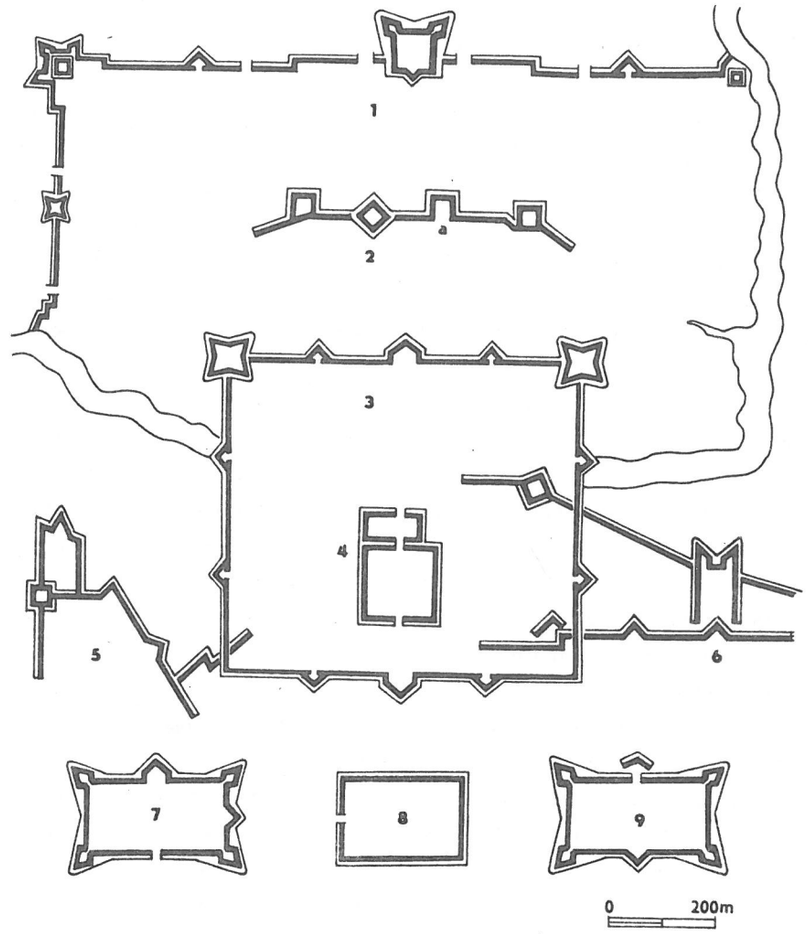

Fig. 3 - fortified encampments. 1 - a field camp of the Polish army /after Naronowicz-Naroński, in: Nowakowa - Nowak 1957, 160-161/, 2 - possibilities of integration of redoubts and a rectangular bastion /2a/ into the fortification line /after Christoph Greutter, siege of České-Budějovice in 1619, in: Bohatcová 1966, Fig. 13/, 3 - a field camp for 8,000 soldiers /after Naronowicz-Naroński, in: Nowakowa - Nowak 1957, 176/, 4 - a commanding post of Gustav Adolf in a field camp at Werben on the Labe river 1631 /Langer 1978, 74/, 5 - part of the fortification of a field camp at Air-sur-la-Lys of 1641 - a crown integrated into the fortification line with an incorporated redoubt /after Pieter Snayers, in: Trevor-Roper 1968, 155-156/, 6 - a part of the main fortification line of the same camp with half-redoubts, a flanking break and a redan to which a bicorn connected by an advanced line with a redoubt is joined /ibid./, 7 - a siege camp with corner bastions and with a bastion and half-redoubt in the side centres /after M. Merian, siege of Casale of 1646, in: Kočí - Čechová - Janáček 1974, Fig. 4/, 8 - a siege camp without flanking elements /after Halbmayern - siege of Plzeň of 1618, in: Bohatcová 1966, Fig. 12/, 9 - a siege camp with corner bastions, a half-redoubt at the centre of the longer side and with an entrance protected by a redan /after M. Merian senior, siege of Plzeň of 1618, in: Bělohlávek 1965, 205/. - Opevněná ležení. 1 - polní ležení polského vojska /dle Naronowicze-Naroňského, in: Nowakowa - Nowak 1957, 160-161/, 2 - možnosti zapojení redut a pravoúhlé bašty /2a/ do linie fortifikace /dle Christopha Greuttera - obležení Českých Budějovic 1619, in/ Bohatcová 1966, obr. 13/, 3 - polní ležení pro 8000 vojáků /dle Naronowicze-Naroňského, in: Nowakowa - Nowak 1957, 176/, 4 - velitelské stanoviště Gustava Adolfa v polním ležení u Werbenu na Labi 1631 /Langer 1978, 74/, 5 - část fortifikace polního ležení u Air-sur-la-Lys z r. 1641 - koruna zapojená do linie opevnění se včleněnou redutou /dle Pietera Snayerse, in: Trevor-Roper 1968, 155-156/, 6 - část hlavní linie fortifikace téhož ležení s půlredutami, flankovacím lomením a redanem, k níž jsou připojeny rohy, propojené předsunutou linií s redutou /tamtéž/, 7 - obléhací ležení s nárožními bastiony a bastionem a půlredutou uprostřed stran /dle M. Meriana - obležení Casale 1646, in: Kočí - Čechová - Janáček 1974, obr. 4/, 8 - obléhací ležení bez flankovacích prvků /dle Halbmayerna - obležení Plzně 1618, in: Bohatcová 1966, obr. 12/, 9 - obléhací ležení s nárožními bastiony, půlredutou uprostřed delší strany a vchodem, chráněným redanem /dle M. Meriana st. - obležení Plzně 1618, in: Bělohlávek 1965, 205/.