Locating, Excavating and Reconstructing the Ramparts of Zrínyi-Újvár

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The remains of Zrínyi-Újvár are located on the border of Somogy and Zala Counties (between the settlements of Őrtilos and Belezna), at the north end of Szent Mihály Hill stretching parallel with the Mura in Őrtilos. The exact location of the fortress has been debated until recently by historians. Many of them located it on the right bank of the Mura in today's Croatia,[1] while Hungarian historians believed to have found it on the left bank of the river, on Szent Mihály Hill in Őrtilos.

A military engineer sketch from the legacy of Pál Esterházy represented a considerable step forward in the question above. With this sketch, cartography historian Pál Hrenkó identified the possible location of the fortress,[2] which was confirmed by László Vándor based on late medieval pottery shards discovered during the field survey of the site.

A site plan annexed to *Mars Hungaricus* by Pál Esterházy and a sketch drawn by Montecuccoli during the siege provided useful data for the layout of the fortress. Of these, the map issued by Esterházy yielded the most useful clues for the location of the bastions, the ditch, the ravelin in the ditch, the two buildings within the fortress and the well.

The uncertainties were primarily caused by the large-scale destruction of the fortress, also described by contemporaries, as well as the defensive earthwork built against Yugoslavia in the 1950s. The involvement of battlefield researchers in the investigations and the results of instrumental surveys around the fortress considerably helped eliminate the uncertainties.[3]

A group of faculty members and students at the Zrínyi Miklós University of National Defence, the Section of Battlefield and Conflict Archaeology at the Hungarian Association of Military Science, and the Institute and Museum of Military History formed a joint research team, which (supported by the Directorates of Somogy and Zala County Museums and the Mayor's Offices of Belezna and Őrtilos) endeavoured to identify the traces of the 1664 siege of Zrínyi-Újvár.

The question was finally decided by battlefield exploration, geophysical surveys and archaeological research carried out at the site. They demonstrated that the previous localisation based on historical data and the results of field-walking was appropriate.

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1 *Petric–Feletar–Feletar* 2001.

2 *Hrenkó* 1979. 131.

3 A detailed research history of the fortress is found in our monograph published in 2012: *Hausner–Padányi* 2012.

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Investigations in the territory of the former fortification system of the fortress

The exploration of the fortress and the siege area represent a complex archaeological issue, which is partly due to the size of the area covering nearly 20,000 m², the dense vegetation and the rugged terrain. Our experience, so far, shows that the inner bailey at the heart of the fortress offers favourable conditions for excavations, whereas the extensive area of the siege can be surveyed with metal detectors. In the case of the system of fortifications stretching between the two areas, the research method to be used was not so obvious. Cutting through the rampart can provide information about its structure. As a preparation for this, in 2007, we examined one of the cross-sections of the rampart by drilling holes in it. As a result of this, we found that in the case of the ramparts, the changes were not only caused by destruction, but also by subsequent constructions on the top of it, mainly caused by fortification work in the 1950s. This factor further complicates the difficult task of investigating the rampart, because the earthwork – being of fundamental importance for the fortress – was destroyed by the Ottomans after the end of the siege, according to contemporary sources.[4] The contours of the levelled rampart can be still observed today, but it is unknown if there are any remains of the timber structure. As the area is covered with a forest, it is not possible to use earth-moving machines. Consequently, the rampart can only be cut through with manual tools. This entails digging an approximately fifty-metre-long trench, with a depth of five metres at some places. It will reveal the stratigraphy of the rampart, but there is no guarantee that traces of the timber structure will also be discovered. For the reasons above, the excavation of the rampart was postponed to a later date.

Evliya Çelebi wrote the following about the fortifications of the fortress: "The posts were dug into the ground in a row, and the earth filling was strengthened in a Khorasan [style] with lime, which swallowed up thousands of human-head-sized balls fired from balyemez cannons night and day, as if it had been honey."[5] Since our research team obtained deep seeking metal detectors in 2010, we had the opportunity to explore metal objects lying in greater depth. The search of cannonballs hidden in the ground in the area of the fortifications was formulated as a possible research objective, the importance of which is that the composition of Ottoman siege artillery can be determined on the basis of the projectiles.

During the survey, we used Lorenz Deepmax X6[6] deep search metal detectors made in Germany and ORION[7] metal detectors developed in Hungary, equipped with a 1 × 1 m frame antenna. According to the manufacturer's data, the instruments are able to detect metal objects of approximately 100 cm² up to 1.5 metres depth below the ground level, which corresponds to the size of the cannonballs sought for by us. It is a favourable property of the instruments that they do not sense small metal objects near the ground surface, which makes work more efficient. Over time, we improved our working methods, as well. At places where the frame of the metal detector gave a strong signal, we first removed the upper, 10 to

4 *Pál Esterházy:* Mars Hungaricus. See page 293 of the present volume.

5 *Evliya Çelebi:* Book of Travels. Translated into Hungarian by *Balázs Sudár*. For the English translation see pages 310–311 of the present volume.

6 www.metaldetectors.de/uk/products_deepmax_x6.htm (Accessed: 17 February 2014.)

7 www.metaldetector.hu/orion.html (Accessed: 17 February 2014.)

20 cm thick layer of the soil. If the signal strength did not change, that is, if the signal was not caused by scrap metal items buried in the soil, we marked the spot and used a less sensitive GARETT 2500[8] metal detector with a 20 cm diameter search head to screen the ground. If it did not give any signals, the metal object was certainly buried deeper than 80 cm. In other cases, the display of the GARETT showed the size and location of the target object. Afterwards, we started to remove the soil, but we dug only a narrow trench – approximately 25–30 cm in diameter – towards the object to minimise the destruction of the soil structure caused by the digging. From time to time, we refined the position of the metal object with the search head of the GARETT. If we identified the centre of the signal properly, the signal had to become stronger and stronger. We used the GARETT Pro Pointer in the final phase of the search, which gave signals only when the target had been approached to within a few centimetres. After the extraction of the cannonball, we measured the depth of the object, and recorded the coordinates of the spot with a GPS.

As a result of the search, several cannonballs were detected, which formed two groups. They could be distinguished by their size – weighing 12.5 kg and 14 kg – and also by the place of their discovery. The balls of different sizes were found in two groups, far apart from each another. This phenomenon can be interpreted in a way that the siege guns were primarily targeted at the artillery of the defenders. Since in forts with earth-filled bastions the cannons primarily stood on the bastions, this finding represents an important progress in investigation of fortresses, as the place of the bastions can be determined from the location of the fired cannonballs. By mapping the finds, we were able to pinpoint the presumed sites of two bastions.

The other assumption was based on the relative position of the balls. We observed that the group of seven balls weighing 12.5 kg were found along a straight line. From this, we – erroneously – inferred that this straight line points in the direction of the siege guns. In the current state of the area – being a gradual upward slope – this seemed logical, but we did not take into account that the balls hitting the façade of a 5 to 6 m high rampart would not be buried at a variable depth forming a straight line when viewed from above. In reality, this could have happened if the gun had been brought closer and closer to the fortress, and the balls had been fired from roughly the same lane. It was only later that we found out the real reason for the scatter of cannonballs along a straight line.

In the spring of 2011, when screening the area with a deep search metal detector, we discovered the empty shell of an iron hand grenade at the bottom of the slope, in the continuation of the group of 12.5 kg bullets. From the aspect of the research, this was one of the most important discoveries. Fortunately, due to its size of 7–8 cm diameter, it was large enough for the detector to sense it at a depth of 50 cm.[9] In such depths, a metal object of this size can also be detected with a GARETT 2500 primarily used for screening the siege area. However, because the area of the rampart was scattered with a lot of scrap iron owing to former agricultural cultivation, this instrument was not used there in itself, but only as a complement to the deep search detector.

During the extraction of the find, we found that the clay around it was hard, red and had patches burnt black. We observed a similarity with the burnt layers of the courtyard of

[8] www.garrett.com/hobbysite/hbby_gti2500_key_features.aspx (Accessed: 17 February 2014.)

[9] It is nearly at the bottom of the perceptible surface, so minor objects are not observed by the deep search metal detector.

the fortress. Since we had previously determined that one of the bastions must have been there, we assumed that the burnt remains of the timber structure were covered with the soil. When identifying the feature, we took into account the assumption that the timber structure of the rampart was destroyed by the Ottomans by setting it on fire. When the timber structure filled with earth and the palisade burnt down, erosion made the earth spread out. However, at the bottom of the rampart, parts of the burnt timber structure could remain, since the sliding earth covered them and protected them from destruction. On the basis of a burnt mark found in a 30 × 30 cm pit, this was certainly a bold conclusion, as the burnt clay could get there for many other reasons. Since the archaeological excavation of the rampart was not sufficiently justified, we sought a different method to verify our hypothesis.

Geophysical surveys and evaluation of the results

Based on the results of former geophysical surveys in the area of the fortress, we decided to carry out a magnetometer survey. When surveying the courtyard, the magnetometer reacted very sensitively to the burnt layers. As the area is covered with a thick layer of burnt daub, no significant anomaly could be observed, even though some patterns were recognisable. In contrast, in the area of the earthwork – if our assumption is correct – there is only a relatively homogeneous earth filling in the vicinity of the burnt patch preserved at the base of the rampart, which can be interpreted as the material of the former rampart. So, ideally, the burn mark forms a straight line, which indicates the baseline of the external side of the rampart. Continuing this train of thought, we also considered possible that we would be able to precisely map the ground plan of the rampart due to the successful magnetometer survey.

The archaeological geophysical survey was conducted on 9 March 2012, by Béla Simon and Róbert Loki, co-workers of the Ecthelion Bt. based in Pécs, led by Gábor Bertók. They used a GSM 19 Overhauser magnetometer in a gradiometer configuration (0.01 nT resolution and 0.2 nT absolute accuracy).[10]

The steep slope of the surveyed area, the vegetation and the character of the expected features (presumably burnt structures) justified the use of the survey method, which was undertaken in a 0.5 × 0.5 m grid.

The survey area of 14 × 15 m was marked out on the slope of the presumed rampart, where we sought traces of the former palisade. The survey indicated significant anomalies compared to the 1–2 nT signals of undisturbed soil at two places *(Figure 17).* At the northern edge of the surveyed area, there is an approximately 2 m wide strip running transversely across the site, causing 15–20 nT signals, which is suggestive of a burnt feature. This seems to be confirmed by a burnt layer found at a depth of 50–60 cm during a metal detector search. Based on its shape and nature, it seemed conceivable that this anomaly indicated the remains of the defensive works.

We can see in the image displaying the magnetic anomalies that the distinctive band indicating the burned layer disappears after a while. This can be interpreted in a way that there are no burn marks in the upper parts, but a faint shadow may suggest that they are found at a greater depth here. Currently, there is a contiguous sloping hillside at this place,

[10] For further technical details see www.gemsys.ca/prod_overhauser.htm (Accessed: 16 February 2014.)

but originally the bastions projected outward from the curtain wall. The layer of earth spreading out at the feet of the bastions was the thickest over the lower part of the curtain wall, while towards the projecting structures, it got thinner and thinner. The base of the earthwork was almost at the same level, but compared to the height of the present hill, the former rampart was higher and narrower. The earth falling from its top formed the present hillside. Accordingly, it must be taken into account during the reconstruction that at the lower part of the hill (where the cover layer is 40–50 cm thick) there was an originally 5 to 6 m high rampart, and the height of the curtain wall at the base of the bastions was the same. At that place, the soil cover above the burnt layer may be up to 3–4 m thick.

On superimposing the map of cannonballs found during previous metal detecting surveys and the results of geophysical measurements, it became visible that the straight line formed by the cannonballs was parallel to the red band running at the base of the rampart. Our earlier assumption – namely that the linear scattering of cannonballs pointed towards the siege guns – had to be reconsidered, since cannonballs discovered at about the same distance from the presumed sidewall of the rampart suggest that they were fired at the long side of the palisade and penetrated into the rampart at approximately the same depth. Accordingly, the siege artillery unit was not set up along the extension of the marked line but, on the contrary, perpendicular to that. Taking into account the relief of the ground surface, a visibility test might (in principle) help us determine its location. Nevertheless, it should also be borne in mind that – according to Esterházy – the Ottoman siege cannons were placed on embankments, which were (with great likelihood) demolished later. Since we can roughly determine the place of the cannons, we can use the visibility test to estimate the height of the embankments of cannons.

The results of archaeological investigations – The first attempt to reconstruct the post structure of the spur bastion

Excavations started in the area of the fortress in 2010, under the supervision of László Vándor and László Költő, and with the participation of Gyula Nováki, Máté Varga and Balázs Polgár. Apart from an attempt at cutting through the rampart in 2006, this was fundamentally carried out at two locations before 2012, inside the fortress, and also outside, in its foreground. The excavations were supported by the National Cultural Fund of Hungary, the settlements of Belezna and Őrtilos, the Ministry of Defence, Institute and Museum of Military History, the Zrínyi Miklós University of National Defence (today National University of Public Service), the Directorate of Zala County Museums (Göcsej Museum), and the Directorate of Somogy County Museums (Rippl-Rónai Museum).[11]

Based on the results of the surveys, it was reasonable to excavate the place of the anomaly in the territory of the rampart in the summer of 2013. Our trench No. 2013/5 – that was about 1.5 m wide and about 2.5 m long – was marked out above the line of

[11] Researchers presented the results of complex investigations up to 2012 in a volume edited by Gábor Hausner and József Padányi (*Hausner–Padányi* 2012). For the archaeological finds, comprising mainly stove tiles, discovered in the place of the building that once stood in the courtyard of the fortress, and the structure of the building see *Vándor* 2012. 84–98.

the burnt rampart observed during the geophysical survey, in a way that the line of the anomaly shown by the magnetometric map would preferably be in the middle of the trench *(Figure 5).* During the excavation of the trench, we could observe the structure of a support system consisting of three rows of posts *(Figures 6–10).*

According to our observations based on the current results of the excavation, the earthwork (i.e. the bastions) had a structure consisting of two parallel rows of relatively thick posts with mainly circular cross-sections. The external row of posts was supported by thinner beams leaned diagonally against the posts. In some places, the vertical posts were placed (for unknown reasons) on horizontal planks or beams, which might have connected the two rows of posts. These planks ran either under the other row of posts or between the two rows of columns, serving as a support for the earth heaped up into the rampart and certainly rammed down.

Due to the lack of financial resources and the short period of time available to us, we were, unfortunately, not able to complete the excavation of the rampart. The inner structure of the rampart described above can, therefore, not be considered an accurate reconstruction. We only wanted to demonstrate one possible variant *(Figures 11–12).* Nevertheless, on the basis of this, it is still certain that the rampart was supported by a triple-row post structure. Inside of it, there must have been a cassette-like system formed by planks and beams running under or between the upright posts.

We still cannot tell with certainty what technique was used to erect the posts, either.[12] It is very likely that in this case (as in general) the pits of the posts or beams were not dug individually, but rather two ditches – or perhaps one common and, in this case, rather wide ditch – could have been dug, or (making use of the original differences of the terrain) narrow "terraces" were formed, and the posts were erected inside it – or, in the latter case, on it – and rammed down. Stability during construction and a better support of the earth was achieved through connecting the posts with planks. The reason for the use of the outer supporting row of posts is that the posts of the structure had to hold the mass of the earth filling of the bastion in a relatively high and steep slope.

The structures discovered, for example, at Barcs[13] (with a palisade made up of multiple rows of posts) and Marótpuszta[14] (with a single row of posts) provide good examples of placing posts into pre-dug ditches *(Figures 13a–b–14).* At the moment, it cannot be excluded either (because of the cannonballs hitting the rampart) that we found a section of the wall that had to be repaired during the siege.

Based on the conditions of the terrain and geodetic surveys, the detail of the fortification found in the excavation trench must be the base of the so-called spur bastion built between the north-eastern and south-eastern bastions. Locally, it can be the east–west-oriented section connected to the south-eastern bastion *(Figures 15–16).*

We did not put the soil back into the trench, but we tried to cover it safely for the next excavation season. We wish to extend the trench westwards to find the edge of the presumed ditch of posts and the inner row of posts. We are going to make longitudinal and transverse sections in order to reconstruct the post structure more accurately. We also hope that we will be able to follow the results of the new magnetometric surveys and, thus, determine

[12] For the building methods of palisades see *Tolnai* 2011. 15–23.

[13] *Kovács–Rózsás* 1996. 163–182.

[14] *Költő–Dobó* 2004. 237–255.

the position of the discovered part of the rampart (bastion) in relation to contemporary depictions.

Summary

The process outlined above is only an interim result of the investigations that have been carried out in the territory of the fortress for several years. In the case of a defensive facility, however, the excavation of the ramparts represents one of our most important tasks. This can be achieved by excavating the entire area (about 600–700 m²), but, in this case, only manual force could be applied due to the vegetation and the rugged terrain.

In the process presented above, the search of cannonballs with the proper application of various research methods, the evaluation of interim results and the formulation of new tasks led to the excavation of the rampart. Based on the evaluation of the observed phenomena, new hypotheses had to be made, and during the related research, appropriate methods and tools had to be adopted. In this way, we were able to achieve spectacular results with less energy input and slight disturbance of the area.

The archaeological excavations in 2013 confirmed that a group of cannonballs and a linear anomaly detected by a magnetometer show the place of the ramparts of the fortress. Accordingly, in November 2013, another survey was carried out in the area, which resulted in the identification of a section of the western bastion *(Figure 18).* We are going to continue our investigation where the vegetation allows it. We hope that we will be able to identify the exact location of further parts of the rampart in the field. These results can be compared with the depictions of contemporary military engineer sketches and may serve as a basis for the reconstruction of the fortification system of the fortress.

Figure 1.
Preparations for the survey
Source: picture made by the authors

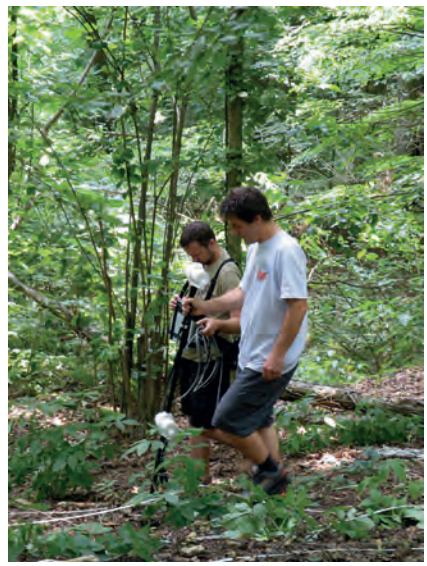

Figure 2.
Magnetometer surveying
Source: picture made by the authors

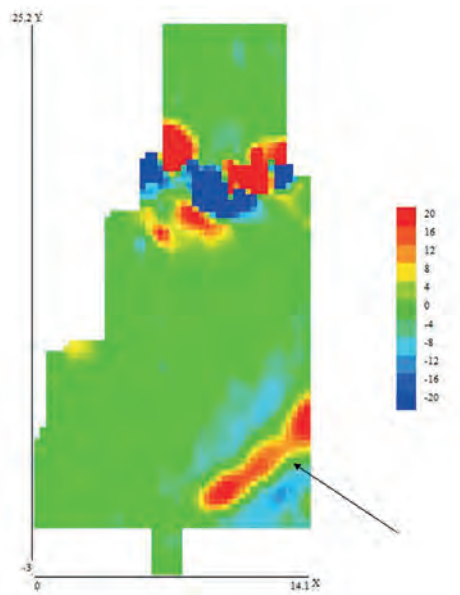

Figure 3.
The line of the burnt down fortification on the magnetometer map
Source: picture made by the authors

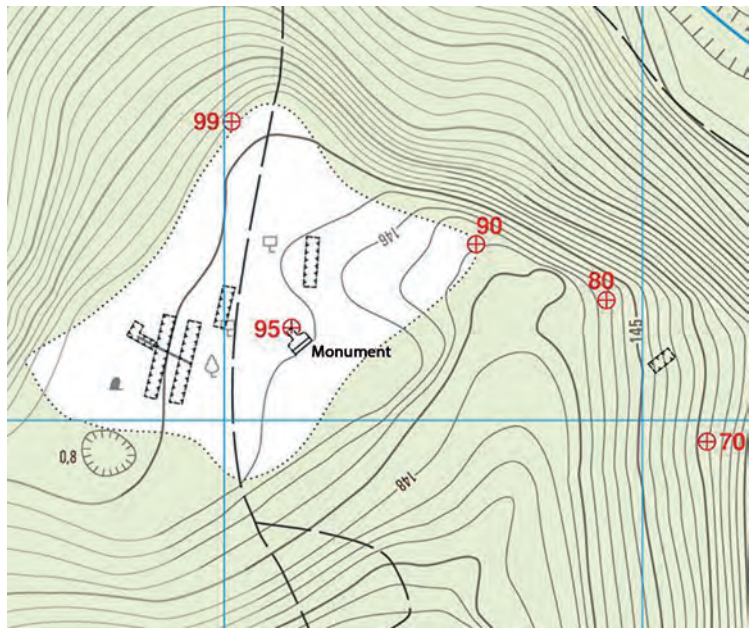

Figure 4.
Trenches of the excavation in 2013
Source: picture made by the authors

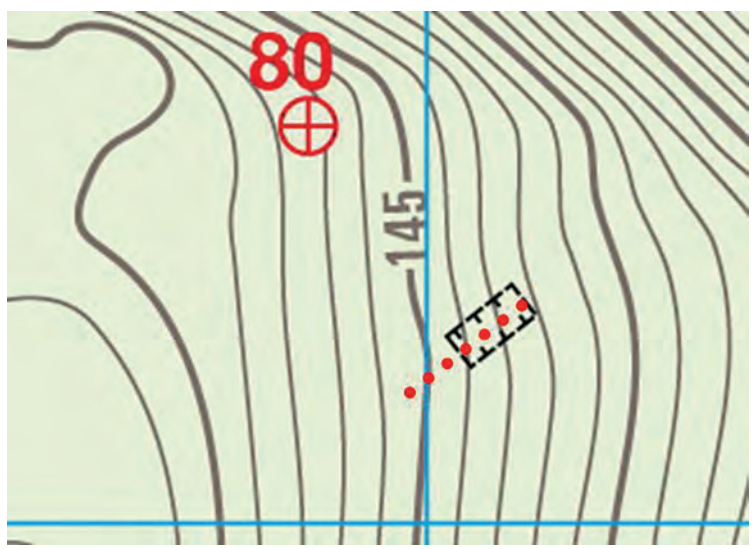

Figure 5.
Trench No. 2013/5 above the rampart detected with geophysical survey
Source: picture made by the authors

Figure 6.
The structure of the burnt down rampart during excavation (from the south)
Source: picture made by the authors

Figure 7.
The uncovered structure of the burnt down rampart (from the north)
Source: picture made by the authors

Figure 8.
The uncovered structure of the burnt down rampart (from the east)
Source: picture made by the authors

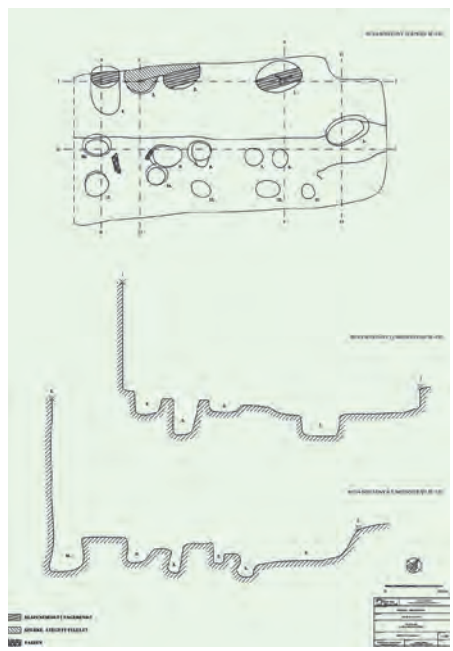

Figure 9.
Drawings of the structure of the rampart, Trench No. 2013/5
Source: Drawings of the ground plan and section walls by Edit Ambrus and Zsolt Nyári

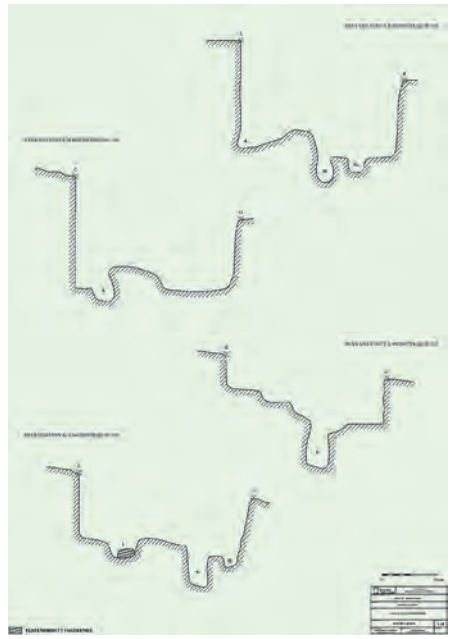

Figure 10.
Drawings of the structure of the rampart, Trench No. 2013/5
Source: Drawings of the section walls by Edit Ambrus and Zsolt Nyári

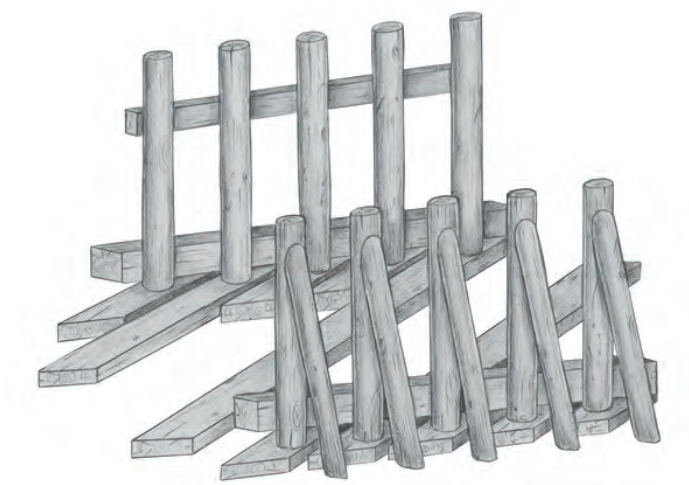

Figure 11.
A possible reconstruction of the post structure of the rampart
Source: drawn by Zsolt Nyári

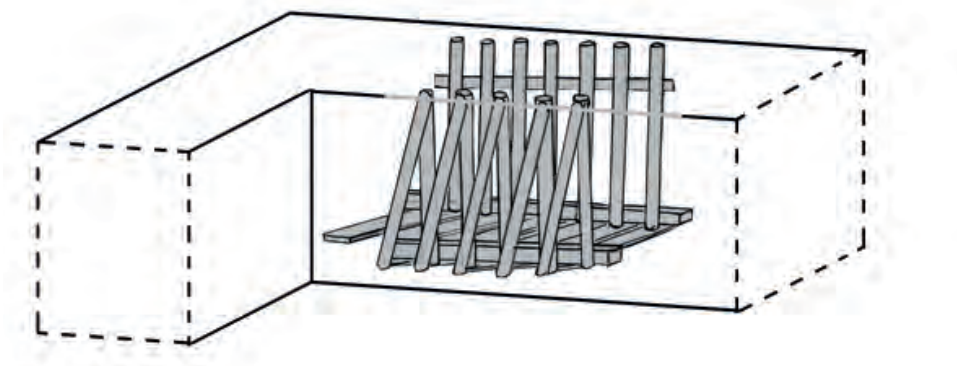

Figure 12.
The position of the post structure within the earthwork
Source: drawn by Zsolt Nyári

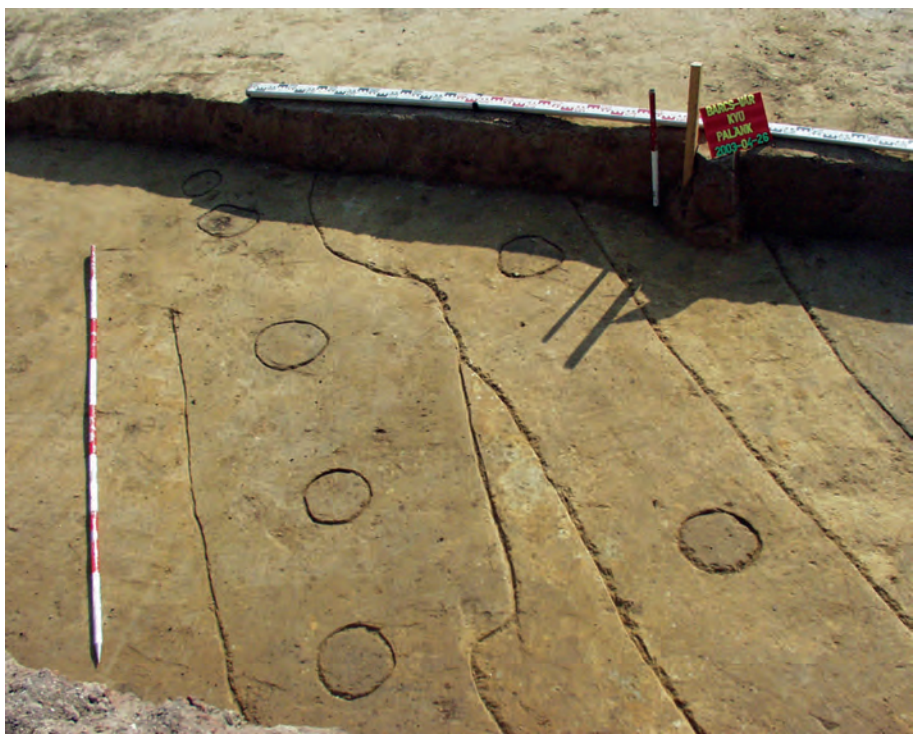

Figure 13a.
The ditch made for the multiple rows of posts of the rampart at Barcs
Source: picture made by László Költő

Figure 13b.
The section of the post rammed around can be seen well in the post ditch
Source: picture made by László Költő

Figure 14.
The north-eastern bastion of the fort of Marót (today Morović, Serbia) with the row of posts of the palisade connected to it
Source: picture made by László Költő

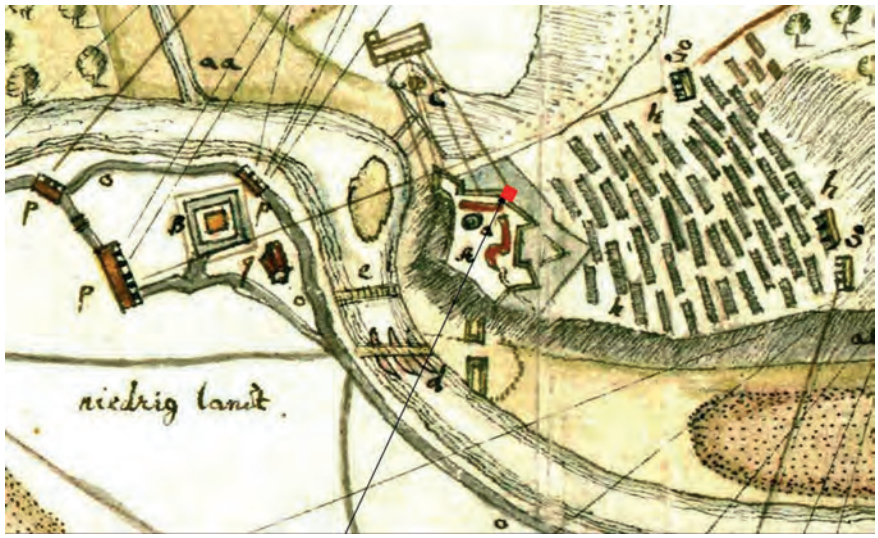

Figure 15.
Probable location of the discovered part of the rampart on the contemporary Esterházy map
Source: compiled by the authors

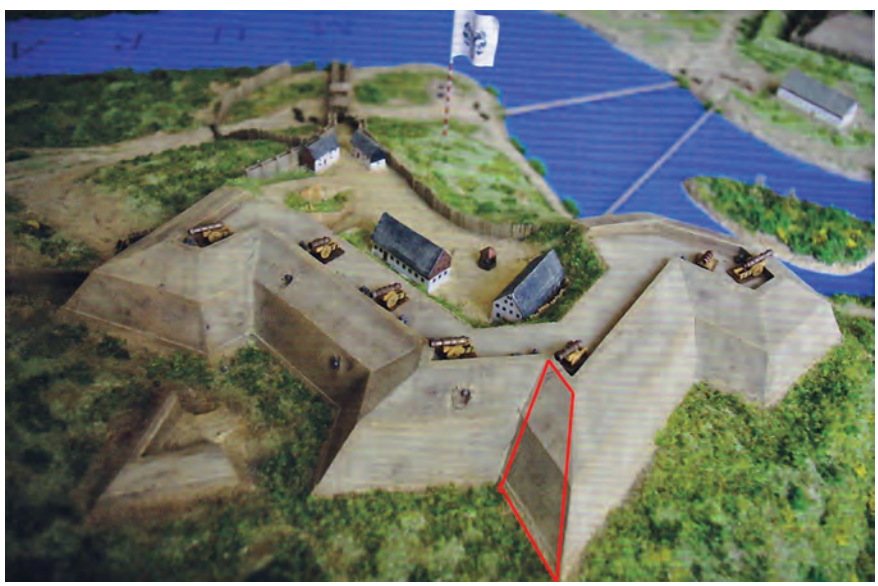

Figure 16.
Probable location of the discovered part of the rampart on the model built by the modellers of the Zrínyi Miklós University of National Defence
Source: compiled by the authors

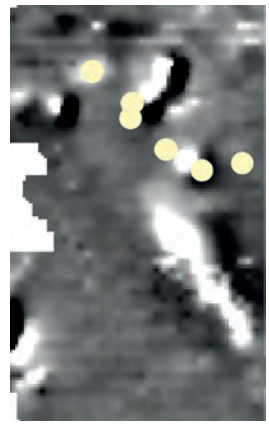

Figure 17.

The scattering of cannonballs over geophysical anomalies

Note: A white line starting in the lower right corner indicates the external side of the rampart. The cannonballs (white circles) penetrated into the rampart 2 m deep on average.

Source: compiled by the authors

Figure 18.

Results of a geophysical survey carried out in November 2013

Note: A part of the western bastion can be seen in the upper left corner.

Source: picture made by the authors