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AERIAL ARCHAEOLOGY AND SETTLEMENT RESEARCH

Examples from the Early Iron Age in Northern Transdanubia

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This paper discusses the results of the aerial archaeological research of Early Iron Age settlements in Northern Transdanubia. The eastern, mountainous area is more difficult to explore, thus we can only talk about some aspects of the detailed research of two fortified settlements (Süttő, Százhalombatta). By comparison, detailed photomaps were made of the settlements in the western part, where cropmarks help in identifying archaeological sites. Intensive excavation activities have been conducted for three decades in the flat NW region, which is split between three countries and dominated by the river Danube and its tributaries. Several studies covered the topic of Early Iron Age settlements in this area and the topographical knowledge gained from the researches helps in interpreting the information from the aerial photographs.

INTRODUCTION

Aerial archaeological reconnaissance takes traditionally a diachronic approach, meaning that despite it has goals concerning the research of periods and phenomena (e.g. prehistoric fortifications, Neolithic circular enclosures, etc.), the primary task is to document accurately the archaeological sites discovered during flights. We based our archaeological prospection on this idea that was also the premise of the research methods of *I. Kuzma* (*2007*), *R. Goguey* and *M. Szabó* (*1995*), *O. Braasch* (*2003*) and *M. Doneus* (*2013*). Even the comprehensive archaeological research of extensive sites such as the ripa Pannonica (*Visy et al. 2011*) resulted in the identification of several archaeological sites from other periods (cf. *Szabó 2016*).

The material piling up in the archives for decades, however, provides an opportunity to evaluate certain periods and some types of archaeological features. In former studies (*Czajlik 2021*; *Winkler/Czajlik 2018*), we analysed the aerial photos of the Early Iron Age burial mounds and their surroundings, but the aim of this paper is to examine the data collected of the settlements that are from the same period. Most of the aerial photography data gathered during our own researches, but we also tried to include Slovakian, Austrian and other Hungarian prospection results in our paper.

GEOGRAPHICAL BACKGROUND OF THE AERIAL ARCHAEOLOGICAL MAPPING IN NORTHERN TRANSDANUBIA

The investigated area can be divided into regions based on their different geographic characteristics (Fig. 1). From east to west, the first major region is NE Transdanubia, a mountainous/hilly area stretching from the southern edge of the Buda Hills to the western part of the Gerecse Mountains. The region is defined by the Gerecse, Visegrád, Pilis Mountains and the Buda Hills – with the larger Zsámbék basin separating them. On the northern and eastern edge, the Danube forms a natural border, while in the south and the west the flatlands and in the south-west the very similar Transdanubian Mountains start. Although the mountains are not high, due to the soil conditions and the variety of terrains they are used

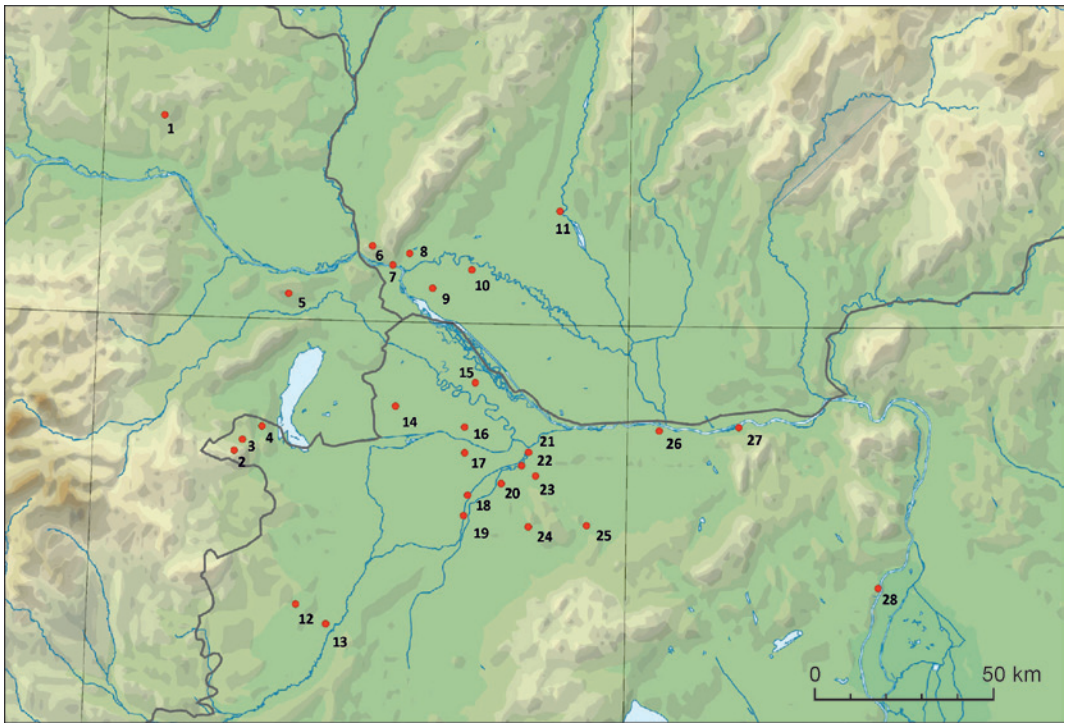


Fig. 1. Northern Transdanubia and the adjacent areas with the Early Iron Age archaeological sites mentioned in the study. 1 – Grossmugl (A); 2 – Sopron-Várhely (HU); 3 – Sopron-Krautacker (HU); Fertőrákos-Kőhidai-dűlő (HU); 5 – Göttlesbrunn (A); Bratislava-Panské (SK); 7 – Bratislava-Dúbravka (SK); 8 – Trnávka-Pri majeri (SK); 9 – Dunajská Lužná (SK); 10 – Dolné Janíky (SK); 11 – Sereď (SK); 12 – Vát-Bodoni-tábla (HU); 13 – Ikervár-Pinkóci-dűlő (HU); 14 – Jánossomorja (HU); 15 – Darnózseli-Parázsszeg (HU); 16 – Lébényszentmiklós-Magasmart (HU); 17 – Bezi-Faluhelyi-dűlő (HU); 18 – Bodonhely (HU); 19 – Árpás-Megág-dűlő (HU); 20 – Koroncó (HU); 21 – Győr-Kálvária-domb (HU); 22 – Győr-Ménfőcsanak (HU); Győrújbarát (HU); 24 – Kajárpéc-Pokolfa-domb (HU); 25 – Tápszentmiklós (HU); 26 – Komárom (HU); 27 – Süttő (HU); 28 – Százhalombatta (HU). Author Z. Czajlik and Á. Marton

mostly for forestry, with vineyards and orchards on the gentler slopes. The landscape character changes to agglomeration close to Budapest. This makes aerial prospection more difficult, because only a few, isolated areas are under arable cultivation, with the exception of the Zsámbék basin. (We know the region's geographical characteristics and the majority of the Early Iron Age archaeological sites discovered there from E. Patek's study, which was published 40 years ago: *Patek 1982–1983*).

Between this mountainous/hilly region and the Rába interfluve lies the relatively flat area of the Győr-Tata terrace region, intersected by the streams flowing into the Danube. Farther west, the northwestern part of the Carpathian Basin is very diverse in terms of both topography and hydrography. This is where the edge of the Eastern Alps (Sopron Mountains) meets the Little Carpathians, but the Leitha Mountains, the Zobor Mountain, and the Sokoró Hills all play an important role in forming the geographic boundaries of the region and dividing it into smaller areas. The two largest of the latter are the alluvial plains of Rába interfluve and Žitný ostrov, but basins (Fertő-Hanság and Vienna Basin) were formed on both sides of the Leitha Mountains as well. The Danube River determines the hydrographical system of the region, as it enters the Carpathian Basin here. After reaching Devín Gate before Bratislava (Porta Hungarica), the river splits intro three main branches (Moson-Danube, Danube, and Little Danube) and takes on the waters of Leitha, Rába, Váh and their tributaries. Numerous lakes were formed on the alluvial areas, Lake Fertő being the largest of them. The swamps of these areas have mostly been drained, however they certainly played a key role in the Prehistoric period, as well as the extensive floods that characterized the entire Holocene, even the historical ages (*Czajlik et al. 2011*).

With the exception of the mountain zones (Sopron Mountains, Little Carpathians, Leitha Mountains, Zobor Mountain) and the former marshlands, which are still unsuitable for cultivation despite drainage, the entire northwestern region is heavily cultivated, thus creating ideal conditions for aerial reconnaissance. In the Hungarian part of the region, intensive field crop production is taking place, adapted to the alluvial areas. In certain years, especially in Rába interfluve, there are high-quality

cropmarks similar to other alluvial gravel fans. Experience has shown that periods of dry weather result in more and highly detailed cropmarks, while in wet years the area may become impossible to observe (*Czajlik et al. 2021*).

Three countries, Austria, Hungary and Slovakia share the northwestern part of the Carpathian basin. We know the results of the traditional topographic surveys done in the Bratislava zone (*Baxa 1991*), aerial photographs and ALS were used in the exemplary topographic mapping of the Leitha Valley and Leitha Mountains (*Doneus/Griebl 2015*). All these countries have famous Early Iron Age settlements but also sites that are only known through smaller excavations and field surveys. These archaeological sites still lack a unified mapping. Distribution maps were published by: *E. Patek* (*1982*) of the Sopron area, *U. Langenecker* (*1996*) of the area at Lake Fertő and the Leitha Mountains, *M. Griebl* (*2015*) of the Leitha region, *É. Ďurkovičová* (*2015*) of the northern part of Žitný ostrov and the foothills of the Little Carpathians and Attila Molnár of Northwestern Hungary and part of Austria all the way to the Leitha Valley (*Czigány/Molnár 2020*).

Excavated Early Iron Age settlements and aerial archaeology in NE Transdanubia and Győr-Tata terrace region

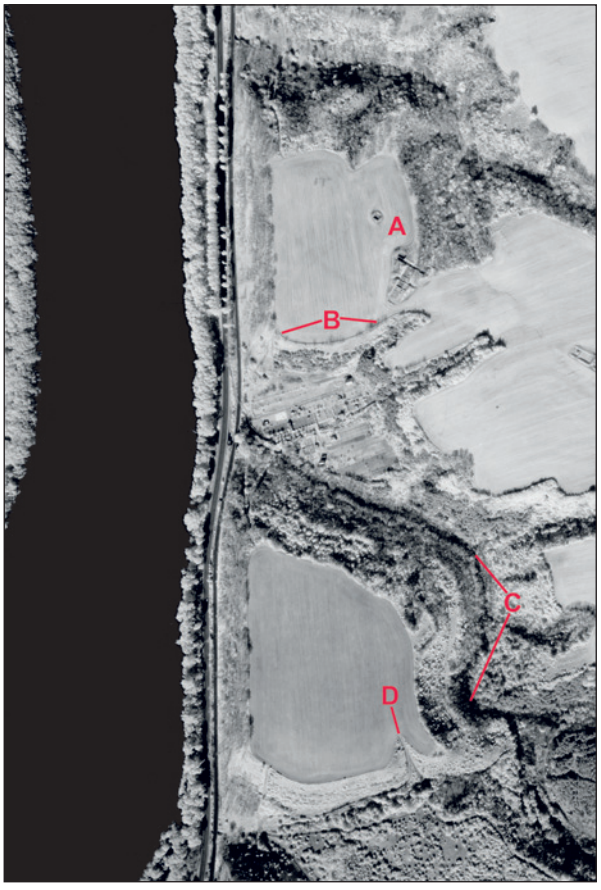


Fig. 2. Early Iron Age settlements to the west of Süttő. Part of the BW infra orthophoto (10th May 1987, https://www.fentrol.hu/hu/). Süttő-Nagysánctető, A – the excavations of G. Vékony; B – rampart (?) of the hilltop settlement (top). Süttő-Nagysánc, C – a natural ditch between the loess plateau and the hilltop settlement; D – gate (?) of the hilltop settlement (bottom).

Out of the Early Iron Age settlements identified topographically in NE Transdanubia, the best known are in Süttő (Fig. 2). Two hilltop settlements adjacent to each other were discovered there, namely Süttő-Nagysánc and Süttő-Nagysánctető. In the area of the latter, the region's most important Early Iron Age settlement excavation was taking place from 1979 (Fig. 2: A); however, we only have preliminary reports about it (*Vékony 1986*; *Vékony/Vadász 1982*). Following the train of thought in the study of G. Vékony, the settlement dates back to the HaC2/D1 period, and É. *Vadász* (*2003*, 112) accepts this conclusion as well. In the case of Süttő-Nagysánctető alongside the various settlement features, traces of an Early Iron Age fortification, more precisely of its gateway (gate?) were identified as well. It is difficult or even impossible to spot the fortification on the latest aerial photos, as the vegetation has become much thicker in the meantime. However, on the BW infra aerial photograph taken on 10 May 1987 for mapping purposes, it is still clearly visible. It is possible that the regular shaped rampart (?) is not entirely prehistoric (cf. Fig 2: B).

In the same photograph, we can easily spot the Early Iron Age hilltop settlement of Süttő-Nagysánc further to the west. The Danube and the erosion gullies caused by the fragmentation of the loess plateau provided a natural defence for the settlement (Fig. 2: C). In the past, fewer bushes covered the area and for this reason, the archive aerial photo shows the topographic position of the archaeological site much better than the new ones. The easiest to approach the settlement is from the southwest, the Early Iron Age gate (?) was also presumably built there (Fig. 2: D).

The topographic information we had previously on the Early Iron Age settlement in Százhalombatta was based on the investigation of the Bronze Age settlement (*Kovács 1963*; *Poroszlai 2000*; *Poroszlai/Vicze*

Fig. 3. Százhalombatta, aerial view of a part of the Bronze Age/Early Iron Age settlements to the north of the Iron Age fortification (19th June 2020). Photo Z. Czajlik.

2004). Thanks to the intensive researches conducted in 2018, which included aerial photography and magnetometer surveys, as well as surface collection, we were able to define the borders of the Early Iron Age settlement more precisely (*Czajlik et al. 2019*, 172, 173). In the aerial photos taken in June 2020, the settlement features are clearly visible in the winter crops. Most of them are filled-up pits; however, some of the larger cropmarks indicate sunken featured buildings (Fig. 3). Emphasising that part of the archaeological features discovered during the field survey set up over the area are definitely from the Bronze Age, there is a clear correlation between the cropmark and the Early Iron Age finds collected in the grid-system (Fig. 4).

During excavations in the Komárom zone, Early Iron Age archaeological features were identified at the *Brigetio canabae legionis* (Szőny-Dunapart) site (*Bartus et al. 2018*, 76). Although the region has been investigated from the air intensively and successfully for almost three decades, we do not know about other archaeological sites, which date undoubtedly back to the Early Iron Age. In 2000, O. Braasch documented the traces of burial mounds close to Tápszentmiklós (*Visy 2003*, 117). In the same site in 2006, we photographed the traces of even more mounds than what we had known of previously (*Czajlik/Tankó/Winkler 2007*, 122, 123). During the field survey across the mound traces slightly above surface, pottery fragments from both the Late Bronze Age and the Árpád period were collected, although the sherds from the latter period are irrelevant concerning the age of the mounds (*Visy 2004*). In the same zone, we discovered the traces of a large and – based on its shape and size – prehistoric settlement in 2005 (*Czajlik/Bödőcs 2006*, 155).

Excavated Early Iron Age settlements and aerial archaeology in NW Hungary and adjacent areas

Most of the Early Iron Age settlements in the Hungarian part of the region were discovered during the archaeological excavations related to the construction projects of the last decades. Previously the Sopron area, especially the hilltop settlement (*Patek 1982*, 120–132) and burial mounds (*Patek 1993*) of Burgstall, as well as the creek-side settlement and cemetery of Sopron-Krautacker (*Jerem 1981*; *1986*; *Schwellnus*

Fig. 4. Százhalombatta, the Bronze Age/Early Iron Age settlements to the north of the Iron Age fortification. A – combining the results of the rectified aerial photos (fig. 3); B – the field survey in grid system. Authors Z. Czajlik, R. Gergácz and L. Rupnik.

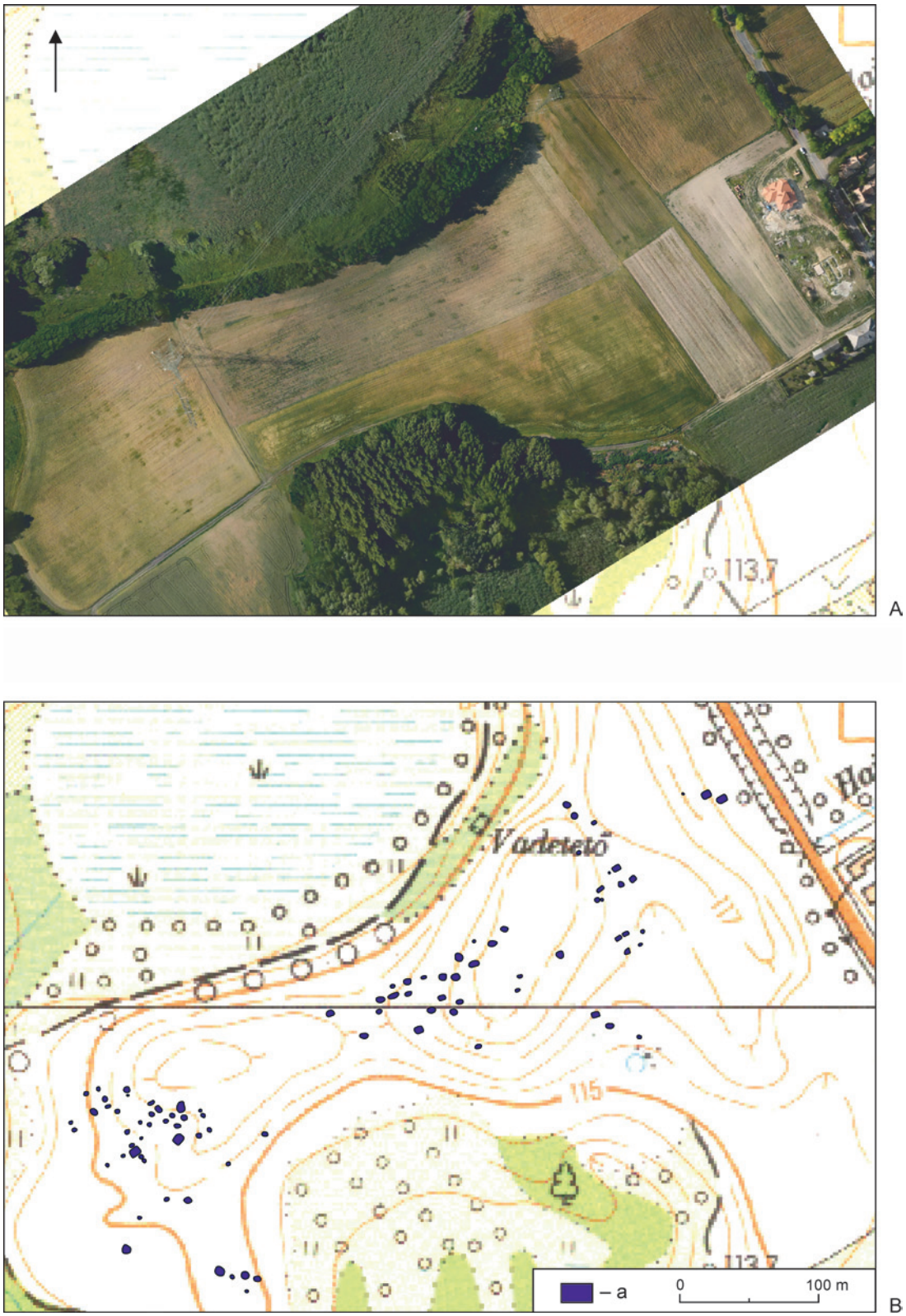


Fig. 5. Lébényszentmiklós-Magasmart. Early Iron Age lake-side settlements. A – aerial photo. Photo Z. Czajlik, 22nd June 2003; B – rectification and interpretation. Author L. Rupnik, 2021 (on EOTR 1 : 10,000 topographical map). Legend: a – positive cropmarks.

2011) became known internationally. By the 2010s, the more than 35 hectares large Győr-Ménfőcsanak site became the region's most significant Early Iron Age settlement. The northern part of the site along the Marcal river was excavated in 1990–1991 in relation to the construction of the M1 highway (Szeles-dűlő, *Figler et al. 1992*; *Németh et al. 1993*), the largest, central area was unearthed between 2009–2011 (Széles-földek, *Ďurkovič 2015a*; *2015b*)[1], and the southern part in 2005–2006 (Eperföldek, *Egry 2007*, 31, 32, 45–47). We have more information about the multi-period site from further excavations to the east but there are no traces of significant Early Iron Age settlements in that area. For now, we know little about the largest excavated Early Iron Age cemetery of the region at Bezi-Faluhelyi-dűlő (*Molnár 2014*), however regarding smaller grave complexes, there were publications on the Fertőrákos cemetery (*Ďurkovič 2009*) and the Nagybarát (Győrújbarát) burial mound (*Figler 2010*). From the excavated settlement parts, we know the Kajárpéc-Pokolfadomb (*Németh T. 1996*, 370–372), Darnózseli-Parázsszeg (*Németh T. 1996*, 372–376), Lébényszentmiklós-Magasmart (Fig. 5; *Ďurkovič 2007*, 15–18), Koroncó-Wesselényi utca (*Molnár 2013*, 185–191), Koroncó-Bábota (*Czigány/Molnár 2020*) and Győr-Kálvária-domb (*Molnár/Ujvári 2020*, 402–408) sites in detail.

Regarding the wider region, the settlement of Göttlesbrunn in the Leitha Valley is an important reference point (*Griebl 2004*). Early Iron Age sites in the Bratislava area are well-investigated (*Čambal 2008*), especially the Bratislava-Dúbravka excavations were known previously (*Stegmann-Rajtár 1996*). Among the first publications of the region was the Early Iron Age settlement of Sereď (*Paulík 1955*). In addition, there have been recent reports about smaller Early Iron Age settlement excavations in Žitný ostrov, for example on the Dolné Janíky (*Čambal/Gregor 2007*) and the Dunajská Lužná-Nové Košariská settlement, which is of the same age as the famous burial mounds (*Čambal 2015*). There has been progress in the investigation of the Rába Valley as well. Besides the reports on the Early Iron Age cemetery of Hegyfalu (*Molnár 2006*) and the settlement of Vát-Bodon-tábla (*Molnár/Farkas 2011*), preliminary results have been published on the Ikervár-Pinkóci-dűlő excavation (*Nagy et al. 2012*), rich in unique archaeological features and finds.

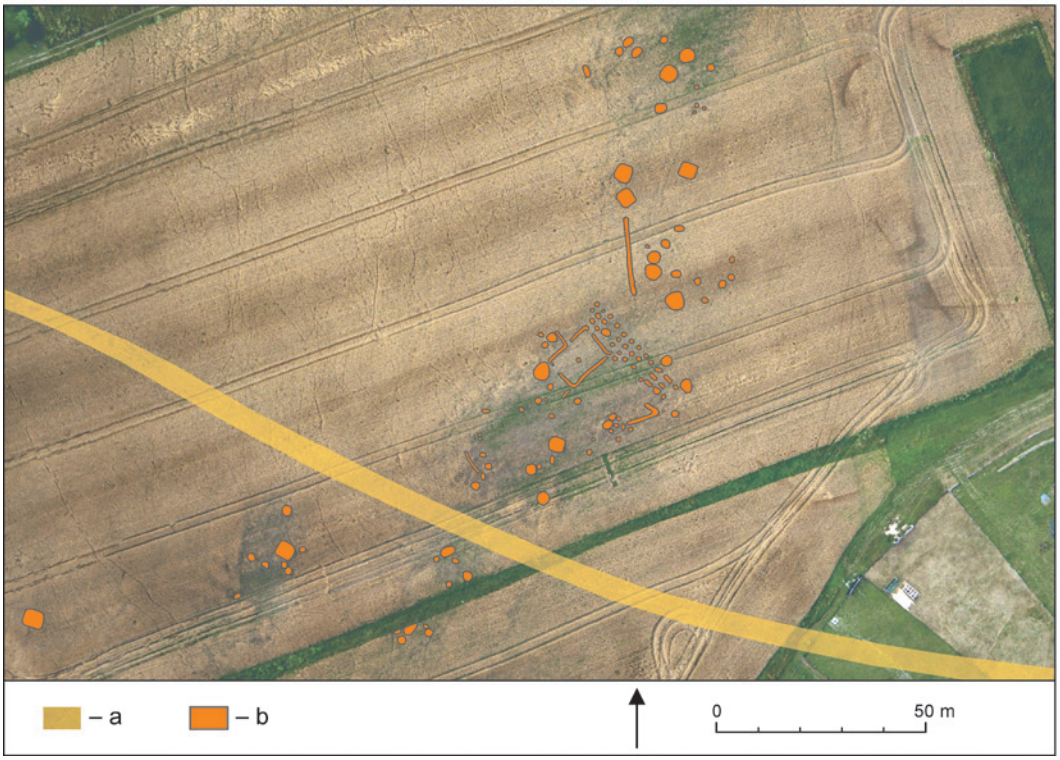
In classifying the Hungarian archaeological sites chronologically, Sopron-Burgstall, Sopron-Krautacker and Győr-Ménfőcsanak–Széles-földek are the main points of reference. The earliest settlements can be listed into the period from the end of Ha B to the end of HaC1 (750–650 BC). We have limited information about them, (Fertőrákos-Kőhidai-dűlő; Fig. 6; *Ďurkovič 2009*), Koroncó-Wesselényi utca (*Molnár 2013*, 185–191) and certain archaeological features of Győr-Ménfőcsanak–Széles-földek (*Ďurkovič 2015a*; *2015b*), except for Sopron-Burgstall and the region's hilltop settlements. Although numerous settlements and excavated burial mounds, as well as the Hegyfalu cemetery (*Molnár 2006*), are from the earlier phase of the Early Iron Age (HaC2–D1, 650–550 BC), the younger period (HaD2–D3/LTA, 550–450 BC) can be detected more and more often in the case of various settlements (Győr-Ménfőcsanak–Széles-földek, *Molnár 2007*; Lébényszentmiklós-Magasmart, *Ďurkovič 2007*, 15–18; Koroncó-Újtelep?, *Czigány/Molnár 2020*). In addition, based on our current knowledge, some settlements started only in the younger period (e.g. Győr-Káptalandomb, *Molnár/Ujvári 2020*, 401–408; Koroncó-Bábota, *Czigány/Molnár 2020*).

The excavations revealed that the region's Early Iron Age settlements had relatively few post-in-ground buildings. Identifying and dating these dwellings that can be reconstructed based on the positions of the postholes both raise an issue. 23 such buildings were unearthed at Sopron-Krautacker (*Schwellnus 2011*, fig. 3), one at Sopron-Burgstall (*Patek 1982*, 151), one at Dunajská Lužná-Nové Košariská (*Čambal 2015*, fig. 13) and there were several similar buildings at Győr-Ménfőcsanak-Eperföldek (*Egry 2007*, 31).

It seems that sunken featured buildings and storage pits characterized the region's Early Iron Age settlements listed above. The 29 buildings excavated in Sopron-Krautacker had partly irregular sides, but we can find relatively wide buildings with a nearly square-shaped base as well among them (*Schwellnus 2011*, fig. 5). Similar shapes can be observed in the case of the five buildings unearthed in Bratislava-Dúbravka (*Stegmann-Rajtár 1996*, fig. 2). Based on the maps and documented features, many of the 44 buildings excavated at the Győr-Ménfőcsanak–Széles-földek settlement had irregular sides and square-shaped base (*Ďurkovič 2015a*, fig. 3: 2, 4, 5, 7), however, according to the measurements on our list of archaeological features there were rectangle shaped, sunken featured houses too (*Ďurkovič 2015a*, 140–143). In the southern part of the site (Eperföldek) four Early Iron Age sunken featured buildings were excavated, of which at least two were square shaped with rounded corners (*Egry 2007*, 45, 46). At the site Vát-Bodon-tábla there were three smaller and four larger square shaped sunken featured buildings (*Molnár/Farkas 2011*, fig. 4–7). Similar buildings at Koroncó-Wesselényi utca (*Molnár 2013*, 187, 188) and Dunajská Lužná-

[1] http://doktori.btk.elte.hu/hist/durkoviceva/diss.pdf

A



B

Fig. 6. Fertőrákos-Kőhidai-dűlő. Neolithic/Early Iron Age/Late Iron Age settlement. A – aerial photo. Photo Z. Czajlik, 2nd July 2018; B – rectification and interpretation. Author L. Rupnik, 2021. Legend: a – historical road; b – positive cropmarks.

Nové Košariská (*Čambal 2015*, fig. 11; 12) are also square shaped, however at Koroncó-Bábota there are three more or less square shaped buildings with irregular sides (*Czigány/Molnár 2020*, 105–107). Several buildings with similar base have been excavated in Sered', however the Celtic sunken featured buildings discovered there are rather rectangle shaped with rounded corners (*Paulík 1955*, 137, 138, map). It should be noted that most of the Late Iron Age buildings excavated right next to the Early Iron Age settlement at Győr-Ménfőcsanak are also rectangle shaped (*Tankó 2020*, 116, fig. 48).

Based on the examples listed above we can state that in this region there were several types of sunken featured buildings in the Early Iron Age. Their sides are either irregular or (more often) regular, and their base is mostly square-shaped or rounded square shaped. Without analysing the more than 2,500-year history of sunken featured buildings/pit-houses, it seems very likely that the rounded rectangle shape is not typical of the buildings used in the Early Iron Age.

With the exception of Győr-Ménfőcsanak, we have no information about large-scale excavations of Early Iron Age settlements in the region. Therefore, we should be careful when speaking about the density of the settlements. However, it seems that – at least the archaeologically important features – were not built close to each other, but rather in smaller groups, which suggests looser, dispersed settlements, farmsteads, and manors. Higher density settlements were discovered only at the Sopron-Krautacker site (*Schwellnus 2011*, fig. 2, especially Areal C) and in a smaller part of the central area at Győr-Ménfőcsanak–Széles-földek (*Ďurkovič 2015a*, especially fig. 4.1).

Magnetometer geophysical measurements, performed in 2016–2017 at Grossmugl (Austria) documented sunken featured buildings in Hintern Gärten, Hinterbrunn and Totenweg. The dating of archaeological features, most of which belong probably to the Early Iron Age, based on excavations and field survey (*Lindinger 2020,* 140–157).

In the past three decades, aerial archaeological reconnaissance has been carried out in all three countries. In Slovakia, I. Kuzma photographed the Žitný ostrov region regularly since the late 1980s (*Kuzma 2007*; *2012*; *2013*), in Austria M. Doneus investigated the Leitha Valley (*Doneus 2015*; *Klammer et al. 2017*), while in Hungary M. Szabó photographed an Early Iron Age site at Jánossomorja (*Szabó 2016*, 164), in the framework of the *ripa Pannonica* programme of the Aerial Achaeological Archive of the University of Pécs. I. Kuzma identified traces of Early Iron Age mounds on several occasions, and settlements of similar age were photographed in the Bratislava area in the 1990s (Trnávka-Pri Majeri, Bratislava-Panské, cf. *Hanzelyová/Kuzma/Rajtár 1993*; *1995*).

On behalf of Eötvös Loránd University, René Goguey made the first flight in 1993. Since 2003, Z. Czajlik has been regularly photographing the area of the Rába interfluve within the framework of various research programmes. Besides examining the impact of the above-mentioned historical/archaeological age alluvial floods (*Czajlik et al. 2011*), very detailed and easily understandable cropmark phenomena can be observed in connection with the gravel alluvial fans of Rába interfluve (*Czajlik et al. 2021*). Using our aerial photographs, É. Ďurkovič published a study previously on the topographic features of the Early Iron Age settlements in the region (*Ďurkovič 2010*), while we published the research on burial mounds in cooperation with M. Winkler (*Winkler/Czajlik 2018*).

Between 2010–2012 a Hungarian – German joint research programme used aerial archaeology, magnetometer geophysics, systematic field survey and trial excavations in a microregion of the Rába valley. The investigations revealed two important Early Iron Age settlements: Árpás-Megág-dűlő and Bodonhely. At Árpás-Megág-dűlő (identified by Z. Czajlik in 2003 using aerial photography, *Czajlik 2004*, 114) F. Teichner estimated in an area of 10 ha at least 60 sunken featured buildings (*Teichner 2021*, 100–119), which could belong mostly to the HaC2/D1 period (*Nagy/Drăgan 2021*, 224–235). The Early Iron Age part of the multiperiod site at Bodonhely (*Teichner 2021*, 120–145) is the same age (*Nagy/Drăgan 2021*, 211–224).

RESULTS

So far, the aerial photography of the large sites known for decades has been successful out of the three areas only in NE Transdanubia. Despite the intensive research in Süttő, no cropmarks revealing settlement features were observed. Studying the archive footage has made it easier to interpret some known phenomenon (the possible rampart, gate, etc.). At Százhalombatta however, we managed to document settlement features that partly date back to the Early Iron Age, after 28 years of aerial archaeological reconnaissance.

Fig. 7. Szárföld-Felső-tag. Early Iron Age settlement. Aerial photo-mosaic Z. Czajlik, 22nd June 2003, 17th June 2009 and 27th June 2010; rectification and interpretation L. Rupnik, 2021. Legend: a – area of the Early Iron Age settlement.

For now, we cannot consider the aerial survey of the Győr-Tata terrace region a success either regarding the Hallstatt period. Despite intensive aerial archaeological activities – which proved quite effective in gaining knowledge of other periods – we only have minimal information about the Early Iron Age period of the area.

In the Rába interfluve region, however, we have aerial photo documentation of eight Early Iron Age settlements. The flights took place exclusively in the beginning of summer, with the purpose of observing the cropmark. We took photographs of certain sites only in one year (Lébényszentmiklós-Magasmart 2003; Árpás-Megág-dűlő 2003; Fertőrákos-Kőhidai-dűlő 2018), while others were photographed regularly: Szárföld-Felső-tag (2003, 2008, 2009, 2010, 2020; Fig. 7), Bágyogszovát-Közép-mező (2008, 2009), Kóny-Füzes-dűlő (2009, 2011, 2020). Lébényszentmiklós-Magasmart and Fertőrákos-Kőhidai-dűlő were already known from previous field research, but we discovered most of the settlements listed above through aerial archaeology. We conducted field surveys at some of the areas located with the help of the photographs, and *É. Ďurkovič* (*2010*) processed the results.

A more detailed analysis is hindered by the fact that not all archaeological features observed in the aerial photos can be listed as Early Iron Age, especially if the presence of other periods can be detected among the finds. Based on the excavated Early Iron Age features and the results of the field survey, there is a significant difference between the size and intensity of the settlements of the region. At Lébényszentmiklós-Magasmart there were most likely 2 manors, while at Szárföld-Felső-tag and Árpás-Megág-dűlő were discovered larger settlements. In the region only at the Fertőrákos-Kőhidai-dűlő settlement were we able to document a post-in-ground building. Based on the field survey it dates back to the Neolithic/Early Iron/Late Iron Age.

However, the majority of the possibly Early Iron Age archaeological features observed from the air are sunken featured buildings, matching the results of the excavations (see above). The fact that there are similar types of buildings in the area from later archaeological periods (mainly Celtic, Roman Age and 11th–13th c.) makes their interpretation more difficult.

CLOSING REMARKS

In our study, we discussed three different uses of aerial photos in archaeology, the study of archival materials, the monitoring of known archaeological sites and the archaeological reconnaissance surveys based on the observation of cropmarks. An important aspect of the methodology of aerial archaeology is that often it does not help in determining the age of the documented features. However, together with field survey and excavation data, it has proven effective in the study of Early Iron Age settlements in lasting, decade-long investigations.

A more detailed analysis of the different types of sunken featured buildings is a task for the future, as their importance in the Early Iron Age settlements of the region is already obvious based on the data currently available. However, based on the available data obtained through excavation and aerial photography, it appears that the constructions that were built above the ground, around a framework of wooden posts, are far less common in this region, in contrast to the Czech Basin and southern Germany, where the aerial archaeological prospection was more successful in discovering these building types (*Gojda et al. 2022*).

The differences between the three regions can be explained by a variety of reasons. The geographic conditions are naturally different in NE Transdanubia, however, there does not seem to be such a contrast between the Győr-Tata terrace region and the flat areas in the northwestern part of the Carpathian Basin that would explain the large gap in the number of sites. One could argue that the effectiveness of aerial surveys depends on geomorphological reasons and the proportion of arable land as well. This may explain the relative lack of success of the aerial surveys, but we have to remember that NE Transdanubia is the easiest to reach from the small airfields close to Budapest (Budakeszi-Farkashegy, Budaörs, Tököl). The distance is actually the greatest in the case of the northwestern region, thus reducing the frequency of flights. In addition, the precipitation of the previous six months also influence how observable the cropmarks are in this zone (*Czajlik et al. 2021*). Paradoxically, aerial archaeology in researching the Early Iron Age settlements has proved most successful in this region.

We can probably receive a coherent answer to the above mentioned – seemingly contradictory – observations only if we assume that the intensity of the settlement system varied both within the Early Iron Age and from area to area. Nevertheless, before we accept this conclusion, it would be necessary to carry out a similar or even more detailed aerial archaeological analysis of the regions to the north, in Southwestern Slovakia and to the south, in Central Transdanubia.

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Letecký archeologický prieskum sídlisk

Príklady zo staršej doby železnej na území severného Zadunajska

Zoltán Czajlik

Súhrn

Koncom roka 1980 sa v strednej Európe začali vykonávať systematické letecké archeologické prieskumy. Severozápadnú časť Karpatskej kotliny skúmali M. Doneus v Rakúsku, I. Kuzma a J. Rajtár na Slovensku, v Maďarsku to boli R. Goguey, O. Brasch, neskôr Z. Czajlik a M. Szabó. Datovanie zistených anomálii leteckou prospekciou nie je možné. Z tohto dôvodu je nevyhnutné podrobne dokumentovať všetky objekty počas leteckého prieskumu, aby mohli byť neskôr skúmané v rámci povrchového a geofyzikálneho prieskumu, prípadne menšieho zisťovacieho terénneho výskumu.

Geografické pomery severnej časti Zadunajska z hľadiska geomorfológie terénu a porastového pokrytia sú značne odlišné. Východná časť územia má charakter stredného pohoria, panva Zsámbéki je obklopená pohorím Buda, Pilis a Gerecse. Okrem toho je územie poľnohospodársky obrábané. Veľké plochy sú sčasti zastavané alebo sa tam vyskytujú lesy a ovocné sady. Dané podmienky sťažujú letecký prieskum, hlavne pri identifikovaní anomálií v obilí. Metóda leteckého prieskumu bola úspešná len pri sídliskách Süttő a Százhalombatta z obdobia staršej doby železnej. Na pobreží Dunaja, na západnej terase Süttő, sú vedľa seba dve známe výšinné sídliská z obdobia staršej doby železnej. Na archívnych záberoch je možné vo východnej časti územia rozpoznať v rámci starších výskumov aj priekopy sídliska. V západnej časti hradiska je viditeľný potok, ktorý slúžil ako prirodzená bariéra pri ochrane sídliska. V juhozápadnej časti hradiska môžeme identifikovať vstupné brány. Na území obce Százhalombatta sa po 28 rokoch systematického leteckého prieskumu podarilo časovo datovať niektoré sídliskové objekty do staršej doby železnej (čiastočne zahĺbené objekty).

V západnej časti skúmaného územia, na trase Győr-Tata, bola situácia ohľadom možností prieskumu oveľa priaznivejšia, no napriek tomu bolo zistených oveľa menej objektov z doby železnej. Identifikované boli však mnohé náleziská z ďalších období.

Poznatky ostatných bádateľov, ako aj naše, ukázali, že v severozápadnej časti Karpatskej kotliny, ktorá má väčšinou nížinný charakter a je poľnohospodársky obrábaná, pomáha pri zdokumentovaní archeologických nálezísk množstvo kvalitných porastových anomálií. Predchádzajúce prieskumy potvrdili, že v nížine Kisalföld, na území Žitného ostrova a Viedenskej panve, pravdepodobne existovali viaceré neznáme alebo neidentifikované mohyly. Na území Rakúska, Slovenska a Maďarska sa v posledných rokoch uskutočnilo množstvo výskumov pri veľkoplošných investičných výskumoch a boli preskúmané aj publikované časti sídlisk zo staršej doby železnej. Niektoré sídliská bolo možné sčasti alebo celkovo zaradiť do staršej doby železnej práve podľa špecifických štruktúr zahĺbených objektov alebo na základe povrchového zberu. Vyznačujú sa tým náleziská Szárföld-Felső tag a Árpás-Megág dűlő, ktoré pravdepodobne reprezentovali rozsiahle sídliská, ako je to aj v prípade najlepšie preskúmaného sídliska v regióne na lokalite Ménfőcsanak s datovaním do staršej doby železnej. Známe sú aj menšie dvory/majery. V katastri obce Lébényszentmiklós-magasmart boli leteckým prieskumom identifikované viaceré náleziská, z ktorých aspoň jedno môžeme s istotou zaradiť do staršej doby železnej.

Výsledky potvrdili, že prostredníctvom spojenia leteckých a klasických archeologických prieskumov je možné postrehnúť špecifické sídliskové aj topografické anomálie, ktoré sú typické pre jednotlivé archeologické obdobia. Na území severného Zadunajska trvalo dve desaťročia, kým sa dosiahli uvedené výsledky. Analýza väčšieho regiónu bude možná len v prípade, ak sa bude na južnom Slovensku pokračovať v leteckom archeologickom prieskume a v strednej časti Zadunajska sa pozornosť upriami na podrobnejší výskum sídlisk zo staršej doby železnej.

Obr. 1. Archeologické náleziská zo staršej doby železnej v severnej časti Zadunajska a jej okolí. 1 – Grossmugl (A); 2 – Sopron-Várhely (HU); 3 – Sopron-Krautacker (HU); 4 – Fertőrákos-Kőhidai-dűlő (HU); 5 – Göttlesbrunn (A); 6 – Bratislava-Panské (SK); 7 – Bratislava-Dúbravka (SK); 8 – Trnávka-Pri majeri (SK); 9 – Dunajská Lužná (SK); 10 – Dolné Janíky (SK); 11 – Sereď (SK); 12 – Vát-Bodoni-tábla (HU); 13 – Ikervár-Pinkóci-dűlő (HU); 14 – Jánossomorja (HU); 15 – Darnózseli-Parázsszeg (HU); 16 – Lébényszentmiklós-Magasmart (HU); 17 – Bezi-Faluhelyi-dűlő (HU); 18 – Bodonhely (HU); 19 – Árpás-Megág-dűlő (HU); 20 – Koroncó (HU); 21 – Győr-Kálvária-domb (HU); 22 – Győr-Ménfőcsanak (HU); 23 – Győrújbarát (HU); 24 – Kajárpéc-Pokolfa-domb (HU); 25 – Tápszentmiklós (HU); 26 – Komárom (HU); 27 – Süttő (HU); 28 – Százhalombatta (HU). Autor Z. Czajlik a Á. Marton.

Obr. 2. Sídliská zo staršej doby železnej, západne od Süttő. Časť z BW infra orthophoto (10. 5. 1987, https://www.fentrol.hu/hu/). Süttő-Nagysánctető, A – výskum G. Vékony; B – opevnenie (?) výšinného sídliska (horná časť), Süttő-Nagysánc; C – prírodná priekopa medzi rovinou a výšinným sídliskom; D – vchod (?) výšinného sídliska (dolná časť).

Obr. 3. Százhalombatta, letecký záber časti sídliska z neskorej doby bronzovej/staršej doby železnej, severne od opevnenia hradiska (19. 6. 2020). Foto Z. Czajlik.
Obr. 4. Százhalombatta, sídlisko z neskorej doby bronzovej/staršej doby železnej, severná časť od opevnenia zo staršej doby železnej. A – výsledky kombinovaného výskumu leteckých záberov (obr. 3); B – terénny prieskum. Autori Z. Czajlik, R. Gergácz a L. Rupnik.
Obr. 5. Lébényszentmiklós-Magasmart. Sídlisko zo staršej doby železnej pri jazere. A – letecký záber, foto Z. Czajlik, 22. 6. 2003; B – rektifikácia a interpretácia. Autor L. Rupnik, 2021 (EOTR 1 : 10 000 topografická mapa). Legenda: a – pozitívne porastové štruktúry.
Obr. 6. Fertőrákos-Kőhidai-dűlő. Sídlisko z neolitu/staršej a mladšej doby železnej. A – letecký záber, foto Z. Czajlik, 2. 7. 2018; B – rektifikácia a interpretácia. Autor L. Rupnik, 2021. Legenda: a – historická cesta; b – pozitívne porastové štruktúry.
Obr. 7. Szárföld-Felső-tag. Sídlisko zo staršej doby železnej. Letecký záber – mozaika Z. Czajlik, 22. 6. 2003, 17. 6. 2009 a 27. 6. 2010; rektifikácia a interpretácia L. Rupnik, 2021. Legenda: a – oblasť sídliska zo staršej doby železnej.

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