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INHALT – CONTENTS

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ABBREVIATIONS

AAC	Acta Archaeologica Carpathica (Kraków)
ActaArchHung	Acta Archaeologica Academiae Scientiarum Hungaricae (Budapest)
ActaMusPapensis	Acta Musei Papensis. A Pápai Múzeum Értesítője (Pápa)
Acta Botanica Hungarica	Acta Botanica Hungarica. A quarterly of the Hungarian Academy of Sciences (Budapest)
Aetas	Aetas. Történettudományi Folyóirat (Szeged)
Agria	Agria. Az Egri Múzeum Évkönyve (Eger)
AgrSz	Agrártörténeti Szemle (Budapest)
AKorr	Archäologisches Korrespondenzblatt (Mainz)
Alba Regia	Alba Regia. Annales Musei Stephani Regis. Az István Király Múzeum Évkönyve (Székesfehérvár)
Antaeus	Antaeus. Communicationes ex Instituto Archaeologico (Budapest)
AÖ	Archäologie Österreichs (Wien)
AR	Archeologické Rozhledy (Praha)
ArchA	Archaeologia Austriaca (Wien)
Archaeometry	Archaeometry (London)
Archeometriai Műhely	Archeometriai Műhely. Elektronikus Folyóirat (Budapest)
ArchÉrt	Archaeologiai Értesítő (Budapest)
ArchHung	Archaeologia Hungarica (Budapest)
Arrabona	Arrabona. A Győri Xantus János Múzeum Évkönyve (Győr)
AV	Arheološki Vestnik (Ljubljana)
BAR-IS	British Archaeological Reports – International Series (Supplementary) (Oxford)
BudRég	Budapest Régiségei (Budapest)
Burgen und Schlösser	Burgen und Schlösser. Zeitschrift für Burgenforschung und Denkmalpflege (Heidelberg)
Cahiers LandArc	Les Cahiers LandArc (Fleurance)
Castrum	Castrum. A Castrum Bene Egyesület Hírlevele (Budapest)
CommArchHung	Communicationes Archaeologicae Hungariae (Budapest)
Cumania	Cumania. Bács-Kiskun Megyei Múzeumok Közleményei. Acta Museorum ex Comitatu Bács-Kiskun (Kecskemét)
Demográfia	Demográfia. Népességtudományi Folyóirat (Budapest)
DissPann	Dissertationes Pannonicae (Budapest)
DuDolg	Dunántúli Dolgozatok (Pécs)

Építés-Építészettudomány	Építés- Építészettudomány. A Magyar Tudományos Akadémia Műszaki Tudományok Osztályának Közleményei (Budapest)
Érem	Az Érem (Budapest)
ÉT	Élet és Tudomány (Budapest)
Ethnographia	Ethnographia. A Magyar Néprajzi Társaság Folyóirata (Budapest)
FMTÉ	Fejér Megyei Történeti Évkönyv (Székesfehérvár)
FolArch	Folia Archaeologica (Budapest)
FontArchHung	Fontes Archaeologici Hungariae (Budapest)
FÖ	Fundberichte aus Österreich (Wien)
Föld és Ember	Föld és Ember. Negyedévenkint Megjelenő Tudományos Szemle (Budapest)
FrK	Földrajzi Közlemények (Budapest)
Geomorphology	Journal of Geomorphology (New York)
Gesta	Gesta. Historical Review (Miskolc)
Gymnasium	Gymnasium. Zeitschrift für Kultur der Antike und humanistische Bildung (Heidelberg)
GySz	Győri Szemle (Győr)
Határtalan Régészet	Határtalan régészet. Archeológiai Magazin. A Móra Ferenc Múzeum Régészeti Magazinja. Régészeti Ismeretterjesztő Magazin (Szeged)
HungArch	Hungarian Archaeology. E-Journal (Budapest)
Hungarian Studies	Hungarian Studies. A Journal of the International Association for Hungarian Studies and Balassi Institute (Budapest)
Jahrbuch des RGZM	Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz (Mainz)
JAMÉ	A Nyíregyházi Jósa András Múzeum Évkönyve (Nyíregyháza)
JAS	Journal of Archaeological Science (London)
JCAA	The Journal of Computer Applications in Archaeology
KDMK	Kuny Domokos Múzeum Közleményei (Tata)
KMMK	Komárom-Esztergom Megyei Múzeumok Közleményei (Tata)
Korall	Korall. Társadalomtörténeti Folyóirat (Budapest)
KRMK	A Kaposvári Rippl-Rónai Múzeum Közleményei (Kaposvár)
LDMK	A Laczkó Dezső Múzeum Közleményei (Veszprém)
MatArchSlov	Materialia Archaeologica Slovaca (Nitra)
MFMÉ StudArch	A Móra Ferenc Múzeum Évkönyve – Studia Archaeologica (Szeged)
MHKÁS	Magyarország honfoglalás kori és kora Árpád-kori sírleletei (Budapest)
MittArchInst	Mitteilungen des Archäologischen Instituts der Ungarischen Akademie der Wissenschaften (Budapest)
MNy	Magyar Nyelv (Budapest)
Múzeumcafé	Múzeumcafé. A Múzeumok Magazinja (Budapest)

Múzeumi Hírlevél	Múzeumi Hírlevél. A Kalocsai Múzeumbarátok Köre Kiadványa (Kalocsa)
MRT	Magyarország Régészeti Topográfiája (Budapest)
Ókor	Ókor. Folyóirat az Antik Kultúrákról (Budapest)
Őrégészeti Levelek	Őrégészeti Levelek. Prehistoric Newsletter (Budapest)
PA	Památky Archeologické (Praha)
PBF	Prähistorische Bronzefunde (München)
PNAS	Proceedings of the National Academy of Sciences (Washington, D. C.)
Quaternary Int	Quaternary International. The Journal of the International Union for Quaternary Research (Oxford – New York)
RégFüz	Régészeti Füzetek (Budapest)
Remote Sens	Remote Sensing (Tulsa)
Savaria	Savaria. A Vas Megyei Múzeumok Értesítője (Szombathely)
SbNM	Sbornik Národního Muzea v Praze Ser. A. (Praha)
SlA	Slovenská Archeológia (Bratislava)
SMK	Somogyi Múzeumok Közleményei (Kaposvár)
SSz	Soproni Szemle (Sopron)
Studia Hercynia	Studia Hercynia. Journal of the Institute of Classical Archaeology (Praha)
ŠtZ	Študijné Zvesti Arheologického Ústavu Slovenskej Akademie Vied (Nitra)
Századok	Századok. A Magyar Történelmi Társulat Közlönye (Budapest)
Turul	Turul. A Magyar Heraldikai és Genealogiai Társaság Közlönye (Budapest)
UPA	Universitätsforschungen zur prähistorischen Archäologie (Bonn)
VAH	Varia Archaeologica Hungarica (Budapest)
VMMK	A Veszprém Megyei Múzeumok Közleményei (Veszprém)
WMMÉ	A Wosinsky Mór Múzeum Évkönyve (Szekszárd)
ZalaiMúz	Zalai Múzeum (Zalaegerszeg)
ZbSNM	Zborník Slovenského Národného Múzea. Archeológia (Bratislava)
ZfAM	Zeitschrift für Archäologie des Mittelalters (Köln)

FOREWORD FROM THE EXECUTIVE EDITOR

Following the previous two *Antaeus* volumes, which were dedicated to specific archaeological periods – the Middle Ages (37th) and the Bronze Age (38th) – the present volume features studies that examine the spatial and landscape dimensions of human settlements across periods from the Early Bronze Age to the Ottoman Era. The scope of analysis extends from the internal structure of individual settlements to broader regional perspectives. The studies revolve around exploring settlement dynamics, tracing patterns of landscape use, mapping activity zones and territories, outlining crop and livestock production, and examining the role of spatial boundaries in the lives of communities. The contributions consistently integrate multidisciplinary sources and methods, often employing state-of-the-art geospatial technologies to advance research.

Eszter Melis's study investigates settlement patterns at the transition between the Early and Late Bronze Ages. Focusing on northwestern Hungary, a region situated at the intersection of multiple Bronze Age cultures in the Carpathian Basin, the detailed settlement network analysis offers valuable insight for international research.

Ágnes Kolláth and her colleagues present a comprehensive archaeological investigation of a Bronze Age hillfort and a medieval village near Székesfehérvár-Börgönd, Hungary. Their work emphasizes the integration of archaeological findings with environmental history data while showcasing the potential of non-invasive methods for reconstructing multi-period sites in the context of the landscape.

The study by Péter Langó and Miklós Takács also focuses on northwestern Hungary, examining the roles of Árpád Age (11th–13th-century) borders within the Kingdom of Hungary. Their research underscores the complexity of these borders as dynamic zones of interaction, encompassing both defensive and cultural-economic functions.

Bianka Kovács and her team contributed with a study synthesizing archaeological, historical, and archaeobotanical data to analyse how the establishment of Tata Castle reshaped the surrounding landscape.

László Ferenczi and Tibor Ákos Rácz explore the medieval settlement pattern in Pest County, Hungary, with a particular focus on the Dabas district. Combining geospatial analysis with historical and archaeological data, including surface and metal detector surveys, their study reframes interdisciplinary approaches to medieval settlement networks and examines long-term processes of desertion and hierarchical shifts.

The research by Zsófia Bocsi and her colleagues adopts a holistic approach to the study of castles, addressing not only fortifications but also the socio-economic and cultural landscapes of their surrounding domains. Their investigation of Veleg, one of the smallest villages in the Csókakő castle domain, examines the chronological dynamics, population size, social hierarchy, and land-use patterns of the settlement through historical analysis and and by applying complex non-invasive archaeological methods.

The volume concludes with a methodological contribution by Károly Belényesy, who explores the underlying potential of LiDAR technology for the study of historical landscapes. The publication of examples demonstrating laser scanning techniques may inspire advancements in ongoing research, encourage the creation of a LiDAR survey with national coverage, and attract international attention.

The upcoming 40th volume of *Antaeus* will be published under the guidance of a renewed editorial board, to whom we extend our best wishes for success in their endeavours. We also express our sincere gratitude to the authors, illustrators, and all those who have contributed to the journal over the past twenty years.

ANTAEUS 39 (2023) 13–51

ESZTER MELIS

OBSERVATIONS ABOUT THE SETTLEMENT NETWORK IN THE PERIOD BETWEEN THE END OF THE EARLY AND THE START OF THE LATE BRONZE AGE IN NORTHWESTERN HUNGARY (GYŐR-MOSON-SOPRON COUNTY, HUNGARY)

Zusammenfassung: Die Untersuchung des bronzezeitlichen Siedlungsnetzwerks beinhaltet wichtige Merkmale der Sozialstruktur jener Periode und reflektiert auf Lage und Aufbau der Siedlungen, bzw. auf organisatorische Aspekte der Gemeinschaften. Die ungarische und internationale Forschung fokussiert sich auf die Analyse der Tells und ihrer Umgebungen auf dem mittleren und östlichen Gebiet des heutigen Ungarns, zwischen 2200/2100 und 1500/1400 BC. Das untersuchte Areal in Nordwest-Transdanubien liegt in der bislang nur wenig untersuchten Peripherie der Kultur der transdanubischen inkrustierten Keramik (DMKK) und der davor verbreiteten Kisapostag-Kultur (oder auch früheste inkrustierte Keramikkultur genannt).

Im Rahmen der Recherche in Fachliteratur, Datenbank und Museen konnte ich 75 Siedlungsspuren aus dem heutigen Komitat Győr-Moson-Sopron auf die Periode zwischen dem Ende der ungarischen Frühbronzezeit und der ersten Hälfte der Spätbronzezeit datieren. Eines der Ziele der vorliegenden Studie war die Abgrenzung der Siedlungszonen der verschiedenen Sachkulturen im Zusammenhang mit den natürlichen Gegebenheiten. Dabei stellte sich unter anderem die Frage, ob sich zwischen den Siedlungen Unterschiede bemerkbar machen, bzw. ob bei den grundsätzlichen Siedlungstypen zeitliche Veränderungen nachvollziehbar sind. Abschließend gehe ich kurz auf die Position des untersuchten Gebiets ein, die es im spätbronzezeitlichen Siedlungsnetzwerk Transdanubiens eingenommen hatte.

Keywords: settlement network, density analysis, hilltop settlements, open settlements, territories, Middle Bronze Age, Transdanubian Encrusted Pottery culture, Gáta–Wieselburg culture, Northwestern Hungary

The research on Bronze Age settlement networks has revealed important characteristics of the organisation of the related communities, while the setting and composition of the settlements reflect essential aspects of the structure of society. Domestic and international settlement research on the central and eastern parts of today's Hungary in the period in the focus of this study, i.e., 2200/2100–1500/1400 BC,[1] has always concentrated on tell settlements and their surroundings in the first place, revealing heterarchical and multi-level settlement networks.[2] Early and Middle Bronze Age settlement research in Transdanubia has distinguished between hilltop and open settlements.[3]

[1] *Vicze – Earle – Artursson 2005; Earle et al. 2012; Earle et al. 2014; Dani et al. 2018; Jaeger et al. 2018; Szathmári et al. 2019; Vicze – Sørensen 2023* 35–51.

[2] *Kulcsár – Szeverényi 2012; Duffy 2014* 279–289; *Kienlin – P. Fischl – Pusztai 2018* 11–92; *Dani et al. 2019* 853–862; *Szabó 2023.*

[3] *Kiss 2012a* 205–224; *Dani et al. 2019* 862–864.

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The study region in Northwestern Transdanubia represents the barely researched western periphery of the distribution areas of the Transdanubian Encrusted Pottery culture (TEPC) and the preceding Kisapostag culture (or the earliest phase of TEPC).[4] Positioned at the meeting of three macroregions of Hungary – the more-or-less plain Little Hungarian Plain (Kisalföld), the West Hungarian Border Region, i.e., the foothills of the Alps, and the Transdanubian Mountains –, the area of Győr-Moson-Sopron County counts as a border zone from a geographical point of view, too. The largest region of the Little Hungarian Plain is the Győri-medence [Basin], stretching from the estuary of the Rába River to Lake Fertő [Lake Neusiedl] in the north-west and from the county's to the country's border with Slovakia north-south.[5] This region comprises plain and hilly lands, while its western zone consists of the plain wetlands of the Répce River, i.e., the Hanság microregion. Even today, when the marshes have been drained with channels, about a quarter of Hanság's surface is covered with water in periods of abundant precipitation.[6] The research area also includes the western parts of the Győr–Tatai-teraszvidék [Terraces] and the Igmánd–Kisbéri-medence up to the Cuhai-Bakony Stream,[7] as well as the northern part of the Pápa–Devecseri-sík [Plain] and the northernmost stretches of the Transdanubian Mountains (Pannonhalmi-dombság [Hills], part of the Öreg-Bakony [Old Bakony] Mountain Range, Pápai and Súri Bakonyalja).[8]

The latest overview targeting the Bronze Age record of Győr and its region was the *'Bronzkori kultúrák Győr környékén'* ['Bronze Age cultures in the area of Győr'] published by Sándor Mithay in 1941.[9] Even this early work, based mainly on stray finds, reflects how diverse the record of the first half of the Bronze Age is in the area: besides Kisapostag and TEPC findings, Mithay mentions finds assigned to the *Litzenkeramik*, the Mad'arovce group, and the Gáta and Únětice (Aunjetitz) cultures, respectively.[10] István Bóna believed that in the Middle Bronze Age, the border between TEPC and the 'Gáta group' (today: Gáta–Wieselburg culture) was in the Hanság, along the Répce/Rábca rivers; a monograph by Viktória Kiss enlists six TEPC settlements from this area.[11] Based on Early Bronze Age sites, András Figler outlined dissimilar evolution in the areas east and west of Hanság:[12] in the east, the Somogyvár–Vinkovci culture was replaced by early Kisapostag communities, while in the west, i.e., the broader area of Lake Fertő, groups of Bell Beaker origin, the Oggau–Wipfing–Ragelsdorf phase or group and the Leithaprodersdorf group appeared,[13] followed by sites of the Gáta–Wieselburg culture.[14] Little is known of the settlements of the latter; only a few partially excavated settlements have been published in Slovakia and Hungary.[15]

[4] *Bóna 1975* 197, Verbreitungskarte I, II; *Bóna 1992* 15–16; *Kiss 2012a* 264.
[5] *MKK 2010* 295–318.
[6] *MKK 2010* 306–308.
[7] *MKK 2010* 330–338.
[8] *MKK 2010* 325–330, 582–585.
[9] *Mithay 1941,* often cited as 'Mithay 1942'. The related work was published first in 1941 as a separate study and in 1942 as a chapter of the monograph *Győr története a vaskorszakig* [The Prehistory of Győr until the Iron Age] by Sándor Gallus and Sándor Mithay (in the series *Győr szabad királyi város monográfiái* [Monographs of the Free Royal Town of Győr] edited by Elemér Lovas); this latter version became widely known later.
[10] *Mithay 1941* 3–16.
[11] *Bóna 1975* 235–236; *Kiss 2012a:* Bakonyszentlászló-Kesellőhegy I. (11), Dör (75), Győr-Ménfőcsanak-Bevásárlóközpont (115), Győr-Ménfőcsanak-Szeles-dűlő (116), Mosonszentmiklós-Akasztódomb (215), Románd-Pápai út (266).
[12] *Figler 1994.*
[13] *Figler 1994; Neugebauer 1994* 44–48; *Kiss 2012b* 321, fig. 3.
[14] *Leeb 1987* Abb. 1; *Nagy 2013; Melis et al. 2022.*
[15] *Károlyi 1984; Mellnerová Šuteková et al. 2015; Bartík et al. 2016; Melis et al. 2022.*

In the north, along the Danube River, the study area borders some groups of the Únětice culture, a predominant cultural complex in the Early Bronze Age of Central Europe.[16] Its late period is represented by the Věteřov culture and its Böheimkirchen group in Moravia and Lower Austria, the Mad'arovce culture in Slovakia, contemporary with the second half of the Middle Bronze Age in Hungary.[17] Lately, traits of the late Únětice and Věteřov cultures have been identified in the record of several Middle Bronze Age settlements in western Hungary, which indicate the spreading of the Mad'arovce–Věteřov–Böheimkirchen complex in the area.[18] Vessels typical of the Mad'arovce culture appear in late TEPC find assemblages, including the settlement at Mosonszentmiklós-Akasztódomb.[19] Besides, *Litzenkeramik* (pseudo-corded ware) vessels can be observed in the Middle Bronze Age settlements in Northwestern Transdanubia, always accompanied by finds with other cultural connections.[20] Occasional *Litzenkeramik* vessels appear in the record of the sites from the Late Kisapostag–Early Encrusted Pottery phase, while their proportion in early Tumulus culture find assemblages is considerably higher.[21] The Tumulus culture gained ground in the territory of the county at the end of the Middle Bronze Age; several settlements are available in academic literature and enlisted in the Central Register of Archaeological Sites in Hungary (IVO), and information about some partially excavated settlements from the older phase of the culture has also been published.[22]

A complex research of the related literature, data archives, and museum collections[23] yielded information about 75 settlements altogether in the territory of Győr-Moson-Sopron County from the period between the end of the Early and the start of the Late Bronze Age *(Table 1)*.[24] All data of the sites were mapped and analysed in QGIS; this phase included a kernel density

[16] *Bóna 1992* 16–17; *Neugebauer 1994* 101–118; *Furmánek – Veliačik – Vladár 1999* 33–40, Abb. 8; *Krenn-Leeb 2011* Abb. 1.

[17] *Bóna 1992* 16–17; *Neugebauer 1994* 119–140; *Furmánek – Veliačik – Vladár 1999* 47–49, Abb. 13.

[18] *Kvassay – Kiss – Bondár 2004* 126–139, figs. 11–19; *Békei 2007; Kiss 2012b; Ilon – Nagy 2013; Melis 2014.*

[19] *Torma 1976; Kiss 2002* 484–490, Abb. 5–7; *Melis 2023* 118–127.

[20] The field report mentions a *Litzenkeramik* settlement from Rábapatona-Országúti-dűlő sites I and II; however, the object photos and drawings in the database of the Hungarian National Museum (HNM) reflect early Kisapostag-style fragments (HNM Archaeological Database, https://archeodatabase.hnm.hu/hu/node/787, and https://archeodatabase.hnm.hu/hu/node/786, both accessed on 18.05.2023).

[21] *Kovács 1997; Vékony 2000; Kiss 2013; Melis 2017; Ilon 2019.*

[22] As the dating of most sites known from reports and diverse site registers was given only as 'Tumulus culture', without further specification, there is no information about their age within the period. In some cases, the descriptions mention early Tumulus culture characteristics *(Figler 1993a; Figler 1997a; Egry 2002; Ilon 2019)*. The list of sites behind this study does not include those from the transitive phase of the Tumulus and Urnfield cultures (e.g., Börcs-Paphomlok: *Figler 1996a;* Mosonmagyaróvár-Német-dűlő: *Figler 1997d;* Mosonszentmiklós-Gyepföldek-dűlő: *Aszt 2001*).

[23] In 2015, at the start of the related research, the remains of 21 settlements, mentioned in diverse publications, could be connected with this period (*Melis 2017* fig. 1, Appendix). This list was completed with sites via research in archives and museum collections, during which Judit Antoni, Ágnes Aszt, Szilvia Bíró, Dávid Czigány, Tamás Czuppon, Ildikó Egry, János Gömöri, András Hargitai, János Hatos, Róbert Herbály, Gábor Ilon, Attila Mrenka, Andrea Nagy, Veronika Németh, Krisztina Pesti, Péter Polgár, Bálint Savanyú, Péter Tomka, Ferenc Ujvári, and Júlia Zámbó helped me. I am grateful to them for the possibility to survey and process their find materials and the additional information about their observations in the excavations. I surveyed the excavated find material of the included the Early and Middle Bronze Age sites, where it was possible, and even processed some (*Table 1,* sites 25, 41, 45, and 49); as a result, their original field dating has been modified in more than one cases (e.g., *Table 1,* sites 4, 7, 15, 21, 25, and 48).

[24] *Melis 2023.* The study area covered the territory of Győr-Moson-Sopron County, the administrative areas of Fenyőfő, Bakonyszentlászló, Veszprémvarsány, Bakonygyirót, Románd, Sikátor, Bakonypéterd, and Lázi, which belonged to Veszprém County until 1999 and 2002 also included.

analysis of spatial data. This study aims to delineate distinct inhabitation zones of communities with dissimilar cultural ties in context with diverse natural settings. Besides, we seek to answer whether there are differences in the structure of the settlements of culturally distinct communities and whether main settlement types change over time. Finally, the place of the study area in the Middle Bronze Age settlement network of Transdanubia is evaluated.

Inhabitation zones

The changes in the inhabitation zones of distinct cultural units were studied in three phases: the transitive phase of the Early and Middle Bronze Ages (2200/2100–1900/1800 BC), the Middle Bronze Age (1900/1800–1600/1500 BC), and the transition from the Middle to Late Bronze Ages and the early Late Bronze Age (1600/1500–1300/1200 BC), respectively. The first phase, i.e., the transitive phase of the Early and Middle Bronze Ages, includes the settlements of the Kisapostag and the Gáta–Wieselburg cultures, which appear clearly separately on the kernel density map even with a supposed 10-km-radius catchment area, as the nearest settlements are 30 km away (*Table 1,* sites 4 and 6). The westernmost site of the Kisapostag culture in the study area is Barbacs-Lanizsai-dűlő (*Table 1,* site 4), the find material of which comprises pottery with wrapped stick[25] and pattern tool impressions filled with encrustation and miniature wagon wheels in pottery.[26]

While the settlements of the Kisapostag culture were concentrated in the central part of the Little Hungarian Plain and were scattered in the northern foothill region of the Transdanubian Mountains, communities of the Gáta–Wieselburg culture inhabited only the West Hungarian Border Region and the north-western corner of the Hungarian part of the Little Hungarian Plain. The biggest concentration of Kisapostag settlements was observed in the northern part of the Pápa–Devecseri-sík and the northern and central zones of the Csornai-sík *(fig. 1)*. This concentration may partly be a result of research inhomogeneity and partly due to the Rába–Rábca–Danube and Marcal rivers joining in this land. It has remained a question whether the perimeter ditches engirding several settlements at a distance of only 5 km from each other (*Table 1,* sites 16, 57, and 59) are the marks of central settlements or enclosing the settlement this way was simply a custom in the region. Hilltop settlements of the culture have been discovered in the Pannonhalmi-dombság and the Pápai Bakonyalja in the south-east (Ravazd-Villibald-domb, Bakonyszentlászló-Kesellő-hegy I; *Table 1,* sites 3 and 64).

Currently, only a few Gáta–Wieselburg settlements have been identified in the territory of Hungary. Two settlements are known from the Leitha region in the northern part of the Mosoni-sík (*Table 1,* sites 25 and 62), and more, including two supposed hilltop settlements, in the one-time wetlands around Lake Fertő and the Fertő-medence (*Table 1,* sites 12, 14, and 49). Besides, Gáta–Wieselburg settlements were scattered on the Répce-sík, a lower plain region of the West Hungarian Border Region at the border of Győr-Moson-Sopron and Vas counties (*Table 1,* sites 6 and 73).

In the Middle Bronze Age (1900/1800–1600/1500 BC), numerous settlements of TEPC have been established in the central part of the Little Hungarian Plain and the northern stretches of

[25] V. Kiss refers to this technique as ‘reeled stick’ impression; see *Kiss 2012a* 18–19.
[26] *Nagy – Pesti 2019a.*

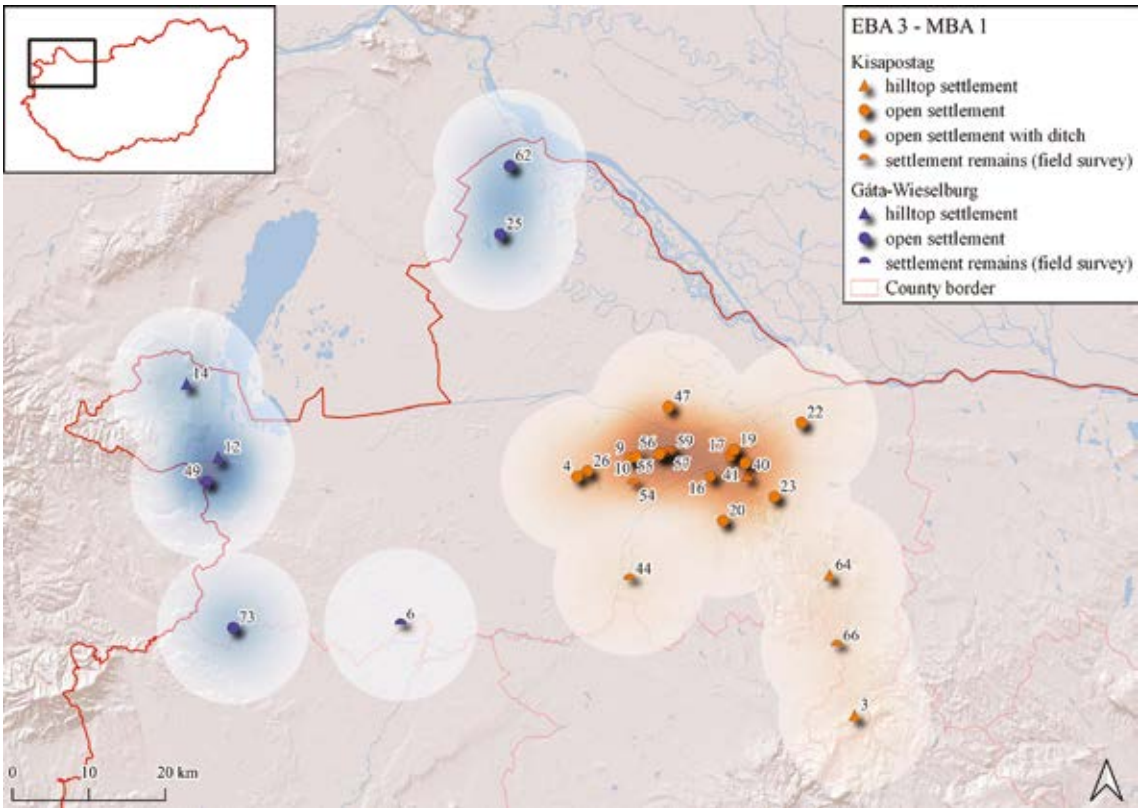

Fig. 1. Kernel density map with a 10-km catchment area of the settlements of communities with diverse cultural backgrounds (Gáta–Wieselburg, Kisapostag) in the transitive phase of the Early and Middle Bronze Ages in the area of Győr-Moson-Sopron County (site numbers are resolved in *Table 1*) (©Eszter Melis)

the Transdanubian Mountains *(fig. 2)*.[27] The most intensive inhabitation covered the Csornai-sík, while the number of their settlements north of that, along the Danube, was considerably higher than in the previous (Kisapostag) phase; thus, the southern part of the Mosoni-sík was also inhabited densely by TEPC communities. In contrast, no TEPC settlements are known from the right bank of the Marcal River, i.e., the Pápa–Devecseri-sík. Another seeming settlement concentration is to be observed in the Pannonhalmi-dombság: the surface finds of the identified settlements were collected in extensive field walking surveys conducted as part of the preparation of Volume 4 of the Archaeological Topography of Hungary series,[28] as well as other projects in the area of Sokoró[29] (*Table 1,* sites 1, 2, 3, 67, 69, and 70).

[27] Gábor Bándi mentions several TEPC sites (stray finds and cemeteries) from the Kapuvár Plain (*Bándi 1972* 46–47, Map 2); however, Viktória Kiss does not consider some related to the culture (*Kiss 2012a* 64, footnote 246). The fragments of the urn with outward-bulging rim in the material of the 1958 excavation at Kisfalud-Kázmérdomb (*Nováki 1959* 8–9) point to the previous Early Bronze Age Phases 1 and 2. Páli-Kispáli-dűlő is mentioned as a 'Bronze Age' urn cemetery, the material of which has been lost since its discovery (*Nováki 1960b* 10). Besides, János Gömöri mentions Middle Bronze Age pits with encrusted pottery fragments from Sopron-Bécsi u., Határátkelő, excavated in 1993 *(Gömöri 1996)*. I had no chance to examine this material until now, but, as I have found pottery with encrusted decoration both in late Únětice/Věteřov (*Melis 2014* 54–56) and Tumulus culture contexts (*Melis 2020* 357, note 32) in the territory of Győr-Moson-Sopron County, I believe currently there is no conclusive evidence of the settling of TEPC communities west of the Csornai-sík.

[28] *MRT 4* 26, site 3/3, 39, site 8/7, 51, site 12/11, 224, site 68/13.

[29] *Molnár 2009.*

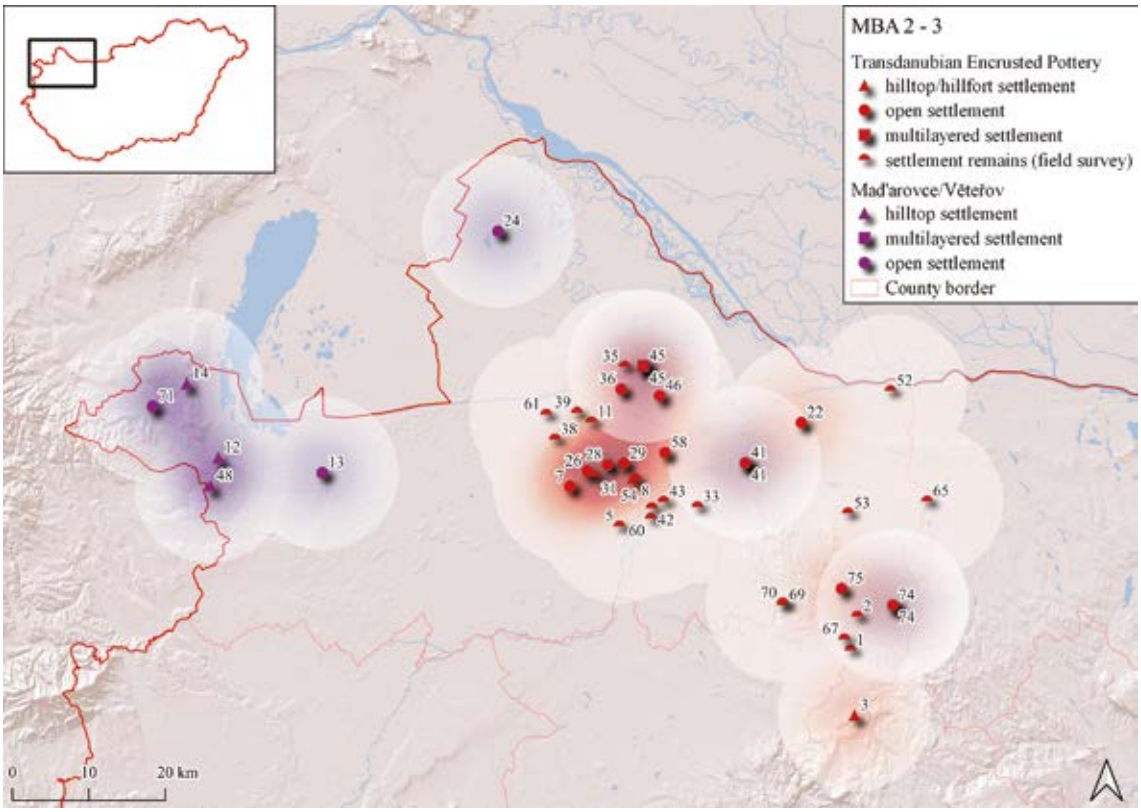

Fig. 2. Kernel density map with a 10-km catchment area of the settlements of communities with diverse cultural backgrounds (TEPC, Mad'arovce–Věteřov) in the Middle Bronze Age in the area of Győr-Moson-Sopron County (site numbers are resolved in *Table 1*) (©Eszter Melis)

Life in the Kisapostag and TEPC phases was continuous on several settlements on the Csornai-sík, the Győr–Tata Terraces, and in numerous microregions of the Transdanubian Mountains (*Table 1,* sites 3, 22, 26, 41, and 64); while some sites founded by TEPC communities also remained in use in the following Tumulus culture phase (*Table 1,* sites 7, 39, 41, and 61). Besides, artefacts in the style of the coeval Mad'arovce–Věteřov–Böheimkirchen complex and the *Litzenkeramik* appear in the find material of numerous TEPC settlements (*Table 1,* sites 41, 45, 54, and 74). The proportion of Mad'arovce- or Věteřov-style find material in the record of some TEPC settlements east of Hanság is higher (*Table 1,* sites 41, 45, and 74), based on which the settling of the related communities may be hypothesised in these cases. We have little information on how many settlements of the Gáta–Wieselburg culture survived into the younger and late phases of TEPC; the few encrusted pottery vessels recovered from Gáta–Wieselburg graves could be linked with the Late Kisapostag–Early Encrusted Pottery phase and the older phase of TEPC, while the graves themselves bear Únětice or Věteřov characteristics.[30]

The Late Kisapostag–Early Encrusted Pottery-style pottery found together with late Únětice/early Věteřov-style find material indicate that late Únětice/Věteřov communities settled in Transdanubia in the older phase of TEPC.[31] Based on these chronological anchors of contemporaneities, settlements with Mad'arovce- and Věteřov-style find material are presented here together with those of TEPC *(fig. 2).* Sites of primarily Mad'arovce and Věteřov character seem to have been frequent south of Lake Fertő in the West Hungarian Border Region, their

[30] *Neugebauer 1994* Abb. 30. 3; *Kiss 2000* 28, Tab. 1, Tab. 2. 19–20; *Kiss 2002* Abb. 1. 1, Abb. 2. 19–20; *Melis 2015* 349, Tab. II. 2.

[31] *Békei 2007* 53–54; *Melis 2014* 56.

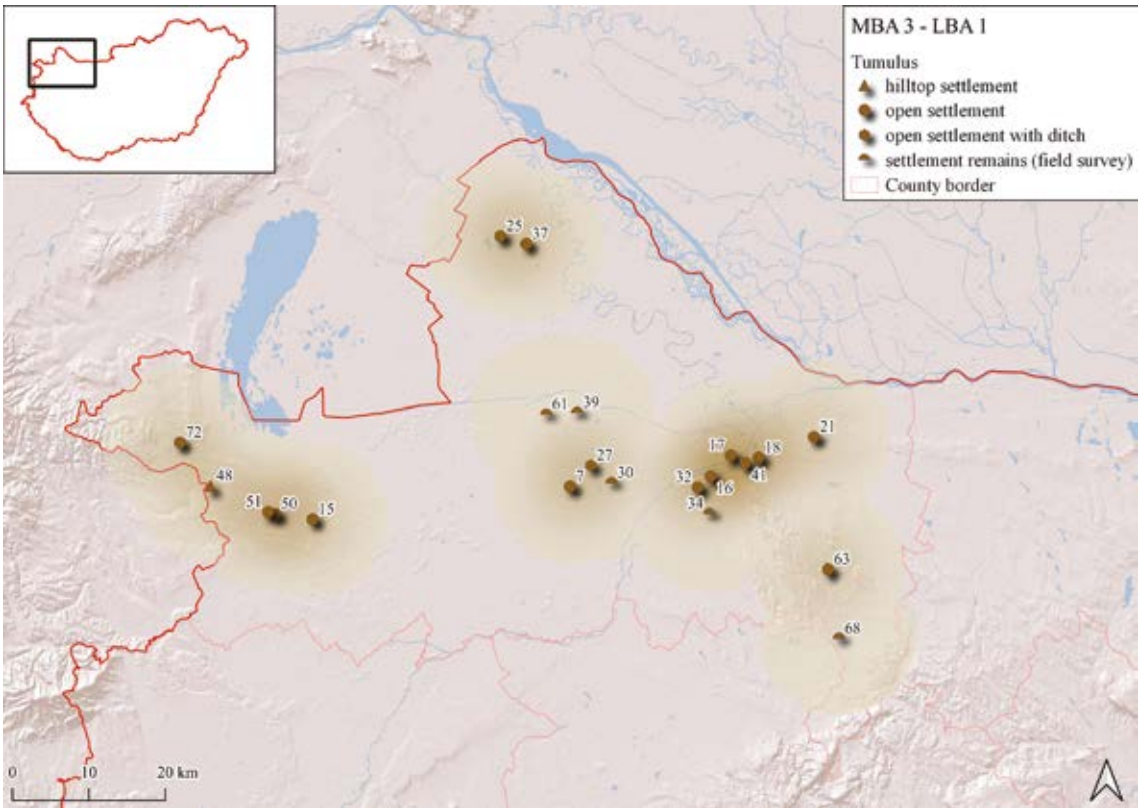

Fig. 3. Kernel density map of Tumulus culture settlements in the transitive phase of the Middle and Late Bronze Ages in the area of Győr-Moson-Sopron County (site numbers are resolved in *Table 1*) (©Eszter Melis)

distribution overlapping the dwelling area of communities of the Gáta–Wieselburg culture (*Table 1,* sites 12, 13, 14, 48, and 71), while some were also identified in the northern and southern zones of the Moson Plain, at the estuary of the Rába River, and in the foothill region of the Transdanubian Mountains (*Table 1,* sites 24, 41, 45, and 74). Albeit there may be chronological differences between the sites (e.g., the settlement at Ménfőcsanak belongs to Phase 2, while Mosonszentmiklós to Phase 3 of the Middle Bronze Age), these 'western'-style find assemblages east of Hanság seem to appear at strategic places (meeting zone of diverse regions and estuaries), indicating a patchwork of all cultures having inhabited the territory of Győr-Moson-Sopron County in Phases 2 and 3 of the Middle Bronze Age. Due to a lack of detailed information on the intensity and extent of most sites, only fortified and hilltop settlements were assigned to a higher category, and the multilayer settlement at Mosonszentmiklós-Akasztódomb can be interpreted as some kind of centre (*Table 1,* sites 3 and 45).

At the turn of the Middle and Late Bronze Ages and in the early Late Bronze Age (1600/1500–1300/1200 BC), settlements of the Tumulus culture appeared in the region in focus. Based on a kernel density map of known settlements, where each site has been given a catchment area of 10 km in radius, the dwelling zone of the related communities stretched, with lesser gaps, northwest-southeast from the northern part of the Moson Plain to the feet of the Transdanubian Mountains *(fig. 3).* The disappearance of the patchwork of communities with diverse cultural backgrounds along the Moson Danube River is an important change compared to the previous phase; the most intensively settled area in this phase is along the Rába River. Available data suggest that the Hanság and Kapuvári-sík microregions were uninhabited in the early Late Bronze Age; the distance between the Tumulus culture settlements at Dör and Fertőszentmiklós

is more than 30 km (*Table 1,* sites 7 and 15). The communities inhabiting the Ikva-sík south of Lake Fertő in the west had a cultural background similar to those in the Little Hungarian Plain at the time (*Table 1,* sites 15, 48, 50, 51, and 72).

While the available body of data on settlement networks depends heavily on how well-researched each included area is, it allows drawing some conclusions and outlining major tendencies. In the transitive phase of the Early and Middle Bronze Ages, communities of diverse cultural units inhabited spatially distinct zones in the western and eastern parts of the study area. During the Middle Bronze Age, the area occupied by TEPC communities was bigger than that of the Kisapostag culture in the previous period and included Mad'arovce–Věteřov elements, which appeared in the western zone in the late phase of the Gáta–Wieselburg culture; also, Mad'arovce–Věteřov communities probably established separate settlements in those parts. The cultural difference between the eastern and western halves of the study area disappeared at the transition of the Middle and Late Bronze Ages when Tumulus culture communities settled all over the region. Although the lands between the Csorna- and Ikva-sík have remained uninhabited throughout this period, too, Tumulus culture settlements appeared along the Rábca and Moson Danube rivers in the Mosoni-sík.

Settlement types

The collected sites from the end of the Early and the Middle Bronze Age in Northwestern Transdanubia were classified as open and hilltop settlements based on their location. Settlements positioned on top of elevations at least 20 m above the surrounding area and with steep slopes on at least two sides were considered hilltop settlements. As the remains of earthworks are usually barely visible and their dating is problematic, the only certainly fortified settlement from the period in focus in the territory of Győr-Moson-Sopron County is Bakonyszentlászló-Kesellő-hegy I. (*Table 1,* site 3). The foundations of perimeter ditches have been identified on several hilltop and open settlements (*Table 1,* sites 16, 27, 40, 57, and 59), but interpreting them as the remains of fortifications is debated (see more about these features below). Most excavation data indicate single-layer open settlements; as even the excavated sites are only partially unearthed and the processing of the recovered find material and data of only a small proportion has been completed, little is known about their extent, and their structure could hardly be investigated either. We only know of a single multilayer settlement (*Table 1,* site 45). Besides, settlements identified exclusively from surface finds recovered in field walkings in the collection were handled separately *(fig. 4)*.

Open settlements

In the collection, most settlements dated to 2200/2100–1500/1400 BC were positioned on low elevations of only a couple of metres above their environment. Previous overviews of the Gáta–Wieselburg culture mention two settlements in the territory of Győr-Moson-Sopron County, at Szakony-Kavicsbánya and on the outskirts of Fertőszéplak.[32] Most newly identified sites of the culture are also open and single-layer ones (*Table 1,* sites 6, 25, 49, and 62). Settlement pits and building-related features of the culture have been unearthed on top of a slight elevation north-west of the Arany Stream at Nagycenk-Kövesmező.[33] The identification of Gáta–Wieselburg settlements is problematic because they often appear together with the record of other Bronze

[32] *Leeb 1987* 236–237; *Nagy 2013* 79–80. As the context of the artefacts from Fertőszéplak is uncertain, they were classified as stray finds.

[33] *Melis et al. 2022* fig. 2.

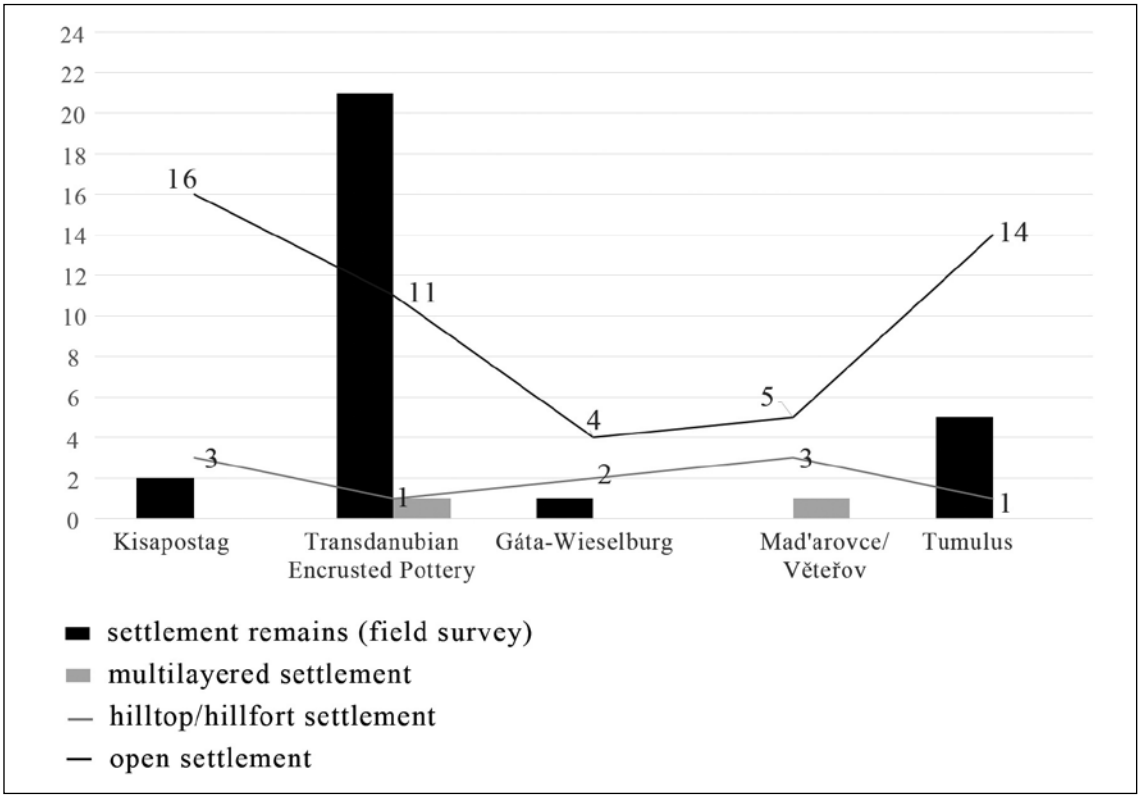

Fig. 4. Distribution of settlement types in diverse cultural units (©Eszter Melis)

Age cultures (Tumulus culture, *Litzenkeramik*, Mad'arovce–Věteřov–Böheimkirchen complex). For example, the building excavated at Hegyfalu (Vas County) contained a blend of Tumulus culture and Gáta–Wieselburg-style finds.[34]

The settlement at Nagycenk was probably continuously inhabited after Phase 2 of the Early Bronze Age. As the result of a systematic field walking survey of the site, a 40-hectare settlement was outlined on the eastern, southern, and western slopes of the low elevation (with its top at 169 m a.B.s.l.).[35] Tumulus culture settlement features were also unearthed at Hegyeshalom-Országúti-dűlő; the fifteen features (mostly pits) associated with the Gáta–Wieselburg culture were scattered in a slightly sloping 20-hectare area at 125 m a.B.s.l.[36] In summary, both Gáta–Wieselburg settlements in the territory of Győr-Moson-Sopron County are over 10 hectares in extent, situated on slightly sloping land, and seem to have a dispersed, loose structure. Besides, Gáta–Wieselburg settlement features and findings have been published from Oroszvár (Bratislava-Rusovce, Slovakia); albeit the diverse development-led excavations on the site only concerned small areas, the results have also outlined an open settlement with settlement features of the Věteřov culture nearby.[37] While according to observations of Gáta–Wieselburg sites in Austria, the culture's settlements were usually situated away from cemeteries,[38] the distance between them at Oroszvár (Bratislava-Rusovce, Slovakia), Nagycenk, Hegyeshalom, and Szakony was always less than a kilometre, sometimes no more than a few hundred metres.[39]

[34] *Károlyi 1984* 133–143.
[35] *Melis et al. 2022; Melis et al. 2023.*
[36] *Aszt 2008; Melis 2023* figs. 24–25.
[37] *Mellnerová Šuteková et al. 2015; Bartík et al. 2016.*
[38] *Krenn-Leeb 2011* 19.
[39] *Nováki 1960a; Nováki 1965a; Bartík et al. 2016; Gömöri – Melis – Kiss 2018* fig. 1; *Melis 2023* fig. 16.

The settlements of the Kisapostag culture in the previous period were also situated on low elevations; however, perimeter ditches were discovered around several of them (*Table 1,* sites 16, 40, 57, and 59). Circular ditches were a characteristic of settlements in Transdanubia at the end of the Early Bronze Age. As settlement features are usually found both in and outside the enclosed area,[40] the function of these structures is a question: they could have a role in defence, a function related to subsistence (e.g., animal keeping), or could separate social or ritual spaces. Most known circular ditches of the Kisapostag culture are clustered in the western zone of Lake Balaton.[41] Amongst the Kisapostag settlements from Győr-Moson-Sopron County in the collection, perimeter ditches are especially frequent at the estuary of the Rába River, where they occur on both plainland and hilltop settlements (*Table 1,* sites 16, 40, 57, and 59). Based on preliminary reports on the research of settlements in Northwestern Hungary, Early Bronze Age settlement features were found exclusively within the enclosed area.[42] In context with the enclosed settlement concentration at the western (western zone of Lake Balaton) and northwestern (estuary of the Rába River) fringes of the distribution area of the Kisapostag culture, the possibility of their defensive role arose. However, it is difficult to see clearly in this question as considerably fewer Kisapostag settlements have been identified in the central zone of the culture's distribution area, and the material obtained from most still awaits processing.

A general structure of the Kisapostag culture's open settlements may be reconstructed from excavation material: settlement phenomena are usually scattered over large areas. For example, at Ménfőcsanak-Széles-földek (112–116 m a.B.s.l.), settlement features dating to the end of the Early and the start of the Middle Bronze Age were scattered over an area of 60 hectares, outlining several clusters.[43]

In contrast to the previous Kisapostag period, no limiter structure could be identified on TEPC settlements, while surface settlement traces were identified on field walks in Győr-Moson-Sopron County. Identified by their characteristic pottery record, a considerable part (21 sites) of TEPC sites is only known from field walk data *(fig. 4).*[44] Besides, sixteen sites are known from preliminary excavation reports, based on which the standard TEPC settlement in the territory of Northwestern Hungary was single-layer. An area of about three hectares in the higher zones of the horizontal settlement at Ménfőcsanak-Széles-földek, established by a community of the Kisapostag culture, remained in use in the early phase of TEPC. Based on the excavated find material, the settlement features assigned to the older phase of TEPC were concentrated in the eastern zone of the slight elevation at 116 m a.B.s.l.[45]

The site at Mosonszentmiklós-Akasztódomb is the single known multilayer TEPC settlement in the county. The two buildings on top of each other – or two phases of the same house – in a 1.20-1.40 m-thick Bronze Age layer indicate at least two occupation horizons. The upper horizon contained abundant and characteristic find material of younger and late TEPC, with some

[40] *Bondár 1989* Abb. 5; *Kiss 2003* fig. 10; *Kiss 2012a* 206–207, fig. 57.

[41] Balatongyörök: *Torma 1972a;* Balatonmagyaród: *Bondár 1989; Bondár – Honti – Kiss 2000;* Ordacsehi: *Kiss – Kulcsár 2007; Kiss 2007;* Vörs: *Honti 1996* 47–48.

[42] *Egry 2003a; Polgár 2018a; Polgár 2020.*

[43] *Melis 2014* fig. 2; *Tóth – Melis – Ilon 2016* fig. 2; *Melis 2023* fig. 40.

[44] It must be kept in mind that as in several cases the sites were surveyed by archaeologists specialised in periods other than the Bronze Age, the few encrusted fragmentary pottery finds were often identified as TEPC even if they belong actually to the Late Kisapostag–Early Encrusted Pottery phase or the Kisapostag culture. However, the data from the 1994 field walk survey led by Károly Takács can be considered more reliable as that project was coordinated by András Figler (*Table 1,* sites 8, 11, 30, 31, 38, 39, 54, and 61).

[45] *Tóth – Melis – Ilon 2016* fig. 2.

Mad'arovce-style artefacts.[46] Shared settlements of the Mad'arovce culture and TEPC are frequent in the neighbouring Komárom-Esztergom County, especially along the Danube River; two evaluations of a completely and a partially unearthed site have been published.[47] In Southwestern Slovakia, Mad'arovce culture settlements often include multiple occupation horizons[48] or were established on top of previous Únětice and/or Hatvan culture layers.[49] Such settlements are usually fortified there and in the Slovakian part of the Little Hungarian Plain, too.[50] Based on these analogies, the settlement at Mosonszentmiklós-Akasztódomb may be interpreted as a local centre in this period.

All known settlements of the Tumulus culture but Nagycenk-Alsó-domb-dűlő (*Table 1,* site 48) are positioned on top of low elevations and are single-layer, albeit the buildings renewed close to each other on the settlement of Kóny-Gázvezeték I., Babarcsi tópart (*Table 1,* site 27) attest to intensive settling.[51] The ditch section unearthed north-east of the post-framed buildings on this site may be the remains of the one-time perimeter ditch.[52]

Hilltop settlements

The foregrounds of the Transdanubian Mountains are spotted with hilltop settlements of the Kisapostag culture (*Table 1,* sites 3, 40, and 64). The site at Ravazd-Villibald-domb, on top of a hill towering 163 m above the Pándzsa Stream, was described earlier by András Figler as the only 'Kisapostag' settlement of the county *(fig. 5. 2)*.[53] An Early Bronze Age depot with bronze and gold items was found at the south-western rim of the hill in 1984;[54] the test excavation in the same area revealed eleven pits and a grave of the Kisapostag culture, while another pit contained late Kisapostag pottery with transitional TEPC stylistic traits.[55] Later summaries also mention a shaft-hole axe casting mould found together with a late Somogyvár–Vinkovci-style vessel.[56] Further research on the site focused on the medieval church;[57] Károly Takács carried out field walks on the hilltop and mentions fortifications on the northern side.[58] The higher proportion (compared to coeval sites) of wild game and small ungulates (sheep and goat) in the 1984 excavation record of the Somogyvár–Vinkovci and Kisapostag horizons of the site was explained by its relatively high location.[59] Ménfőcsanak-Csanak-hegy (Szamár-domb) is situated on the northern end of the same eastern range of hills of the Pannonhalmi-dombság as Ravazd-Villibald-domb (*fig. 1,* sites 40 and 64), on top of a marked elevation at 142 m a.B.s.l., with a good view to the north *(fig. 5. 1)*. Péter Polgár has identified a wide and deep ditch of the Kisapostag culture high in the side of the hill, while a semi-sunken building of the same culture has been unearthed on the top.[60] The settlement at Bakonyszentlászló-Kesellő-hegy I., over 350 m a.B.s.l. in the High Bakony Mountains, included settlement features of the Kisapostag culture, the Late Kisapostag–Early

[46] *Uzsoki 1959* 54–55; *Melis 2023* 118–127.
[47] *Kovács 1988* 120–121; *Vadász 2001; Cseh 1999* 29–30, 79.
[48] *Točík 1964; Točík 1978–1981.*
[49] *Točík 1981; Bátora et al. 2012.*
[50] *Furmánek – Veliačik – Vladár 1999* 47–49; *Bátora 2018* fig. 87.
[51] *Egry 2002* 9–10, Map 3.
[52] *Egry 2002* 11, Map 3.
[53] *Figler 1985.*
[54] *Figler 1985; Figler 1986.*
[55] *Figler 1985; Figler 1986.*
[56] *Figler 1994* fig. 2, 30; *Kulcsár 2009* 381, No. 177; *Dani 2013* Appendix 6, fig. 6.
[57] *Tomka 1997.*
[58] *Takács 2009* 266.
[59] *Bartosiewicz 1996* 35, Table 2, figs. 2–3.
[60] *Polgár 2018a.*

Fig. 5. Hilltop and hillfort settlements in the area of Győr-Moson-Sopron County at the end of the Early and in the Middle Bronze Age. 1. Ménfőcsanak-Csanak-hegy (Szamár-domb) (Győr); 2. Ravazd-Villibald-domb; 3. Bakonyszentlászló-Kesellő-hegy I. (after *Nováki 1979* Abb. 2); 4. Fertőboz-Gradinahegy; 5. Fertőrákos-Kecskehegy (after *Nováki 1997* 30); 6. Nagycenk-Alsó-domb-dűlő (©Eszter Melis)

Encrusted Pottery phase, and the older phase of TEPC *(fig. 5. 3)*.[61] Gyula Nováki observed a more than 60 cm thick layer with Bronze Age material on the site and dated, based on pottery, the stone-covered earthen ramparts to the older phase of TEPC.[62]

In Lake Fertő's area, Gyula Nováki excavated two hilltop settlements, dating both to the first half of the Bronze Age.[63] Fertőboz-Gradinahegy *(fig. 5. 4)* is situated at 177.5 m a.B.s.l. on top of a narrowing hilltop at the southern rim of the Fertő Basin with three steep sides, while a double ditch-and-rampart complex closed down access on the southern side. Gyula Nováki cut through the outer rampart, erected between two palisade lines, and the ditch by its outer side in 1963.[64] In 1964, he also cut through the inner rampart and observed stones piled up at its outer palisade wall to support the earthen structure.[65] The find material is currently under evaluation; while the pottery raised the possibility of assigning the features to the Gáta–Wieselburg and/or late Únětice/Věteřov cultural complexes, a recent radiocarbon data from the remains of one of the wooden posts has questioned the Bronze Age origin of the fortifications.[66]

The other site is Fertőrákos-Kecskehegy in the western zone of the Fertő Basin, where Gyula Nováki investigated the fortifications of a settlement on top of a hill at 218 m a.B.s.l., towering above the valley of the Rákos Stream *(fig 5. 5)*. He opened a metre-wide exploratory trench cutting through the western end of the inner rampart in 1948, observing a similar sandwich structure with palisade walls on either side, as well as a 90 cm-wide dry stone wall between the inner edge of the ditch and the rampart.[67] The earthen body of the rampart comprised several Early and Middle Bronze Age pottery fragments, but Nováki also found Celtic or Roman wheel-thrown sherds close to the modern surface.[68] The arched outer rampart connected the two ends of the inner rampart; a ditch (a short section of which had been filled by today) run along its outer side.[69] A recent metal detector survey brought to light a bronze halberd of the Únětice culture from the area of the presumed hillfort.[70]

The settlement at Nagycenk-Alsó-domb-dűlő is situated at 180 m a.B.s.l. on top of a large plateau 20 m above the valley of the Arany Stream just before it flows into the Ikva River south of Lake Fertő *(fig. 5. 6)*. Based on the pre-established criteria, this site classifies as a hilltop settlement. The two sides of the hill facing a curve of the stream are steep; the site was excavated preceding the construction of Motorway M85, but no phenomenon indicating a prehistoric fortification was unearthed.[71] The find material is characteristic of the transition of the Middle and Late Bronze Ages with Mad'arovce, early Tumulus culture, and abundant *Litzenkeramik*-style fragments.[72]

Based on the survey behind this study, hilltop settlements emerged in Northwestern Transdanubia with the Kisapostag culture; several settlements in this period – including plainland and hilltop ones – were engirded by perimeter ditches of unknown function. The clarification of the extent of the settlement at Ménfőcsanak-Csanak-hegy is problematic due partially to the area being built-up; based on its currently estimated size of 1 ha, it was a smaller one. Ravazd-

[61] *Nováki 1979* 78–84, Pl. 7–8; *Kiss 2012a* 270.
[62] *Nováki 1979* 78–84; *Kiss 2012a* 209, fig. 62, Pl. 1. 1–17.
[63] *Nováki 1975* 328, fig. 4.
[64] *Nováki 1964a; Nováki 1964b; Nováki 1975* 328.
[65] *Nováki 1965b; Nováki 1965c.*
[66] *Jankovits in print.* I thank Katalin Jankovits and Viktória Kiss for the information on the site.
[67] *Nováki 1952; Nováki 1997* 29–32.
[68] *Nováki 1952; Nováki 1997* 30.
[69] *Nováki 1952; Nováki 1997* 30, 32.
[70] *Mrenka 2022* 15–17, fig. 3, Tab. 3.
[71] *Savanyú 2020c.*
[72] I thank Attila Mrenka and Bárint Savanyú for the possibility to see the find material.

Villibald-domb (5 ha) was almost as big as the fortified area at Bakonyszentlászló-Kesellő-hegy I. (5.9 ha).[73] Several Middle Bronze Age hilltop settlements are known from the area of Lake Fertő; they have yet to be assigned to ceramic styles and linked with nearby settlements and cemeteries. Fertőrákos-Kecskehegy covers 3 ha,[74] while the plateau of Nagycenk-Alsó-domb-dűlő extends to 18 ha.

Outlook on the settlement networks of the surrounding areas

Hilltop settlements probably formed the skeleton of the Middle Bronze Age TEPC settlement network.[75] The work summarising the data on over a hundred TEPC sites from Hungary describes fifteen as hilltop settlements.[76] The TEPC site register of Komárom-Esztergom County, neighbouring the study area from the east, includes four hilltop settlements of the Tokod group, a cultural unit coeval with the Late Kisapostag–Early Encrusted Pottery transitive phase and partially the older phase of TEPC.[77] Besides, two hilltop settlements[78] with the timber-supported rampart – 2 m high in the first phase and 2.5–3 m high in the second – and the related ditch surrounding the settlement at Süttő-Nagysánctető were assigned to TEPC.[79] In the last phase of the settlement, dating to the transition between the Middle and Late Bronze Ages (Rei Bz B), the fortification lost its function and the houses with TEPC–Mad'arovce-style find material were built on top of the ramparts.[80] The 1.5–1.6 m-thick layer related to multiple Bronze Age occupation horizons at Veszprém-Várhegy in Veszprém County contained material dating to the Late Kisapostag–Early Encrusted Pottery and younger TEPC phases, respectively.[81] Most younger TEPC hilltop settlements have been discovered in southern Transdanubia, completing previous research by Mór Wosinsky.[82]

Sites interpreted as central settlements in the transitive phase of the Early and Middle Bronze Ages and the Middle Bronze Age, respectively, are summarised in *Table 2* (based on literature and completing the list of data gleaned from Győr-Moson-Sopron County). These central settlements usually had more than one occupation horizon; upon mapping their supposed areas of influence,[83] the transitive phase of the Early and Middle Bronze Ages (2200/2100–1900/1800 BC, Kisapostag culture, Late Kisapostag–Early Encrusted Pottery transitive phase, Tokod group, Gáta–Wieselburg culture) and the Middle Bronze Age (1900/1800–1600/1500 BC, TEPC, Mad'arovce–Věteřov culture) were distinguished *(fig. 6)*.

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[73] *Nováki 1979* 78–79, fig. 2.

[74] *Nováki 1997* 30, 32–33.

[75] *Dani et al. 2016* 232.

[76] *Kiss 2012a* 211, 215. Bakonyszentlászló-Kesellőhegy I. (11), Szentkirályszabadja-Kőhegy II. (321), Dunaszekcső-Várhegy (83), Gyulaj-Pogányvár (122), Harc-Várhegy (127), Kölesd-Csonthegy (181), Mucsi-(Lengyel)-Sánc (220), Pécs-Mecsekszabolcs (253), Pécs-Nagyárpád (254), Simontornya-Mozsi-hegy (278), Somogyvár-Kupavárhegy (289), Süttő-Nagysánctető (292), Tihany-Óvár (350), Tolnanémedi-Nebojsza (356), Veszprém-Várhegy (386–387).

[77] Sárisáp-Quadriburg I, Süttő-Kissánc, Tokod-Leshegy, Tokod-Sáncok: *Nováki 1975* 327; *Cseh 1999* 28–29.

[78] *Cseh 1999* 51, site 22. 1, 52, site 24. 3.

[79] *Vadász – Vékony 1982; Vékony 2000* 178–179; *Kiss 2012a* 210, 297, fig. 62. 2.

[80] *Vékony 2000* 178–180.

[81] *Csányi 1978*.

[82] *Kiss 2012a* 215; *Dani et al. 2019* figs. 14–15.

[83] The cells of the theoretical influence areas were generated in QGIS based on the central points of the sites. Their sides are determined by straight lines drawn at a right angle at the midpoint of the lines connecting neighbouring settlements. These cells are known as Thiessen (*Sánta 2010* 31; *Priskin et al. 2013* 6) or Voronoi polygons (*Puskás 2023* 291–294, fig. 5).

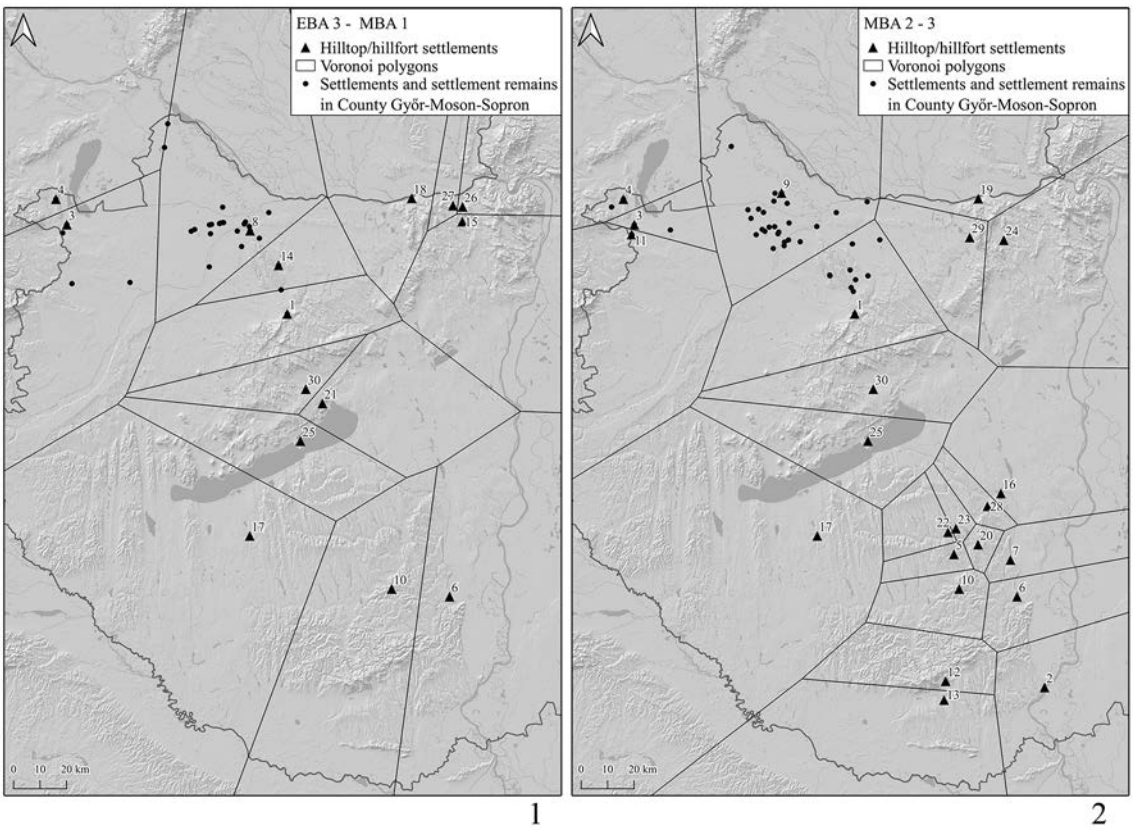

Fig. 6. 1. Hilltop and hillfort settlements and the Voronoi polygons representing their hypothesised influence areas in the transitive phase of the Early and Middle Bronze Ages in Transdanubia; 2. Hilltop and hillfort settlements and the Voronoi polygons representing their hypothesised influence areas in Transdanubia (site numbers are resolved in *Table 2*) (©Eszter Melis)

In the transitive phase of the Early and Middle Bronze Ages, more hilltop settlements seem to have been north of Lake Balaton than south of it *(fig. 6. 1)*, mainly sites of the Tokod group along the Danube and other settlements in the southern and northern foregrounds of the Bakony Mountains. Most open Kisapostag sites in Győr-Moson-Sopron County lie in the supposed influence area of the northernmost central settlement, Ménfőcsanak-Csanak-hegy. The Gáta–Wieselburg settlements south of Lake Fertő lie in the influence areas of diverse central settlements.

Based on the available literature completed with data from research in Győr-Moson-Sopron and Komárom-Esztergom counties, fewer central settlements were in northern Transdanubia in the Middle Bronze Age than in the previous period *(fig. 6. 2)*. Large cells (also known as Thiessen or Voronoi polygons) appear on the Voronoi diagram generated based on the central settlements, dividing the eastern part of Győr-Moson-Sopron County with open TEPC settlements into two zones, the foregrounds of the Transdanubian Mountains and the Little Hungarian Plain. The large cells – supposed influence areas – reflect, on the one hand, the state of research in the particular regions while, on the other hand, they might also indicate a social structure different than that of the communities residing in the territory of Central Hungary and the Great Hungarian Plain at the time.[84]

Considerably smaller influence areas were calculated for Fertőboz-Gradinahegy (*Table 2,* site 3) in the Lake Fertő area; however, the larger territories of Fertőrákos-Kecskehegy and

[84] *Dani et al. 2019* 863–864.

Nagycenk-Alsó-domb-dűlő (*Table 2,* sites 4 and 11) could be connected with similar settlements in Burgenland, which distorts the model in the western areas. Collecting the settlements with similar dating in Austria and cross-border analysis are beyond the scope of this study; therefore, only a few sites well-known from archaeological literature are mentioned. Darufalva-Tábor (Drassburg-Taborac, Austria), one of the eponymous sites of the Guntramsdorf–Drassburg group, the Austrian group of *Litzenkeramik*, lies at 234 m a.B.S.l., only 12 km away from the recent shore of Lake Fertő, on top of a plateau with three steep sides. The Bronze Age settlement at the site is only one in a row of occupations from the Neolithic to the Early Middle Ages, the fortifications belonging to the latter.[85] Based on the scatter of settlement features assigned to the *Litzenkeramik*, the entire plateau (save perhaps for the central zone) was inhabited in the period matching the Middle Bronze Age in Hungary, while there is no conclusive evidence of a fortification in this horizon.[86] Nagyhöflány-Föllik-hegy (Großhöflein-Föllik, Austria) is situated on a plateau of 4.5 ha, divided by a ditch into two unequal parts. The plateau rises 92 m above the valley of the Sulz Stream and flattens southwards. The steep sides were engirded by a dry stone wall fortifying a palisade wall, while the gently sloping southern side was also protected by a V-profile ditch. The site was first inhabited at the end of the Mesolithic, and the youngest findings dated to the Roman Period; however, based on the find material, the main occupation horizons are those of the Late Neolithic and the *Litzenkeramik* settlements.[87] A double *Litzenkeramik* burial was found on the site at 272 m a.B.s.l.; the grave cut through a pit of the Věteřov culture.[88]

In the Early Bronze Age of Central Europe (roughly coeval with the Middle Bronze Age in Hungary), hilltop and/or fortified settlements were established in a vast area from the territory of today's Switzerland to Eastern Slovakia.[89] While some regional differences are present, they all represent a similar lifestyle; their emergence was probably brought about by the formation of an active connection network involving the related communities (more specifically, their elite) aimed at an effective exploitation of available natural resources.[90] A major concentration of hilltop settlements was identified in Southwestern Slovakia, neighbouring the study area in the north; the emergence of this cluster is probably connected with the copper ore reserves of the Spiš-Gemer Ore Mountains.[91]

Summary

The territory of Győr-Moson-Sopron County has been a little researched area; the recent survey has revealed a more dense settlement network there between the end of the Early Bronze Age and the start of the Late Bronze Age than hypothesized before. Based on the author's research, the wetlands of the Hanság and the Kapuvár Plain were mostly uninhabited for 800 years from 2200/2100 to 1500/1400 BC. West of that, settlements of the Gáta–Wieselburg culture were scattered in the transitive phase of the Early and Middle Bronze Ages, while communities of the coeval Kisapostag culture inhabited more intensively the eastern zone of the county, especially the lands between the Rába and Rábca rivers *(fig. 1)*.

Considerably more TEPC settlements distributed in a significantly larger area have been identified in the county's territory; their elevated number suggests a population increase compared

[85] *Neugebauer 1994* 141–143; *Müller 2016* 6–7, Abb. 1–2.
[86] *Müller 2016* 50–52, Abb. 8.
[87] *Benkovsky-Pivovarová – Gömöri – Kaus 1988* 12, fig. 5.
[88] *Benkovsky-Pivovarová – Gömöri – Kaus 1988* 8–10, figs. 3–4; *Vékony 2000* 176–177.
[89] *Ettel 2010* 353–354, Abb. 1; *Jaeger 2016*.
[90] *Jaeger 2016* 139.
[91] *Ettel 2010* 354–355; *Duberow – Pernicka –Krenn-Leeb 2009* fig. 1.

to the previous period. The most intensively settled parts at the time of TEPC were those between the Rába and Moson Danube rivers, with another settlement concentration in the foregrounds of the Transdanubian Mountains *(fig. 2)*. Settlements were sparse west of the Hanság in the Middle Bronze Age, while sites with similar find material, bearing the stylistic traits of the Mad'arovce–Věteřov–Böheimkirchen cultural complex, have also been discovered in the eastern parts of the county, indicating a patchwork of communities with diverse cultural background inhabiting these lands. This diversity had disappeared by the start of the Late Bronze Age, and settlements of the Tumulus culture emerged along the Rába River and in the area of Lake Fertő. While Tumulus culture settlements spread over an even bigger area than Kisapostag or TEPC in the previous periods, their count is significantly lower, indicating a population decrease.

Upon analysing the setting of the sites, a distinction was made between open and hilltop settlements; the former were preponderant in all three periods *(fig. 4)*. Large-scale excavations have revealed extensive settlements, stretching tens of hectares of the Kisapostag and Gáta–Wieselburg cultures; however, all of them are non-intensive, consisting of scattered, loose clusters of settlement features. The higher intensity of TEPC settlements and the multilayer settlement of the culture at Mosonszentmiklós indicate prolonged settling. Completing the work of Gyula Nováki, a couple of hilltop settlements from the end of the Early and the Middle Bronze Ages were identified in the Pannonhalmi- and Fertőmelléki-dombság. The analysis of the newly identified sites with the coeval hilltop and hillfort settlements collected from literature outlined a relatively articulated settlement network in the transitive phase of the Early and Middle Bronze Ages. In the following Middle Bronze Age, the Voronoi cells of TEPC settlements match the settlement concentrations in the area between the Rába and Moson Danube rivers and the foregrounds of the Transdanubian Mountains. The assessment of the difference or hierarchy between the settlements requires significantly more excavations or non-destructive investigations, in order to determine their extent and intensity and reveal special features or items, as well as a comprehensive survey of their catchment areas, including the reconstruction of the water network and the identification of the possibly available natural resources.[92]

[92] *Duffy 2014; Kienlin – P. Fischl – Pusztai 2018*.

Table 1. Identified settlements and settlement traces from the period between the end of the Early Bronze Age to the early Late Bronze Age in the area of Győr-Moson-Sopron County

No.	Site name	IVO ID No.	Settlement type	Archaeological culture	Archaeological investigation	References
1	Bakonygyirót-Felső-győri-föld	7150	settlement remains (field survey)	Transdanubian Encrusted Pottery	1967 field walking, István Torma	*MRT 4* 26, site 3/3, Pl. 4, 11; *Kiss 2012a* 270, site 9.
2	Bakonypéterd-Tó-réti-dűlő	7217	settlement remains (field survey)	Transdanubian Encrusted Pottery	1967 field walking, István Torma	*MRT 4* 38–39, site 8/7; *Kiss 2012a* 270, site 10.
3	Bakonyszentlászló-Kesellő-hegy I.	7271	hillfort settlement	Kisapostag, Transdanubian Encrusted Pottery	1962–1964 excavation, Gyula Nováki	*MRT 4* 51, 12/11; *Nováki 1979* 75–123; *Kiss 2012a* 270, site 11.
4	Barbacs-Lanizsai-dűlő I./ Dör-Hegy-dűlő	70377/ 24124	open settlement	Kisapostag	2011–2012 excavation, Andrea Nagy and Krisztina Pesti	*Nagy – Pesti 2019a;* Krisztina Pesti and Róbert Herbály pers. comm.
5	Bodonhely-Irtás-dűlő	78703	settlement remains (field survey)	Transdanubian Encrusted Pottery	2010 field walking, Károly Takács	*Takács 2012.*
6	Dénesfa-Szikes-dűlő	1678	settlement remains (field survey)	Gáta–Wieselburg	1975 field walking, Sándor Faragó	Central Register of Archaeological Sites in Hungary (IVO); *Egry 2003b.*
7	Dör-Nagygát eleje	24127	open settlement	Transdanubian Encrusted Pottery, Tumulus	1997 excavation, Péter Tomka	*Egry – Szőnyi – Tomka 1997a; Tomka 2001; Kiss 2012a* 276, site 75; Péter Tomka pers. comm.
8	Enese-Fudi-puszta	32266	settlement remains (field survey)	Transdanubian Encrusted Pottery	1994 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO)
9	Enese-Pippani-dűlő	51434	open settlement	Kisapostag	2008–2009 excavation, Judit Antoni	*Antoni 2009; Antoni 2010a; Antoni 2010b; Antoni – Csupor – Udvardi 2012.*
10	Enese-Szabadság u. 72.	1684	open settlement	Kisapostag	2002 excavation, Péter Langó	*Langó 2004*; *Langó – Mende 2006* 231.
11	Fehértó-Tószárszeg	31136	settlement remains (field survey)	Transdanubian Encrusted Pottery	1994 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO)
12	Fertőboz-Gradinahegy	1704	hilltop settlement	Gáta–Wieselburg, Věteřov, *Litzenkeramik*	1963–1964 excavation, Gyula Nováki	*Nováki 1964a; Nováki 1964b; Nováki 1965b; Nováki 1965c; Nováki 1975* 323–329.
13	Fertőd-Sportpálya	46339	open settlement	Věteřov	2017 excavation, Ferenc Ujvári	Ferenc Ujvári pers. comm.
14	Fertőrákos-Kecskehegy	47593	hilltop settlement	Gáta–Wieselburg, Věteřov	1948 excavation, Gyula Nováki	*Nováki 1952; Nováki 1997* 29–33; *Mrenka 2022* 15–17, fig. 3, Pl. 3.

No.	Site name	IVO ID No.	Settlement type	Archaeological culture	Archaeological investigation	References
15	Fertőszentmiklós-Ikva-part	90357	open settlement	Tumulus	2019 excavation, Bálint Savanyú	*Savanyú 2020a* 38–39; Bálint Savanyú pers. comm.
16	Gyirmót-Borsó-dűlő (Győr)	21459	open settlement with ditch	Kisapostag, Tumulus	2001 excavation, Ildikó Egry	*Egry 2003a.*
17	Győr-Fövenyesdomb	45019	open settlement	Kisapostag, Tumulus	1991 excavation, András Figler	*Figler 1993a; Figler 1994* 23.
18	Győr-Pápai úti Állatvásártér	28829	open settlement	Tumulus	1999 excavation, Ildikó Egry	*Egry 2001* 57–58.
19	Győr-Szabadrét-domb	83843	open settlement	Kisapostag	1991 excavation, András Figler	*Figler 1993b* 15.
20	Győrszemere-Nagyszentpál- Kőris	93235	open settlement	Kisapostag	2021 excavation, Dávid Czigány	Dávid Czigány pers. comm.
21	Győrszentiván-Révhegyitag (Győr)	80787	open settlement	Tumulus	2015 excavation, Krisztina Pesti and Ferenc Ujvári	Ferenc Ujvári pers. comm.
22	Győrszentiván-Úsztató-rét II. (Győr)	73109	open settlement	Kisapostag, Transdanubian Encrusted Pottery	2015 excavation, Dávid Czigány	Central Register of Archaeological Sites in Hungary (IVO); Dávid Czigány pers. comm.
23	Győrújbarát-Rákóczi TSZ-től északra	57232	open settlement	Kisapostag	2014 excavation, Andrea Nagy and Róbert Herbály	Róbert Herbály pers. comm.
24	Hegyeshalom-Ház-dűlő (Ház-dűlő II.)	52829/ 52831	open settlement	Věteřov	2022 archaeological observation, Tamás Czuppon and Veronika Németh	Veronika Németh pers. comm.
25	Hegyeshalom-Országúti-dűlő	53597	open settlement	Gáta–Wieselburg, Tumulus	2006–2007 test excavation, Ágnes Aszt, 2014–2015 archaeological observation and rescue excavation, Róbert Herbály and Krisztina Pesti, 2016 test excavation, András Hargitai	*Aszt 2008; Melis 2020* 357, footnote 32.
26	Kóny-Döri határra dűlő	24326	open settlement	Kisapostag, Transdanubian Encrusted Pottery	2011, 2013 excavation, Andrea Nagy and Krisztina Pesti	*Nagy – Pesti 2019b.*
27	Kóny-Gázvezeték I./ Barbacsi tópart	24322	open settlement with ditch	Tumulus	1997 excavation, Ildikó Egry	*Egry 2002.*
28	Kóny-Káptalani-dűlő II.	77855	open settlement	Transdanubian Encrusted Pottery	2013 excavation, Dávid Czigány	*Czigány 2019.*

No.	Site name	IVO ID No.	Settlement type	Archaeological culture	Archaeological investigation	References
29	Kóny-Proletár-dűlő	51436	open settlement	Transdanubian Encrusted Pottery	2008–2009 excavation, Krisztina Varga	*Varga 2010.*
30	Kóny-Tökös-domb	24328	settlement remains (field survey)	Tumulus	1994 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO).
31	Kóny-Várhely	32261	settlement remains (field survey)	Transdanubian Encrusted Pottery	1994 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO).
32	Koroncó-Bábota	24266	open settlement	Tumulus	1939–1941 excavation, Sándor Mithay, Árpád Bottyán, Sándor Gallus, 2014 test excavation, Mária Zita Tokai, 2015 excavation, Dávid Czigány	*Mithay – Bottyán 1940; Mithay 1941* 7, Map 3, 2, Pl. III. 9–10, Pl. IV. 1; *Bándi 1967* 28; *Bándi 1972* 42; *Kiss 2012a* 286, site 176; *Czigány – Molnár 2020; Tokai 2021* 96–97.
33	Koroncó-Bősze-domb	24283	settlement remains (field survey)	Transdanubian Encrusted Pottery	1947 field walking, Béla Szőke and Sándor Mithay; 2002 field walking, Ildikó Egry	Central Register of Archaeological Sites in Hungary (IVO); *Bándi 1972* 46, 2. Map 14.
34	Koroncó-Haraszt II.	24287	settlement remains (field survey)	Tumulus	2002 field walking, Ildikó Egry	Central Register of Archaeological Sites in Hungary (IVO)
35	Lébény-Kölesszi-dűlő III.	74385	settlement remains (field survey)	Transdanubian Encrusted Pottery	2010 field walking, Máté Stibrányi	Central Register of Archaeological Sites in Hungary (IVO)
36	Lébény-Magasmart	24342	open settlement	Transdanubian Encrusted Pottery	1964 excavation, Rezső Pusztai	*Pusztai 1967* 5.
37	Levél-Borjúlegelő (Gázvezeték 2/2 lh.)	24372	open settlement	Tumulus	1995 excavation, András Figler	*Figler 1997a.*
38	Maglóca-Hany	31213	settlement remains (field survey)	Transdanubian Encrusted Pottery	1994 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO).
39	Markotabödöge-Vadlúd-sziget	31211	settlement remains (field survey)	Transdanubian Encrusted Pottery, Tumulus	1994 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO).
40	Ménfőcsanak-Csanak-hegy (Szamár-domb) (Győr)	77285	hilltop settlement with ditch	Kisapostag	2011 excavation, Péter Polgár	*Polgár 2018a.*

No.	Site name	IVO ID No.	Settlement type	Archaeological culture	Archaeological investigation	References
41	Ménfőcsanak-Széles-földek (Győr)	34305	open settlement	Kisapostag, Transdanubian Encrusted Pottery, *Litzenkeramik,* Veteřov, Tumulus	1990–1991 excavation, Péter Tomka, 1993–1994 excavation, Andrea Vaday, 1995, 1996, 1998, 2004, 2005–2006 excavations, Ildikó Egry, 2009–2011 excavation, Gábor Ilon	*Mithay 1941 6,* Map 2, 4, Pl. III, 1–7; *Figler 1996a; Vaday 1996–1997; Vaday 1997; Kovács 1997; Egry – Szőnyi – Tomka 1997b; Egry 2007; Kiss – Vaday – Fábián 2011; Melis 2011; Ilon 2012; Ilon 2014; Melis 2014; Ilon 2015; Tóth – Melis – Ilon 2016; Ilon 2019.*
42	Mérges-Homokos-domb	25612	settlement remains (field survey)	Transdanubian Encrusted Pottery	2006 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO).
43	Mérges-Mérgesi-csatorna keleti oldala	68849	settlement remains (field survey)	Transdanubian Encrusted Pottery	2006. field walking Károly Takács	Central Register of Archaeological Sites in Hungary (IVO).
44	Mórichida-Dombiföld, Faluhelyi-legelő	40999	settlement remains (field survey)	Kisapostag	collection, 2002 field walking, Péter Tomka	*Mithay 1941* 5, Map 2, 7; Pl. II, 5; Central Register of Archaeological Sites in Hungary (IVO).
45	Mosonszentmiklós-Akasztódomb	31088	multilayered settlement	Transdanubian Encrusted Pottery, Mad'arovce, *Litzenkeramik*	1957, 1966 excavation, András Uzsoki	*Uzsoki 1958; Uzsoki 1959; Uzsoki – Gabler 1967; Kiss 2012a* 289, site 315.
46	Mosonszentmiklós-Horgas II.	31128	open settlement	Transdanubian Encrusted Pottery	1996 excavation, András Figler	Central Register of Archaeological Sites in Hungary (IVO).
47	Mosonszentmiklós-Pál major	31139	open settlement	Kisapostag	1993–1995 excavation, András Figler	*Figler 1996b; Figler 1997b; Figler 1997c.*
48	Nagycenk-Alsó-domb-dűlő	63176	hilltop settlement	Mad'arovce, *Litzenkeramik,* Tumulus	2017 test excavation, Andrea Nagy and Attila Mrenka, 2018 excavation, Bálint Savanyú	*Savanyú 2020c;* Central Register of Archaeological Sites in Hungary (IVO); Bálint Savanyú pers. comm.
49	Nagycenk-Kövesmező	61358	open settlement	Gáta–Wieselburg	2005 excavation, János Gömöri, 2018 field walking, Eszter Melis	*Gömöri 2012* 12–13; *Gömöri – Melis – Kiss 2018; Melis et al. 2022.*
50	Nagylózs-Baglya-szeg összevont lelőhely	89387	open settlement	Tumulus	2018 excavation, Andrea Cséki	*Cséki 2020.*
51	Nagylózs-Sós-rét	86045	open settlement	Tumulus	2018 excavation, Gábor Márkus	*Márkus 2020.*
52	Nagyszentjános-Gönyűi úti Alsó Táblák	93869	settlement remains (field survey)	Transdanubian Encrusted Pottery	2017 field walking, Eszter Melis	Central Register of Archaeological Sites in Hungary (IVO).

No.	Site name	IVO ID No.	Settlement type	Archaeological culture	Archaeological investigation	References
53	Pázmándfalu-Réti-földek II.	82391	settlement remains (field survey)	Transdanubian Encrusted Pottery	2012 field walking, Máté Losonczi	Central Register of Archaeological Sites in Hungary (IVO).
54	Rábacsécsény-Fudi-puszta II.	32267	settlement remains (field survey)	Kisapostag, Transdanubian Encrusted Pottery, *Litzenkeramik*	collection, 1994, 2006 field walking, Károly Takács	*Mithay 1941* 12–13, Pl. II, 3, Pl. IX, 3–5, Pl. X, 7; *Kiss 2012a* 294, site 261; *Takács 2007.*
55	Rábapatona-Országúton felüli dűlő I.	67461	open settlement	Kisapostag/*Litzenkeramik*	2008 excavation, Ildikó Egry	Central Register of Archaeological Sites in Hungary (IVO); Hungarian National Museum Archaeology Database https://archeodatabase.hnm.hu/en/node/787, 01.06.2023.
56	Rábapatona-Országúton felüli dűlő II.	67459	open settlement	Kisapostag/ *Litzenkeramik*	2008 excavation, Ildikó Egry	*Egry 2009;* Central Register of Archaeological Sites in Hungary (IVO); Hungarian National Museum Archaeology Database, https://archeodatabase.hnm.hu/en/node/786, 01.06.2023.
57	Rábapatona-Országúton felüli dűlő III.	70195	open settlement with ditch	Kisapostag	2011 excavation, Péter Polgár, 2012–2014 excavation, Péter Polgár and Dávid Czigány	*Polgár 2018b; Polgár 2021; Polgár – Czigány 2021a.*
58	Rábapatona-Országúton felüli dűlő V.	84815	open settlement	Transdanubian Encrusted Pottery	2013–2014 excavation, Dávid Czigány	*Czigány 2021.*
59	Rábapatona-Poszogó-domb összevont lelőhely	33024	open settlement with ditch	Kisapostag	2011 excavation, Péter Polgár, 2012–2014 excavation, Péter Polgár and Dávid Czigány	*Polgár 2018b; Polgár 2021; Polgár – Czigány 2021b.*
60	Rábaszentmihály-Tajtó-domb	33152	settlement remains (field survey)	Transdanubian Encrusted Pottery	collection	Central Register of Archaeological Sites in Hungary (IVO).
61	Rábcakapi-Jend-domb	31198	settlement remains (field survey)	Transdanubian Encrusted Pottery, Tumulus	1951 field walking, Sándor Mithay, 1994 field walking, Károly Takács	Central Register of Archaeological Sites in Hungary (IVO).
62	Rajka-Hosszú-szántók	54025	open settlement	Gáta–Wieselburg	1996 excavation, András Figler	Central Register of Archaeological Sites in Hungary (IVO).

No.	Site name	IVO ID No.	Settlement type	Archaeological culture	Archaeological investigation	References
63	Ravazd-Simahegy, Piskótagyár	32320	open settlement	Tumulus	1997 excavation, Eszter Szőnyi and Péter Tomka	*Tomka – Szőnyi 2001.*
64	Ravazd-Villibald-domb	32321	hilltop settlement	Kisapostag	1984–1985 excavation, András Figler, 1995 excavation, Péter Tomka	*Figler 1985; Figler 1986; Bartosiewicz 1996; Tomka 1997; Kulcsár 2009* 381, site 177; *Takács 2009.*
65	Rétalap-Gulyakút	24131	settlement remains (field survey)	Transdanubian Encrusted Pottery	1992 field walking, Péter Tomka	Central Register of Archaeological Sites in Hungary (IVO).
66	Románd-Erdő-földek (Waldackerl)	9113	settlement remains (field survey)	Kisapostag	1965, 1968 field walking, István Torma, 1967 field walking, Margit Dax and Szilvia Palágyi	*MRT 4* 223, site 68/10, fig. 43; *Bándi 1972* 47.
67	Románd-Pápai út	9116	settlement remains (field survey)	Transdanubian Encrusted Pottery	1965, 1967 field walking, István Torma	*MRT 4* 224, site 68/13, Pl. 4, 12–14; *Kiss 2012a* 294, site 266.
68	Románd-Romándi-major I.	9111	settlement remains (field survey)	Tumulus	1967 field walking, István Torma	*MRT 4* 223, site 68/8, Pl. 5, 20–25.
69	Sokorópátka-Faluhely alsó	33161	settlement remains (field survey)	Transdanubian Encrusted Pottery	collection, 2007–2008 field walking, Szilvia Bíró	Central Register of Archaeological Sites in Hungary (IVO); *Molnár 2009* 94–95.
70	Sokorópátka-Faluhely felső	33168	settlement remains (field survey)	Transdanubian Encrusted Pottery	2007–2008 field walking, Szilvia Bíró	Central Register of Archaeological Sites in Hungary (IVO); *Molnár 2009* 94–95.
71	Sopron-Krautacker	38636	open settlement	Věteřov	1973–1987 excavation, Erzsébet Jerem	*Kiss in print* 24, fig. 10, 71.
72	Sopron-Lóversenytér	88981	open settlement	*Litzenkeramik,* Tumulus	2018 excavation, Bálint Savanyú, 2021 excavation, Attila Mrenka	Central Register of Archaeological Sites in Hungary (IVO); *Savanyú 2020b;* Bálint Savanyú and Attila Mrenka pers. comm.
73	Szakony-Kavicsbánya	34028	open settlement	Gáta–Wieselburg	1964 excavation, Gyula Nováki	*Nováki 1965a; Leeb 1987* 278; *Ilon 1996.*
74	Tápszentmiklós-Zörögök-dűlő (Kavicsbánya)	34065	open settlement	Transdanubian Encrusted Pottery, Mad'arovce	1997 excavation, András Figler, 2007 excavation, Szilvia Bíró and Attila Molnár	*Bíró – Molnár 2008* 290; Central Register of Archaeological Sites in Hungary (IVO).
75	Tarjánpuszta-Vasasföld II./IR 105	32315/32316	open settlement	Transdanubian Encrusted Pottery	1979, 1981 excavation, János Gömöri	*Gömöri 1980* 115; *Gömöri 1982* 73.

Table 2. Hilltop, hillfort, and multilayer settlements in Transdanubia at the end of the Early Bronze Age and in the Middle Bronze Age

No.	Site name	IVO ID No.	County	Archaeological culture / phase	Settlement type	References
1	Bakonyszentlászló-Kesellő-hegy I.	7271	Győr-Moson-Sopron	Late Kisapostag – Early Encrusted Pottery, older phase of Encrusted Pottery	hillfort settlement	*MRT 4* 51, 12/11; *Nováki 1979* 75–123; *Kiss 2012a* 270, site 11.
2	Dunaszekcső-Várhegy	24621	Baranya	older and younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 277, site 83; *Dani et al.* 2019 figs. 14–15.
3	Fertőboz-Gradinahegy	1704	Győr-Moson-Sopron	Gáta–Wieselburg, Věteřov, *Litzenkeramik*	hilltop settlement	*Nováki 1964a; Nováki 1964b; Nováki 1965b; Nováki 1965c; Nováki 1975* 323–329.
4	Fertőrákos-Kecskehegy	47593	Győr-Moson-Sopron	Gáta–Wieselburg, Věteřov	hilltop settlement	*Nováki 1952; Nováki 1997* 29–33; *Mrenka 2022* 15–17, fig. 3, Pl. 3.
5	Gyulaj-Pogányvár	23414	Tolna	older and younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 280, site 122; *Dani et al. 2019* figs. 14–15.
6	Harc-Várhegy	23063	Tolna	Late Kisapostag – Early Encrusted Pottery, younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 281, site 127; *Dani et al. 2019* figs. 14–15.
7	Kölesd-Csonthegy	23057	Tolna	younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 286, site 181; *Dani et al. 2019* figs. 14–15.
8	Ménfőcsanak-Csanak-hegy (Szamár-domb) (Győr)	77285	Győr-Moson-Sopron	Kisapostag	hillfort settlement	*Polgár 2018a.*
9	Mosonszentmiklós-Akasztódomb	31088	Győr-Moson-Sopron	younger phase of Encrusted Pottery	multilayered settlements	*Uzsoki 1958; Uzsoki 1959; Uzsoki – Gabler 1967; Kiss 2012a* 289, site 315.
10	Mucsi (Lengyel)-Sánc	23059	Tolna	Late Kisapostag – Early Encrusted Pottery, older and younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 290, site 220; *Dani et al. 2019* figs. 14–15.
11	Nagycenk-Alsó-domb-dűlő	63176	Győr-Moson-Sopron	Mad'arovce, *Litzenkeramik,* Tumulus	hilltop settlement	*Savanyú 2020c;* Central Register of Archaeological Sites in Hungary (IVO); Bálint Savanyú pers.comm.
12	Pécs-Mecsekszabolcs/Pécs-Szabolcs-Középhegy-dűlő	38076	Baranya	older and younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 293, site 254; *Dani et al. 2019* figs. 14–15.
13	Pécs-Nagyárpád	59397	Baranya	younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 293, site 253; *Dani et al.* 2019 figs. 14–15.
14	Ravazd-Villibald-domb	32321	Győr-Moson-Sopron	Kisapostag, Late Kisapostag – Early Encrusted Pottery	hilltop settlement	*Figler 1985; Figler 1986; Bartosiewicz 1996; Tomka 1997; Kulcsár 2009* 381, site 177.
15	Sárisáp-Quadriburg I.	2558	Komárom-Esztergom	Tokod group	hillfort settlement	*Nováki 1975* 327; *Cseh 1999* 66, site 34. 3.

No.	Site name	IVO ID No.	County	Archaeological culture / phase	Settlement type	References
16	Simontornya-Mozsihegy	50756	Tolna	younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 296, site 278; *Dani et al. 2019* figs. 14–15.
17	Somogyvár-Kupavárhegy	20405	Somogy	Late Kisapostag – Early Encrusted Pottery, younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 297, site 289; *Dani et al. 2019* figs. 14–15.
18	Süttő-Kissánc	2586	Komárom-Esztergom	Tokod group	hillfort settlement	*Cseh 1999* 67, site 35. 3.
19	Süttő-Nagysánctető	2587	Komárom-Esztergom	older and younger phase of Encrusted Pottery	hillfort settlement	*Cseh 1999* 67–68, site 35. 4; *Kiss 2012a* 297, site 292; *Dani et al. 2019* figs. 14–15.
20	Szárazd-Vaskapu	23737	Tolna	younger phase of Encrusted Pottery	hilltop settlement	*Dani et al. 2019* figs. 14–15.
21	Szentkirályszabadja-Kőhegy II.	9322	Veszprém	Late Kisapostag – Early Encrusted Pottery	hilltop settlement	*Kiss 2012a* 300, site 321.
22	Tamási-Dorombos	40428	Tolna	younger phase of Encrusted Pottery	hilltop settlement	*Dani et al. 2019* figs. 14–15.
23	Tamási-Henye	40691	Tolna	younger phase of Encrusted Pottery	hilltop settlement	*Dani et al. 2019* figs. 14–15.
24	Tarján-Szalánkai-dűlő	56009	Komárom-Esztergom	Encrusted Pottery	hilltop settlement	*Cseh 1999* 51, site 22. 1.
25	Tihany-Óvár	9433	Veszprém	Late Kisapostag – Early Encrusted Pottery, younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 304, site 350; *Dani et al. 2019* figs. 14–15.
26	Tokod-Leshegy	2655	Komárom-Esztergom	Tokod group	hillfort settlement	*Torma 1972b; Nováki 1975* 327; *Cseh 1999* 71, site 37. 7.
27	Tokod-Sáncok	2640	Komárom-Esztergom	Tokod group	hillfort settlement	*Torma 1972b; Nováki 1975* 327; *Cseh 1999* 71, site 37. 9.
28	Tolnanémedi-Nebojsza	23413	Tolna	younger phase of Encrusted Pottery	hilltop settlement	*Kiss 2012a* 305, site 356; *Dani et al. 2019* figs. 14–15.
29	Vértesszőlős-Magaslati telep	50538?	Komárom-Esztergom	Encrusted Pottery	hilltop settlement	*Cseh 1999* 52, site 24. 3.
30	Veszprém-Várhegy, Törvényszéki épület, Szt. György kápolna and Gizella-kápolna	9648, 9736	Veszprém	Late Kisapostag – Early Encrusted Pottery, younger phase of Encrusted Pottery	hilltop settlement	*Csányi 1978; Kiss 2012a* 310, site 386, 387; *Dani et al. 2019* figs. 14–15.

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ANTAEUS 39 (2023) 53–101

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ÁKOS EKRIK – BIANKA GINA KOVÁCS – ZSÓFIA NÁDAI

COMPLEX ARCHAEOLOGICAL RESEARCH OF A BRONZE AGE HILLFORT AND A MEDIEVAL VILLAGE AT SZÉKESFEHÉRVÁR-BÖRGÖND (HUNGARY)

Zusammenfassung: Vorliegende Studie konzentriert sich auf die Erforschung der archäologischen Fundorte unweit des heutigen Börgönd (Komitat Fejér, Ungarn) und untersucht die Auswirkung der Umweltbedingungen hinsichtlich der Niederlassung. Auf dem erforschten Gebiet liegen ein bronzezeitliches Erdwerk und die dazugehörigen Satellitensiedlungen, bzw. eine mittelalterliche Kirche mit Dorf. Zwischen 2019 und 2023 führten wir in mehreren Etappen Fundortanalysen mit Drohnen durch und nahmen geophysische Analysen (Bodenradar, Magnetometer) und Nachforschungen mit Metalldetektoren vor. Die Ergebnisse, die sich aus der Verarbeitung der gesammelten Daten und Funde ergaben, verglichen wir mit den umweltarchäologischen Bezügen der historischen und kartographischen Quellen. Auf dieser Grundlage zeichneten sich die hydrographischen Veränderungen des Velencer Sees ab, woraus hervorging, dass sich die Siedlungen in Zeiten der Gewässerregulierung auf einer niedrigeren Terrainebene befanden.

Keywords: Bronze Age hillfort, medieval settlement, metal detector survey, geophysical survey, find distribution, material culture, historical waterscapes

Börgönd (earlier Börgöndpuszta) is located in eastern Transdanubia (Hungary). Today, it belongs to the administrative area of Székesfehérvár, the seat of Fejér County, halfway between Budapest and Lake Balaton. It lies about 10-12 km south-east of the historic town centre and about 2.5-3 km away from the built-up part, on the western fringes of the Dinnyési-fertő, a part of the marshland around Lake Velence. Currently, Börgönd is a dead-end village with about 450-500 residents, some 750 m away from Road No. E66 *(fig. 1)*.

The research area is about 1.5 km south of the inhabited part of the village, on a hill stretching north-south by the marshland. The greater part of the elevation is ploughed, save for a kilometre-long strip on a slope and a south-western stretch of the hilltop, covered by a dense, shrubby secondary black locust forest. The stretch extends to 40 × 120 m with a straight, 30 m-wide, shrubby strip at its western end. This strip, now difficult to walk even on foot, aligns with the current dirt road network crisscrossing the fields. The forested part appears on the satellite images as a characteristic patch in the shape of a number 1; the highest point, known as Szent László-hegy [Szent László Hill] or Lászlóhegy is positioned at its north-eastern end *(fig. 2)*.

The extent of the non-submerged plain between the reeds and wetlands of the Dinnyési-fertő and the elevation in focus depends highly on the weather. A dirt road runs there northwest-southeast from Fő utca ['Main Street'] in Börgönd towards Seregélyes, the neighbouring settlement. Today, this dirt road turns west just before reaching Seregélyes and joins a side road of Road No. E66. However, sections of its former path are still visible on satellite images, outlined by forest belts marking the boundaries between plots, and (nearly) impassable byroads in fields.

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Fig. 1. The position of Börgönd (Börgöndpuszta) on the outskirts of Székesfehérvár on a geomorphologic map of Hungary (©Zsóka Varga)

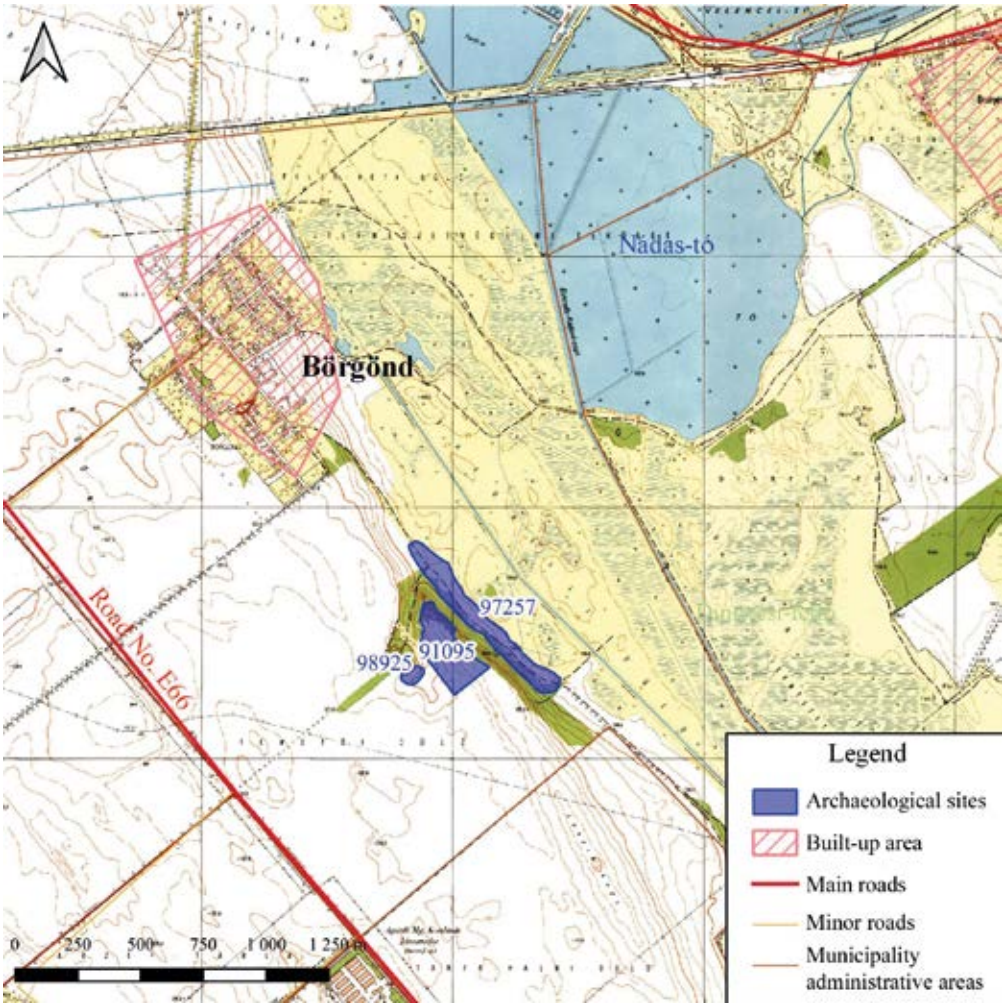

Fig. 2. The position of the research areas in relation to Börgöndpuszta (©Zsófia Nádai)

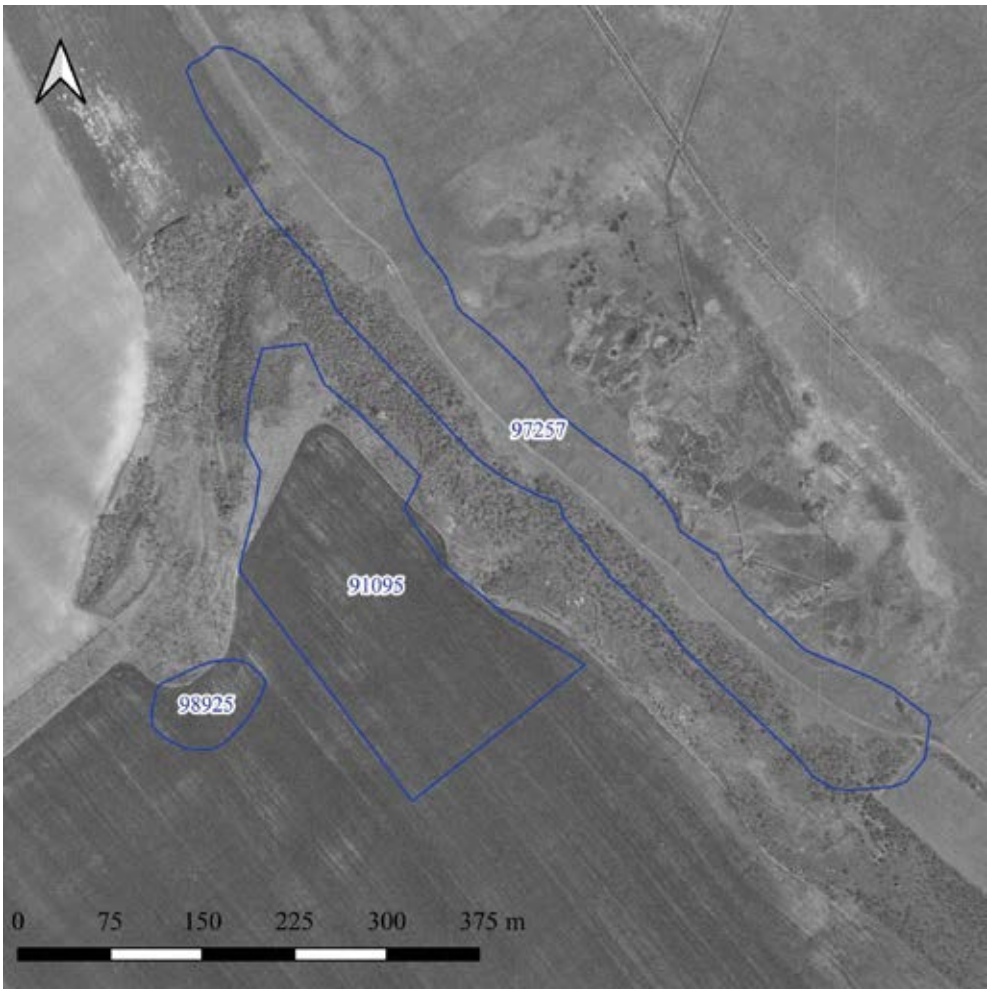

Fig. 3. Military aerial photo from 1968, showing the path of the one-time road and the mounds of the medieval houses (©Ákos Ekrik, ©Zsófia Nádai, source: Digital Aerial Image Archives of the Lechner Knowledge Center Non-Profit Ltd. 1968-0037-6939, https://www.fentrol.hu/hu/legifoto/113844)

The first archaeological site in the area was identified thanks to this dirt road, which originally ran right beside the forested part *(fig. 3),* until the local agricultural cooperative decided to move its path to the east, closer to the swamp in 1979. Cropmarks showing its former path are still visible on satellite images and ortophotos *(fig. 4).* The work required the uneven terrain to be levelled, revealing that the small protrusions are in fact the debris of one-time houses containing pottery in abundance. The workers of the cooperative reported the discovery to the local museum in Székesfehérvár, and Zsuzsanna Bánki conducted archaeological observation on the site, publishing the results in *Régészeti Füzetek* in a short report titled Börgönd-Horgos-oldal.[1] Máté Stibrányi surveyed the site as part of his PhD research in 2008, collecting late medieval pottery in the known area of the one-time village and Árpád Age sherds up the hill. He also supposed, based on historical maps, that the church of the medieval village was situated at the south-western end of the shorter arm of the number 1-shaped forest patch, at the entrance of the double valley cutting into the hill.[2]

[1] *Bánki 1979* 110. Based on the field documentation, the research was certainly conducted on the Székesfehérvár-Börgönd, Faluhelyi-dűlő [ID No. 97257] site.

[2] *Stibrányi 2015* 11. Enlisted as Székesfehérvár-Börgönd, Temetői-dűlő [ID No. 98925] in the Central Register of Archaeological Sites in Hungary (IVO).

Fig. 4. Ortophoto of the 3D photogrammetry survey showing the research area (©Adrián Berta, ©Ákos Ekrik, ©Zsófia Nádai)

Stibrányi and Gábor Váczi have also identified a small hillfort, of only 0.6 ha, of the Vatya culture on Szent László-hegy above the medieval village.[3] Based on pottery collected on the intensive settlement on a plateau south of the fortification, they dated the construction and use of the hillfort to the period between the end of the Early Bronze Age and the end of the Middle Bronze Age.[4] Later, Bálint Savanyú surveyed the site, determining the extent of the Bronze Age settlement.[5]

A team from the Archaeological Institute of the Research Centre for the Humanities of the Hungarian Research Network (AI HUN-REN) started investigating the medieval features of the site within the frame of the project *'Medieval and Early Modern Period archaeological topography of the area of Székesfehérvár',* part of the *'Árpád-ház'* [Árpád Dynasty] programme, in 2019. At the same time, Ágnes Kovács from the King St. Stephen Museum (Szent István Király Múzeum, hereinafter as SZIKM) in Székesfehérvár, unearthed a pit of the Vatya culture during the archaeological observation of soil condition tests in the area. She has decided to improve her knowledge of the Bronze Age fortification and settlement and started a metal detector survey project within the frame of the Community Archaeology Programme of SZIKM. The investigations have been concerted since 2021 to gain as much information on the site as possible by applying non- and minimum-destructive methods. Particular emphasis has been laid on the relationship of the one-time inhabitants with the landscape and the outlining and comparing of the ways of how they interacted with and used their environment.

[3] Registered as Székesfehérvár-Börgönd, Lászlóhegy [ID No. 91095] in IVO.
[4] *Váczi – Stibrányi 2008* 208–211.
[5] In 2015, according to IVO.

Methods

The areas of all settlements were surveyed first; next, a team of volunteers from SZIKM conducted multiple metal detector surveys using their own equipment. Geophysical surveys were carried out using a magnetometer and a ground-penetrating radar (GPR); besides, the site was drone-mapped. A third field walking campaign was conducted in December 2023, with a focus on recording possible elevation changes and other soil marks in the sparse vegetation[6] *(fig. 5)*.

A SENSYS MAGNETO® MXPDA 5-channel pushcart magnetometer system with FGM-650 vertical fluxgate gradiometers with 0.5 m spacing, capable of detecting anomalies to a depth of 0.75-1 m, was used for the survey. With a progress of about 4-5 km/h, this system recorded the x, y, z, and nT values of a 0.5 × 0.08 m data point grid of the surveyed area. The recorded data were corrected in real time by an RTK-assisted GNSS system.

Raw data were displayed on a GeoTIFF raster image with a 0.25 m/pixel resolution, which was processed in multiple steps using Magneto®Arch 3.01-12, Snuffler 1.32, and Quantum GIS 3.26.1. This method is based on the observation that archaeological phenomena have their own magnetic field due primarily to the different remanent magnetic fields in their components; this field is different to its environment and can be measured (and, thus, separated) using a magnetometer. While this method is effective for locating anomalies, i.e., features of archaeological interest, it cannot be used alone or directly to determine their age.[7]

Altogether, 6.7 ha were surveyed this way in two goes and four parts, following the changes in land cover (first three fields of 4.05, 2.2, and 0.25 ha, with another 0.2 ha next time; in the north-western and central zones, the forested strip bordered and divided the surveyed plots). The second survey trip focused on the supposed 0.2 ha area of the medieval church building; we started with clearing the field from shrubbery and then surveyed it with a finer, 0.25 m sensor grid (partially overlapping the area of the previous survey).

The area of the medieval church building was also GPR surveyed in three small zones (BOR2: 22 × 25 m, BOR3: 18 × 48 m, BOR4: 5 × 12 m) using a Malå GX 450HDR GPR device with 450 mHz nominal frequency and 0.5 m spacing in Object Mapper mode. With such setting, the device was suitable for detecting buried buildings and structures in particular.[8] Raw data were processed in GPRSlice and displayed and evaluated in QuantumGIS 3.26.1.

The 3D photogrammetry survey of the terrain was made using a DJI Phantom 4 RTK unmanned aerial vehicle *(fig. 4)*. Data were georeferenced during recording by a DJI D-RTK2 device. Raw data were processed using Agisoft Metashape and displayed in digital terrain model (DTM) *(fig. 6)* and orthomosaic images for further evaluation.[9]

As the four sites in the study area – two Bronze Age and two medieval ones – are more or less distinct, they can be discussed separately in this paper. First, the geographical setting is presented, then the results of the research on the Vatya culture features: the research history of the site, the structure of the hillfort with analogies from the culture, and the recovered find material.

Next, the results of the investigations in the area of the supposed church and the medieval village are discussed, involving the presentation of the related historical sources, the evaluation

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[6] We are grateful to all participants for their efforts, including Csaba Bartha, Márton Bohn, Attila Csiki, Tamás Danka, Krisztián Felgyői, Endre Fogarasi, Gyula Gyulay, Dömötör Kovács, Zsuzsanna Lencsés, András Megyeri, Attila Mihályi, Csaba Molnár, Csaba Nagy, Zoltán Németh, Attila Pápai, József Pásztor, Gábor Tarbay, László Vadon, Dávid Varga, and Dénes Veszeli. The geophisical surveys were led by Adrián Berta, with the participation of his collegues of HUN-REN: Elek Benkő, Ákos Ekrik, Ágnes Kolláth, Bianka Gina Kovács, Tibor Marton, Eszter Melis and Zsófia Nádai.

[7] *Schmidt et al. 2015* 59–67.

[8] *Schmidt et al. 2015* 77–88.

[9] *Westoby et al. 2012*.

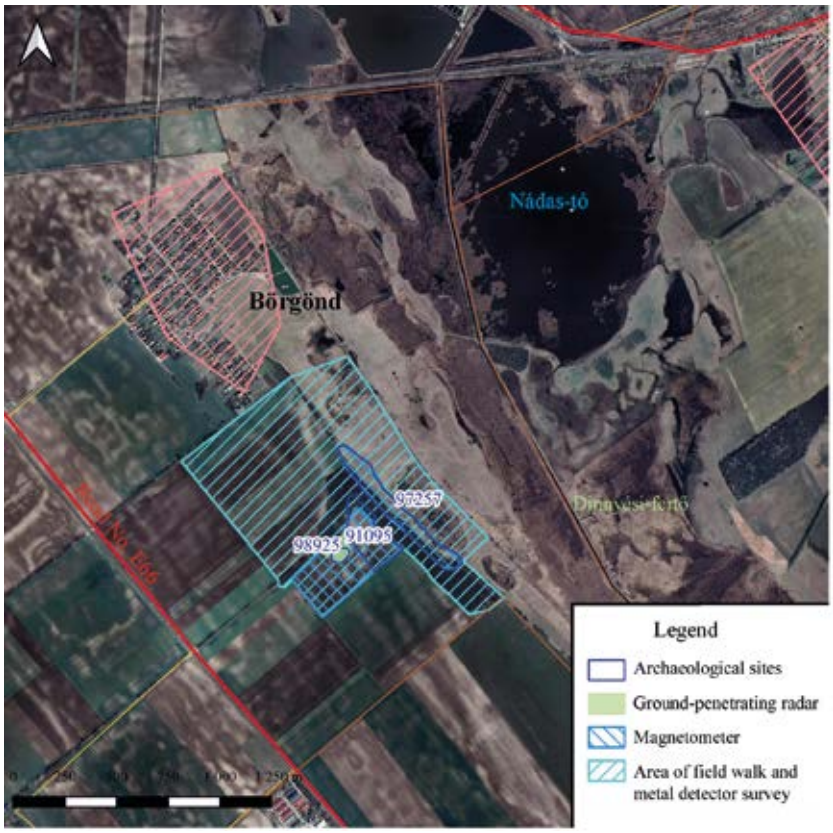


Fig. 5. The position of the geophysical survey zones (©Zsófia Nádai)

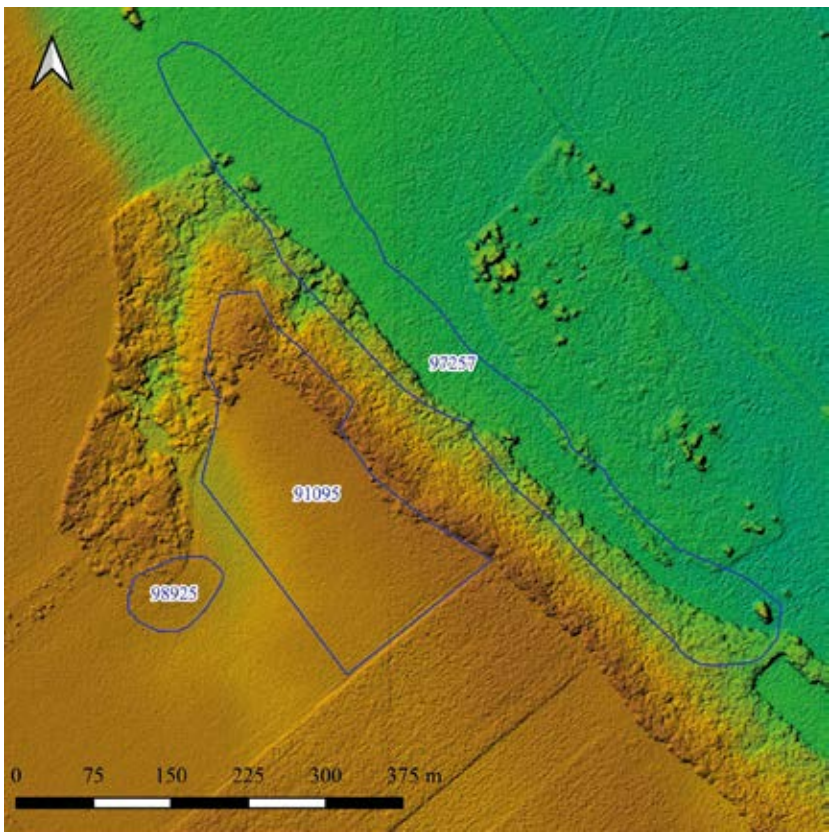


Fig. 6. Digital terrain model (DTM) of the research area (©Adrián Berta, ©Ákos Ekrik, ©Zsófia Nádai)

of the data gleaned by non-destructive and metal detector surveys, and the find material. It is followed by a summary of our conclusions regarding the position, dating, and characteristics of the church and the village, also collecting their analogies and shedding light on their connections with other settlements. Lastly, we draw our conclusions regarding the sites' relationship with the wider landscape and its changes through time.

The geological setting of Börgönd and its surroundings

In geological terms, Börgönd is part of the Central Mezőföld microregion, which, albeit located in Transdanubia, is similar to the Great Hungarian Plain. It is practically an eroded alluvial cone, gently sloping towards the Danube River in the south-east and divided by shallow valleys. The proportion of open water and wetlands in the region is 0.6% today. Most parts have chernozem soil, but alluvial meadow soils and humic sandy soil also occur. Currently, most fields are ploughed and divided by forested strips or dirt lanes.[10] According to the geological map of Hungary *(fig. 7),* the northern part of the higher terrain, including Szent László-hegy, next to Börgöndpuszta is loess, while the area south of it is sand; the lands east of the higher terrain consist of riverine and paludal deposits, surrounded by eluvial and deluvial deposits, until the next village, Seregélyes.[11] The eluvial and deluvial deposits mark the areas of previous watercourses and waterlogged areas, of which only the Dinnyési-fertő (the relic of the one-time western basin of Lake Velence) has remained after the water regulation. Lake Velence is a relatively young formation, dating back to the Old Holocene Period about 10,000 years ago.[12] Originally, Lake Velence formed in two perpendicular grabens: the northeast-southwest depression, which is its basin today, and a northwest-southeast-directed one in the place of today's Dinnyési-fertő. The western basin, continuously filled with the deposit of the Császár-víz Stream, appears on historical maps as Nádas-tó [the name meaning Lake of Reeds].

In its natural state, the water system of Lake Velence was characterised by great diversity: the water level could fluctuate by up to 2–2.5 m, bringing about dramatic changes in the shoreline. Even a slight rise in water level could push the shallow southern shoreline outwards by 100 m.[13] Alder carrs and small gallery forests surrounded the lake; the open water surface was bordered by a wide strip of reeds in the northern and a narrow strip in the southern zone. The coastline was also diverse, with open water, reed-grass, reeds, sedges, and meadows in different proportions.[14] The swamps of the Nádas-tó were drained in the 18th century by canals.[15] Lake Velence remained untouched by human landscaping activity until the mid-19th century. It suffered the first major transformation during the construction of the Budapest–Fiume railway line in the mid-19th century when the current basin was severed from Nádas-tó.[16]

The sites south-east of Börgönd, i.e. the people who settled there, adapted their lifestyle to the natural setting. This original environment, giving a frame to human presence in archaeological and historical periods, may be best reconstructed from the water regulation map of Lake Velence from 1791 *(fig. 8. 1),*[17] the maps of the Habsburg military surveys *(fig. 9),* and a cadastral map from the end

[10] *Csorba 2021* 26–27.
[11] Geological key sections of Hungary by the Mining and Geological Survey of Hungary (MBFSZ).
[12] *Ádám 1955* 319; *Ádám 1959* 221, 225; *Boromisza 2012* 89.
[13] *Boromisza 2012* 89–90.
[14] *Boromisza 2012* 89.
[15] *Ádám 1955* 324; *Ádám 1959* 218.
[16] *Boromisza 2012* 90.
[17] *MNL OL* Map Archive, S 12–Div. XIII.–No. 220:1 (https://maps.hungaricana.hu/hu/MOLTerkeptar/5232/).

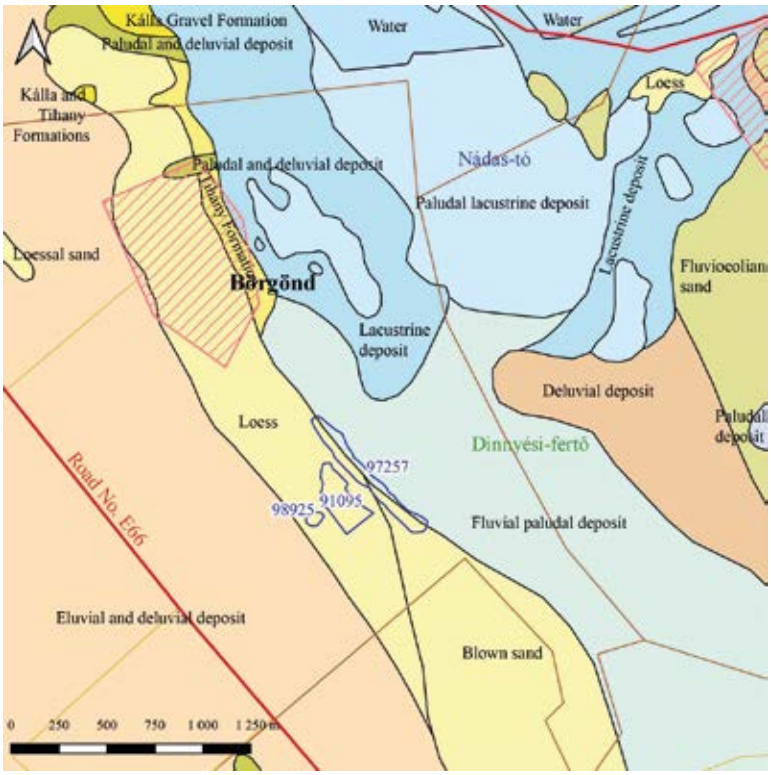


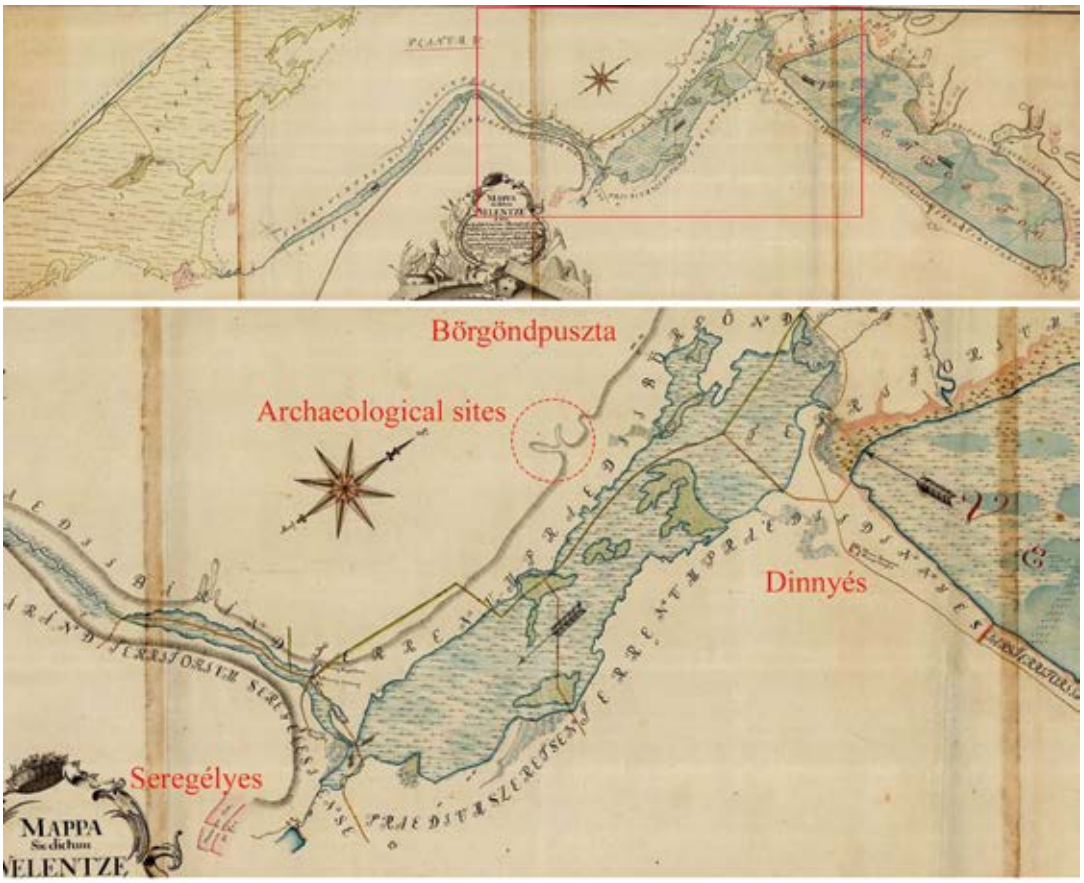
Fig. 7. Soil types based on the geological map of Hungary and the known perimeters of the sites (©Zsófia Nádai, source: Mining and Geological Survey of Hungary (MBFSZ) https://map.mbfsz.gov.hu/fdt_alapszelvenyek/)

of the 19th century *(fig. 8. 2).*[18] In some cases, these provide a good starting point for the research of the relation between the one-time settlers and their environment, as the settlement marked as 'Börgönd' or 'Börgöndpuszta' in these Early Modern Period maps is in the place of today's Börgönd. A prominent feature marked on these maps is the hill range stretching in a northwest-southeast direction following the west border of the wetlands of the so-called 'Nádas-tó' or 'Szerecsenyi-Nádas-tó'. On its west and south sides the elevation continues in the low, undulating hills of the Mezőföld.

A glimpse at these historical maps also reveals that the roads from Székesfehérvár towards Seregélyes ran through this area from north-west to south-east, following the valleys and elevations. By the time of the second Habsburg military survey (1858), the path of the main road from Székesfehérvár had been straightened and ran in the line of today's Road No. E66 *(fig. 9. 2),*[19] but the map of the first Habsburg military survey from 1783 *(fig. 9. 1)*[20] shows the road network of the area as it was in the Early Modern Period.[21] On this map, the regional road (marked by a relatively thick line) bypassing Börgöndpuszta from the west turns slightly eastward south of the settlement and runs between the two hill ranges.[22] The same map marks smaller roads running in and out of Börgönd, showing the settlement site as a junction point.

The latest historical event, which had an important effect on the research conducted in the area was World War II, when the Szent László-hegy was built into a gun emplacement. Zig-zag lined

[18] *Stibrányi 2015* 115.
[19] *Kovács 2002* insert no. 20.
[20] *Kovács 2002* insert no. 4.
[21] *Stibrányi 2015* 69–70.
[22] *Stibrányi 2015* Maps 29, 37–38. In his PhD dissertation, Máté Stibrányi reconstructed this path for the medieval dirt road between Börgönd and Seregélyes.



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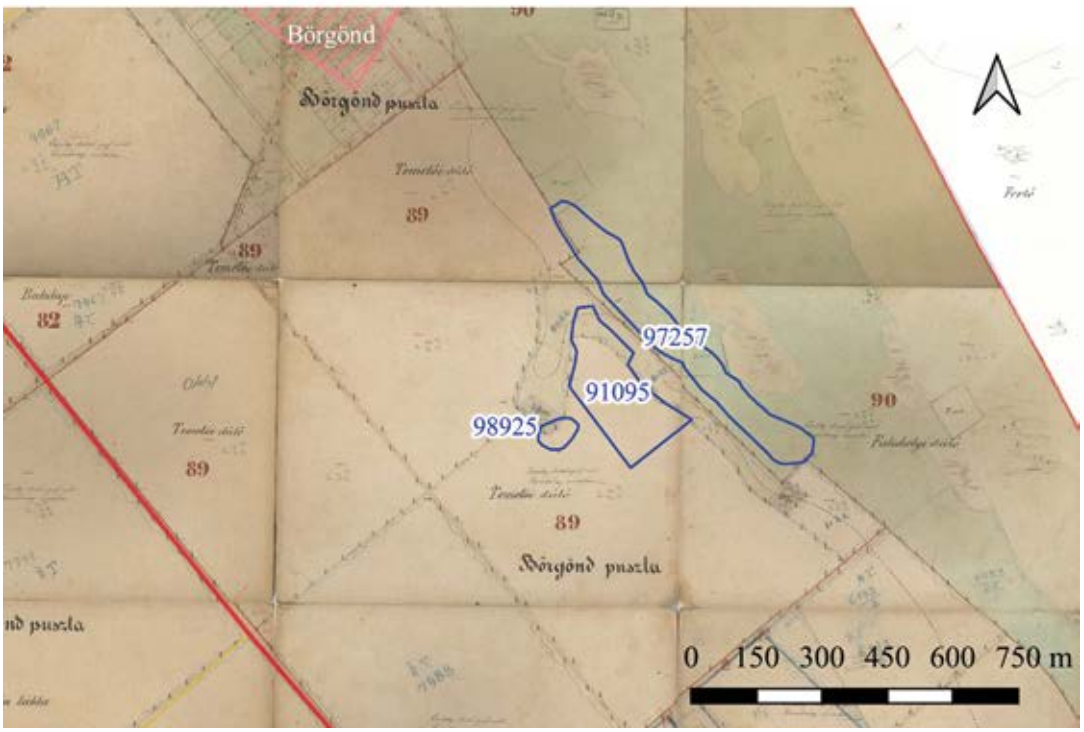

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Fig. 8. 1. Water regulation plan of Lake Velence from 1791 (©Zsófia Nádai, Source: *MNL OL* Map Archive: S12–Div.XIII–No. 220:1 (https://maps.hungaricana.hu/hu/MOLTerkeptar/5232); 2. Section of the Cadastral map from 1884. (Source: https://maps.arcanum.com/en/map/cadastral/)

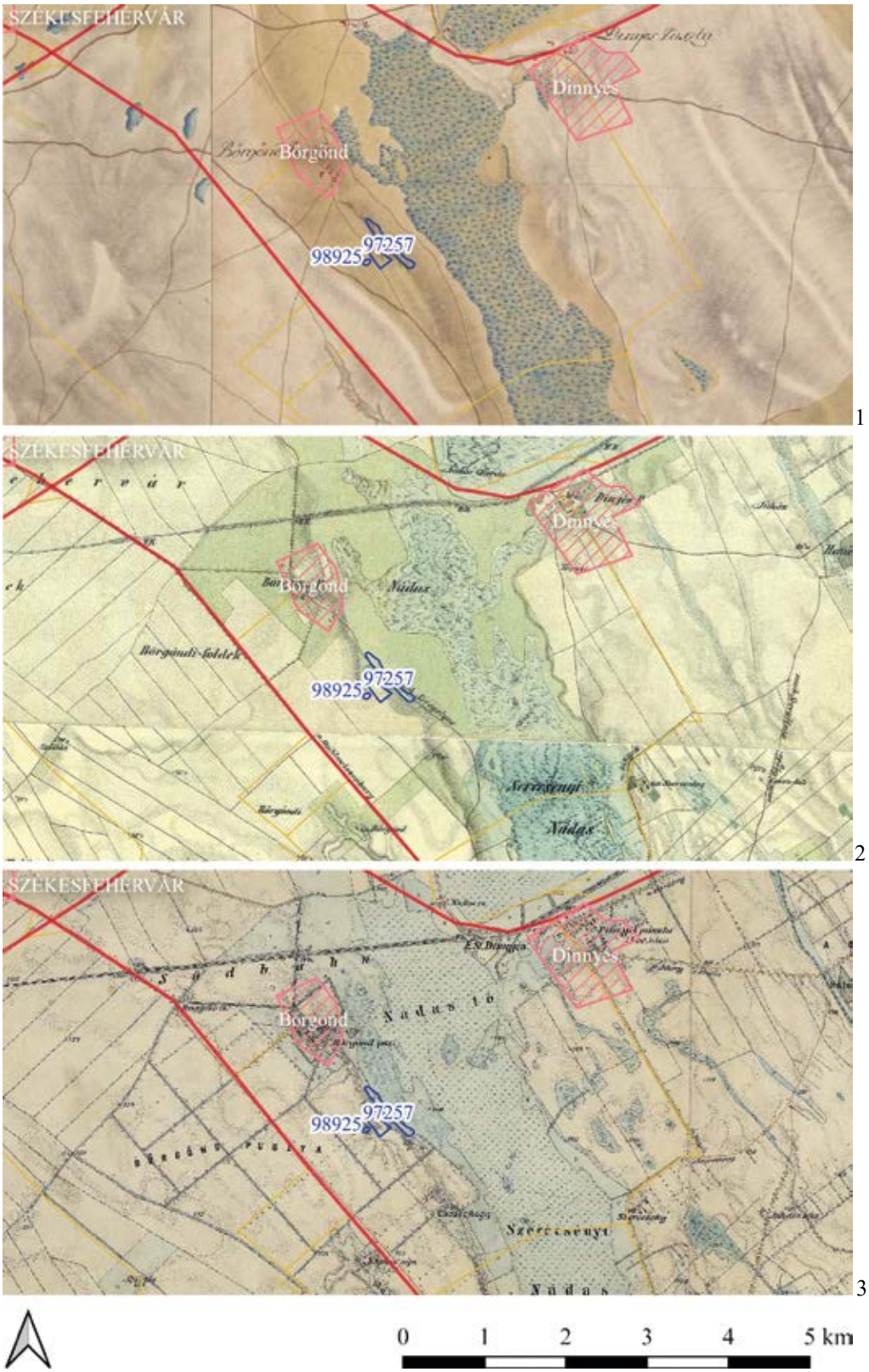

Fig. 9. Sections of the Habsburg military surveys (©Ákos Ekrik, ©Zsófia Nádai): 1. The study area on a map of the First Habsburg Military Survey from 1783 (https://maps.arcanum.com/hu/map/firstsurvey-hungary/); 2. The study area on a map of the Second Habsburg Military Survey from 1858 (Source: https://maps.arcanum.com/hu/map/secondsurvey-hungary/), 3. The study area on a map of the third Habsburg Military Survey from 1882. (Source: https://maps.arcanum.com/hu/map/thirdsurvey75000/)

entrenchments run along the edges and through the forest strip on the hill and various types of ammunition and shells are scattered in the whole vicinity. These phenomena make field-walking more difficult and have a disturbing effect on the metal detector, magnetometer, and GPR-surveys.

Archaeological sites

Börgönd, (Szent) Lászlóhegy [ID No. 91095], a Bronze Age fortified settlement

The site and its research history

Szent László-hegy is a low hill and the highest point of the hill range in the study area. The hill's eastern slope decreases severely into the swampland. The north-western site towers above a steep gully, thus ending in the north in a pointy, triangular protrusion, where the hillfort of the Middle Bronze Age Vatya culture is located.[23] After the first publication, the site has been known by academia as Székesfehérvár-Börgöndpuszta-Lászlóhegy,[24] while its official name in the Central Register of Archaeological Sites in Hungary (IVO) is Székesfehérvár-Börgönd-(Szent) László-hegy. The northern part of the hillfort falls in the forested strip separated from the ploughlands by a ditch by its southern edge. The fortification continues on the ploughland in the south; the ditch closing off this settlement part was still visible in the early 2000s. The northern and eastern sides of the hillfort are accompanied by a 10-12 m wide terrace in the steep hillside.[25] As barely any archaeological finds were collected outside the ditch in the ploughed field, the area inside it – about 165 m long and of 1.5 hectares – was identified as the site.[26] The hillfort, on an about 20-25 m high elevation, towers above the surrounding marshlands, offering a great view of the glittering open water of Lake Velence on one side and the range of the Velence Mountains, home to another Middle Bronze Age centre, Pákozdvár, in the administrative area of today's Pákozd.[27]

The relationship between the settlement and the lake was probably much closer in the Bronze Age than today. The hillfort at Börgönd was positioned only ca. 600-800 m away from the western basin of Lake Velence; thus, its setting is closely similar to that of other coeval hillforts of the Vatya culture in the Vál Valley (Baracska, Kajászó, and Vál),[28] which were all established on the top of a high plateau at the edge of the broad valley of a stream. Besides, similar is the setting of some hillforts in the catchment area of Cikola-víz, a stream in the south-eastern part of Fejér County (e.g., Perkáta-Forrás-dűlő, Perkáta-Faluhelyi-dűlő: the fortified settlements are positioned on the higher, southern zones of the loess plateaus, often by the edge, next to a steeply sloping side.[29]

In terms of climate history, the Middle Bronze Age fell into the Beech phase of the Subboreal stage of the Old Holocene Period. The average temperature increased after the cold climate characterising the Early Bronze Age, and the weather became markedly wetter. As floods were frequent, rivers abounded with water, and groundwater levels were high. Settlements were usually established on top of flood-free elevations next to floodplains.[30]

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[23] *Váczi – Stibrányi 2008*.

[24] See, e.g., *Reményi 2012* 277, 279; *Szeverényi – Kulcsár 2012* 295, 316.

[25] *Váczi – Stibrányi 2008* 208; *Terei et al. 2011* 87.

[26] *Váczi – Stibrányi 2008* 209; *Terei et al. 2011* 87.

[27] *Marosi 1930* 53; *Horváth – Kozák – Pető 2001a* 13–14.

[28] S*zeverényi – Kulcsár 2012* 298–301. A large settlement of the Vatya culture was identified in the administrative area of Baracska, also on the plateau at the edge of the Vál Valley, in 2022. The site was registered in IVO as Baracska, Keleti-dűlő (ID No. 8595).

[29] *Reményi et al. 2013* 55.

[30] *Somogyi 1987* 29; *Reményi 2005* 3.

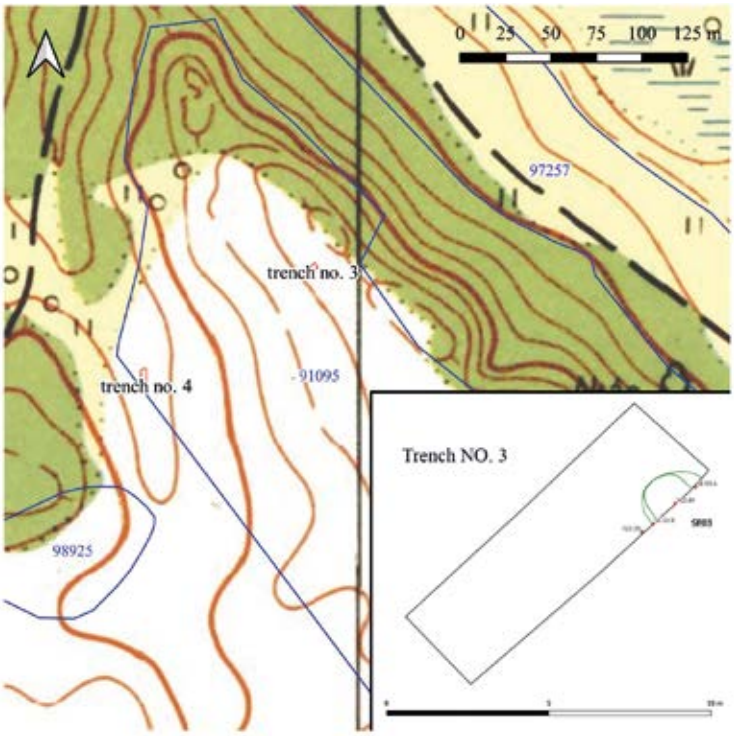


Fig. 10. Survey of the soil condition tests in the hillfort in February 2020 (drawing and digitizing by SZIKM)

Research on the Bronze Age hillfort in 2020–2021

In February 2020, the company cultivating crops on the field opened a trench in the area of the site to check the soil's condition *(fig. 10).* Luckily, the works were reported to the museum, and the discovered archaeological features were documented properly. The 2.5 × 10 m trench No. 3 deepened gradually towards the south-west; its deepest point was 2.20 m from the current surface. The archaeologists from SZIKM identified three features in it.

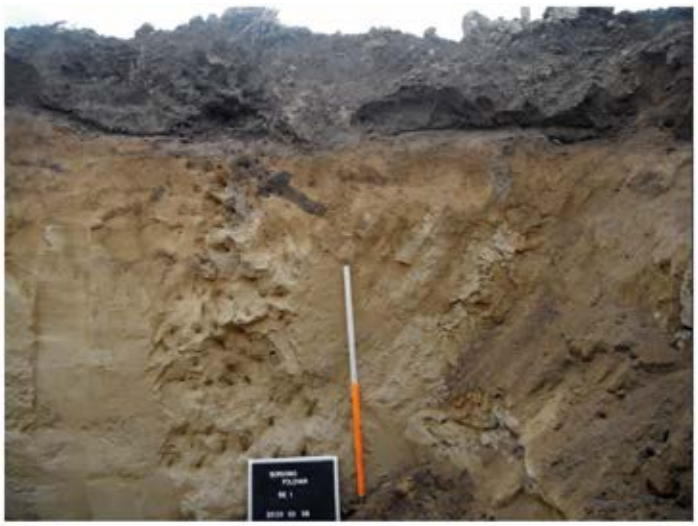
SE-1: hard, thin, light grey plaster layer, like a trodden surface, at a depth of 0.55–0.60 m, covered by a layer of humus mixed with ash, pottery fragments, animal bones, and yellow clay. Its extent could not be determined *(fig. 11. 1).*

SE-2: Upside-down-trapezoidal-profile soil stain under the topsoil in the southern and northern profiles at the middle of the trench. It could be assigned to the Vatya culture based on its grey-brown, ashy fill with clay and soot inclusions; it could be a pit or a ditch *(fig. 11. 2).*

SE-3: Red, ashy, sooty soil stain of a pit with a small vessel in the profile wall at the south-eastern end of the trench. The part falling in the area of the trench was unearthed. It was a large beehive-shaped storage pit with potsherds, animal bones, and a spindle disc in its loose, ashy, and sooty fill. The pit also contained four fine miniature pottery bowls *(fig. 11. 3).*

It was clear from the profile of the trench that the Bronze Age settlement in this part is single-layered, and its features start relatively high, right under the topsoil. The 2020 survey yielded numerous surface findings, mostly potsherds and grindstone fragments, which were scattered in an area considerably bigger than the registered extent of the site; however, the settlement ditches were not visible anymore on the ploughed field.

Two one-day metal detector surveys were conducted in the ploughed part of the site on 29 July and 4 August 2021 after reaping. Pottery and grindstone fragments were collected from about the same area as the previous year. No potsherd was found in the forested strip due to the thick



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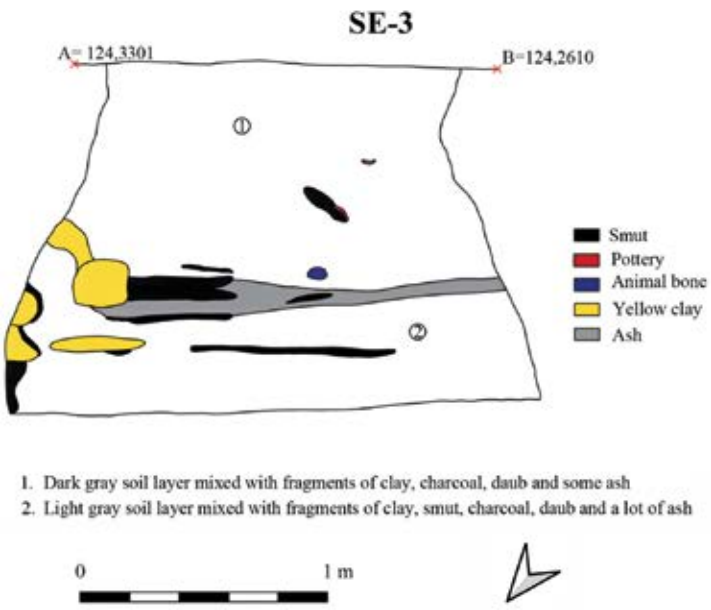


3

Fig. 11. Profiles of the soil condition test trench (Trench No. 3): 1. SE-1; 2. SE-2; 3. SE-3 (photos by Ágnes Kovács, drawing by Teofil Rétfalvi)

Fig. 12. Surface of the hillfort in July 2021 (©Ágnes Kovács)

undergrowth, but a beautiful crescent-shaped pendant was recovered from the northern, fortified centre of the site *(fig. 13. b. 7; fig. 15. 7).* Also, the remains of an about one metre-high earthen rampart of unknown age were observed in the forested strip bordering the ploughed field from the northeast. While the shape and size of this earthwork are similar to those at the eastern edge of the Vatya hillfort at Kajászó-Várdomb,[31] its chronological position is unknown.

Our team also investigated the Bronze Age hillfort, carrying out a magnetometer survey there on 14–16 July 2022 *(fig. 13).* The crops had been reaped on the fields above the hillfort by then, but the surface was covered by a thick blanket of drying crop stems, preventing them from conducting a metal detector survey in the area. Vatya-style potsherds and the fragment of a polished stone axe were collected from the field at the northern zone of the hillfort.

The structure of the hillfort

The semicircular ditch at the northern corner of the ploughed field on the magnetometer survey *(fig. 13. a)* image matches the soil stain on a 2015 satellite image by Google Earth, highlighted on the map with a red dashed line. Máté Stibrányi and Gábor Váczi detected the remains of probably this ditch on the surface.[32] The outline of the ditch is not clear anymore in the 2017 satellite image and is barely discernible in the one taken in 2023. All important bronze finds that could be assigned to the Vatya culture were discovered in the soil stain of the ditch, including a bronze dagger found in the topsoil layer *(fig. 13. b. 2).* The southern end of the ditch extends slightly over the registered perimeters of the site, roughly matching the surface find scatter recorded by Máté Stibrányi and Gábor Váczi in their first survey.

Another ditch starts south of the arched trench on the magnetometer survey map. This second ditch is probably the continuation of another ditch observed in the 2017 satellite image and roughly matches the surface find scatter recorded in 2020 and 2021. Some pottery sherds and a few grindstone fragments were collected in this outer zone of the site.

Based on the above, we believe the hillfort constitutes of diverse parts. The actual hillfort, of 0.6 ha, stood at the northernmost point of the site, which is currently under the forested strip

[31] *Terei et al. 2011* 65.
[32] *Váczi – Stibrányi 2008* 209, Abb. 2.

(fig. 13. a. 1).[33] A settlement engirded by the semicircular ditch lay south of it *(fig. 13. a. 2);* its surface abounded with findings in the early 2000s and 2020–2021 (the bronze finds collected at that time can also be linked with this settlement). Based on the intensity of the surface finds' scatter and the composition of the find material *(fig. 13. b),* the hillfort and the settlement were an important centre in the period.

The investigations in 2020–2021 outlined another settlement part outside the arched ditch of the settlement around the hillfort. Agricultural activity (probably ploughing) has disturbed the surface of this outer settlement extensively, but the surface find scatter recorded in 2020–2021 *(fig. 12)* closely matches the line of the second ditch identified on the magnetometer survey map and the satellite image. Conclusively, there must have been a second, less intensive settlement zone, also engirded by a ditch, outside the arched ditch of the central settlement; this hypothesis is also supported by the dense scatter of features (probably pits) in the area in question *(fig. 13. a. 3).*

The plateau continues ca. 5–10 m below the hillfort on its northern side but still markedly above the marshy plain. The fourth Bronze Age settlement part was discovered there; it was probably also an external settlement of the hillfort *(fig. 13. a. 4).* The trench opened in this part in 2020 provided evidence that this part is single-layer.

Finds from the Bronze Age hillfort

The pottery collected from the area of the hillfort is rather fragmentary. The only vessels with a full profile are the four small bowls recovered from SE-3, a pit in the soil condition test trench opened in 2020 *(figs. 14–15).*

1. Highly burnished, small bowl with everted rim, a concave upper side, and a slightly convex, rounded bottom with an omphalic, flat base. Black, made of sand-tempered clay. The sharp belly line is decorated by a circular row of short, vertical strokes, with three parallel lines of horizontal strokes below. The omphalic base is also surrounded by a circle of short, radial strokes in three concentric circles. The incised strokes and lines were filled with white lime paste. A single band handle connects the rim with the belly line *(fig. 14. 1).*[34]
2. Highly burnished small bowl with an everted rim, a concave upper side, and a slightly convex, rounded bottom with an omphalic, flat base. Black and dark grey, with beige spots; undecorated. Made of sand-tempered clay. A single band handle connects the rim with the belly line *(fig. 15. 1).*[35]
3. Highly burnished miniature bowl with everted rim, a concave upper side, and a slightly convex, rounded bottom with an omphalic, flat base. Black inside and dark grey outside, with beige spots; made of sand-tempered clay. A single band handle connects the rim with the belly line *(fig. 15. 2).*[36]
4. Highly burnished miniature bowl with everted rim, a concave upper side, and a slightly convex, rounded bottom with an omphalic, flat base. Dark grey inside and light grey outside, with brown spots; made of sand-tempered clay. The belly line is decorated with a circular row of short, vertical strokes connected to the omphalic base with four bundles of three lines forming a cross. The bottom corner of each quarter is filled with a triple stroke. The incised patterns were filled with white lime paste, the remains of which are still visible at points *(fig. 14. 2).*[37]

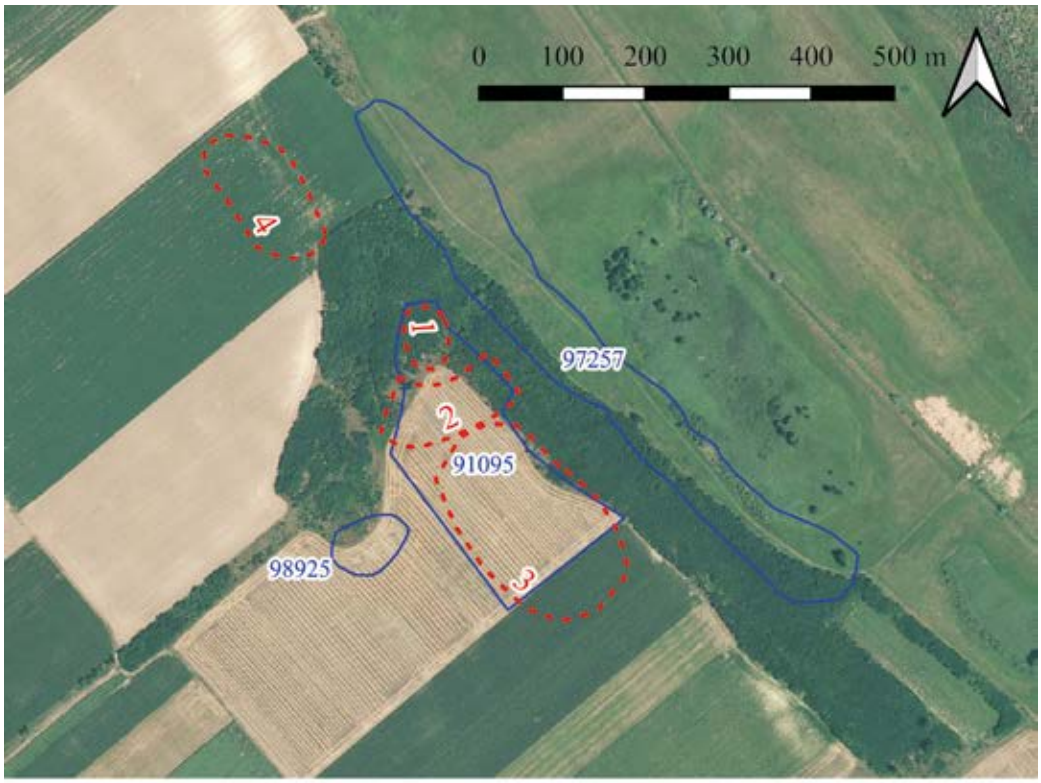
[33] *Váczi – Stibrányi 2008* 208.

[34] Inventory number in the collection of the King St. Stephen Museum in Székesfehérvár: Inv. No. SZIKM 2023.4.1.1. Diameters: rim 7.4 cm, base 1.4 cm; height: 3.4 cm.

[35] Inv. No. SZIKM 2023.4.1.2. Diameters: rim 7.5–8 cm, base 1.3 cm; height 3.5 cm.

[36] Inv. No. SZIKM 2023.4.1.3. Diameters: rim 7.7–7.9 cm, base 1.5 cm; height 3.3 cm.

[37] Inv. No. SZIKM 2023.4.1.4. Diameters: rim 7.8 cm, base 1.8 cm; height 3.5 cm.



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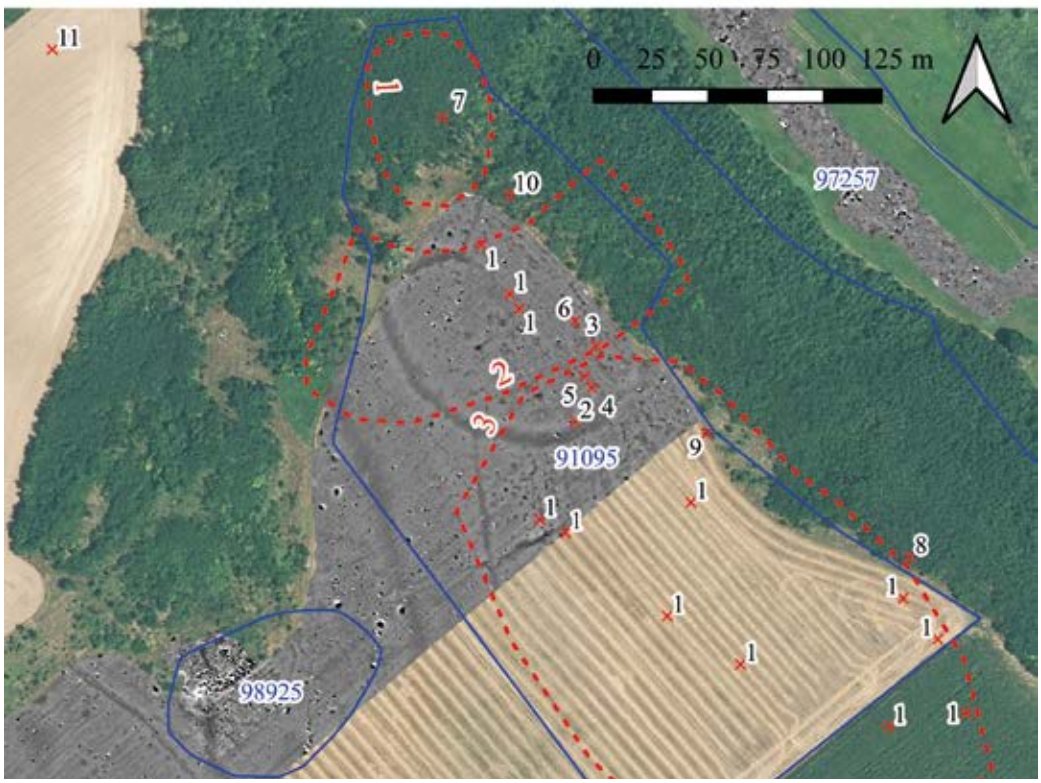

b

Fig. 13. a. Structure of the hillfort studied in 2020–2022: 1. Semicircular ditch; 2–3. Outline of the ditches based on the satellite images from 2023; 4. Satellite settlement. b. Metal detector finds in the area of the hillfort during the field walk campaign 2020–2022, overlaid on the results of the geophisical survey. Red crosses mark the distribution of Bronze Age finds: 1. Pottery sherd; 2. Bronze dagger; 3. Bronze spearhead *(fig. 19. 3);* 4. Bronze awl *(fig. 19. 4);* 5. Wheel-shaped pendant *(fig. 19. 5);* 6. Bronze pendant fragment; 7. Lunula pendant *(fig. 19. 7);* 8. World War II trench; 9. The bund ditch; 10. The beginning of the bund ditch; 11. The northern edge of the hillfort (Find distribution survey by SZIKM ©Ágnes Kovács, ©Zsófia Nádai)

Fig. 14. Decorated miniature bowls from SE-3: 1. Inv. No. SZIKM 2023.4.1.1; 2. Inv. No. SZIKM 2023.4.1.4. (©Zsóka Varga, ©Ágnes Kovács)

Fig. 15. 1. Undecorated miniature pottery vessel (Inv. No. SZIKM 2023.4.1.2); 2. Undecorated miniature pottery vessel (Inv. No. SZIKM 2023.4.1.3); 3. Bronze socketed spearhead (Inv. No. SZIKM 2023.4.3.1); 4. Bronze awl with a rectangular profile (Inv. No. SZIKM 2023.4.3.4); 5. Chipped stone saw made from a crescent-shaped splinter (Inv. No. SZIKM 2023.4.8); 6. Triangular bronze dagger (Inv. No. SZIKM 2023.4.2.1); 7. Bronze wheel-shaped pendant (Inv. No. SZIKM 2023.4.3.2); 8. Knapped stone saw (Inv. No. SZIKM 2023.4.3.8.) (©Zsóka Varga, ©Ágnes Kovács)

Miniature bowl variants first appeared in the Vatya culture in its classical Szigetszentmiklós phase. This find group includes small conical bowls and downsized imitations of large bowls, often on a low pedestal.[38] Such miniature vessels were still in fashion in Phase I of the Vatya culture but disappeared by Phase II.[39]

Their elaboration, shape, and decoration assign the small bowls found in Börgönd to the Late Vatya pottery style; the dark, black-yellow brown spotted, burnished surface and the careful elaboration are characteristic of Phase III of the culture.[40] The rim of the bowls is wider than the shoulder, and the bottom part is slightly convex rather than straight, i.e. it follows the Vatya pottery style instead of that of the Nagyrév culture.[41] By their shape, the bowls found in Börgönd could be identified as a Vatya type that is considered to be the predecessor of the so-called 'kettle-hat helmet-shaped' bowls: their wide, flared rim continues in a concave neck, and their lower part is also slightly convex. This formal variant first appeared in Phase II of the Vatya culture and remained in fashion in the following phases, too.[42]

The circular row of short strokes on the belly line of the bowls is a characteristic of Vatya phase II-style bowls,[43] while the concentric circles and the fourfold division of the bottom part are typical of kettle hat-shaped bowls like, for example, the one recovered from a grave in the Late Vatya culture cemetery at Dunakeszi-Kopolya: that bowl is also decorated with a fourfold-divided pattern with short strokes and tiny circle imprints.[44] Another bowl from the same cemetery is an upsized version with similar decoration to the small bowls found in Börgönd (with a circular row of short strokes on the belly line, fourfold division of the bottom by lines, and short incisions in the quarters).[45] Similar decoration appears on a small early Koszider-style bowl from Grave 748 of Dunaújváros-Duna-dűlő, a cemetery: the base of the vessel is surrounded by concentric circles, the outermost consisting of small circles itself, and the bottom is divided in four by straight triple line bundles.[46]

Concentric circles and motifs arranged in circles are another characteristic of kettle-hat-shaped vessels, the base of which is almost always adorned with some circular pattern. For example, the whole bottom part of such a bowl found in Cegléd-Öregszőlők is covered in concentric circles.[47]

Although a shape akin to the bowls' from Börgönd and the concentric circle motif appear already in Phase II of the Vatya culture, their design, elaboration, and connection with the decoration of kettle-hat-shaped bowls suggest they are younger, probably dating to the Vatya III–Koszider phase. Small bowls are part of the Vatya pottery inventory, albeit their number is low. For example, a small bowl with a rim of only 12 cm in diameter was recovered from the area of the hillfort at Börgönd in the early 2000s,[48] and a relatively small bowl, of only 14.5 cm in diameter and 6.6 cm high, was found in the neck of the urn in Grave 5 at the cemetery of Dunaújváros-Duna-dűlő.[49] The smallest bowl in that cemetery comes from Grave 748, dating to the early Koszider phase;[50] its shape and decoration are similar to that of the pieces from Börgönd,

[38] *Vicze 2011* 67.
[39] *Vicze 2011* 115.
[40] *Bóna 1975* 60.
[41] *Vicze 2011* 99.
[42] *Vicze 2011* 115, 122.
[43] *Vicze 2011* 116.
[44] *Kovács 1989* Abb. 8. 2.
[45] *Kovács 1989* Abb. 8. 4.
[46] *Vicze 2011* Pl. 182. 9.
[47] *Bóna 1975* Taf. 43. 6.
[48] *Váczi – Stibrányi 2008* 209–210, Taf. 3. 8.
[49] *Kutzián 1945* 511, 516, fig. 4. 6.
[50] *Vicze 2011* Pl. 182. 9.

and its rim is ca. 12 cm in diameter. As the size of the few small Vatya bowls ranges 12–16 cm, the bowls recovered from the Börgönd site, with rim diameters of only 7.5–8 cm, are unusually small, resembling, in this respect, the miniature vessels of the neighbouring Transdanubian Encrusted Pottery culture (TEPC) instead (see, e.g., the miniature bowls in Grave 14 of Királyszentistván).[51] In the border zones of cultures, pottery styles of diverse cultures became gradually more and more similar in the Koszider phase;[52] therefore, the miniature bowls from Börgönd may be interpreted as a mark of the intensification of interaction between Vatya and TEPC communities at that time.

The 2021 metal detector survey yielded relatively few Bronze Age metal finds. All five artefacts presented below were discovered in the 20–30 cm thick topsoil layer and could not be assigned to archaeological features *(fig. 15. 3–8).* Besides these, the Bronze Age metal record of the site comprises a crescent-shaped pendant fragment and three tiny bronze nuggets.

1. Triangular bronze dagger with a flat blade and V-profile cutting edge; its tip broke off. The heels are also damaged; originally, the shoulder or hilt-side end of the blade was probably rounded. The hilt was fastened with four rivets to the blade, two of which (in the two inner holes) persisted, while the other two are missing from the outer holes. The rivets are simple, with round, flattened heads *(fig. 15. 6).*[53]
2. Bronze socketed spearhead; two matching fragments, incomplete. The spearhead's fuller widens at the transition, strengthening the socket. The socket's edge is reinforced with three ribs *(fig. 15. 3).*[54]
3. Wheel-shaped pendant. Openwork, with a cross in the outer ring. The centre of the cross is adorned with two small, round, conical knobs, the smaller on top of the bigger *(fig. 15. 5).*[55]
4. Small lunula (crescent-shaped bronze pendant) with a triangular profile. The suspension loop is rolled backwards, while the arms of the crescent swirl inwards and the tips touch *(fig. 15. 7).*[56]
5. Thin tapered bronze awl; one end broke off *(fig. 15. 4).*[57]

Dagger

Triangular bronze daggers with rounded shoulders first appeared in the Carpathian Basin at the end of the Early Bronze Age; their hilt, made from organic material, was fastened with usually 3–5 rivets to the blade. Tibor Kovács believed their appearance here to mark southeast European influence in the region; the oldest known example was found in Grave 9 of the Pitvaros cemetery.[58] Triangular daggers with riveted-on hilts spread quickly along the Danube, becoming regular additions to graves of the Kisapostag and Vatya cultures. The dagger found at Börgönd is relatively small and undecorated; it has no central ridge, the shoulder is rounded-trapezoidal, while the blade is tapered and has a flattened-plum-pit-shaped profile. Based on its shape and size, it could be dated to the oldest phase of the Vatya culture.[59] Its closest analogies are also known from early Vatya cemeteries, including two pieces from Ercsi-Sinatelep[60] and three from Biatorbágy-Szarvasugrás.[61] Viktória Kiss dated the triangular daggers without a central ridge

[51] *Bóna 1975* Taf. 225. 4–9.
[52] *P. Fischl – Reményi 2013* 733.
[53] Inv. No. SZIKM 2023.4.2.1. Length 6.3 cm, width 4.1 cm, thickness 0.3 cm.
[54] Inv. No. SZIKM 2023.4.3.1. Length 9.3 cm, width 3.8 cm, thickness 2.1 cm.
[55] Inv. No. SZIKM 2023.4.3.2. Diameter 3.2–3.3 cm, thickness 0.3–1 cm.
[56] Inv. No. SZIKM 2023.4.3.3. Length 2.6 cm, width 2.3 cm, thickness 0.2 cm.
[57] Inv. No. SZIKM 2023.4.3.4. Length 4.5 cm, width 0.8 cm, thickness 0.5 cm.
[58] *Kovács 1973* 160–161; *P. Fischl – Kulcsár 2011* 65.
[59] *Bóna 1975* 49–50.
[60] *Bándi 1966* 11, 14.
[61] *Mali 2014* 29, 31, 34–35.

to the end of the Early and start of the Middle Bronze Age;[62] the known analogies of the dagger from Börgönd, a stray find from Somogy County and one found in the area of Büssü in the same county,[63] could also be dated to this period. The appearance of bronze daggers in the find material is probably marking the emergence of social inequality and a hierarchical society, where persons of a special social position were provided with a bronze dagger for the afterlife.[64] However, the distribution of metal grave goods of the early Vatya culture is still relatively homogenous.[65]

Spearhead

The bronze spearhead was already fragmented upon discovery, and the exact shape of its tip could not be reconstructed. The unique decoration of its socket leaves no questions about its dating: the best analogy to the circular, groovy lines around the socket, imitating ribbing, is known from one of the earliest known spearheads recovered from Grave 35 of the Battonya cemetery of the early Maros culture.[66]

The spearhead, a stray find from Szigetszentmiklós-Felsőtag, bears a similar decoration. A cemetery of the Nagyrév and early Vatya cultures having been known on the northern outskirts of Szigetszentmiklós, Rózsa Kalicz-Schreiber dated the stray spearhead to the early Vatya culture or its advanced phase at the latest, which is thus one of the oldest spearheads known from the Carpathian Basin.[67]

The perforation on the socket of the spearhead is perpendicular to the blade, which is also a characteristic of early type variants, as spearheads with a perforation in line with the blade only appeared first in the Koszider phase.[68] In summary, based on the decoration of the socket and the position of the perforation, the spearhead found at Börgönd is one of the oldest in the Carpathian Basin; like the piece from Szigetszentmiklós, it can be dated to the early Vatya culture.[69]

Wheel-shaped pendant

Wheel-shaped pendants were widespread in the territory of today's Germany and Switzerland and remained in fashion for a prolonged period from the Göggenhofen phase of the Tumulus culture to the Ha B1.[70] Only a few examples are known from the Middle Bronze Age Carpathian Basin. Alexandra Găvan published a piece from Nitriansky Hrádok-Zámeček (Slovakia); the casting mould of the object was also found on the site.[71] Besides, another example is known from a depot discovered on the outskirts of Temesnagyfalu (Satu Mare, Romania); Carol Kacsó dated the find assemblage to the Koszider phase.[72] Flat four-spoke pendants also appear in Tumulus culture context; see the ones from Sopronnyék, dated to after the Koszider Period,[73] or the Late Tumulus Period specimen, assigned to the Ópályi hoard horizon, from Felsődobsza.[74] Four-spoke openwork wheel pendants are incorporated, as central elements, in the design of Kisterenye-type large pendants with rib decoration (known, e.g., from Kisterenye and Rimaszombat);[75] besides,

[62] *Kiss 1999* 155.
[63] *Kiss 1999* 155, Taf. I. 1–2.
[64] *Vicze 2011* 108; *Mali 2014* 44–45; *Szeverényi – Kiss 2018* 41.
[65] *Bóna 1975* 52.
[66] *Kovács 1975* 28, Abb. 4. 5, Abb. 5.
[67] *Kalicz-Schreiber 1995* 31, 48.
[68] *Szeverényi 2008* 59.
[69] *Kalicz-Schreiber 1995* 48; *Szeverényi 2008* 59.
[70] *Wels-Weyrauch 1991* 53.
[71] *Găvan 2015* 132.
[72] *Kacsó 1998* 12, 16–17.
[73] *Mozsolics 1973* 53, Taf. 3. 4–6.
[74] *Moszolics 1973* 53, Taf. 47. 32.
[75] *Mozsolics 1973* 52–53, Taf. 21, Taf. 40. 8.

the Late Tumulus Period Deposit IV of Velem-Szt. Vid, discovered in 1977, comprised thirteen wheel-shaped pendants.[76] This latter assemblage included three pendants similar to the one from Börgönd (openwork, with a 'cross' in the middle)[77] Wheel-shaped pendants survive into the Late Bronze Age (see the finds of, e.g., Celldömölk-Sághegy[78]), but the design of the late variants is markedly different from the one found in Börgönd, comprising two concentric circles and at least eight spokes. The design of the pendant discovered in Deposit I of Sióagárd-Leányvár is the closest to our find from the archaeological record of the Urnfield culture.[79]

Crescent-shaped pendant

Two crescent-shaped pendants, a complete and a fragment, were found in the area of the hillfort at Börgönd. The type appeared first at the end of the Early Bronze Age; the oldest specimens were recovered from burials of the Kisapostag culture, while younger ones were frequent additions to Vatya burials, occurring in the record of almost every known Vatya site. Variants of the type also appear in TEPC sites, albeit less frequently than in the Danube Region.[80] The complete pendant from Börgönd *(fig. 15. 7),* with inward-rolled horns, represents a more closed younger variant. Such a pendant was also found in the Temesnagyfalu depot (mentioned above), which included an analogy to the wheel-shaped pendant.[81]

Awl

The last metal artefact is a pointy bronze awl with a rectangular profile; one of its tips broke off. Alexandra Găvan mentions seventeen bronze awls from Bronze Age tell settlements in the Carpathian Basin; however, these all come from layers assigned to the Otomani–Füzesabony cultural complex. Bronze awls may also be found in graves of the Füzesabony culture but are rare in depots.[82] Ildikó Szatmári published five bronze awls from the Füzesabony-Öregdomb tell settlement.[83] Such artefacts are considerably more rare in the western parts of the Carpathian Basin: one is known from a grave of the Kisapostag culture at Zamárdi, and another from a Grave 1 of Márok, a TEPC burial.[84] The Vatya depot unearthed at Solymár-Várhegy-Mátyás-domb consisted of a bronze awl, a bronze axe, a bronze needle, and several mugs in a bowl.[85]

Stone tools

The stone tools of the hillfort at Börgönd are also worth mentioning. Gábor Váczi and Máté Stibrányi collected a polished mace fragment from the surface in one of their surveys.[86] Maces are usually linked with important tribal centres; the record of Pákozdvár, the largest Vatya hillfort, included three polished stone mace fragments.[87]

[76] *Bándi – Fekete 1984* 126.
[77] *Bándi – Fekete 1984* 116–117, fig. 20. 2, 4, 5.
[78] *Patek 1968* 147; *Patek 1968* Taf. XXVIII. 30–36.
[79] *Váczi 2014* 45, 47, fig. 2. 28.
[80] *Mozsolics 1967* 87; *Kiss 2012* 111.
[81] *Kacsó 1998* V. 1.
[82] *Găvan 2015* 115.
[83] *Szathmári 2017* 58–59.
[84] *Kiss 2012* 134.
[85] *Valkó 1941* 99–100.
[86] *Váczi – Stibrányi 2008* 209–210, Taf. 3. 5.
[87] *Horváth – Kozák – Pető 2000* 14–15.

A knapped stone tool was also found on the surface during the metal detector survey in 2021.

1. Saw. Bifacial saw with finely retouched cutting edge, made from a crescent-shaped splinter. With sickle-gloss on both sides of the edge *(fig. 15. 8).*[88]

Knapped stone saws with a serrated, retouched edge are frequent finds in settlements of the Vatya culture, appearing on Bölcske-Vörösgyír,[89] Igar-Galástya, Lovasberény-Mihályvár, Pákozd-Pákozdvár,[90] and Százhalombatta-Földvár.[91] Erzsébet Bácskay analysed the use-wear traces on the tools, concluding that the sheen on them is caused by crop stems with high cellulose content; therefore, knapped saws of this type are also called 'reaping knife-like sickles'.[92]

Börgönd, Temetői-dűlő [ID No. 98925], a supposed medieval church site

As mentioned above, Máté Stibrányi identified first the place of the old graveyard of Börgönd village on a cadastral map compiled in 1884,[93] showing a fenced-in rectangular area with the surrounding fields marked 'Temetői-dűlő' [Cemetery Field]. Tree icons and 'sz.e.' (=*szálerdő,* seedling forest) marking fill the enclosed part, accessible through a today overgrown dirt road amidst the ploughlands *(fig. 8. 2).* The place appears with similar markings on the 1:25 000 and 1:75 000 maps of the third Habsburg military survey, compiled in 1882 *(fig. 9. 3).*[94] However, the fenced-in area is not marked on the relevant map of the second and first Habsburg military surveys from 1858 *(fig. 9. 2)* and 1783 *(fig. 9. 1).*[95] On the latter, a small, lonely marking is visible on the north-western side of the western stretch of the hilltop; it is uncertain however, if it is deliberate or a flaw on the map. Otherwise, no ecclesiastic feature is displayed in the area of Börgönd on this earliest survey map. It has also to be noted that none of these historical maps mark the enclosed area as a cemetery in use. They indicate a graveyard and, later, a chapel on the northern edge of the recent settlement instead. It is possible that the abandoned but still known burial site on the hilltop was fenced in and tidied up to some extent in the 19th century (as an act of piety or with a new purpose in mind), but no direct evidence of that has been obtained yet. A village resident told us on one of our outings that he played in the old cemetery as a child in the 1970s and remembers seeing dates from the 1600s and 1700s written on some of the tombstones. He did not know though, when these stones were taken down, neither could find them anymore.

The once fenced-in area is partly ploughed, partly covered by shrubs and seedlings today; during our surveys, we found at its southern and south-western fringes worked stones of various sizes, mortar crumbs, and some bone fragments, and collected medieval potsherds. Besides, we discovered a carved stone fallen in the World War II trench following the edge of the forest. The stone could come from the cemetery but could be a simple landmark, too, as the 19th-century cadastral map has proven that the forested strip was a border between plots at that time.

Geophysical surveys

The magnetometer survey has revealed part of a structure of two concentric circles, in the ploughed part of Temetői-dűlő, on the border of the once enclosed 'old cemetery' area *(fig. 16).* The anomaly of the two features does not stand out clearly at points. The biggest distance between two points of the detected part of the outer circle is 55 m. During the first survey, the area of the

[88] Inv. No. SZIKM 2023.4.3.8, 3.2 × 1.9 × 0.5 cm.
[89] *Horváth – Kozák – Pető 1999* 64.
[90] *Horváth – Kozák – Pető 2001a* 9, 12, 15.
[91] *Horváth – Kozák – Pető 2001b* 200.
[92] *Horváth – Kozák – Pető 2001b* 200.
[93] *Stibrányi 2015* 115.
[94] *Kovács 2002* insert no. 28.
[95] *Kovács 2002* insert no. 20, insert no. 4.

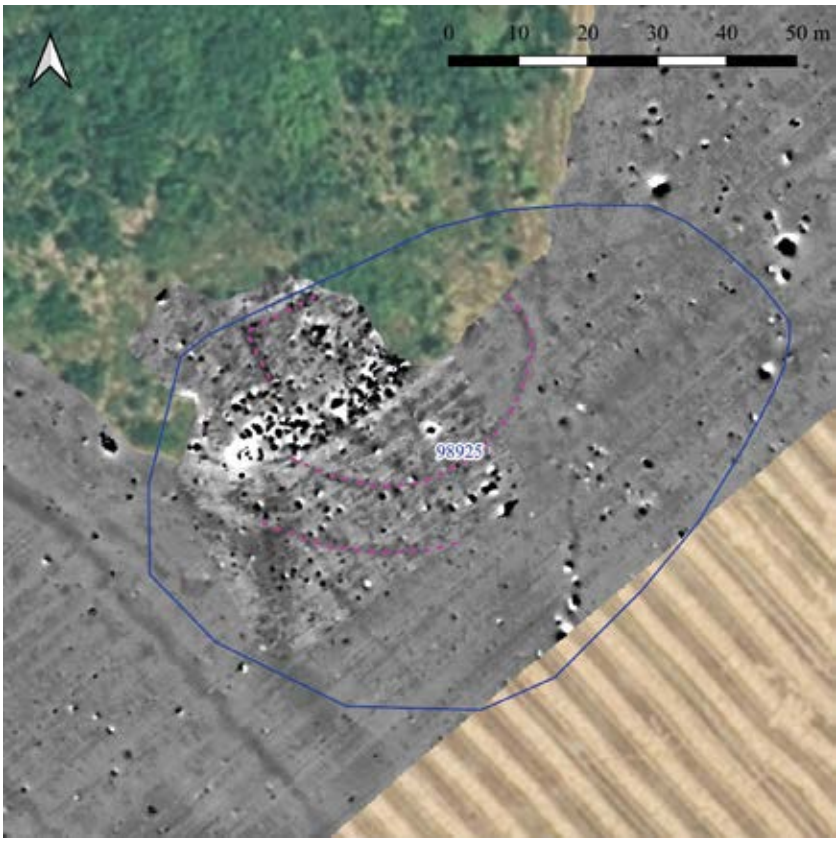

Fig. 16. Magnetometer survey map of Temetői-dűlő (-10/10 nT) (©Adrián Berta)

shrubby and forested strip of land in the northern zone was not accessible; therefore, we started the second survey with clearing the undergrowth in a part of that. After that, the surveyed area could be expanded; this second survey was more accurate than the first, as data were recorded with a 0.25 m sensor spacing. As the area was highly contaminated, no clear image of the part inside the double circular trench could be obtained. The quadrangular corner of a structure was discerned there, but the detail was insufficient to define its character with absolute certainty. Selected parts of this area were also GPR surveyed (BOR2–4) to collect more data. However, even these surveys did not provide suitable information for distinguishing surely identifiable archaeological features.

Pottery finds

Medieval potsherds – four rim, a handle, and a few side fragments – , a few bone fragments, pieces of stone, and mortar crumbs were collected from an area of about 40 × 90 m next to the southern corner of the shrubs covering the hilltop, at and within the concentric double trench structure. All rim fragments came from pots made from clay tempered with medium fine, dark sand and fired to yellow-white. They were part of bulging, everted rims with slightly curved lips and rounded edges *(fig. 17. 1–2)* of about 15–26 cm diameter.[96] Similar pots are known from Székesfehérvár[97] and the wider area of the Vértes Mountains,[98] based on which these fragments could be dated to the second half of the 15th–early 16th centuries. The handle fragment of a

[96] Inv. Nos. SZIKM 2023.4.5.1–2.
[97] *Siklósi 1993* 76, figs. 6–7.
[98] *Kovács 2021; Kovács 2022; Kovács 2023.*

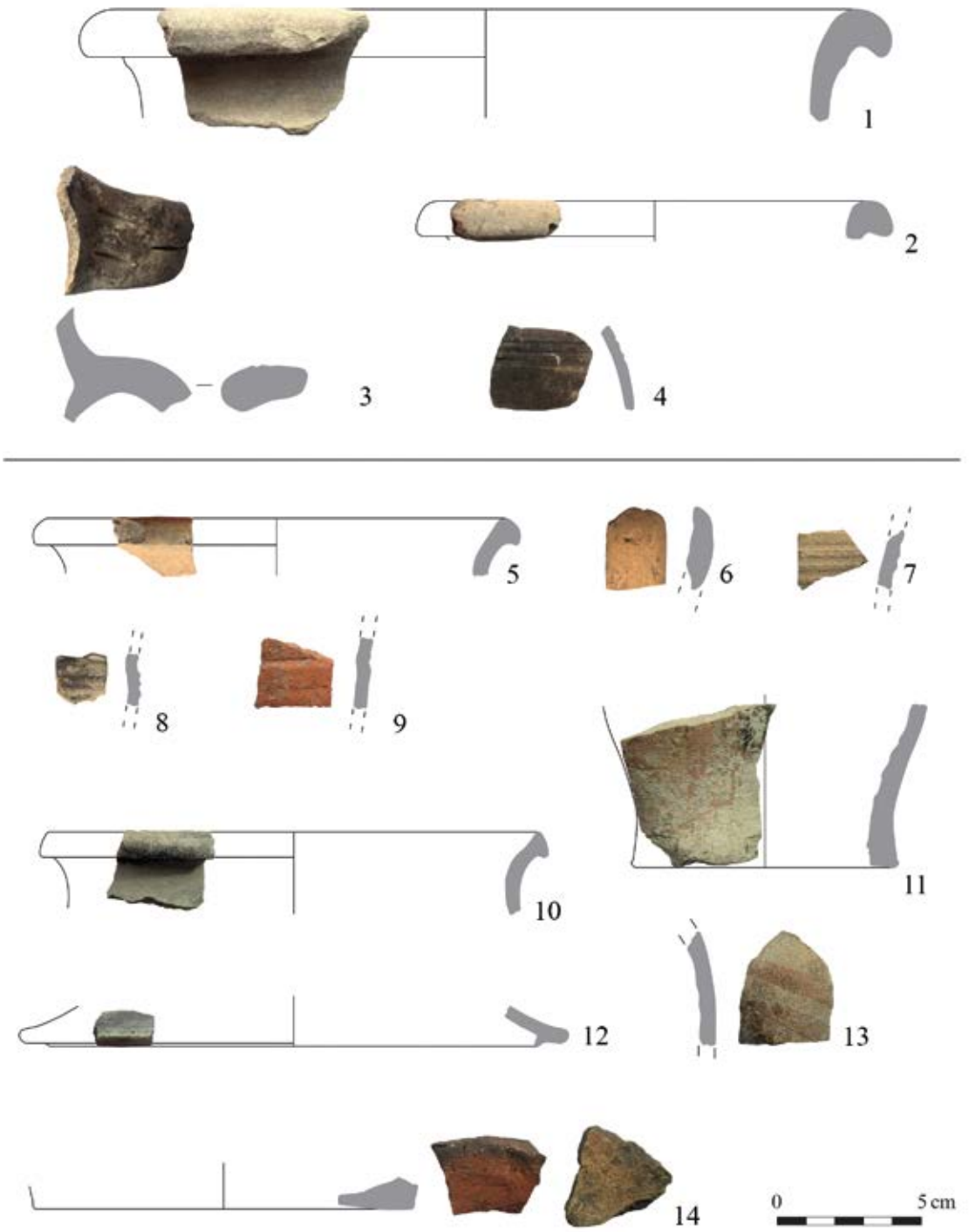

Fig. 17. Surface pottery finds collected in the medieval sites. Fragments 1–4 are from the supposed medieval church site, Temetői-dűlő [ID No. 98925], and fragments 5–14 are from the medieval village site, the area of Faluhelyi-dűlő [ID No. 97257] (©Bianka Kovács, ©Nóra Mészáros)

flat band handle with incisions once belonged to a liquid container, probably a pitcher. It is pale pink, made of clay tempered with fine sand and a few larger, red inclusions *(fig. 17. 3).*[99] Pitchers with incised decoration on their handles first appeared in the 14th century,[100] but some variants remained in fashion for a longer time;[101] thus, the fragment could be dated only approximately to the 14th–15th centuries. The material of some side fragments is akin to the rim fragments; one has three incised lines on the shoulder. The remaining side fragments were made of gravel-tempered clay and fired to red. As they are sooted and burnt outside, they were probably part of cooking pots once. In summary, the pottery collected in the area of the Temetői-dűlő could be dated to the Late Middle Ages.

In conclusion, our working hypothesis is that the one-time church – represented by the rectangular corner on the surveys – stood within the double trench. However, this could not be proven indisputably, as no finds could be collected from the shrubby zone, despite our attempts on four field walking campaigns (two metal detector-aided). To gather more accurate information on this part of the site, further magnetometer and GPR surveys must be carried out after clearing the area from the vegetation cover. Repeated field walkings in various states of vegetation could also help the research.

Börgönd, Faluhelyi-dűlő [ID No. 97257], a medieval village site

Zsuzsanna Bánki described the site as a 14th–16th-century village destroyed by fire. She found, amongst other late medieval pottery finds, several cup-shaped stove tiles and hypothesised (without further explanation) that the one-time inhabitants were engaged with fishing in the first place.[102]

The Börgönd (medieval form: *Bwrgwn/Bergen*) toponym first appears in Árpád Age documents. The placename appearing in two transcripts of the deed of foundation of the Veszprém Bishopric from 1009 possibly refers to this settlement. The name *'Bergeni'* appears in a transcript made in the Tihany convent;[103] however, another transcript, made after the second half of the thirteenth century mentions *'Beren'* instead,[104] which, according to results of recent archival research, may better be identified with one of the few settlements named *'Berény'* in Fejér County.[105] The first certain mention of Börgönd is dated to 1249 when Székesfehérvár shared a border with *'Bwrgwn'*.[106] Next, it appears in a document describing the lands of *Noe*, a village mentioned as its southern neighbour (in the forms *'Bergen'* and *'Felbergen';* according to the document, the south-eastern neighbour at that time was *'Meed'*).[107] The Árpád Age *Noe* was identified as a settlement on the western outskirts of Kisfalud, part of Székesfehérvár today, and the expansion of the modern village allowed for the excavation of a fairly large part.[108] As *Meed,* later Dinnyésméd, lay in the territory of the recent Dinnyés village, the coeval Börgönd had to be somewhere within its current administrative area, too.[109]

[99] Inv. No. SZIKM 2023.4.5.3.
[100] *Feld 1987* 265.
[101] E.g., *Holl – Parádi 1982* Abb. 159.
[102] *Bánki 1979* 110.
[103] *Sarnyai 2022* 296–297; Transcript: *MNL OL DL* 4; *DHA* 44–48.
[104] Transcript: *VFL* III.1.a.1. Veszprém eccl. et capit 9; *MNL OL DF* 200655; *DHA.* 8.
[105] *Farkas 1991* 202–203; *Györffy 1987* 354; *Érszegi 2010* 23; *FNESZ* 1. 251.
[106] *Györffy 1987* 354; *Csánki 1897* 321; *MNL OL DL* 640.
[107] *Zsoldos – Thoroczkay – Kiss 2016* 232; *MNL OL DL* 640. *RA* II/4. 211 (no. 4208.).
[108] *Mesterházy 2017.* Enlisted in IVO as Székesfehérvár-Kisfalud-Újtelep [ID No. 29158].
[109] *Györffy 1987* 354, 394.

Fig. 18. Magnetometer survey map of Faluhelyi-dűlő (-20/20 nT). Red arrow marks a ca. 5 × 15 m area with anomalies, probably the remains of a late medieval house (©Ákos Ekrik, ©Zsófia Nádai, ©Adrián Berta)

Geophysical survey

The site's land cover is heterogeneous: it is bordered by wetlands in the east, with a dirt road west of it, followed by a 25–65 m wide meadow and the forested strip. A row of 0.7–0.8 m high bumps, each with an area of ca. 10 × 15–20 m, can be seen between the dirt road and the forest strip; the western end of the row runs under the forest. These mounds could be identified as the remains of the houses of the medieval Börgönd village.[110] A magnetometer survey was conducted on about 2.4 ha between the wetland and the forest, revealing nine anomalies right under the bumps on a 300 m long, northwest-southeast directed area, which could thus be identified as said houses. Due to the land cover, they could only be partially investigated; thus, the ground plan of most buildings could not be measured precisely. The houses were parallel, and their main axis was northeast-southwest. The northernmost house also had a perpendicular addition, i.e., its ground plan was probably L-shaped. Besides, north of the houses, the anomaly of a trench running northwest-southeast outlined, which, based on its shape and relative position to the anomalies of the village, is unlikely medieval. This trench is supposed to continue on the other side of the forest and run into the anomaly of the Bronze Age hillfort at the highest point of the terrain *(fig. 18).*

Metal finds

Two metal detector surveys were conducted in the area of the medieval site by the institutions participating in the research and involving the community archaeology team of the county. In the course of these, altogether 34 medieval metal artefacts were collected in July 2021 and August 2022. The finds included several coins, clothing accessories, and tools dating from the first decades of the Árpád Age to the early Ottoman Conquest Period, indicating that the area was continuously inhabited in these centuries.

[110] *Stibrányi 2015* 115.

Fig. 19. Metal detector finds from the sites and their close area: 1. Nuremberg-type book corner fitting from 1475–1530 (Inv. No. SZIKM 2023.4.4.3); 2. Bronze finger ring (Inv. No. SZIKM 2023.4.4.8); 3. Cast signet ring, worn (Inv. No. SZIKM 2023.4.3.16); 4. Convex bronze band ring (Inv. No. SZIKM 2023.4.3.17); 5. Bronze band ring with a pair of incised parallel lines (Inv. No. SZIKM 2023.4.4.14); 6. Bronze ring with an engraved capital I (Inv. No. SZIKM 2023.4.4.13); 7. Hammered bronze signet ring with engraved double cross and bird pair from the late 13th–early 14th centuries (Inv. No. SZIKM 2023.4.4.6); 8. Buckle belt with a D-shaped frame (Inv. No. SZIKM 2023.4.4.23); 9. Denar of Duke Leopold VI of Austria (1198–1230) minted in 1220–1230 (CNA Cg4, Inv. No. SZIKM 2023.4.3.18; 1.55 g); 10. Denar of King (Saint) Stephen I of Hungary (997–1038) with 'REGIA CIVITAS' legend in the reverse (CHN.I.3, Inv. No. SZIKM 2023.4.4.21; 0.85 g); 11. Denar of Louis II of Hungary from 1524 (CNH.II. 308A, H846; Inv. No. SZIKM 2023.4.3.19; 0,47g); 12. Denar of Duke Frederick the Fair of Austria (1314–1330) (CNA B230, Inv. No. SZIKM 2023.4.3.20; 0.36 g) (©Zsófia Nádai, ©Zsóka Varga)

Covering the whole period from the emergence of the Kingdom of Hungary to the Battle of Mohács, the five coins are great anchors for dating the medieval village.[111] The series starts with a denar of King (Saint) Stephen I with REGIA CIVITAS in the legend of the reverse, minted between 997 and 1038 *(fig. 19. 10)*.[112] The next period is represented by a Friesach denar of a type, specimens of which are frequently found in coin hoards from the time of the Mongol Invasion. This piece has another completely unreadable coin corroded onto its reverse side. It was probably issued by Prince Leopold IV of Austria (1198–1230) minted around 1220–1230 in Pettau *(fig. 19. 9)*.[113] The next coin, a denar from Vienna with the *Bindenschild*, i.e., the Austrian coat of arms with barry of five on its obverse, was issued by Frederich the Fair (Duke of Austria in 1314–1330) and minted in the early 14th century *(fig. 19. 12)*.[114] The youngest medieval coin was issued by King Louis II of Hungary (1516–1526) and minted in 1524, two years before the Battle of Mohács, which marked the beginning of the Early Modern Era, intertwining with the Ottoman Conquest Period in Hungary *(fig. 19. 11)*.[115]

The six bronze rings recovered from the site thus far also cover all periods of the Middle Ages. The series includes four simple hammered metal sheet band rings, representing a type present in the medieval record since the Árpád Age.[116] The outer side of one of the two undecorated band rings[117] is convex *(fig. 19. 2, 4)*.[118] The two decorated rings could be dated to the Late Middle Ages;[119] one is decorated with a capital 'I',[120] while the other features three circular, parallel ribs *(fig. 19. 5)*.[121]

Signet rings are easier to date. They appeared first in the late 12th century, in context with the spreading of writing and the use of written records, and were popular from the end of the century on.[122] The find material collected on the site included two bronze signet rings, a hammered and a cast one. Hammered rings were made in the Carpathian Basin from the Hungarian Conquest Period, while casting only appeared – and exclusively amongst signet rings – from the late 14th century. Cast rings imported from the Balkans may be found in the archaeological record up to the 11th century; whether the presence of casting reflects an influence from the Balkans or was a local metallurgical achievement cannot be determined.[123] The cast signet ring recovered from the site is heavily damaged: only a part of its bezel survived, and the engraving has become so eroded that it cannot be discerned anymore *(fig. 19. 3)*.[124] By the applied technology, it was made in the 14th–15th centuries at the earliest, but its dating cannot be specified.[125] The other signet ring was hammered out from a thick metal sheet; the signet in its oval bezel features a double cross with a bird on each side in an oval frame *(fig. 19. 7)*.[126] The birds step outwards and turn their heads back, looking at each other. Originally, the double cross was part of the royal insignia and has become part of the iconography of private signet rings, probably via coins, to express a

[111] We are grateful to Dr. Csaba Tóth (Hungarian National Museum) for his help with identifying the coins.
[112] CNH.I.3. Inv. No. SZIKM 2023.4.4.21, 0.85 g.
[113] CAN Cg4. Inv. No. SZIKM 2023.4.3.18, 1.55 g.
[114] CAN B230. Inv. No. SZIKM 2023.4.3.20, 0.36 g. Found a little south of the Faluhelyi-dűlő site.
[115] CNH.II.308A, H846. Inv. No. SZIKM 2023.4.3.19, 0.47 g.
[116] *Horváth 2016* 79.
[117] Inv. No. SZIKM 2023.4.4.8.
[118] Inv. No. SZIKM 2023.4.3.17.
[119] *Horváth 2016* 79–80.
[120] Inv. No. SZIKM 2023.4.4.13.
[121] Inv. No. SZIKM 2023.4.4.14.
[122] *Lovag 1980* 234.
[123] *Rózsa – Szigeti 2021* 268–269.
[124] Inv. No. SZIKM 2023.4.3.16.
[125] *Litauszky 2012* 14; *Rózsa – Szigeti 2021* 269.
[126] Inv. No. SZIKM 2023.4.4.6. The ring was found a little north-east of the settlement.

right conferred on the owner by the king.[127] In the 14th–15th centuries, incised frames gradually vanished from signet images.[128] Bird representations first appeared in this context in the second half of the 13th century and became increasingly schematic in the 14th–15th centuries; however, the frame in the case of the signet image of the find discussed does not seem to have a dating value.[129] In summary, the signet ring with the double cross and bird representations was made sometime between the second half of the 13th and the early 14th centuries.

The presence of a book mount in such a tiny settlement may be of special significance *(fig. 19. 1)*.[130] The piece collected in the Börgönd site is a lozengiform, openwork, repoussé corner fitting made from a copper sheet with two adjacent sides bent down and under to fit the corner of the cover, the other two edges lobed and shaped with an unifoil terminal in the fourth corner. The piece features a central prominent truncated conical boss at the stem of the large openwork trefoil acanthus leaf stretching towards it from the opposite corner and dominating the framed field. The leaf motif is enhanced by hatched bands of incised strokes. Small, leafy branches ending in dotted rosettes accompany the two sides of the leaf motif. The straight edges have seven and eight lobes, respectively, adorned by a chased continuous row of dotted semicircles around larger, embossed, round knobs. The repoussé technique and the truncated conical central knob are characteristic of late medieval book corner fittings, and the acanthus motif and the details of its design help specify this dating: the fitting is a specimen of the Nuremberg type, made between 1475 and 1530.[131]

The analogies from the territory of the Kingdom of Hungary hive a hint at how frequent these fittings were at the time. Almost identical corner mounts, identical up to details like the lobed edges and the chased dot motifs, were found during the excavation of the Szent Zsigmond [St. Sigismund] Church in Buda[132] and the investigations of the Cistercian monastery in Pilisszentkereszt.[133] This type of book fitting was widespread in Central Europe and German territories as well. Such a piece could persist in a historical environment way more favourable in this respect than that of Hungary, i.e. in the Munich Court Library. Elek Benkő published a medieval book cover from the Munich Court Library with a complete set of fittings made in Nuremberg, featuring identical corner mounts.[134] This book's[135] binding was made in Master Schedel's bookbinding workshop in Nuremberg at the turn of the 15th and 16th centuries. With 250 persisting bindings, the workshop of Master Schedel was the biggest of the twenty-six of Nuremberg; they often bound the works by Hartmann Schedel, which means that the book fittings were most likely made in Nurenberg.

[127] King Béla III (1171–1196) included it amongst his royal insignia and had it designed into his coins (CNH.I.112). *Lovag 1980* 233; *Litauszky 2012* 26–27.

[128] *Litauszky 2012* 26–27.

[129] Different from the usual eagle representations in heraldry. Earlier, Mária Hlatky *(Hlatky 1938)* classified the signet rings with a simple line frame to the turn of the 13th and 14th centuries AD.

[130] Inv. No. SZIKM 2023.4.4.3.

[131] *Benkő – Barkóczy 2018* 176; *Adler – Ansorge 2007* 173–174 (ALM 2001/59/529, Abb. 13. 3). As the book corner fitting is a single stray find, it cannot be excluded that it got into the site in context with the reparation or rebinding of an older volume.

[132] *Ujhelyi 2017* 46–48, Taf. I. 2003.4.3.

[133] *Benkő – Barkóczy 2018* 184, fig. 15 below left.

[134] *Benkő – Barkóczy 2018* 184, fig. 15 centre; *Wagner 2006* 34–35.

[135] A transcription by Hartmann Schedel around 1500, a collection of manuscripts of the greatest humanists of the era. The Fuggers obtained two volumes for their library from Melchior, Schedel's grandson, and published them in print under the title 'Celtis Collection'. The book discussed got to the Munich Court Library as part of the Fuggers' Library. *Wagner 2006* 34; Münchener Hofbibliothek: https://mdz-nbn-resolving.de/urn:nbn:de:bvb:12-bsb00015883-3 [last accessed on 22. 06. 2023.].

The collection of the Morgan Library and Museum also includes a 15th-century book[136] bound in leather stretched over wooden plates of 21 × 15.5 cm and fitted with five very similar copper mounts on each side, made around the turn of the 15th and 16th centuries. These analogies help us identify the workshop where the fitting could have been made and the size of the book it covered.

The noteworthy finds of the site also include a bronze belt buckle with a heart-shaped pin guard *(fig. 19. 8).*[137] It belongs to the type of buckles with a D-shaped frame; one of its close analogies was recovered from 15th–16th-century context in the area of the Royal Palace of Buda,[138] while another, in the collection of the Hungarian National Museum, was dated to the end of the 14th century.[139] Another analogy is known from a rural context from Csepely.[140] In summary, the D-shaped belt buckle from Börgönd could be dated to the Late Middle Ages.

The metal detector survey yielded more, mainly late medieval and early modern, artefacts: lead fragments,[141] two conical bronze cover plate fragments,[142] fragments of iron fittings and bands,[143] horseshoes,[144] boot nails,[145] and iron nails.

Pottery finds

As the area of Faluhelyi-dűlő is currently a meadow, pottery could only be collected from molehills in tiny fragments during the first survey of the site. This meagre collection was completed by some larger pieces found while digging for metal objects in the metal detector survey and some finds dug out by wild boars, collected in the third field walking campaign; thus, the current pottery record consists of a few side fragments, three rim fragments, two base fragments, and a broken piece of handle. Two of the rim fragments belonged to pots and one to a lid. The pot rim fragments *(fig. 17. 5, 10)*[146] are similar to the yellow-white pot type described above, and they were also part of vessels with everted, bulging, rounded rims and mouth diameters of 15 and 17 cm, respectively. The third rim fragment *(fig. 17. 12)*[147] belonged to an off-white lid of 17 cm diameter, with a rounded rim and a flange, made from clay tempered with medium-fine sand. A fragment of a vessel base, 8 cm in diameter, is yellow *(fig. 17. 11),*[148] while the other, of a base 12 cm in diameter, is red and coarser, tempered with gravel *(fig. 17. 14).*[149] Based on the burn and soot marks, both belonged to cooking pots. The band handle fragment has an orange shade freckled with dark dots due to the sand temper in its material *(fig. 17. 6).*[150] The side fragments include an orange-coloured piece with red painting, most probably of a liquid container *(fig. 17. 13),*[151] exact

[136] It is a collection of epistles by Gasparino Barzizza, printed in 1470 in the workshop of Michael Udalricus Martinus. The book was part of the library of the Benedictine Monastery of Saint Mang in Füssen, Bavaria. The binding was most likely also made there. Source: https://www.themorgan.org/incunables/133638 [last accessed on 22. 06. 2023.].
[137] Inv. No. SZIKM 2023.4.4.23.
[138] *Horváth 2016* 94–95.
[139] *Lovag – Kovács – Garam 1999* 92.
[140] *Kovalovszki 1969* 247, fig. 35.
[141] Inv. Nos. SZIKM 2023.4.3.23–24.
[142] Inv. Nos. SZIKM 2023.4.4.16, SZIKM 2023.4.4.20; *Horváth 2016* Taf. XXXVIII, fig. 2.
[143] Inv. Nos. SZIKM 2023.4.4.4, SZIKM 2023.4.4.9, SZIKM 2023.4.4.17.
[144] Inv. Nos. SZIKM 2023.4.4.5, SZIKM 2023.4.4.18. The horseshoes were dated to the 15th century based on the design of the nail groove. *Gere 2003* 29.
[145] Inv. No. SZIKM 2023.4.3.21.
[146] Inv. No. SZIKM 2023.4.4.28.
[147] Inv. No. SZIKM 2023.4.4.30.
[148] Inv. No. SZIKM 2023.4.5.4.
[149] Inv. No. SZIKM 2023.4.4.36.
[150] Inv. No. SZIKM 2023.4.5.5.
[151] Inv. No. SZIKM 2023.4.4.33.

analogies to which are known from 15th-century contexts in Székesfehérvár[152] and the Castle of Csókakő.[153] Save for two, the rest of the side fragments are either fine yellow or coarser red; a red and two yellow pieces are decorated with incised lines *(fig. 17. 7–9).*[154] Besides, there is a single grey sherd of a vessel representing the so-called Austrian ware, which is but too uncharacteristic for specifying its dating within the 13th–16th century range. A T-profile rim fragment[155] of a red pottery cauldron with gravel temper and a thick, tiny fragment with crushed lime temper prove that the area was inhabited already in the Árpád Age.

Conclusions

Bronze Age

Fortifications of the Vatya culture

At the end of the Early Bronze Age, the Kisapostag and Nagyrév cultures amalgamated along the Danube, and a new cultural unit, the Vatya culture, emerged, which persisted throughout all three phases of the Middle Bronze Age; based on the radiocarbon sequences of Százhalombatta-Földvár and Kakucs-Balla-domb, this equals to about 2000/1900–1500/1450 BC, i.e., the Rei Bz A2–B1 phases.[156]

The early Middle Bronze Age fell in the middle phase of the Subboreal climatic stage, characterised by a warmer climate and more precipitation compared to the previous one. Favourable climatic conditions and Early Bronze Age technical innovations like, for example, the plough, the use of draught animals, and the manuring of fields brought about a considerable population increase. This was the heyday of Bronze Age tell settlements in the Carpathian Basin.[157]

In the Vatya culture's time, life continued uninterrupted in the tell settlements established by communities of the Nagyrév culture on the right bank of the Danube. These large centres were started around 2300/2200 BC, i.e., at the end of the Early Bronze Age, and accumulated a sequence of occupation layers reaching up to 6 m by the end of the Middle Bronze Age. Hillforts, the flagship settlement types of the Vatya culture, only emerged in the second half of its life, on top of elevations, often near water – along streams discharging into the Danube, the valleys of the Sárvíz, Váli-víz, and Benta streams, and the Velence Mountains. At the same time, the tells on the right bank of the Danube were fortified, and new hillforts were established along a former branch of the river; the easternmost Vatya hillfort is Alpár-Várdomb at the right bank of the Tisza River. The latest overview of the culture enlists 53 hillforts and fortifications.[158]

Vatya hillforts were established usually on (loess) plateaus with steep sides towering above the surrounding plain and providing excellent views in all directions. The tapered end of the plateau was usually closed by a deep, V-profile trench; the 'severed' small area was the actual fortification or 'small fort', while the settlement (the 'big fort'), often also surrounded by a ditch, stretched on the other side of the trench. Settlement features are frequently identified also outside this second trench. The exact structure of Vatya hillforts is dissimilar as they were always adapted to the actual terrain.

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[152] *Siklósi 1983* Abb. 4.
[153] *Kovács 2023* fig. 9.
[154] Inv. Nos. SZIKM 2023.4.5.5–7.
[155] Similar to the type b defined by Miklós Takács for the clay cauldrons of the Little Hungarian Plain (*Takács 1996* 169, Abb. 16).
[156] *Jaeger – Kulcsár 2013* 289; *Kiss et al. 2019* 187.
[157] *Reményi 2005* 1–3; *P. Fischl – Reményi 2013* 727.
[158] *Dani et al. 2019* 853.

However, Vatya hillforts share some structural elements, including the V-shaped trenches and lesser levelled terraces. The geophysical survey of Perkáta-Forrás-dűlő I has revealed a Vatya hillfort where the ditch was accompanied by another feature, perhaps a palisade wall.[159] At Alpár-Várdomb, the earthen rampart was constructed from the fill of the trench when it was dug, and had no internal support structure.[160] In contrast, the rampart at Pákozdvár was reinforced with stones in a clay 'mortar' in two or three rows under the earthen surface.[161] The geophysical survey has outlined a deep ditch around the settlement at Kakucs-Turján, dividing the inhabited part of the site into three parts. The three settlement parts seem to have had diverse functions: most settlement features concentrated in one part, with significantly less household waste in the second next to it (probably because it was built up later), while only wells and water reservoirs in the third zone, probably used for pasturing animals.[162]

While the fortified Vatya settlements of Early Bronze Age origin along the right bank of the Danube are real tells with a thick layer sequence, that of the hillforts established in Phase 2 or 3 of the Middle Bronze Age is significantly thinner with fewer occupation horizons; therefore, these were considered earlier 'pseudo-tells'.[163] The 2.5 m-thick layer sequence of Sárbogárd-Bolondvár comprised six occupation horizons,[164] the ca. 1.5 m-thick sequence of Aba-Bolondvár eight horizons,[165] while the completely excavated small fort of Lovasberény-Mihályvár proved to be single-layer on the highest part and multi-layer in the lower western and north-western zones.[166] In summary, while the thin occupation layer of the Börgönd hillfort is rare amongst similar settlements of the Vatya culture, it also occurs in other sites, like Lovasberény-Mihályvár.

The simplest Vatya hillforts are single-layer settlements engirded by a ditch. Besides, some are divided into two parts, while recent research has identified some consisting of three or more distinct zones.[167] At Perkáta-Forrás-dűlő, a linear structure, perhaps a one-time road, led from the ditch of the small fort to the second settlement part, also surrounded by a trench.[168] Field walks conducted in the last couple of years resulted in the identification of settlement features around several Vatya hillforts, including the western side of Vál-Pogányvár, the southern side of Kajászó-várdomb, and around Aba-Bolondvár and Ercsi-Bolondvár. In summary, the tripartite structure of the Börgönd settlement and the settlement part on the northern side of the fortification match the characteristics of coeval settlements in Fejér County.

The fortified settlements stood at a distance of 5–10 km from each other, providing the backbone of the Vatya settlement network, with a dense sub-network of single-layer open settlements of various sizes between them: Börgönd-Szent-László-hegy lays 6 km north-north-east from Aba-Bolondvár and 7.5 km south-south-east of Székesfehérvár-Csala-Rózsahegy. Moreover, the hillfort of Börgönd is situated in the border zone of two cultural complexes: Bálint Savanyú unearthed a TEPC settlement at Székesfehérvár-Hosszúéri-dűlő és Ezres-puszta között ['between Hosszúéri-dűlő and Ezres-puszta'], only 15 km in the north-west, in 2014 *(fig 20)*.[169]

The research in the Benta Valley at the north-eastern fringes of Fejér County made possible the reconstruction a distinct geopolitical unit in the study area, which at the time of the Vatya

[159] *Reményi – Pető 2015.*
[160] *Bóna – Nováki 1982* 64.
[161] *Marosi 1930* 56.
[162] *Jaeger et al. 2021* 198–200.
[163] *Bóna 1992* 24; *Reményi 2012* 276.
[164] *Bándi 1960* 150.
[165] *Kovács 1963* 131.
[166] *F. Petres – Bándi 1969* 173.
[167] *Dani et al. 2019* 853.
[168] *Reményi – Pető 2015.*
[169] *Pozsgai – Savanyú 2016* 9.

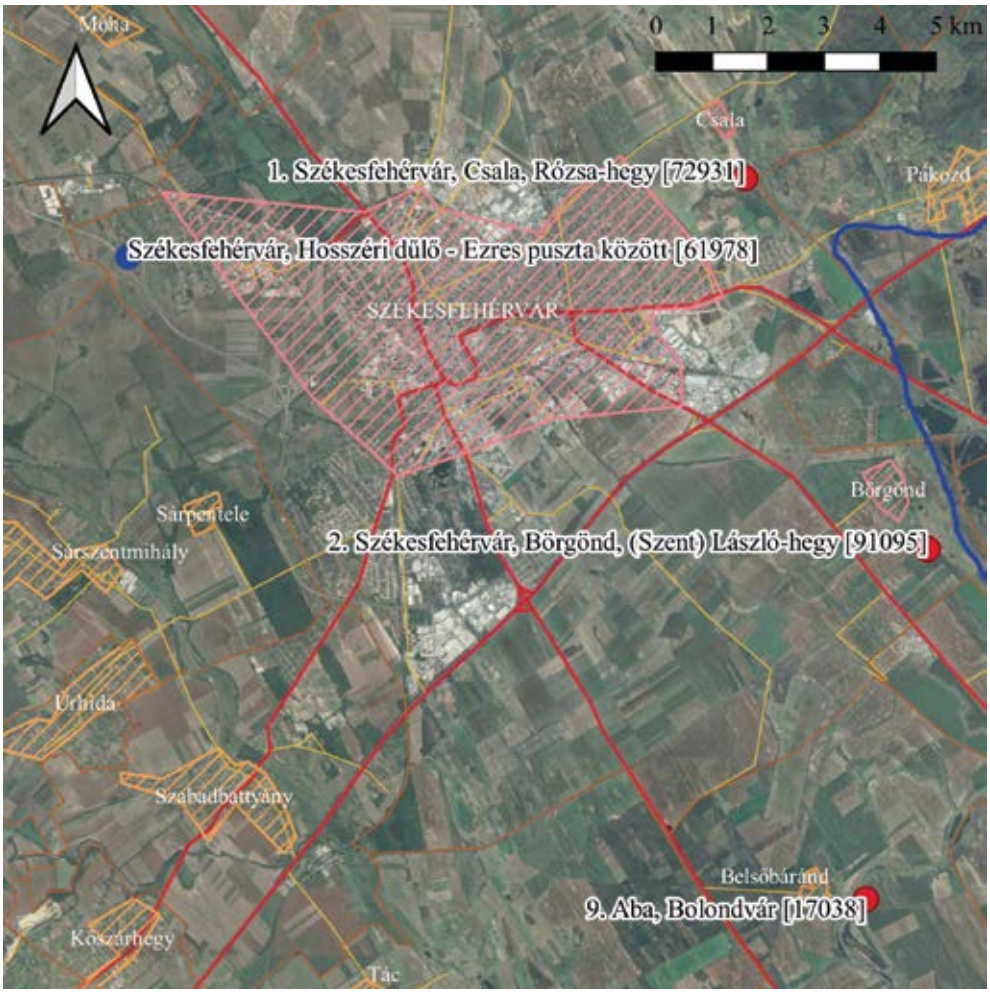

Fig. 20. Fortified settlements around Székesfehérvár-Börgönd-(Szent) László-hegy. Red dots: Vatya culture, blue dot: Transdanubian Encrusted Pottery culture (©Ágnes Kovács, ©Zsófia Nádai)

culture belonged under a single rule with its centre on the tell settlement by the Danube and four minor fortified settlements throughout the valley, guarding the life of the smaller and bigger open settlements between them.[170] Probably a similar formation existed in the valley of the Váli Stream on the eastern bank of Lake Velence at the time.[171]

The question arising in context with the hillfort of Börgönd is whether a similar formation existed also around Lake Velence. The coastal area of the lake has not been investigated systematically, and the current built-up density hinders any research considerably. IVO contains five Vatya settlements around the lake (sites Nos. 2, 4, 6, 7, and 8 on *fig. 21*), and Gábor Váczi presented some more he had identified in the area in a summary published in 2003, including Site No. 3 on the survey map of *fig. 21*, which is actually two sites, a Vatya phase II–III settlement and a Vatya–Koszider phase cemetery next to it.[172] Only a part of the Vatya cemetery at Velencefürdő is enlisted in the central site register as 'Gárdony, Berzsenyi Dániel utca 8'.

[170] *Earle – Kolb 2010* 73; *Szeverényi – Kulcsár 2012* 294–298.
[171] *Szeverényi – Kulcsár 2012* 298.
[172] *Váczi 2003* 41–45, 49.

Fig. 21. Sites of the Middle Bronze Age Vatya culture around Lake Velence. Vatya sites, marked by red dots: 1. Székesfehérvár-Csala-Rózsa-hegy; 2. Székesfehérvár-Börgönd-Szent-László-hegy; 3. Velencefürdő (cemetery and settlement in *Váczi 2003,* enlisted as 'Gárdony, No. 8 Berzsenyi Dániel Street' in IVO); 4. Kápolnásnyék-Vörösmarty Múzeum; 5. Velence-Meszlényi-kastély (in *Váczi 2003,* enlisted as 'Velence, Bágyom-ér partja' dated to the Bronze Age in IVO); 6. Sukoró-Koldusárok; 7. Nadap-Kőbánya [Stone Quarry]; 8. Pákozd-Pákozdvár.
Bronze Age sites, marked by yellow dots: 1. Székesfehérvár-Kisfalud-Felsőmajor; 2. Gárdony-Szemere Béla and Deák Ferenc streets; 3. Sukoró-Országút alatti-dűlő; 4. Sukoró, Lapos-dűlő
(©Ágnes Kovács, ©Zsófia Nádai)

As the location of another late Vatya site identified by Gábor Váczi at Velence-Meszlényi-kastély [Velence-Meszlényi Castle][173] matches that of a Bronze Age site under the name 'Bágyom-ér partja' in the central register, the two sites are probably the same. Besides, he mentions a site at Velence-Szőlőhegy without further specification.[174]

The site at Székesfehérvár-Csala-Rózsa-hegy is enlisted in IVO as 'Bronze Age'; this could be specified in a survey conducted in February 2023, when typical Vatya-style pottery and a sherd with wrapped stick[175] imprints, characteristic of the Kisapostag culture, were collected from the surface. The Bronze Age pottery record retrieved from the area of the Börgönd hillfort comprised similar fragments.[176] Csala-Rózsa-hegy is currently far from Lake Velence, but it is

[173] *Váczi 2003* 41, 49.
[174] *Váczi 2003* 41–43, 49.
[175] Also known as reeled stick in the literature. *Vicze 2011* 71–72.
[176] *Váczi – Stibrányi 2008* 209–211.

situated on the bank of Császár-víz, the stream filling the lake, next to the supposed bank of the former Nádas-tó.

IVO includes several 'Bronze Age' sites from the area of Lake Velence; based on their location, we believe these also belong to the Vatya culture.

The precise extent of Nádas-tó, the former western basin of Lake Velence, is unknown. On the sketch published by László Ádám[177] it is pretty similar to the map of the current reeds around the lake by Gábor Mezősi.[178] Therefore, the path of the blue line marking the probable boundary of the reeds in prehistory in the survey map in *fig. 21* was determined by merging the two. This reconstruction is necessarily imprecise as the lake's shoreline changed rapidly before the construction of an artificial shoreline in the 19th and 20th centuries; thus, the Bronze Age extent of the lake is impossible to reconstruct precisely.

The survey map also reveals that the sites of the Vatya culture surround the lake. Communities of the Kisapostag culture settled at corners of Lake Velence already in the Early Bronze Age – the known sites being Kápolnásnyék-Vörösmarty Múzeum at the south-eastern, Székesfehérvár-Börgönd-Szent-László-hegy at the south-western, and Székesfehérvár-Csala-Rózsa-hegy at the north-western corner. These settlements survived into the Middle Bronze Age, up to the Koszider phase, and their network became completed by settlements newly established by Vatya communities. Besides known late Vatya sites (e.g., the cemetery at Velencefürdő and Velence-Meszlényi-kastély)[179] the settlements at Börgönd[180] and Csala-Rózsa-hegy probably persisted up to the Koszider phase.

The Middle Bronze Age settlements around Lake Velence were established in very diverse ecological settings: plainlands and near the lake by the southern shore, as well as on top of hills somewhat away from the water on the northern and western sides. Besides, there is Pákozdvár, the largest Vatya settlement, which was built on top of a stretch of the Velence Mountains towering above the lake. Despite Pákozdvár lying in a forested mountain region unsuitable for crop cultivation, Arnold Marosi collected ten litres of 'charred wheat' from one of the settlement pits excavated in 1925.[181] Currently, no Middle Bronze Age geopolitical formations like those in the Benta and Váli valleys could be outlined around the lake. This area was probably also densely inhabited, and the settlements belonged under more than one rule.

Until lately, Middle Bronze Age fortified settlements were seen as keeps for protecting the residents from the attacks of Tumulus culture people at the end of the period and evaluated accordingly.[182] The current scientific consensus, however, implies a less violent and more intricate web of reasons behind the dawn of tell cultures at the end of the Middle Bronze Age, while hillfort settlements – the ones with a thin layer sequence just as well as the great tells – are interpreted as centres performing complex social and economic functions.[183]

Vatya hillforts are closely linked with metallurgical activities. A bronzesmith's workshop was unearthed at Lovasberény-Mihályvár, and casting moulds and metalworking tools are frequent finds on other sites, too. Besides, depots were usually hidden in and around hillforts, indicating a social aspect of metallurgy in this period: the elite that could afford to accumulate bronze items for a hoard lived in the fortified centres.[184] Some particular prestige items, like the ones made from amber, amongst the finds of hillforts indicate that the residents participated in long-distance

[177] *Ádám 1955* 326, fig. 5.
[178] *Mezősi 2011* 162, fig. 3. 13.
[179] *Váczi 2003* 45, 47–48.
[180] *Váczi – Stibrányi 2008* 211.
[181] *Marosi 1930* 57.
[182] *Bóna 1975* 58; *Bóna 1992* 24; S*zeverényi – Kulcsár 2012* 288–292.
[183] *Reményi 2012* 276; *Szeverényi – Kulcsár 2012* 291–292; *P. Fischl – Reményi 2013* 726.
[184] *P. Fischl – Reményi 2013* 733.

trade. While long-lived tells on the plainland were always established amidst fertile arable lands, hillforts can also be found in mountainous settings like, e.g., the Gödöllő Hills and the Buda Mountains, or the best example, Pákozdvár, an important local (perhaps tribal) centre in Fejér County. The exchange of goods – especially lithic and metal raw materials and/or products – must have been substantial in the subsistence of mountain settlements, just like wool production and the trading of wool products.[185]

The Vatya settlement network, consisting of fortified and minor open settlements, has always been seen as a hierarchical system reflecting a gradually more stratified society.[186] At the same time, some believed a simple hierarchical model is unsuitable for describing the Vatya inhabitation pattern[187] and, albeit there are signs of social stratification, the community-centred perspective should be highlighted instead amongst the agents at work in organising the Vatya society.[188] The pottery record of Kakucs-Turján outlines a homogenous and not-so-stratified community.[189]

Bronze Age Börgönd

The settlement at Székesfehérvár-Börgönd-Szent László-hegy was established by a community of the Kisapostag culture at the end of the Early Bronze Age. During the Middle Bronze Age, it became a fortified settlement of the Vatya culture, persisting throughout the period. It was probably a single-layer settlement with three settlement parts and another outer settlement north of the small fort. At the end of the Middle Bronze Age, the resident community probably maintained close connections with nearby TEPC communities, as suggested by the four encrusted bowls found in the settlement area. The bronze dagger and spear, also found there, could belong to a warrior who lived in the Börgönd settlement in its early phase. Lake Velence, which expanded almost to the site, must have played an important part in the life of the inhabitants, as did agriculture, based on the grindstone fragments and the sickle blade in the record.

Medieval Börgönd

Following the mentions in 1249 and 1298 (see above), Börgönd does not appear in documents for a long time, until 1558, when, after the cease of the line of Tamás Zedgyes, it became a property of the Treasury; the text refers to the village in the current form of its name, without the *'Fel'* [Upper] affix.[190] This name appears regularly from the mid-17th century in documents related to the possession disputes of local landlords; a record in 1660 mentions it as *puszta* [abandoned].[191] Its borders were surveyed in 1701; a related testimony reveals that it had an Ottoman owner before.[192] On the relevant maps of the first Habsburg military survey and later surveys, the village is displayed where it stands today with the name *'Börgöndpuszta';* however, the *'Felbergen'* [Upper Bergen] name in the 1298 document implies the existence of a *'Bergen'* or *'Albergen'* [Lower Bergen], i.e. that the settlement consisted of two parts at that time. One of the two settlements was certainly the one identified by our surveys, but currently, there is no evidence of whether the other lay where the village is today – save for some uncertain information.

Alán Kralovánszky, archaeologist of the King St. Stephen Museum in Székesfehérvár, unearthed a part of a Late Avar Period (8th–9th-century) cemetery in a rescue excavation related

[185] *Reményi 2012* 279–280; *P. Fischl – Reményi 2013* 728.
[186] *Reményi 2012* 278; *P. Fischl – Reményi 2013* 729.
[187] *Dani et al. 2019* 856.
[188] *Earle – Kolb 2010* 74.
[189] *Jaeger et al. 2021* 206.
[190] City Archive and Research Centre. The History of Székesfehérvár (https://albaarchivum.hu/torteneti-osszefoglalo-szekesfehervarrol/).
[191] *Farkas 1991* 221–222.
[192] *Móra 1972* 220–221.

to the construction of grain silos by the local agricultural co-operative in 1960. He could only save the site because the local teacher, having learned about the workers finding bones upon digging, notified the museum. Upon arrival, Kralovánszky found the features he later identified as the remains of a late medieval or early modern period house and the related pits above the graves mostly excavated away and could only document their deepest part on the bottom of the silo pit.[193] As he has given non-matching and rather broad periods for the dating of the features in the excavation report and the short summary of the results in the yearbook of the museum, it can only be stated that the area was in use preceding the establishment of the modern-day Börgöndpuszta. It must be noted, however, that the site of the 1960 rescue excavation lies along the same dirt road as the settlement site in our study area.

Based on the above, a working hypothesis can be formulated: Felbergen, the part closer to Noe, was situated at least partially where the village stands today, while (Al)Bergen lay south of it along the road, at the foot of Szent László-hegy. Accepting that the church stood in the area of the 'old cemetery' would mean that it stood right between the two settlements. However, as we detected medieval find material in considerable concentrations in the area of the church, it cannot be excluded either that the other settlement core was on the hill around the church building – but neither proven, for the time being, as no certainly medieval buildings could be identified there. Some more surveys in the eastern and southern part of the current settlement, especially in the area of Alán Kralovánszky's 1960 excavation site, may help decide this question, which we plan to go on with shortly.

Find material and residents

The metal record of the site implies that the area of (Al)Bergen was inhabited uninterrupted from the Árpád Age to the end of the Middle Ages. Besides their dating value, the recovered metal objects open a window to the daily life, standard of living, financial state, and education of the inhabitants, just like the connections and significance of the settlement and their changes.

According to the evidence of the Friesach and Vienna denars, the settlement entered the long-distance trade network of the area already in the 13th–14th centuries. The spread of these coins is usually connected with cattle trade.[194] Without further proof, one can only state at this point that the settlement participated in regional trade.

If related to the profane instead of the religious sphere of life, the material relics of literacy, including the signet ring *(fig. 19. 7)* and the book corner fitting *(fig. 19. 1),* can be connected with trade in the first place. The 14th-century signet ring is a high-value prestige item used probably for validating documents and signing contracts on a regular basis, implying active literacy. The late medieval book corner fitting is another evidence of regional trade-related activity but points to a significantly later time. The chronological hiatus between the two finds does not necessarily mean the cease of trading; it must be kept in mind that the current record is a highly selective assemblage of random surface finds. The book fitting, made between 1475 and 1530, might represent an upswing in trade at the end of the period: such fittings were mass-produced in Germany and got to bookbinding workshops in the Kingdom of Hungary by trade, while to the settlements like the one at Börgönd, with books. This book corner fitting has also arrived in the territory of Hungary on the order of an ecclesiastical or lay bookbinding workshop.[195]

The fitting was probably part of an eight-part set consisting of four corner fittings, two square mounts, and two buckles; based on its size, it protected a printed book bound in wood boards covered with leather. An analysis of Nuremberg-type sheet metal book fittings has revealed

[193] *Kralovánszky 1963.*
[194] *Rózsa – Szigeti 2021* 269.
[195] Another possibility is that it got to the site with a book bound abroad.

a linear connection between the size of the mounts and the related books. Based on that, the 6.2 cm long corner fitting could belong to a 22–33 cm long book, which is a medium-sized medieval book, falling into the range the specimens of which were most frequently completed with metal fittings.[196]

What kind of a book could be the one this corner fitting adorned? It could be seen from the analogies presented above that besides ecclesiastical works, non-religious literature had also gained ground in the period in question; maybe such a book could find its way to Börgönd. Another option is, that the fitting belongs to the missal used in the local church, and it was bound with bought fittings in the bookbinding workshops of the Holy Mary Provostship or the Saint Stephen Hospitaller Convent in the nearby Székesfehérvár.

The lives of peasants and lower nobles did not necessarily differ fundamentally in rural settlements; they can only be distinguished on large-scale excavations based on the remains of bigger houses and the occasional prestige items.[197] The signet ring and the book corner fitting might be such items, but it must be noted that stove tiles, another find group considered a marker of the residences of lower nobility, are currently missing from the record. Thus, at this point, it is only reasonable to suppose the presence of rich peasants at Börgönd.[198]

Almost every pottery fragment collected in the area of the two sites of the medieval village could be dated to the Late Middle Ages, with a predominance of finds representing the period right before the destruction of the village, i.e., the second half of the 15th and first half of the 16th centuries. Based on the available analogies, most pottery vessels were made in the wider area, and only a single sherd indicated that products of distant pottery centres also reached the settlement.

Buildings and settlement structure

The geophysical surveys and field walks outlined late medieval surface buildings in the area of the Faluhelyi-dűlő site. Due to the lack of excavation, nothing more can be said about their structure; they could be log houses, timber-framed buildings, or those with diverse types of earthen and daub walls *(fig. 18).*

The extent of the building marked by an arrow on *fig. 18*, the geophysical survey map of the site, can be estimated: the related anomalies were detected in an area of 5 × 15 m. In light of the excavated late medieval residential buildings presented below and ethnographic analogies, this length indicates that the house was multipartite. Multipartite buildings with a living room, a kitchen, and a storage room represent, besides a spatial separation of diverse activities and functions, technological development: innovations in heating systems led to the appearance of smoke-free rooms.[199]

The northwest-southeast-directed part of the building with the L-shaped ground plan could also be measured; it was about 6 × 20 m. The size, again, indicates a multipartite residential building akin to the ones unearthed in the medieval Csőt village[200] and at Sarvaly.[201] Based on

[196] *Benkő – Barkóczy 2018* 184–185.
[197] *Ferenczi – Sárosi – Zatykó 2023* 179–188.
[198] Proving such hypotheses requires more intensive research of the site and the related archival resources.
[199] *Barabás – Gilyén 1987* 166.
[200] *Irásné Melis 2004* 183–185.
[201] *Holl 1979* 40. Several points of the chapter reconstructing the evolution history of medieval residential buildings at the end of the study are debated.

ethnographic analogies, this part could also be an outbuilding.[202] This, however, has to remain a hypothesis until further investigations, as without excavation, one cannot even tell whether the two buildings are coeval.

While the extent of several residential buildings could not be estimated, they provide information on the settlement's structure, as the relatively high built-up density indicates a settlement definitely more developed than a cluster of farmsteads. The northeast-southwest directed patches are parallel, indicating the short ends of the houses facing the street. As the Middle Mezőföld microregion is situated in Transdanubia but is more similar to the Great Hungarian Plain, analogies must have been searched for in both regions. The best examples of late medieval settlement morphology in the latter area are Túrkeve-Móric and Szentkirály.[203] The houses in both usually stand on top of small flood-free elevations, sometimes close to the water, like in Móric. However, in Szentkirály, a two-street village along a crossroads, the dirt road's path and the morphology of the valley determined the position of the houses, and the main factor influencing the choice where to build them was distance from the road rather than elevation.

Without clarifying the extent of the village, it cannot be determined whether the identified buildings belonged to a one-street settlement or a street of a more complex one. The significance of the settlement hints at the former; the dirt road could have been west of the identified houses, and its other side was probably built up akin to this one. It has to be noted, however, that a network of 0.5–1 m deep ditches web the hillside above the remains of the village. Some of these must be natural gulches or World War II entrenchments, but the name 'Horgos-oldal' used for the site by Zsuzsanna Bánki, indicates that some of them were considered roads by the locals because the word *horhos*, appearing here as *horgos*, means 'old (hillside) road deepened by water'.[204] The presence of such roads would be logical because if the church was indeed on the hilltop, roads must have led there. However, as finds were sporadic in this part of the site, further conclusions cannot be drawn. The area east of the houses is waterlogged even today, and no finds were recovered from there during our summer outings either, when most of the swamp was dried out, indicating that the eastern limits of the settlement have been found. In the current phase of research, plot sizes and the typical arrangement of the buildings within the plots have remained a question.

Based on the distribution of metal findings, the investigated part of Faluhelyi-dűlő was inhabited already in the early Árpád Age *(fig. 22).* However, the geophysical surveys only revealed late medieval surface buildings and no Árpád Age semi-sunken houses, and the pottery collected from the surface could also be dated to mostly the Late Middle Age. Besides, previous research in the area also yielded almost only late medieval structures and finds. The seeming lack of Árpád Age settlement features may be explained by that the anomalies of the late medieval houses were too strong, covering their signals, or that the Árpád Age settlement core is outside the survey area.

[202] Diverse forms of the quadrangular arrangement of buildings in a plot appear in the ethnographic record. The earliest building complexes in Transdanubia with an L-shaped ground plan are known from the excavations of Sarvaly. The outbuilding (usually a stable) was 'turned in' by 90 degrees to effectively use space in the long but thin plots. According to the current academic consensus, these L-shaped building complexes were the predecessors of the closed house complexes characteristic of the Őrség region (in western Transdanubia), which consisted of timber-framed surface residential and outbuildings on a stone foundation arranged in a closed rectangle with an inner courtyard in the centre (*Barabás – Gilyén 1987* 27–30).

[203] András Pálóczi-Horváth has compared the available data in *Pálóczi-Horváth 2013.* Móric: 280, fig. 1, Szentkirály: 283, fig. 2.

[204] https://www.arcanum.com/hu/online-kiadvanyok/Lexikonok-a-magyar-nyelv-ertelmezo-szotara-1BE8B/h-2E554/horhos-30F4B/ [last accessed on 22. 06. 2023].

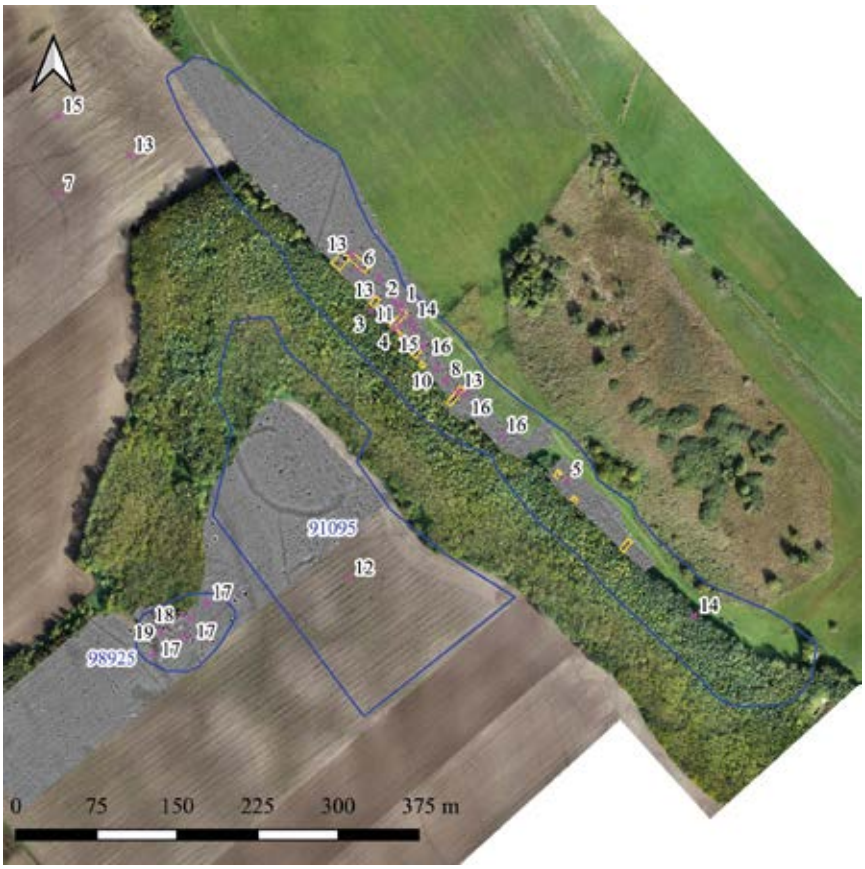

Fig. 22. Structure of the supposed (Al)Bergen [Lower Bergen]. The traces of medieval houses marked by yellow and the pink crosses mark the distribution of medieval finds: 1. Book corner fitting *(fig. 27. 1);* 2. Bronze finger ring *(fig. 27. 2);* 3. Cast signet ring *(fig. 27. 3);* 4. Band ring *(fig. 27. 4)*; 5. Band ring *(fig. 27. 5);* 6. Bronze ring *(fig. 27. 6);* 7. Signet ring *(fig. 27. 7)*; 8. Buckle belt *(fig. 27. 8);* 9. Denar of Duke Leopold VI of Austria (*fig. 27. 9* , without coordinates); 10. Denar with 'REGIA CIVITAS' in the legend *(fig. 27. 10);* 11. Denar from 1524 *(fig. 27. 11);* 12. Denar of Duke Frederick *(fig. 27. 12);* 13. Iron fragment; 14. Horseshoe fragment; 15. Roman coin; 16. Bronze fragment; 17. Pottery sherd; 18. Mortar; 19. Bone (©Zsófia Nádai)

Landscape and settlements

People exploited the morphological characteristics of the landscape in both the Bronze Age and medieval times, inhabiting the top of the elevations stretching northwest-southeast. The western coastline of lakes Velence and Nádas and the marshland of today's Dinnyési-fertő fundamentally determined the position of settlements and roads in every historical period. On the relevant map of the first Habsburg military survey *(fig. 9. 1),* the main road is marked passing through the wider area west of 'Börgöndpuszta' (already where it is today) but closer to it than the modern Route E66, running in the valley between the two hill ranges south of the settlement. Besides, a road crosses (and determines) the medieval village site, running on the shore of Nádas-tó, branching out from the road leading to 'Börgöndpuszta', which itself diverges from the west-east Székesfehérvár–Adony road. An inn (with '*w. h.*' = *Wirtshaus* marking) is indicated at the latter junction, suggesting the significance of this route. It seems that the lesser ones connecting the two main roads – leading to ferryable sections of the Danube (Székesfehérvár–Dinnyés–Adony, Székesfehérvár–Seregélyes–Dunaföldvár) – meet and branch out at 'Börgöndpuszta', one of them leading by the supposed medieval church site.

This rather complex road system, as recorded on a survey before most modern water regulations around Székesfehérvár, is probably the result of environmental instability. The water levels of the wetlands were constantly changing, necessitating the development of alternative routes between the crossings at Dinnyés and Seregélyes. These routes, determined by the environment, seem to have existed throughout history, their use constantly changing with the seasons and the destination of the travellers. Throughout history, the role of 'main road' seems to have alternated between the one following the shore of Nádas-tó (with less changes in elevation) and the other through the hills (which was drier); the Bronze Age sites in the area seem to be more open towards the latter. The supposed church site, probably determined in the Early Árpád Age, is also clearly oriented towards the higher grounds, while the site of the late medieval village follows the road by the lake. Our knowledge of Roman Period sites in the vicinity is limited; stray finds (Late Roman coins and a ring)[205] were recovered from along the lower road and a rather large settlement site is known beside it further to the south.[206] Our results indicate that besides climatic changes, primarily water regulation shaped the historic landscape in the area. Waterflow was much less extensively controlled in the Bronze and Early Árpád Ages than in the Roman Period, the Late Árpád Age, and in late medieval times.[207] The abandonment of artificial water systems, like dams and canals in the Ottoman Era[208] could also play a role in that the lower road and the general area of the late medieval village at Börgönd-Faluhelyi-dűlő became less desirable, which, eventually, could lead to its complete abandonment after the initial destruction, while Börgönd at its current location continued to exist.[209] We hope that we can shed more light on these processes by further research in the near future.

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[205] Roman gemstone inlaid gold plated bronze ring (Inv. No. SZIKM 2023.4.3.11); Roman coins (Inv. Nos. SZIKM 2023.4.2.4–5, 2023.4.4.7, and 2023.4.4.19).

[206] Székesfehérvár, Tanya-halmi-dűlő (ID No. 92173).

[207] According to earlier research, vast water regulation works were carried out in the Carpathian Basin in the younger phases of the Árpád Age (12th–13th centuries), which may or may not have been maintained in the less centralised kingdom in the Late Middle Ages. (*Ferenczi 2008* 341–346.) However, the highly important Buda–Székesfehérvár road was probably kept passable, and it also had a crucial influence on the study area.

[208] Only a few related features are known around Székesfehérvár, but the massive dams at Pátka (Székesfehérvár, Kőrakás-major, ID No. 25353) and Fehérvárcsurgó (Fehérvárcsurgó-Vaskapu, ID No. 21878) hint at their extent and significance.

[209] The fact, that the old church site possibly remained in use and the abandoned village persisted as a part of the common knowledge indicate that the wider Börgönd area was more-or-less continuously inhabited, settlers leaving their settlement only in more turbulent periods of the Ottoman Era.

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PÉTER LANGÓ – MIKLÓS TAKÁCS

ON BOTH SIDES OF THE BORDER: DEFENSE AND COOPERATION
ARCHAEOLOGICAL RESEARCH OF THE ÁRPÁD AGE BORDERS OF THE KINGDOM OF HUNGARY[1]

Zusammenfassung: Es ist offenkundig, dass Grenzen in Mitteleuropa (selbst im Mittelalter) verschiedene und teilweise widersprüchliche Rollen spielten. Eine davon – und die auf den ersten Blick vielleicht offensichtlichste – war die strategisch-militärische Rolle. Mittelalterliche Herrscher strebten in der Regel nicht nach einem friedlichen Miteinander mit ihren Nachbarn, sondern danach, das Territorium ihrer Länder zu vergrößern. Diese Einstellung war zu jener Zeit weit verbreitet, teilweise auch deshalb, weil sie durch die Notwendigkeit angeheizt wurde, die militärischen Gefolgschaften um ihre Herrscher kontinuierlich zu versorgen.

Im Gegensatz zur militärischen Rolle gibt es jedoch bereits im Frühmittelalter Hinweise auf grenzüberschreitende Beziehungen, insbesondere im Fernhandel. Schriftliche Quellen und archäologische Artefakte legen nahe, dass die Grenzen des mittelalterlichen Königreichs Ungarns der Árpádenzeit nicht nur die Landschaft teilten, sondern auch wichtige geographische Regionen miteinander verbanden. Die vorliegende Studie präsentiert eine Analyse beider Aspekte der Grenze des ungarischen Königreichs der Árpádenzeit (11.–13. Jahrhundert).

Keywords: archaeological analysis of borders, western parts of the Carpathian Basin, Kingdom of Hungary in the Árpád Age

It is trivial that (even in the Middle Ages) borders in Central Europe had several partially contradicting roles. One of these – and perhaps the most obvious at first sight – was the strategic military role. The strategic importance is easy to comprehend. Medieval rulers usually did not strive for a peaceful coexistence with their neighbours but rather to increase the territory of their countries. Needless to say, they could only do that at the expense of said neighbours. This attitude was common in the era, partially because it was also stimulated by the necessity of providing the military entourage around the rulers (with the German term: *Gefolgschaft*)[2] with a continuous supply. Neighbouring states understood exactly these aspirations and usually made efforts to prevent them. The most important means of defence was to increase, or at least maintain, the strength of their military power. Simultaneously, protecting the borders also played an important role in defence by minimising the possibility of sudden attacks. As opposed to the military role, there is evidence of cross-border relations (especially long-distance trade) already in the Early Middle Ages. Written sources and archaeological artefacts suggest that the borders of the medieval Kingdom of Hungary in the Árpád Age not only divided the landscape but also represented important geographical regions of connecting.

[1] The present study was written within the frame of the NKFI project (ID 132030) '*Life on the Frontier. Early Árpádian Age Settlements of the Moson Plain, way of life in the light of environmental conditions*'.

[2] About this term, see *Olberg 1988* lines 1171–1172.

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The study presents an analysis of both aspects of the border of the Kingdom of Hungary in the Árpád Age (11th–13th centuries). First, some archaeological finds are discussed that can be connected with border protection, together with a description of the topographic characteristics of the respective archaeological sites on a regional level. The second part contains an analysis of the connections of a single find, illustrating that one may reveal long-distance connections via micro-level analyses.

Changes in the concept of border in historiography and archaeology

Since the Middle Ages, the idea of boundaries has evolved according to diverse viewpoints and ideologies but never free from political and ideological constructs – enough to think about the original *topos* concept related to natural borders,[3] widely employed in Antiquity, and the comments made by ancient writers on the guardian role of kings as 'everlasting defenders' *(aeternus defensor)* entrusted with preserving the borders.[4] Geopolitical borders were seen as crucial components of political and power representation, but politics could not be excluded from the study of many other types of borders, including geographical, linguistic, religious, cultural, and social.[5] From the outset of nationalist movements, the size of a nation's territory and the position of its borders became key issues. The use and analysis of the idea of historical space in contemporary historical research have fundamentally altered the hitherto widely accepted and uncomplicated image of the historical boundaries of a specific geopolitical unit. Meanwhile, social sciences, including archaeology, have developed scientific perspectives in the research of borders.[6]

When delineating the borders of the early Árpádian Principality and later the Kingdom of Hungary under the Árpád dynasty, it is worth considering that historical records indicate that Hungarians occupied the central parts of the Carpathian Basin in several stages, which resulted in dynamic changes in the 'borderline' during this period.[7] Initially, Hungarian tribes only occupied the lands east of the left bank of the Danube.[8] Later, unlike the Franks or the Roman Empire before them, but similarly to the Avars, they crossed the natural boundary the river represented, expanding their dwelling area to lands west of the Danube, including Transdanubia. Hungarians occupied lands on both sides of the river, and for a significant part of the 10th century, their rule extended to the western zone of the Danube Basin, beyond the Carpathian Basin.

However, István Dienes and István Bóna's results reminded academics that it is not always possible to properly define the limits of the early Hungarian Principality based only on archaeological evidence.[9] Challenges may emerge from methodological issues when assessing the archaeological record, the difficulty of comparing modern and coeval written sources,[10] and last but not least, from the fact that different medieval political entities had different conceptions of borders, which cannot be precisely equated with the concept of state borders developed in

[3] *Hornstein 1957.*

[4] *Whittaker 1994; Whittaker 2004.*

[5] *Urciuoli 1995.*

[6] *Green – Perlman 1985; Lightfoot – Martinez 1995.*

[7] *Bóna 2000* 33–35. Recently, Béla Miklós Szőke re-examined the chronology of the settling of the Hungarian tribes, reconstructing it as a process that started in the mid-9th century and lasted for decades; see *Szőke 2004* 108–110.

[8] *Szőke 1994* 168–194; *Szőke 2004*. For the eastern borders of the Carolingian Empire, see *Vékony 1986; Wolfram 2002.*

[9] *Dienes 1972* 25–26; *Bóna 1986* 576.

[10] Several Hungarian studies have recently focused on these methodological issues; see *Révész 2007; Takács 2007b; Horváth 2014* 339–342.

later periods.[11] It is important to remember that the limits in this region were not like those of the former Roman Empire, i.e., clear to define based on written and archaeological evidence. By Late Antiquity, the previous Roman *limes* had already changed. Still, the peoples who replaced the Romans in the Early Middle Ages were not thinking in formations resembling those of the earlier period.[12] Owing to their likely steppe-oriented perspective on the subject,[13] 10th-century Hungarians most likely had their own idea of the local Central European border concept. Prominent Hungarian academics György Györffy and Gyula Kristó drew attention to this conceptual and institutional gap when they noted that, at that time, the Hungarian sphere of influence and the actual settlement area did not completely match.[14] Artefacts found in the Carpathian Basin attest to the spread of clothing accessories from the Eastern Alpine region in the 10th century. The record of the period also includes imports from the Balkans and Byzantine territories in the south, reflecting a notion of borders as a broader region separating and connecting the inhabitants on both sides.[15] The coeval record on the other side of the border zone holds several items from the 'inner' neighbouring region, suggesting the transit of different items and the moving of communities.[16] In certain cases, the movement was not influenced by factors like pagans living on the other side of the boundary (such as Hungarians in the 10th and 11th centuries, whom the subjects of the Carolingian Empire perceived as adversaries to be defended against). Saint Coloman, who was mistaken for a Hungarian spy and hanged in Stockerau, Austria, in 1012 while on a journey to the Holy Land, is one of the most well-known victims of mistrust against Hungarians. Western chroniclers described the boundary as a dividing barrier, where the earliest stages of civilisation were found on the western side and the feared savage world beyond. Strangely enough, Hungarians perhaps had a similar notion of themselves and the lands on the other side of the border.[17] The border stood for an uncharted, far-off region that the locals still remembered as being beyond the *'Óperencia'* (the Hungarian word *'Óperencia'* stems from the German expression *'ob der Enns'* [through the Enns, a small river in Bavaria] and denotes the wondrous faraway lands of folk tales full of weirdness, dangers, and adventures). But even when examining near-contemporary written sources, it is crucial to emphasise the necessity for a critical mindset because the surviving memoirs frequently use antiquated cliches, making the accurate reconstruction of the boundary more difficult. Determining borders can also be complicated by 'when', particularly in the centuries of the Árpád Age and especially in the turbulent 10th century when political and military power changes led to multiple revisions of the position and extent of

[11] *Reimitz 2000* 106–108; *Wolfram 2001; Hardt 2001; Hardt 2008.* For the differences between the modern and contemporary concepts, see *Pohl 2000* 17; *Török 2009* XV, 7–8; *Berend 2001* 6–17.

[12] *Curta 2005.*

[13] For the notion of steppe state formations, see *Vásáry 1983.*

[14] *Györffy 2000* 49–53; *Kristó 1996* 245; *Kristó 2002* 254–255. This idea is acknowledged and actively employed by Hungarian historical and archaeological research; see *Veszprémy 2002* 100; *Takács 2013* 647; *Horváth 2014* 342.

[15] *Jaspert 2007* 62–65. For the archaeological aspect of the question, see *Giesler 1980; Giesler 1997.* People living on the frontier were subjects of sometimes more hostile than friendly rules, and they did not see people on the other side simply as rivals. Viewed from the centres, they could be more easily identified with people of similar social status living across the border (under similar circumstances) than with families of the same status but residing in the central territories of the homeland. Cross-border relations were generally more complex than mere opposition; despite the political rivalry and tension between states, people living on the two sides of a border frequently formed marriage and familial bonds. See *Falkenhausen 1984; Matuz 1990* 27–28; *Sivan 1996; Sirks 1996; Curta 2005.*

[16] *Horváth 2014* 340.

[17] The separating effect of different perceptions on the sides of the border has been studied extensively in North America and illustrated by the related literature on frontiers and borders; see, e.g., *Billington 1966* 69–95 with vivid examples.

the frontiers.[18] Gábor Vékony noted that the Hungarian border defence system of the Árpád Age was one tailored to a settled population rather than the migrating nomadic communities of the earlier period.[19] This remark seems valid, given the numerous adjustments made to the political border by the end of the 10th century. It is not easy to imagine that Hungarians built static defence structures that may obstruct a dynamic modification of the border (a favoured thing at the time) and the exploitation of the tactical agility inherent in cavalry warfare, especially as the constant changes in diverse sections of the border were the results of military confrontations. Later, István Bóna returned to this question with an analysis of historical sources, confirming the belief widely held in Hungarian academia that the lands of Hungarians stretched all the way to the river Enns (the *'Óperencia'* of Hungarian folklore) in the West after their victory in 907.[20] However, some philological analyses suggest that the Fulda Annals' reference to the Enns as a border river may have been a literary tool intended to evoke memories of the Avar border zone *(certus limes),* which spread across the river a century before, during the reign of Charlemagne.[21] The question of whether a no man's land along the western border, as suggested by Austrian research, existed in the Early Árpád Age emerges from these facts. Was there such a zone along the western frontier in the Early Árpád Age?[22]

The military aspect of the protection of the western borders of the Kingdom of Hungary in the Árpád Age from an archaeological point of view

First, a characteristic of the terminological background of the concept of borders must be highlighted. Sources written in Latin in the Árpád Age use the words *confinium* and *marchia* to refer to borders,[23] akin to the terminology applied in coeval Western European Latin texts. In a self-revealing way, both terms do not mean the borderline itself but relate to the administration of the border zone. A detailed description of the different analyses of the works of various authors seems unnecessary here, as the results are often convergent or at least the historical reconstructions often follow the same path (despite border-related defence systems being organised in various ways, as presented in the previous chapter). It is enough to draw attention to the approach reflected by Árpád Age written sources, where the border is seen as a zone.[24]

Border protection in the various kingdoms of medieval Europe meant fulfilling many, often seemingly unconnected, tasks. While coeval written sources are scarce, later data and circumstances can also be included in the analysis, and conclusions about these tasks can be drawn with high certainty.[25] As the tasks generally related to border protection were different in times of peace and war, especially when the enemy started a military campaign, they are presented in the following classified based on his aspect.

Tasks connected with the protection of borders in peacetime:

- Being continuously ready for physically protecting the border area.
- Supervising border traffic and collecting toll from incoming and outgoing traders.
- Controlling or at least supervising all other kinds of cross-border connections.
- Collecting information about the conditions and events on the other side of the border.

[18] *Bóna 2000* 25–28, 33–37, 70–71, 76–82.
[19] *Vékony 1983.*
[20] *Bóna 2000* 36.
[21] *Reimitz 2000* 15; *Reimitz 2001* 192; *Horváth 2014* 340; *Vékony 1983* 225.
[22] *Brundke et al. 2017.*
[23] See, e.g., *Zsoldos 2016* 48–63.
[24] *Zsoldos 2016* 48–63.
[25] *Vékony 1983* reflects a similar approach.

Tasks in wartime, especially during enemy campaigns:

- Eliminating, or at least intercepting, relatively small enemy troops that invade the border.
- Slowing down the movement of large enemy troops, hindering their march and the development of the attack.
- Disrupting the communication of the invading enemy and hindering supply (if the main army has already entered the border zone).

In analysing the borders of the kingdoms of medieval Europe, historians worldwide usually recognise the importance of these factors. As a detailed review of the related extensive literature is beyond the scope of this study, we only refer here to a few, in our opinion, most important works. A detailed description of the analyses of various authors also seems unnecessary (some are already referred to above); only the outcome is to be summarised again briefly.

The geographical environment and the power of the neighbouring state fundamentally influenced the protection of the border. With an eye to these, research on medieval borders often approaches the topic as one of areas rather than lines, especially when environmental conditions are moderately favourable for border defence or the opponents are strong.

These aspects taken into account in the research on the borders of the Kingdom of Hungary in the Árpád Age point towards differences in the protection of distinct border sections. Research into the border protection of the era based on written sources and linguistic data[26] has pointed out the presence of two strong opponents, the Byzantine Empire in the Southeast and the Holy Roman Empire in the West,[27] which triggered the development of organised border defence on the southern, southwestern, western, and northwestern frontiers of the Kingdom of Hungary in the Árpád Age. In contrast, border protection relied mainly on natural geography in the northern, north-eastern and eastern frontiers. As for the eastern section, the importance of border protection increased significantly in the 11th–13th centuries because the Carpathian Basin was next to the eastern European steppe, dominated by tribal confederations of nomads at the time, and open to the even if not continuous but repeated raids of their armed groups (see, e.g., the nomadic invasion of 1068 that concluded with the Battle of Kerlés[28] and the Mongol invasion of 1241–1242 that devastated the whole country).[29]

For an archaeological approach to the topic of border protection, the basic question is whether there are any archaeological traces to be connected with the organisation of border control, and if yes, what are these? An archaeological investigation of border control must start with identifying the border zone and defining, as precisely as possible, the areas that can be classified as border regions. When examining the borders of the Kingdom of Hungary in the Árpád Age, great attention must be paid to the watercourses in plainlands and the mountains. These natural obstacles had a determining role in every border zone. The situation was most peculiar in the western frontier, where the Danube, the largest river of the frontier zone, has flown through it from west to east; thus, it could not be the border, and there is no other natural formation either that could serve as a natural division. Accordingly, it is much easier to define the coeval frontiers of the Kingdom of Hungary in the south, east and north: the lower reaches of the Sava River represented a natural border in the south and southwest, as well as the Danube after its confluence, while the Carpathian Mountains in the east and north.[30]

[26] See, e.g., *Zsoldos 2016* 48–63.
[27] *Makk 1996; Engel 2005* 27–37, 49–54.
[28] *Pálóczi Horváth 1989* 121.
[29] *Engel 2005* 98–102.
[30] *Engel 2005* XIII–XV.

When researching the western borders of the Kingdom of Hungary in the Árpád Age, one has to keep in mind not only the lack of natural (geographical) barriers but also the timeline, which, in this case, is unique. Due to steps taken by the emerging Holy Roman Empire already from the 10th century, the western border zone of the Kingdom of Hungary continuously narrowed.[31] According to current hypotheses, the border river at the turn of the 10th and 11th centuries was either the Fischa or the Lajta/Leitha; Hungarian and Austrian reconstructions differ there,[32] but the difference is not essential, as it concerns a zone not broader than 50 km. During the reign of King (Saint) Stephen I, the founder of the state of Hungary (1000–1038), the border within this zone did not change. However, during the short reign of King Sámuel Aba (1041–1044), offensive steps were taken as the Hungarian army expanded the western frontier up to the Fischa River[33] but could not hold the newly occupied lands against the German campaigns that eventually led to the debacle of Sámuel Aba. After several more wars between the Holy Roman Empire and the Kingdom of Hungary, the border between the two states stabilised along the Lajta/Leitha River for centuries.[34]

Research into the protection of the western borders of the Kingdom of Hungary in the Árpád Age is not except to the comprehensive problems of research into the whole period: small number of written sources and the fact that archaeological sites can only be dated roughly. Unfortunately, these problems limit interpretation possibilities considerably. Researchers delving into the era are commonly trying to overcome this major obstacle by formulating general hypotheses and adding details that fit both from geographical and chronological points of view. The general lack of sources confines us to doing the same at some points, even if we are aware of the danger implied in projecting general or perceived tendencies on particular phenomena. Besides, we must deal with chronological difficulties concerning not only and perhaps not primarily the dating and interpretation of settlements but, to the same extent, partially or fully excavated cemeteries – enough to mention the controversial dating(s) of the Gnadendorf grave, which a scholar assigned to the very beginning of the Hungarian Conquest,[35] another to the very end,[36] while yet another to the first third of the 10th century, i.e., the first period (but not the very beginning) of the Hungarian Conquest.[37]

Despite the uncertainties in the dating of particular graves, a general trend can be outlined based on the first sites in the border zones in the century after the Hungarian Conquest. These 'farmstead cemeteries', with a term by László Kovács,[38] consist of a few graves; such have been discovered in the western border zone at Páli,[39] Szakony,[40] Veszkény,[41] Öttevény,[42] and north of the Danube (in today's Slovakia) at Tardoskedd/Tvrdošovce[43] and Vágsellye/Šal'a.[44] Of these, Szakony is perhaps the most important as it could be dated reliably to the first half of the 10th century.[45] These small cemeteries can rightly be considered the legacy of small, mobile

[31] *Csendes 1991* 95–103.
[32] *Kring 1938* 475–486; *Csendes 2001* 64–65.
[33] *Csendes 2001* 65.
[34] *Csendes 2001* 65.
[35] *Révész 2007* 141–144.
[36] *Daim 2007b* 282.
[37] *Takács 2007a* 219–223.
[38] *Kovács 2013* 512, 513, 514, and especially 520.
[39] *Horváth 2022* 49–62.
[40] *Horváth 2022* 73–141.
[41] *Horváth 2022* 143–150.
[42] *Horváth 2014* 183, 301–302.
[43] *Točík 1971* 209–214.
[44] *Točík 1992* 18–132.
[45] *Horváth 2022* 137–141, dating the cemetery to the early 10th century AD.

communities that supervised the border zone. From the second half of the 10th century, larger cemeteries – 'village cemeteries', as László Kovács refers to them[46] – appeared in the western border area, including, e.g., Ikervár,[47] Sorokpolány,[48] Himód,[49] Lébény-Kaszás-domb,[50] and Bruck an der Leitha (Austria).[51] Their emergence presumably indicates that settling down also started in the border zone in the second half of the 10th century.

The topographical position of these cemeteries is telling. The vast majority of 10th-century farmstead cemeteries[52] were established in the western part of the actual border zone. In this light, the Gnadendorf grave is exceptional, regardless of its chronological position.[53] Moreover, a lonely 10th-century grave was found in Lanzenkirchen (Austria) near the Danube, the most important transport route; the feature became well-known only decades after its discovery through Falko Daim's museum data collecting work.[54] The unique character of the border at the western edge of the Carpathian Basin may be illustrated by an early medieval grave discovered during the excavations of the Stephansdom in Vienna.[55] The cause of death of the buried man became completely obvious upon excavating the grave: by an arrow, the head of which was found in the neck area. As the arrowhead was a diamond-shaped type preferred by Hungarian horsemen of the 10th century, one may be right to assume that the deceased was a victim of a Hungarian raid. The question is, of course, how broad conclusions may be drawn from this single find; according to the latest results of research, such hammered arrowheads were used not only by the Hungarians but also in the area of today's Czech Republic and Saxony in the 10th century and perhaps even later. But, considering all arguments impartially, with common sense and taking into account the proximity of Vienna and the Hungarian western border zone, one can say that the grave from the Stephansdom probably really sheds some light on the disturbance caused by Hungarian border protection, regardless of the ethnicity of the deceased and the time of his death[56] – which would be impossible to deduce from only the burial rite and the arrowhead.

As for the village cemeteries[57] in the western part of the Carpathian Basin, it is important to emphasise that most of these were started in the second half of the 10th century and remained in use until the end of the 11th century. This timeline, including the time of the founding of the Hungarian state, reveals a lot about life in the border zone in the 10th and 11th centuries, indicating that the stabilisation of the settlement structure started there.

A glimpse at regional topography reveals that the spread and distribution of village cemeteries largely corresponds with the line of the first fortifications of the newly founded Hungarian

[46] *Kovács 2013* 514, 515, 516, and especially 520.
[47] *Kiss 2000* 41–118.
[48] *Kiss 2000* 146–238.
[49] *Horváth 2022* 9–47.
[50] *Kovács 1995* 1078–1079; *Tomka 2000* 66; *Horváth 2012* 191.
[51] *Kreitner 2000* 182–199.
[52] *Kovács 2013* 512, 513, 514, and especially 520.
[53] Based on available data, it is impossible to decide whether the Gnadendorf burial represents a phenomenon similar to what Hungarian research (see *Cat. Budapest 1996* 437–448) assumes in the case of a grave from Przemyśl (Poland), namely that it is the final resting place of either a border guard or someone who died in a military action. The latter hypothesis has analogies even outside the Carpathian Basin, e.g., at Aspres-lès-Corps (France), a site identified by Mechtilde Schulze-Dörrlamm *(Schulze 1984; Bede – Langó – Sarah 2017; Bede – Langó 2021)*. Answering this question in the case of the Gnadendorf grave would require further excavation to improve our understanding of its context.
[54] *Daim 2007a* 269–272.
[55] *Kühtreiber 2013* 188, 219.
[56] *Schulze-Dörrlamm 2021* 439.
[57] *Kovács 2013* 514, 515, 516, and especially 520.

Kingdom, comprising, e.g., the so-called county forts of Pozsony/Bratislava (Slovakia),[58] Moson,[59] Sopron,[60] and Vasvár. According to the research of István Bóna, the construction of these fortifications started while the Kingdom of Hungary was still in formation.[61] Without discussing István Bóna's related concept in detail, it must be pointed out that its chronological aspects seem suitable only for some forts on the western parts of the nascent kingdom. Drawing more definite conclusions, i.e. 'translating' the observed general trends onto specific sites, is prohibited by the lack of specific data in the case of most sites at the western frontier of the Árpád Age Kingdom of Hungary. In this respect, the newest evidence is ambiguous. While recent radiocarbon data of the Moson fort confirm the hypothesis that it was built relatively early, i.e., already in the first half of the 10th century, the dendrochronological investigations of the wooden structure of the castle of Pozsony/Bratislava (Slovakia) revealed that the earliest fort was erected only in the second third of the 11th century;[62] however, as written sources (the description of the German campaign against Hungary in 1051 in the first place) describe, a county fort at the same place was of key importance a century earlier.[63] Thus, as far as this single data point can lead to more general conclusions, one can hypothesise that the construction of county forts in the western border region extended deep into the 11th century.

A comparison of the concept by István Bóna on the chronology of county forts and other results leads to the assumption that the construction of smaller fortifications in western Hungary could have started immediately after or, to put it more mildly, almost parallel with that of the county forts. These smaller fortifications did not function as county seats; they were more likely built to serve as supply centres and gathering points for the forces of defence of a particular border region section, as emerged from an analysis by Attila Zsoldos of the written sources on several forts at the western border of Hungary, including Darufalva/Drassburg (Austria), Kapuvár, and Babót.[64] The related archaeological material includes Early Árpád Age finds with the fragment of a ribbed neck vessel from the area of the Darufalva/Drassburg fort.[65] Two characteristics of the position of county fortresses and other, smaller forts are definitely worth highlighting: first, they were usually established at dominant points of a given micro-topographic environment; and second, they were not built directly next to the border, but near the inner end of the protected border zone (*gyepű* in Hungarian). This especially applies to the less important fortresses serving as regional centres, the position of which seemingly influenced the density of rural settlements in the area.

The location of the 'gate of Moson' that appears in a source from 1060[66] is a problem of its own kind. Some identify it as the western gate of the Moson fort,[67] while others believe it was a distinct location somewhere between the swamplands of the Hanság and the Moson Danube, the north-eastern branch of the river.[68]

Considering all elements of border protection, one should not forget about a third one, particularly significant in relation to the western frontier the Kingdom of Hungary in the Árpád Age. Written sources, e.g., the records describing the German campaign of 1043 and 1044, indicate

[58] For a short but targeted analysis of this county fort, see *Bóna 1998* 34–35.
[59] *Bóna 1998* 34.
[60] *Bóna 1998* 34.
[61] *Bóna 1998* 63–64.
[62] *Henning – Ruttkay 2011* 284.
[63] *Engel 2005* 30.
[64] *Zsoldos 2016* 48–50.
[65] Described by M. Takács in the collection of the Burgenlisches Landesmuseum in Eisenstadt (Austria).
[66] King Andreas I was captured at the gates of Moson in 1060 *('captus est enim portas Musun'), Györffy 1998* 167.
[67] *Györffy 1998* 167.
[68] *Kiss – Tóth 1999* 109, 111; *Takács 1999* 128.

that Hungarians erected many 'natural obstacles' near the western borders of their country, which the German army was only able to overcome in the second campaign, even then only by employing local guides who led them through.[69] Thus, they could only advance and eventually defeat the Hungarian king Sámuel Aba in the Battle of Ménfő in 1044.[70] A thorough field survey was conducted to identify the mentioned 'natural obstacles' related to border protection. Based on field surveys, Károly Takács concluded that the landscape was perhaps shaped by digging artificial canals at the eastern edge of the swampland of Hanság,[71] to improve border defence. However, this must be viewed with some caution as the chronology of the formation of the related ditches could not be determined precisely.

After evaluating the topographical setting of the archaeological record connected with the protection of the western borders of the Kingdom of Hungary in the Árpád Age, there is still an aspect to be analysed. Did, and if yes, how did the proximity of the border affect the life of the rural communities settled in the border zone? To answer that, one must first determine whether it is even possible to specify where the border zone inside the country was. The line of fortified seats of the westernmost counties, discussed above, may be used in the future for determining the extension of the border zone towards the inner parts of the country;[72] currently, the body of data available from researched Árpád Age rural settlements is insufficient to draw a decisive conclusion regarding the western and other border sections.[73] In summary, the 'inner' edge of the border zone could be identified in the western frontier as a line connecting the county forts of Pozsony/Bratislava, Moson, Sopron, and Vasvár. Even the available scarce archaeological record is enough to see that the density of (identified) Árpád Age rural settlements on the 'inner' side of this line corresponds to the average[74] in other parts of Transdanubia, especially in the Kisalföld (Little Plain), while on the outer side, at least in the Moson area, only the number of farmstead-like settlements seems quite large.[75] This distribution is perhaps a mark of the border zone (even if the number of excavated Árpád Age rural settlements in said region is too small to make definite statements).

Other aspects of the character of the western border of Árpád Age Hungary. Archaeological traits of cross-border relations

In the previous chapter, the parts of Árpád Age material culture of Western Hungary were discussed which may be relevant for the research on the military aspects of border management in times of peace and war. These aspects could be visualised by an analysis of the scatter of specific site types: farmstead and village cemeteries, county forts, and ditches interpreted as results of landscaping activity carried out to improve the efficiency of border defence.

Single artefacts are regularly not connected with the military aspect of the border but with trade or other forms of cross-border connection instead. In the following, several examples of such connections are presented. Most of the presented artefacts are grave finds, but some settlement find types may also be interpreted as evidence of such contacts.

[69] For the related analysis with a map displaying the reconstructed paths, see *Robotka 2000* 374–401.
[70] *Engel 2005* 29.
[71] *Takács 2000a* 27–61.
[72] A result of the survey of the distribution of 10th–11th-century cemeteries in the southern Carpathian Basin. *Takács 2013* 650–654.
[73] For an overview of the current state of research on rural sites of the Árpád Age, see *Takács in print*.
[74] For a recent overview of the distribution of sites, see *Takács 2017* 5–12.
[75] *Takács 1998* 181–191; *Takács 2000b* 244–248.

A. Grave finds

1. Iron knives adorned with antler plates

During the 9th century, the Danube Valley produced unique artefacts such as iron knives adorned with antler plates *(fig. 1).* Their distinctive forms set them apart from the 10th-century fragments discovered in the Carpathian Basin[76] as the latter had no carved antler plates with dots, circles, or other patterns. These objects, along with the workshops that produced them, are scattered on the right bank of the Danube in the valleys of the Morava and Thaya rivers,[77] from the territory of today's Lower Austria through the Little Hungarian Plain and along the Danube to the Danube Bend.[78] Such knives, also discovered in other sites in Transdanubia, were a distinctive relic of the 9th-century Sopronkőhida community with Western links.[79] Maja Petrinec's research confirms the appearance of similar tools in the Adriatic Region.[80] In his previous examination of the specimens found in the Carpathian Basin, Béla Miklós Szőke highlighted that the pieces clearly originated from a 9th-century context and were typical additions to graves of females.[81] Several researchers commented on this: Erik Szameit concluded, based on the evaluation of the Hainbuch cemetery (Austria), that such objects could have been present in Lower Austria in the second half of the 8th century.[82] Maja Petrinec held a similar view, dating the emergence of the knife type to the end of the 8th century based on items from the Auhof-Perg cemetery in Upper Austria.[83] Blanka Kavánová's examination of similar antler knife handles in the Mikulčice region (Czech Republic), some from pre-Moravian contexts, corroborates this opinion.[84]

However, as recent excavation reports have revealed, the type remained in use after the Hungarian tribes settled down and the Principality of Hungary was established. Thus, a variation of straight-backed knives[85] with antler[86] and/or bone handles[87] survived into the 10th and 11th centuries, though in lower quantities and usually in plain shapes. Such knives were found in the extensive 11th-century rural cemetery of Himód-Káposztás *(fig. 1)* and graves discovered in the graveyard of the early parish church[88] at Szombathely-St. Martin Church.[89] While the grave from Szombathely that contained the knife was dated definitely to the 9th century, there is still some disagreement about its chronological position[90] as Béla Miklós Szőke dated the assemblage to the

[76] *Istvánovits 2003* 328–330; *Fehér 2014.*
[77] *Kavánová 1995* 214.
[78] *Szőke 1982.*
[79] *Török 1973* 49–50.
[80] *Petrinec 2009* 298.
[81] *Szőke 1982* 24–25; *Müller 2004* 14. This observation has also been confirmed by contemporary research; cf. *Petrinec 2009* 298. Grave 174 in Břeclav-Pohansko, of a male, is mentioned as an exception by Maja Petrinec (*Petrinec 2009* 298). According to the description by František Kalousek, it contained a knife with a wooden handle; *Kalousek 1971* 111, No. 3, 138.
[82] *Szameit 1990* 109–112, 117. See *Breibert 2005* 410; *Nowotny 2005* 220.
[83] *Petrinec 2009* 298. See *Szőke 1982* 35.
[84] *Kavánová 1995* 215. For the periodisation of this, see *Klanica 1995.*
[85] Ahrens Type 2. 2, *Ahrens 1983* 57–59; *Szőke 1982* 23.
[86] According to the observation of Blanka Kavánová, these handles were made of antlers in Mikulčice; *Kavánová 1995* 214.
[87] *Szőke 1982; Cat. Brescia 2001* 473, No. 81e.
[88] *Kiss 2005.*
[89] *Horváth 2022* 42–47; *Szőke 2010* 35.
[90] The authors assigned the finding to Period A of the cemetery, dating to the 9th century (*Kiss – Tóth 1993* 185; *Kiss 2000* 252).

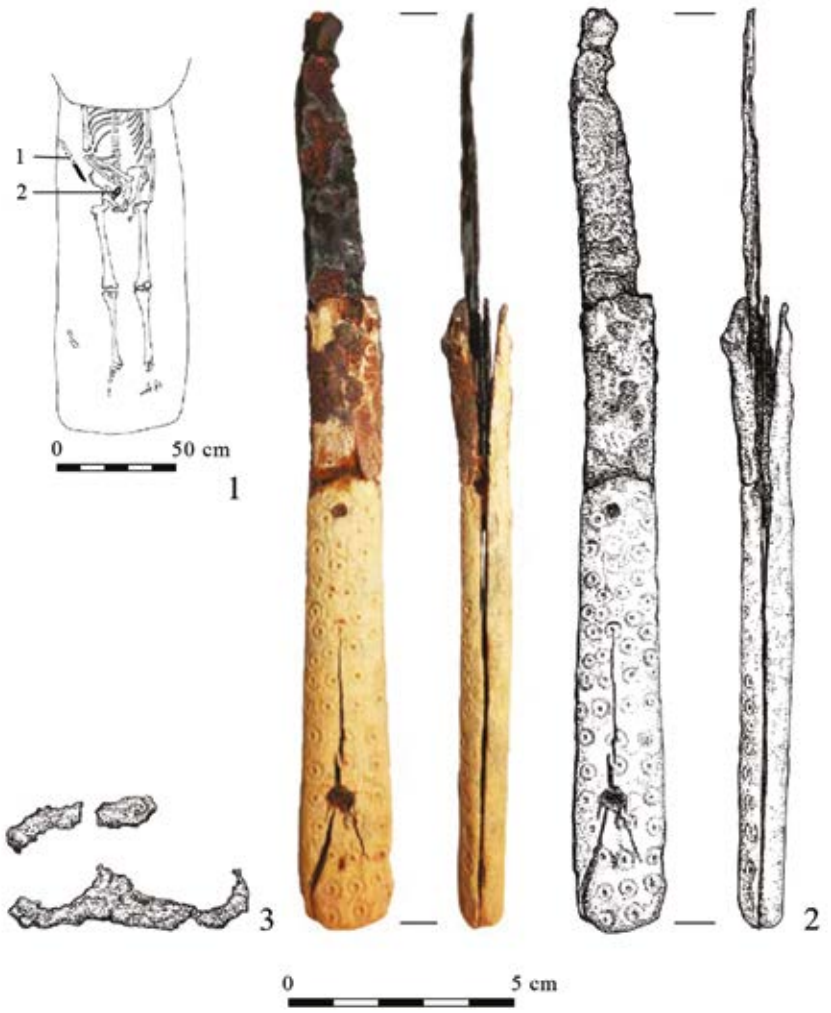

Fig. 1. Himód-Káposztás, Grave 68. Drawing and photo of the antler-handled knife from the grave (based on *Horváth 2022*) (©Péter Langó)

10th century, suggesing that such knives were still in fashion then.[91] A similarity between this knife and the ones from Himód is that they were found in graves of men on both sites.[92]

A study by Maja Petrinec verified that such knives were still used in the 10th century.[93] As Béla Miklós Szőke emphasised, additional proof came from Libice nad Cidlinou (Czech Republic); it was discovered in a location that used to be the Virgin Mary Church and most likely came from a grave.[94] Besides, he also dated some fragments from Grave 70, the grave of a female, of the 9th–11th century cemetery of Tornóc/Trnovec nad Váhom (Slovakia) as the remains of a 10th-century knife,[95] as the feature could be assigned to the 10th-century cemetery part based on both its relative position within the cemetery and the flat arrowhead it contained.[96] Yet another specimen, mentioned recently by Maja Petrinec and found at Šibenik-Sv. Lovre (Croatia) in a late 10th-century context supports the type's survival into the mid or late

[91] *Szőke 2021* 184, note 1386.
[92] *Kiss 2000* 245.
[93] *Petrinec 2009* 299.
[94] *Turek 1969* 130; *Princová – Mařík 2006.*
[95] *Szőke 1982* 38.
[96] *Točík 1971* 143–144, 146, 151, 155.

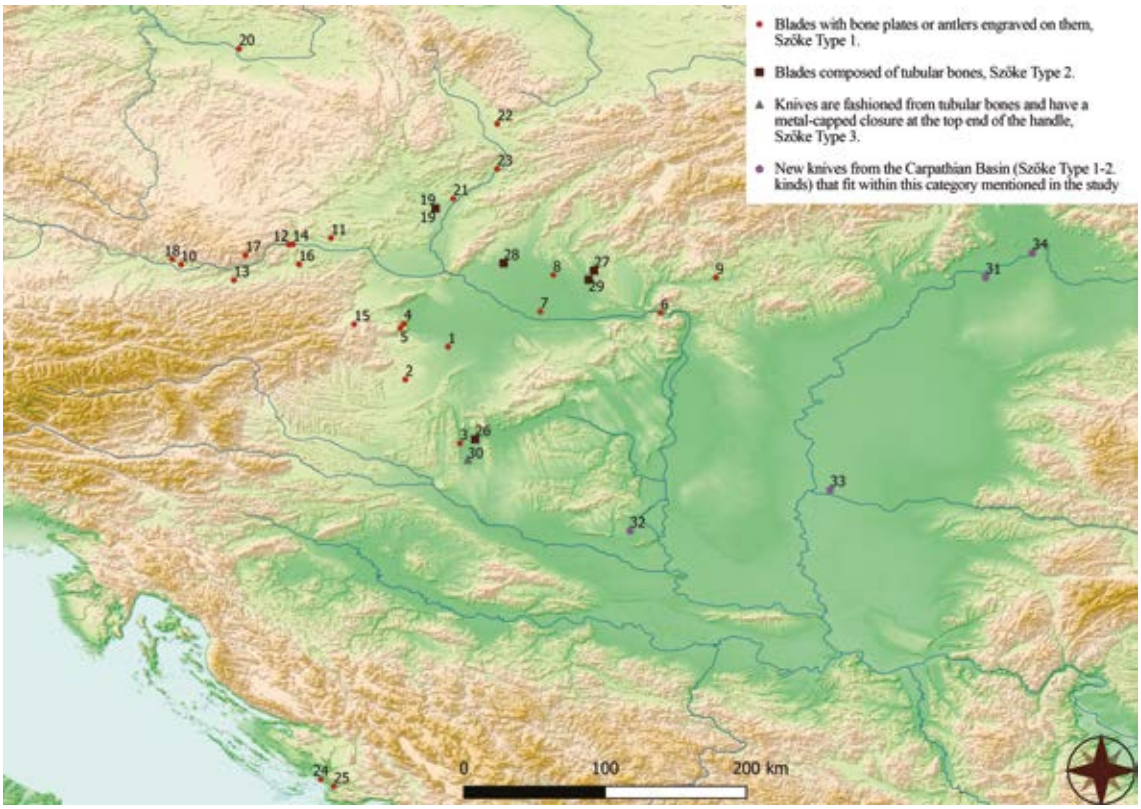

Fig. 2. Distribution of iron knives with a bone or antler handle from the 9th–11th centuries in the Carpathian Basin (©Péter Langó)

10th century.[97] A knife somewhat resembling Type 3 in Béla Miklós Szőke's classification was discovered in Kremsburg (Styria, Austria).[98] Based on the S-shaped rings found alongside it, Austrian scholars dated this artefact to the late 10th century.[99]

The knives from Himód and Szombathely provide more evidence of the persistence of the type into the 10th and 11th centuries. However, this knife type was rare in the Carpathian Basin from the 10th century, appearing mainly in areas that were once in close contact with the western territories of the Danube Valley and the Eastern Alpine region. An analysis of the Tarnóc/Trnovec nad Váhom cemetery suggests that the area of the Váh River continued maintaining these ties in the 10th century. The presence of items like these knives in 10th-century contexts indicates the persistence of contact between communities on the two sides of the border *(fig. 2)*.

2. Earrings from Southeast Europe

A unique pair of earrings of Southeast European origin was found in another grave in the Himód cemetery. The 'lunula pendant earrings' (the lower part of the rings is decorated with a crescent applied inside, over the pendant) were part of a woman's burial *(fig. 3)*. The grave was disturbed, and its fill also contained fragments of a broken torque with hook-and-eye closure and a green glass bead.[100] In our research, the context of these pendants is fascinating. Like other objects from Southeast Europe, such earrings are known mainly from the southern part of the Carpathian Basin

[97] *Petrinec 2009* 299.
[98] *Kühtreiber – Obenaus 2017* 165, Taf. 108.
[99] *Kühtreiber – Obenaus 2017* 165.
[100] *Horváth 2022* 27.

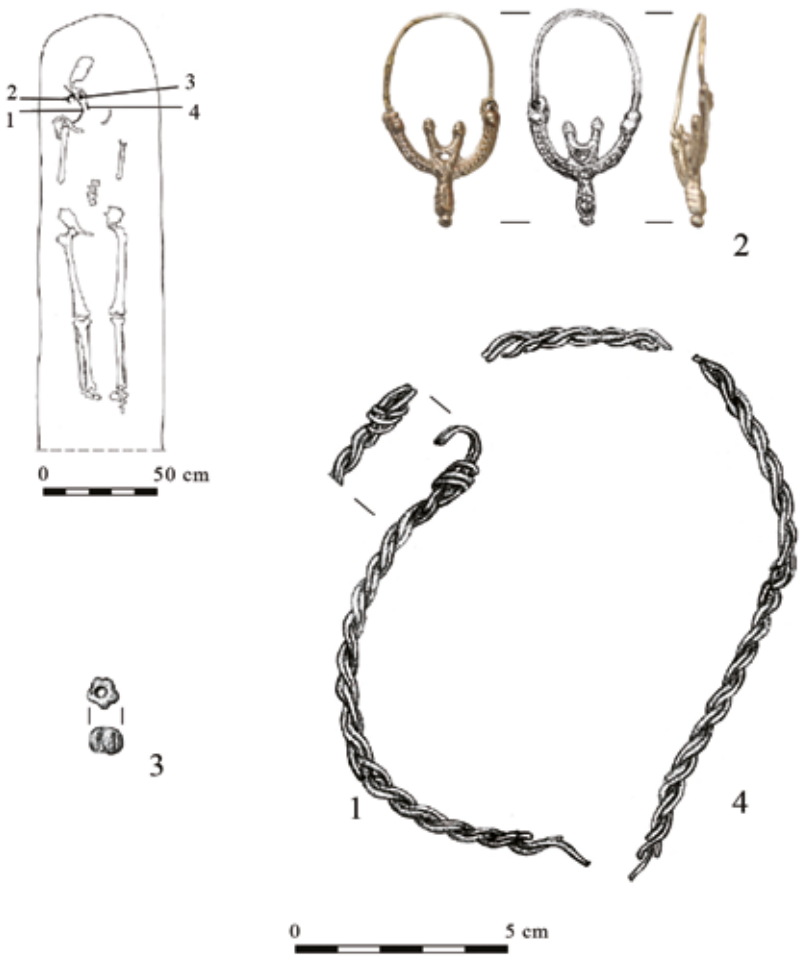

Fig. 3. Himód-Káposztás, Grave 118. 1, 4. Fragments of twisted bronze torques; 2. Drawing and a photo of lunula pendant earrings; 3. Green-coloured engraved glass bead (based on *Horváth 2022* and *Langó 2021*) (©Péter Langó)

and less from the western border area.[101] In a broader context, analogies are known from the East Alpine region and the lands between the Drava and Sava rivers,[102] as well as the territories of today's Croatia and Slovenia.[103] The cast items from the East Alpine region and the Drava–Sava Interfluve are similar to the pieces from Himód, while pressblech variants appear throughout the Balkans. It is yet to be answered how the earrings found at Himód got so far west – through the internal trade networks in the Carpathian Basin or arriving from the West? None of the scenarios can be ruled out due to its scattered distribution (there are only four sites confirmed to be authentic);[104] that said, the latter – the orientation towards the East Alpine region – might be corroborated by the presence of another type, crescent-shaped openwork plate pendant earrings *(fig. 4).* This Southeast European earring type appeared in the north-eastern and western parts of the Carpathian Basin, in the site of Stupava-Mást in Slovakia and,[105] even further west, in the cemetery of Předmostí-Nivky in the

[101] *Mesterházy 1991.*
[102] *Langó 2021* 159–160.
[103] *Petrinec 2009* 254–256.
[104] *Langó 2021* 92–118.
[105] *Kraskovská 1954* 146.

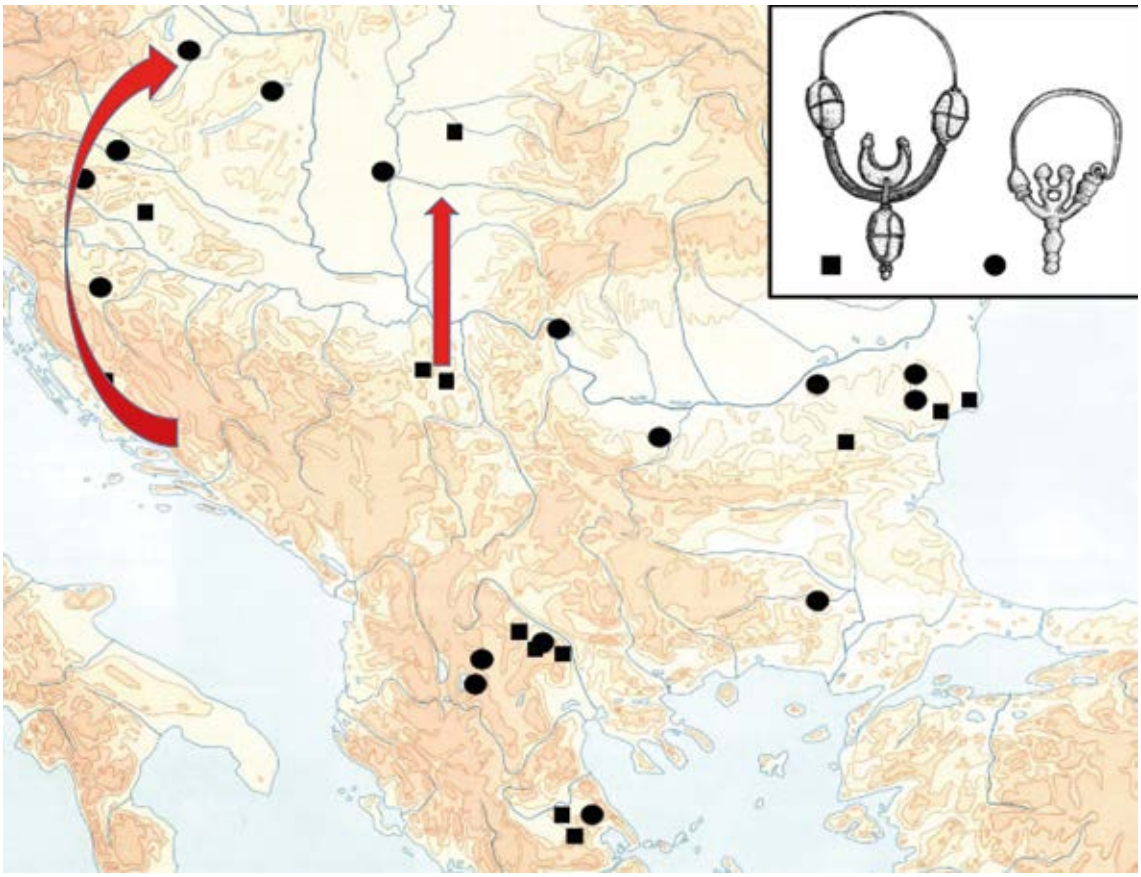

Fig. 4. Distribution of lunula pendants and lunula pendant earrings. Arrows mark the directions of the connection network related to their spread in the Carpathian Basin (©Péter Langó)

Czech Republic.[106] Like the ones found in Himód, these pieces most certainly reached the East Alpine region from the West *(fig. 5).* This route cannot be excluded in the case of other sites within the Carpathian Basin either, as indicated by Grave 278, a distinctive 11th-century burial discovered in the castle of Eger, a town in the north-eastern parts[107] *(fig. 6).* The grave contained, beside a pair of openwork plate earrings similar to the ones mentioned (but foreign to the Carpathian Basin),[108] the remains of an adult female in mortuary clothing with accessories reflecting West Alpine rather than southern fashion.[109] Other burials on the site also contained similar finds.[110] The East Alpine ties of the Eger mortuary community provide a clear explanation for the presence of items originating unmistakably from the region:[111] besides the earrings, a disc brooch[112] and so-called East Alpine-type button-end rings.[113] Károly Kozák, who discovered the assemblages, observed that based on their attire, the people buried here may have come from this East Alpine region.[114] Similar grave finds from other sites (Verpelét, Pétervására) in this region corroborated

[106] *Staňa 1970; Langó 2012.*
[107] *Kozák 1981* 17–18, 26; *Fodor 2008b* 133.
[108] *Fodor 2008b* 133.
[109] *Horváth 2014* 367–392.
[110] *Kozák 1981* 37; *Fodor 2008b* 143.
[111] *Kozák 1981* 37–38; *Horváth 2014* 357–412.
[112] *Kozák 1981* 37; *Fodor 2008b* 143; *Horváth 2014* 373.
[113] *Kozák 1981* 34–35; *Horváth 2014* 360.
[114] *Kozák 1981* 37–38.

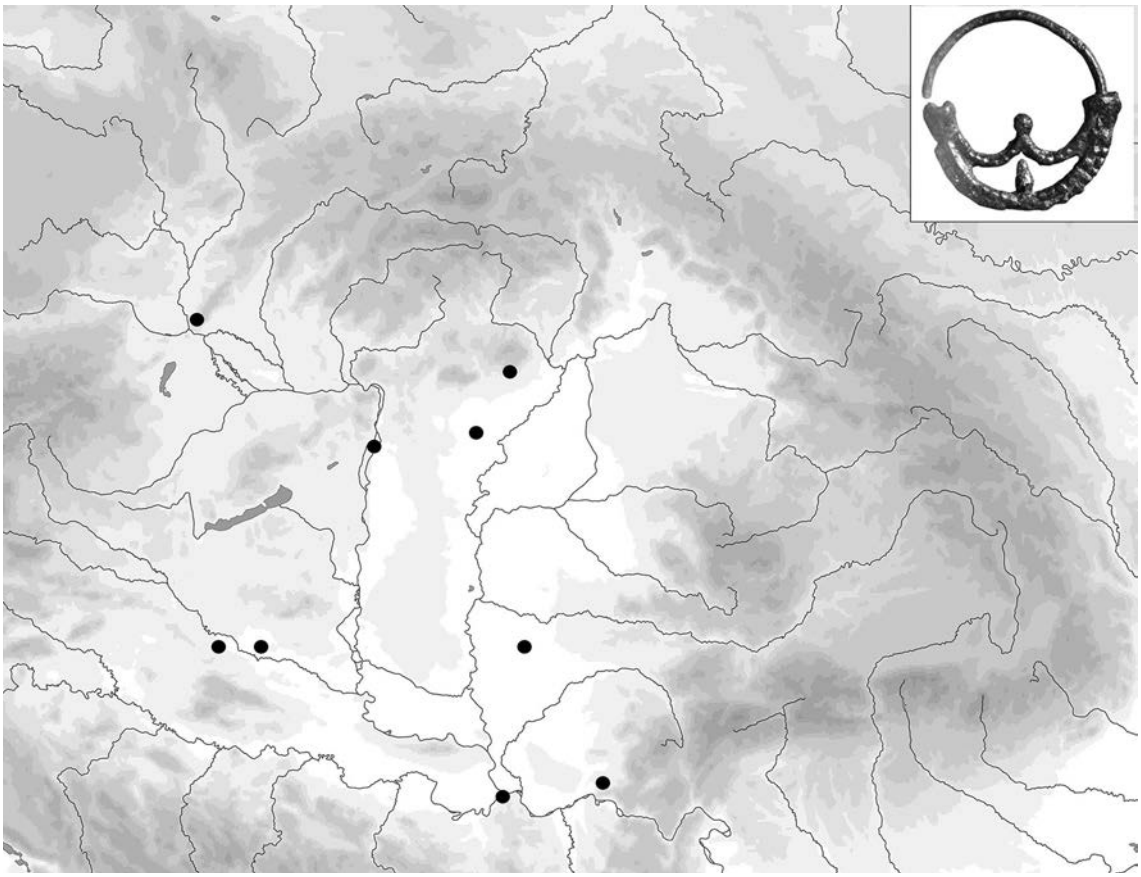

Fig. 5. Distribution of peak-terminated crescent-shaped earrings with inner bend and openwork plate (©Péter Langó)

Fig. 6. Pendants from Grave 278 of Eger-Vár (©Péter Langó)

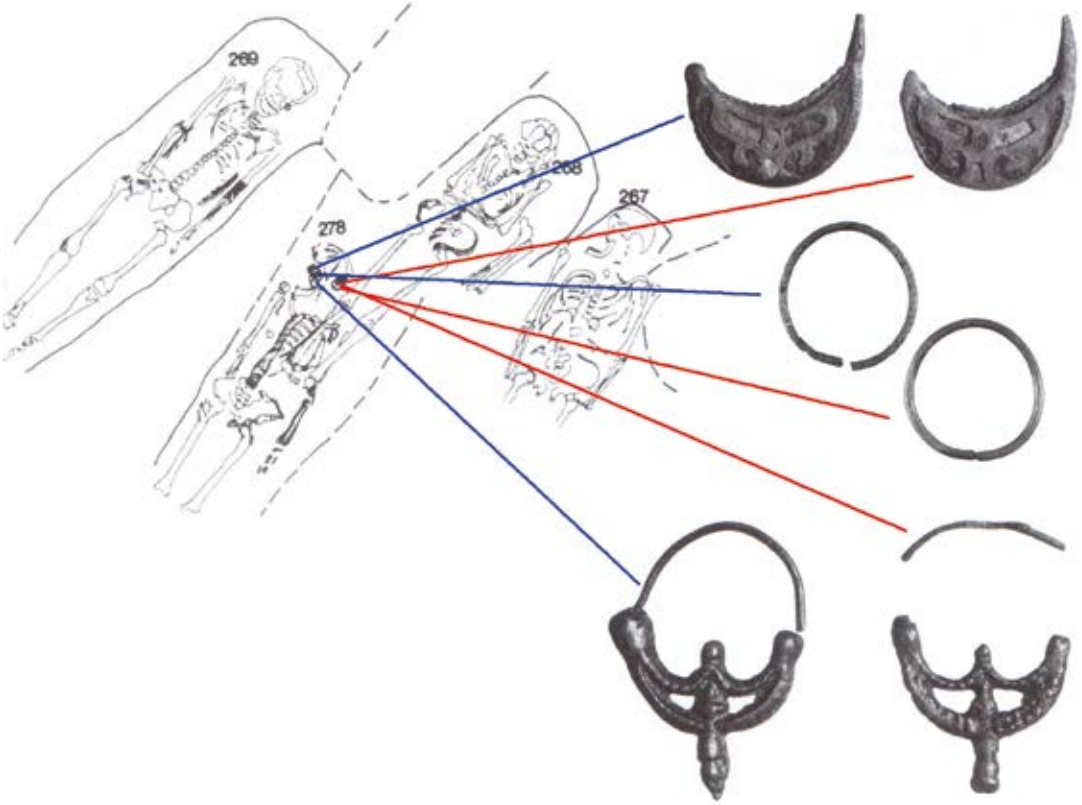

Fig. 7. Position of the earrings in the Grave 278 of Eger-Vár (after *Fodor 2008b*) (©Péter Langó)

his hypothesis.[115] A recent analysis by Ciprián Horváth of the clothing accessories from Grave 278 of Eger verified that the crescent-shaped openwork plate pendant earrings were worn together with some East Alpine-type pendants, parts of the jewellery set of the adult woman's headdress *(fig. 7)*.[116] This provides more evidence in support of the theory that pendant earrings from Southern Europe arrived in the Carpathian Basin directly from the West, and their presence in some graves is proof of a contact network of which the lands west of the borders of the Kingdom of Hungary were part.[117]

B. Settlement finds

1. Graphitic pottery

Graphite-tempered vessels are a special feature of Árpád Age pottery. This type is rare, making up only 0.73% of the Árpád Age pottery found in settlements in Vas County,[118] and also appearing only sporadically in Győr-Moson-Sopron,[119] i.e., other parts of the study area. The importance of graphitic pottery is considerably higher than the frequency of its occurrence because there are no natural sources of graphite in the western parts of the Carpathian Basin,[120] thus, import, in this case, is not a possibility but a must. It is challenging to say anything about the types of Árpád

[115] *Kozák 1981* 38; *Fodor 2008a* 265; *Horváth 2014* 366.
[116] *Horváth 2014* 390. Ciprián Horváth believes that these Southeast European earrings 'probably reached the East Alpine region through the mediation of the Carpathian Basin', which conflicts with the theory mentioned previously (*Horváth 2014* 411).
[117] *Langó 2021* 139.
[118] Based on collection and evaluation by Ildikó Katalin Pap, *Pap 2016* 6.
[119] *Takács 2009* 131–138.
[120] *Péterfi 2016* 462, note 21.

Age graphitic pottery due to the high degree of fragmentation of the related find material. Most fragments from Western Hungary are tiny parts of big, 12th–13th-century storage vessels. The formal features of these sherds, including the thick walls and the bulging rim with a club-shaped profile *(Keulenrand),*[121] indicate that not only raw graphite but also some finished products, i.e., graphitic pottery vessels, were imported to Hungary, in contrast to 9th-century Carolingian Pannonia, where the proportions were the opposite (i.e., most likely not only finished products but also some raw graphite were imported).[122] The big storage vessels in the Árpád Age were imported from Lower Austria,[123] most likely on water, more specifically, the Danube, as corroborated by the spread of this pottery *(fig. 8).*[124] Only a single find, a fragmentary vessel from the easternmost site, Ópusztaszer,[125] could not be connected directly with this trade route.

Conclusions

Borders represent a research topic which, at least in context with the Kingdom of Hungary in the Árpád Age, and especially its western frontiers, is not easily investigated with archaeological methods. The find material may only hint at the significance of the border when interpreted properly.

Despite the difficulties, a proper analysis may reveal evidence indicating the military importance of the border and the connections between its two sides. The military aspect, i.e., border protection, can best be proven and visualised via a topographical analysis of the related sites, including 10th–11th and 11th–13th-century cemeteries, county forts, and ditches. Cross-border trade connections in the Árpád Age Kingdom of Hungary (including the western parts) may be traced via the distribution of some particular artefact types.

Árpád Age borders have clearly nothing in common with modern state borders (the repercussions of which sometimes, like in the case of the Iron Curtain, have a lasting effect on both sides).[126] The political demarcation did not impede cultural exchange among communities residing on either side of the border, irrespective of their location. Thus, the border, functioning within the natural landscape, assumed a segregating function and also enabled the transmission of influences between individuals dwelling in close proximity at either side of the border. Csanád Bálint mentioned the significance of spatial relationship analysis when studying the Hungarian Conquest Period in the southern part of the Carpathian Basin. As the presented examples may also show, this idea is still valid when it comes to the material culture of the western border area in the 10th and 11th centuries, a result of the cultural ties between the various regions on the two sides of the political border which did not overrule them. Thus, Western Transdanubia mediated in the 9th century between the north (Moravian Principality, Ostmark) and the south (Provincial *Carantanorum*, *Pannonia Inferior*, *Dalmatia*).[127] According to Patrick J. Geary, the traditions and customs of the groups that were divided by political boundaries persisted but gradually changed.[128] In the meantime, the previously established cultural networks might continue playing an intermediary role since they are deeper and more lasting than the ‘new’ division.[129]

[121] *Scharrer-Liška 2003* 49–52.
[122] *Merva 2016* 535–536.
[123] *Takács 2009* 131–138.
[124] *Takács 2009* Plate 2.
[125] *Vályi 1995* 279, fig. 2. 2.
[126] For an illustration of its significance from a science historical point of view, see *Török 2009* XV–XVI.
[127] *Szőke 2014* 9–104; *Szőke 2021* 437, note 2784.
[128] *Geary 2001* 30–33. Cf. *Geary 2013* 12–37.
[129] *Romhányi 2017.*

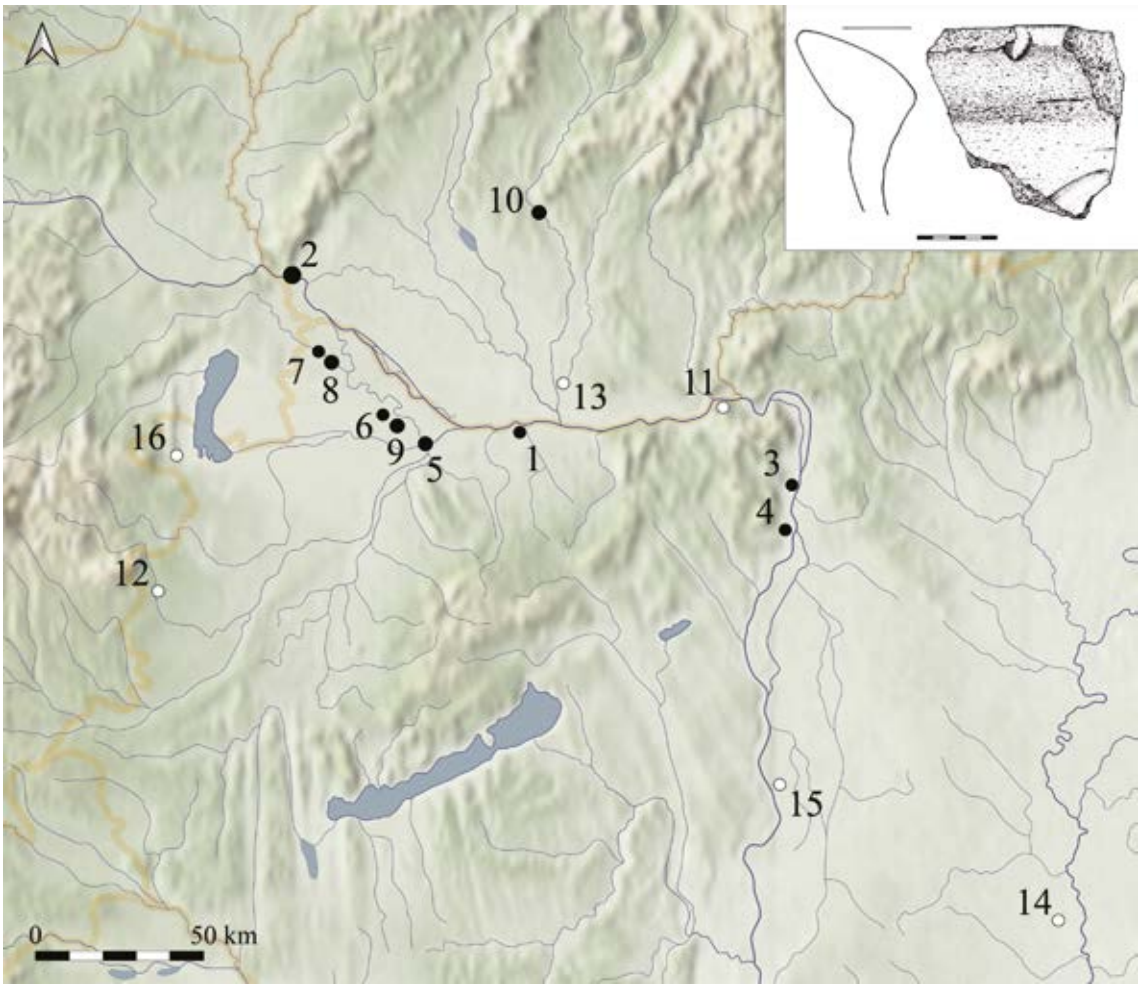

Fig. 8. Distribution of Árpád Age graphitic storage vessels with a club-profiled rim

Sites with identified vessels (black dots): 1. Ács (Personal communication by Nikoletta Lukács); 2. Bratislava-hrad, Bratislava-Vodná veža, Bratislava-Rudnayove nám., Bratislava-Hlavné nám., Bratislava-Uršulínska ul., Bratislava-Leningradská ul., Bratislava-Sedlárska ul., Bratislava-západné suburbium, Bratislava-Nálepkova ul., Bratislava-Dúbravka (Slovakia) (10 sites) (*Fusek – Spišiak 2005* 316, fig. 17); 3. Budapest-Óbuda, Lajos út (1 site) (*Péterfi 2016* 477–490, Pl. 1–3); 4. Budapest XI., Kőérberki út, Kána falu (1 site) (*Terei 2017* 154); 5. Győr-Káptalandomb, Győr-ECE (2 sites) (*Merva 2016* fig. 3. 5); 6. Lébény-Kaszás-domb, Lébény-Bille-domb (2 sites) (*Takács 2009* 135, note 27, Pl. 1. 6); 7. Levél-M1–M15 csomópont (1 site) (*Takács 2009* 135, note 27); 8. Mosonmagyaróvár-Királydomb, Mosonmagyaróvár-Iskola utca, Mosonmagyaróvár-Mosonszentmiklósi pihenő (3 sites) (*Tomka 1976* fig 10. 8; *Takács 2009* 135, note 27; *Aszt 2003* 193); 9. Mosonszentmiklós-Egyéni földek (1 site) (*Takács 2009* 135, note 27); 10. Nitra-Farská ul., Nitra-Mostná ul. (Slovakia) (2 sites) (*Fusek – Spišiak 2005* 316, fig. 17)

Sites with uncertain occurrences (side fragments) (white dots): 11. Esztergom-Kossuth Lajos utca 60, Rác templom (1 site) (*Lázár 2001* 161); 12. Gencsapáti-Besenyő (1 site) (*Koller 2016* 139); 13. Hurbanovo-Bohatá (Slovakia) (1 site) (*Habovštiak 1961* fig. 28. 20–21, 24–26); 14. Ópusztaszer-Szer monostora (1 site) (*Vályi 1995* 279, fig. 2. 2); 15. Solt-Tételhegy (1 site) (*Takács 2014* 116); 16. Sopron-Új utca–Szent György utca sarka (1 site) (*Merva 2016* fig 4. 7) (©Miklós Takács, ©Zsóka Varga)

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LANDSCAPE, SETTLEMENTS, AND ENVIRONMENT AROUND TATA CASTLE IN THE MIDDLE AGES

Zusammenfassung: In unserer Studie untersuchen wir am Beispiel der Umgebung der Burg von Tata, was für Veränderungen der Bau einer Burg hinsichtlich des Umlands mit sich bringt. Tata und die Umgebung der Siedlung erstreckten sich in unmittelbarer Nähe Béla: der Landesmitte *(Medium Regni),* entlang wichtiger Routen, was die Entwicklung der Siedlung ausschlaggebend beeinflusste. Abgesehen von den Dörfern, die uns aus den Quellen bekannt sind, existierten in der Árpádenzeit (11.-13. Jahrhundert) für kürzere und längere Zeiträume auch zahlreiche kleinere Siedlungen im Grenzgebiet. Eine deutliche Entwicklungsdynamik können wir ab dem 14. Jahrhundert feststellen, der teils auch damit zu erklären werden dürfte, dass die Region zu jener Zeit in königliche Obhut genommen wurde. Andererseits spielten sich hier, aufgrund der gesellschaftlichen Veränderungen und der landwirtschaftlichen Neuerungen ähnliche Vorgänge ab, wie in den übrigen Regionen des Landes: die Anzahl der Dörfer schrumpfte und ihre Lagen verfestigten sich. Unter diesen Umständen wurde am Anfang des 15. Jahrhunderts die königliche Burg erbaut, die für das Umland wiederum zahlreiche Veränderungen mit sich brachte, unter anderem die Schaffung des Sees neben der Burg, der bis heute die Umgebung maßgeblich beeinflusst. Unsere Studie untersucht ebendiese Prozesse, ergänzt mit der Analyse des vorliegenden archäologischen und archäobotanischen Fundmaterials.

Keywords: settlement research, historical waterscapes, medieval castle, castle estates, material culture, medieval pottery, metal finds, archaeobotany, Hungary

The town of Tata lies in the valley of the Által-ér (Által Stream), where the Lesser Plain and the Transdanubian Mountains meet in Komárom-Esztergom County, Transdanubia, Hungary *(fig. 1)*. As the area is exceptionally rich in springs and lakes, the settlement is also often referred to as 'The city of waters'.[1] The castle is situated on the shore of Öreg-tó [Lake Öreg] in the heart of the town, on top of a rocky inselberg at 130 m a.B.s.l. In medieval times, the castle was a significant hub because of its vicinity to the *medium regni,* the central part of the Kingdom of Hungary, and the road connecting Buda and Vienna. Moreover, the vast forests abounding with wild game to be hunted made it attractive for kings, too.[2] The study presents an attempt to outline, based on archaeological, historical, and archaeobotanical results, how the surroundings of Tata looked in the Árpád Age and how it changed later, due partly to the presence of the castle.

[1] *Dövényi 2010* 330–334.
[2] *Szatmári-Bíró 1977* 37.

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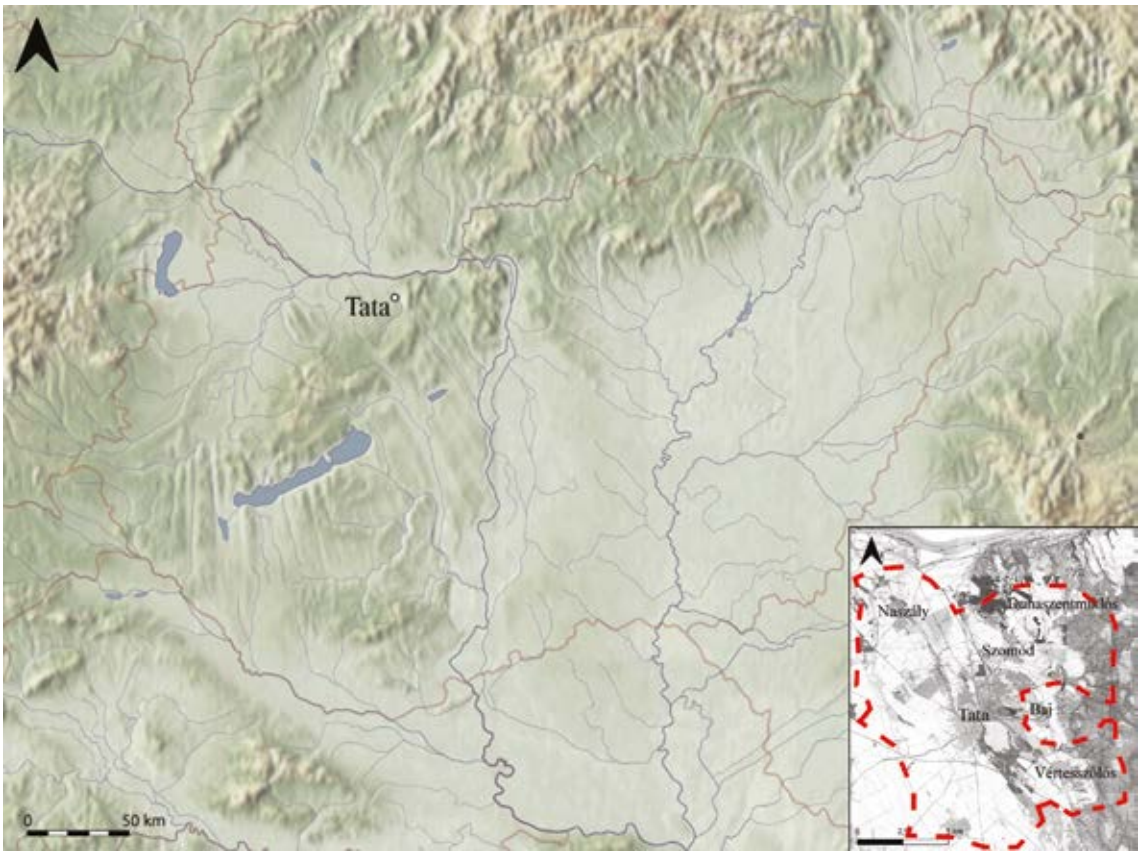

Fig. 1. The position of Tata in relation to the current country border and the study area (©Zsóka Varga, ©Bianka Gina Kovács)

Methods and aspects of research

In late medieval times, the estates of Tata Castle formed a contiguous land in the southern part of the former Komárom County, between today's Tata, Naszály, Szomód, Vértesszőlős, Dunaszentmiklós, the eastern outskirts of Baj, and the northern fringes of Környe *(fig. 1)*. This is the focus area of this study, which involves a survey of all historical and archaeological data related to these settlements. Information-wise, the body of archaeological evidence is rather varied: only a few excavations have been conducted in the study area and, therefore, we also had to rely on data gleaned during the archaeological monitoring of public utility development and reconstruction works and surface find collecting surveys. The quality of the latter is also heterogeneous as it incorporates findings from the past more than fifty years; the first surveys were conducted at the end of the 1960s in context with the preparation of the respective volume of the Archaeological Topography of Hungary (which remained unfinished up to this day). There was another upswing in research in the 2000s, an era of extensive industrial development in the region, and the related activity also intensified in the past decade. For clarity, a detailed discussion of the research history is presented in the Data Archive at the end of this paper. Besides, modern sources and maps and an overview of the current terrain were used to reconstruct the landscape. Last but not least, the yet unpublished archaeobotanical results of a recently completed analysis were pivotal in reconstructing the one-time environment; these are also presented in the study.

Tata and its surroundings before the building of the castle

Landscape and settlements from the Árpád Age to the 14th century

The history of Tata goes back to the 11th century. The name appears first in a charter in 1093, which mentions a Benedictine abbey there. The presence of the monastery and the favourable geographic setting likely made the area (which was the estate of the abbey for a long time) a popular target for settling. The number of charters related to the study area increased in the 13th century, providing more data on several settlements there. The Csák kindred occupied the area in the second half of the century. It became royal property again in the 14th century, and the rapid development, a result of which was that Tata was granted market town rights, started then. The Lackfi family became owners of these lands at the end of the century.[3]

Terrain

The Gerecse Mountains represent the eastern fringes of the study area; the highest peak there is the Öreg-Kovács at 558 m a.B.s.l. The eastern half of the study area is its foothill region with elevations at 150–250 m a.B.s.l. The western half is plainland at 110–150 m a.B.s.l., with only a few lesser elevations like the Látó-hegy [Látó Hill] (183 m) in the northern part of Tata and the Kálvária-domb [Kálvária Hill] (166 m) rising above Öreg-tó in the west.

Hydrographic conditions in the Middle Ages

In the area surrounding Tata, the most important factor determining the position of the settlements was water. The Danube flows north of the study area, the biggest watercourse of which was the Rákos-patak [Rákos Stream] *(lf. Racus),* today Által-ér, which springs from the northern part of the Vértes Mountains and flows towards Tata through Bánhida; as it takes in the water of several hot water springs there, the section under that area was also called Hévíz *(Calida Aqua)* ['Hot Water']. The stream discharges into the Danube at Almás (today: Dunaalmás). Military maps proved to be partially useful for the research of the one-time water bodies of the area. Many streams arriving from the Gerecse Mountains in the east join the Által-ér; for example, the confluence of the Árendás-patak [Árendás Stream] is at Szomód. The watercourses in the western part of the area – the Grébicsi-vízfolyás [Grébicsi Stream] and the Fényes-patak [Fényes Stream] (*fl. Homord* in medieval times) – flew into the one-time Füzegy-patak [Füzegy Stream], which joined the Danube at Füzitő *(fig. 2)*.[4]

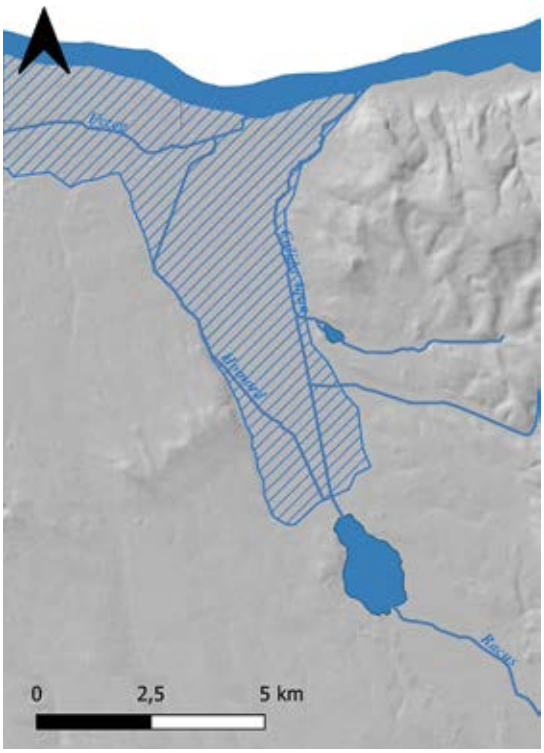

Fig. 2. The terrain of the study area with the one-time watercourses and the estimated extent of the marshland (©Bianka Gina Kovács)

[3] See the Data Archive for detailed historical data.

[4] *Györffy 1987* 389; *Tóth 2013* 84.

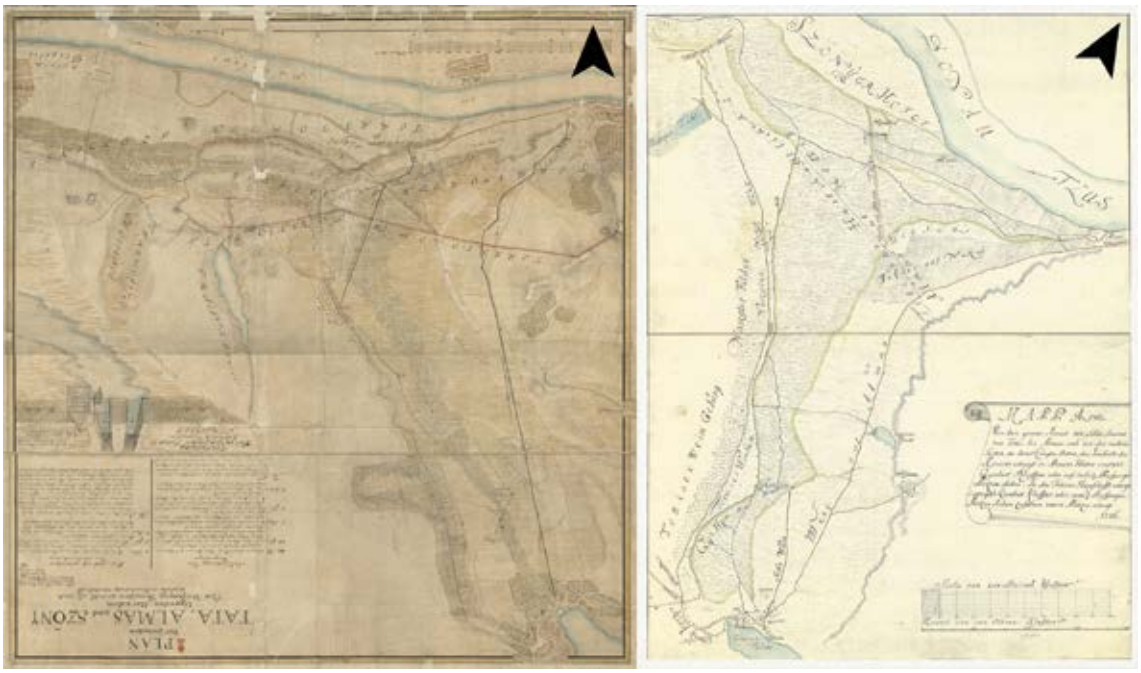

Fig. 3. Surveys made by Sámuel Mikoviny in 1746 of the marshland between Tata, Almás, and Szőny (source: Data Archives of Hungary [MNL] National Data Archive [OL] Data Archive of the princely branch of the Esterházy family, S 11 – No. 290; Institute and Museum of Military History B IX c 715)

The fact that the area between Tata and the Danube was a marshland was another important factor in promoting settling. The swamps were drained only in the 18th century, among the firsts in the country; the works between Tata, Szőny, and Almás, designed by Sámuel Mikoviny, started in 1747. Due to this early date, the marshland did not exist anymore at the time of the First Habsburg Military Survey and, thus, does not appear on the respective maps. However, Mikoviny surveyed the area before the works in 1746 *(fig. 3);* according to his maps and data, the swamps extended to 3,300,000 *négyszögöl* or 2,750 Hungarian *hold*, i.e., almost 12 km^2.[5] The maps and the recent topographic and geomorphological relations help reconstruct where the marshland was once situated *(fig. 2)*.

The hot springs in Tata have always played an important role in the life of the town. More than ten were known in its territory in the Modern Period, many of which also appear on historical maps.[6] These did not freeze over even in winter, so it is no wonder that, according to written sources, mills were sited on them as early as the 13th century. A charter from 1237–1240 mentions two mills of the Benedictine Abbey of Pannonhalma, while another from 1268 reports that Maria Laskarina, queen consort of King Béla IV, sold the mill of Komárom Castle to Walter, Master of the Treasury.[7] In 1331, Tamás Csór, castellan of Csókakő, was granted a mill site. A charter from 1388 describes the positions of the mills of the abbey, which had six of them in Tata at the time. The source also mentions two more mills: one of the nuns of Esztergom Island and one called *Mochochyde*. Only three years later, another document mentions two mills of the Benedictine Abbey of Pannonhalma in the town. In summary, at least ten mills operated within the borders of Tata at the end of the 14th century.[8] Considering that a single mill could supply even 250 people,

[5] *Fülöp – Schmidtmayer 2017* 41.

[6] Map by Sámuel Mikoviny (see *fig. 3*), First Habsburg Military Survey (1782–1785), Second Habsburg Military Survey (1819–1869). source: maps.arcanum.hu [last accessed on 30.10.2023].

[7] *Györffy 1987* 458–459.

[8] *Tóth 2013* 86; *Dreska 2007* 292–293.

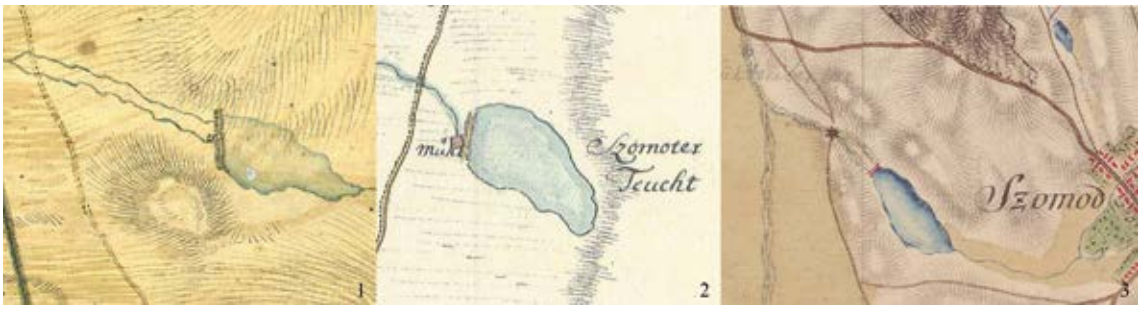

Fig. 4. The mill under the lake at Szomód on the maps of Sámuel Mikoviny (1, 2) and the First Habsburg Military Survey (3)

the milling industry seems to have been important in the economy of the settlement, and renting the mills must have generated substantial profits for the owners.[9] Naturally, mills were also sited on these watercourses outside the town: a mill and a mill site in Szomód were donated to the Cistercian order of Borsmonostor in 1225. The hypothesis of László Ferenczi[10] that this mill is identical to the one appearing on the maps of the First Habsburg Military Survey and Mikoviny under a fish pond on the western outskirts of Szomód seems likely *(fig. 4),* which also raises the possibility that the pond was created in medieval times. The hot springs within Tata were also utilised in baths; these, however, are only known from Ottoman Period engravings and descriptions.[11]

It is important to note that no source from that period mentions Öreg-tó, the biggest water body in the area. It does not appear in the 1388 charter describing these lands in detail either, suggesting that the lake did not yet exist.[12]

Forests, vineyards, ploughlands, and pastures

The eastern part of the study area, comprising the slopes of the Gerecse Mountains, was partly covered by forests. A forest is mentioned in the 13th century near Szomód and a copse in the 14th century on the outskirts of Agostyán.[13] Vineyards are also known from the eastern parts: one is mentioned in the area of Stancs in 1225, and more on the hills next to Újfalu in 1221. This latter settlement was likely a neighbour of Szomód near Tata; it does not appear anymore in later sources.[14] The village of Szőlős ['Vineyard'] does not appear in documents before the 15th century; the name indicates that the settlement also incorporated vineyards. An orchard is mentioned in Szomód in 1225.[15] Besides, ploughlands, hay meadows, meadows, and pastures were scattered all over the area in focus (e.g., 1367: ploughlands, hay meadows, and pastures in Agostyán, 1388: ploughlands on the outskirts of Alsófalu and Felsőfalu, and more called Szentmiklósfölde and Szentmargitfölde).[16]

[9] *Ferenczi 2008* 353, 355.
[10] *Ferenczi 2010* 128, figs. 4–5.
[11] *Schmidtmayer 2011* 211.
[12] *Schmidtmayer 2015* 246.
[13] *Györffy 1987* 456; *Tóth 2013* 85.
[14] *Györffy 1987* 405, 462.
[15] *Györffy 1987* 456.
[16] *Tóth 2013.* The toponyms Szentmiklósfölde ['St. Michael's land'] and Szentmargitfölde ['St. Margaret's land'] might refer to one-time churches, perhaps related to the Cistercian and Benedictine *grangia*s in Szomód (discussed below).

Roads

The main road connecting Buda and Vienna followed the Danube in the first half of the Árpád Age. After the first Mongol invasion, its path changed on the section between Buda and Győr, and the old road was abandoned for the one passing through Buda, Bánhida, and Győr (also called the 'Butchers' Road'). The road leading to Komárom through Tata and passing, according to a 1291 document, the outskirts of Mocsa, branched off this main road towards the north.[17] South of the 'old' main road accompanying the Danube, the first crossing through the swampland was at Tata, which also promoted the development of the settlements along it.[18] The importance of this road is highlighted by the fact that a toll was charged for its use at Tata already in the Late Middle Ages, as reported by several documents dated around 1400. The first one is a charter forged around that time, stating that King (Saint) Stephen I donated the toll of the Tata road to Deodatus *comes,* who passed it on to the Benedictine Abbey of Tata. The forged document likely reflects the arrogation of said abbey around 1400.[19] King Sigismund wrote letters to the toll collectors in Tata in 1401 and 1402. Besides, a 1419 document reports that King Louis I (of Hungary) donated half of the toll collected in Tata to the Abbey of Vértesszentkereszt, which might indicate that the toll was already charged back in the 14th century.[20]

Archaeological data

Except for the built-up part of Tata, archaeological data on the Árpád Age settlement network in the study area were gleaned in surface find collecting surveys and site inspections. More than fifty 11th–14th-century settlements could be identified this way, most of which were not inhabited in the whole period in focus *(fig. 5)*. This tendency matches the one observed in other regions in the country: as a result of the widespread practising of alternate fallowing and relatively high mobility at the time, the inhabited part was barely permanent but moved within the perimeters of the settlement when the cultivated strips of land next to them wore out; moreover, besides villages, the area was also spotted with low-intensity farmstead-like settlements.[21] Written sources from this period also mention more such settlements than 15th-century ones. Such villages, abandoned after the 13th–14th centuries, were Bánkülése, Bodolófölde, Sár, Újfalu, Alsófalu, and Felsőfalu. The last three were likely situated in the territory of today's Tata, albeit Újfalu could also be on the northern outskirts of Szomód.[22] Historical research has generally accepted that Felsőfalu is identical to the later Szentiván, albeit no written source provides evidence on that.[23] Bánkülése and Bodolófölde only appear in 14th-century sources; historical research accepts the hypothesis that both were near Agostyán, on the southern and western outskirts of the village, respectively. However, even if the reasons are different, identifying these settlements with archaeological sites is challenging in all cases: too many suitable sites are known from the territory of Tata, and none from Agostyán. The history of Sár is also interesting: it is mentioned in 1237–1240 as a village, and it even had a perambulation in 1269, only to disappear from all sources after that. Based on the perambulation, the settlement was situated somewhere between Naszály and Almás, and the text mentions the Által-ér *(Calida Aqua)* and the Fényes-forrás *(Homord),* and two toponyms,

[17] *Glaser 1929* 152. A charter by Béla IV on Tömörd mentions the road connecting Tata to the Bánhida–Győr road, joining it at Igmánd.
[18] *Schmidtmayer 2011* 196–197.
[19] *Weisz 2013* 397.
[20] *Schmidtmayer 2011* 197.
[21] *Rácz 2019* 157–158.
[22] *Tóth 2013; Györffy 1987* 462.
[23] *Schmidtmayer 2011* 193.

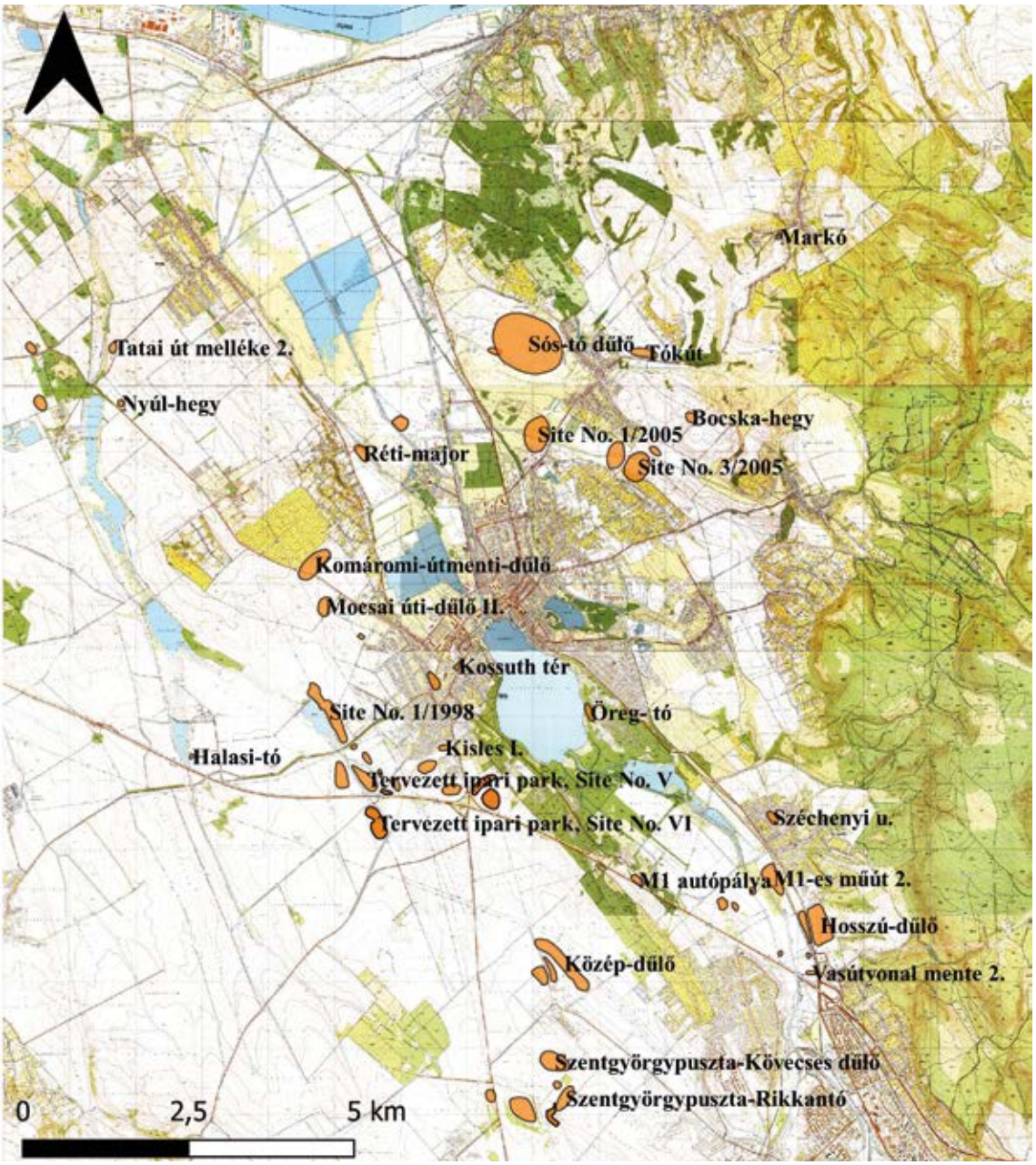

Fig. 5. 11th–14th-century settlement traces in the study area (©Bianka Gina Kovács)

Zaarhonk and *Keurus,* which Györffy believes to have lived on in the Homoki and Kőrősi malom placenames in later cadastral maps. Its name (Sár means 'mud') and approximate location connect the one-time settlement with the marshland. It appears in the 1269 perambulation already as *'terra Saar',* described as being a part of the neighbouring Füzitő,[24] and it is not mentioned in 14th-century sources anymore. The village likely became depopulated, perhaps due to changes in the extent of the marshland.

[24] *Györffy 1987* 450. Cadastral maps (19th century). Source: maps.arcanum.hu, last accessed on 31.10.2023. The site could likely be identified as one of the medieval sites registered on the western outskirts of Dunaalmás (site IDs in the Central Register of Archaeological Sites (IVO) in Hungary: 45283, 45284, 45285, 45289; source: IVO database at www.oeny.hu) or the densely covered 11th–14th-century site, Naszály-Négyes, identified during the 1968 surface find collecting survey (see the Data Archive at the end of this study).

Of the settlements described as the property of Tata in 15th-century sources (see the Data Archive at the end of this study for details), Ótata could be located the most precisely: it could be identified with features unearthed in the area of the main square of today's Tata. Besides, a site with late medieval pottery but no Árpád Age find material is known from the area of Grébics village; thus, the oldest settlement, mentioned first by 13th-century sources, was not there but can be identified with one of the Árpád Age sites on the outskirts of the recent village instead. As only a single medieval site is known from the area of Dunaszentmiklós, its predecessor, the village appearing under the name of *Stancs* in 13th-century sources, was likely in the area where the built-up part of the settlement is today. In contrast, many registered Árpád Age sites are known from the lands belonging to Szomód; this abundance is due to the 'wandering' of the settlements mentioned above and that, according to written sources, a *grangia* (grange) of the Cistercian order and a manor of the Benedictine Abbey of Tata were also located there. Of all these, the identification of the Cistercian grange is the most certain today. Many Árpád Age settlements are known from the administrative areas of Naszály and Szentgyörgy, too; part of these might likely be identified with settlements mentioned in coeval sources. Only the medieval church of Kovácsi was excavated, but the Árpád Age settlement is yet to be located in the currently forested area. And last, as it was mentioned, no Árpád Age settlement is known from the territory of Agostyán.

Identifying the mills mentioned in the sources is also problematic. Archaeological research was conducted on the sites of two current mills (Wagner- and Jenő-malom) in Tata, but neither brought to light evidence of their medieval origin.[25] Ethnographic research has identified some mills mentioned in a 1388 charter with still standing ones built in the 18th century but without any explanation or supporting evidence.[26] Considering the extent of the water regulation works in the territory of the town in the 18th century, such an identification cannot be accepted without archaeological evidence.

General characteristics of the find material

The find material available from most sites comes exclusively from surface collecting surveys and is accordingly scarce. The pottery finds could be classified based on colour, material, and shape, which often also refer to their provenance.[27] The most common vessel type is the pot *(fig. 6. 2–3, 5–14, 16–18),* with specimens made from clay tempered with pebbles or coarse sand and fired to red, pink, yellow, or off-white, usually with dark grey spots outside. They had simple rims with vertical, band-like lips or more complex ones with carinated lips, profiled outside; the first variants with lid grooves appeared in the late Árpád Age. Early variants were decorated with a couple of incised wavy line bundles, while younger ones feature mostly incised straight line bundles or a spiral around their body. Excavated find materials often include pottery with a combination of these patterns, as well as nail imprints and wavy lines. Vessels with a potter's mark on the base are also known exclusively from excavated materials, and their proportion in the pottery records of the respective sites is always rather low. Only two early graphitic vessel fragments have been found; however, grey ware (dark grey vessels and lids fired in a reduction environment but containing no graphite) appears from as early as 13th–14th-century contexts in the excavated find material. The proportion of 'classic' white ware is also insignificant: the surface find assemblages only include a few side fragments of some spiral-decorated or ribbed pots *(fig. 6. 2),* completed by a couple of cup fragments in excavated materials. Fragments of red bottles with roll-stamped patterns are

[25] *Kisné Cseh – Petényi 2004* 18; on S. Petényi's excavation at Jenő-malom [Jenő Mill], see IVO ID No. 63800, Angolpark (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=63800).

[26] *Körmendi 1968* 406–407.

[27] *Holl 1963* 336.

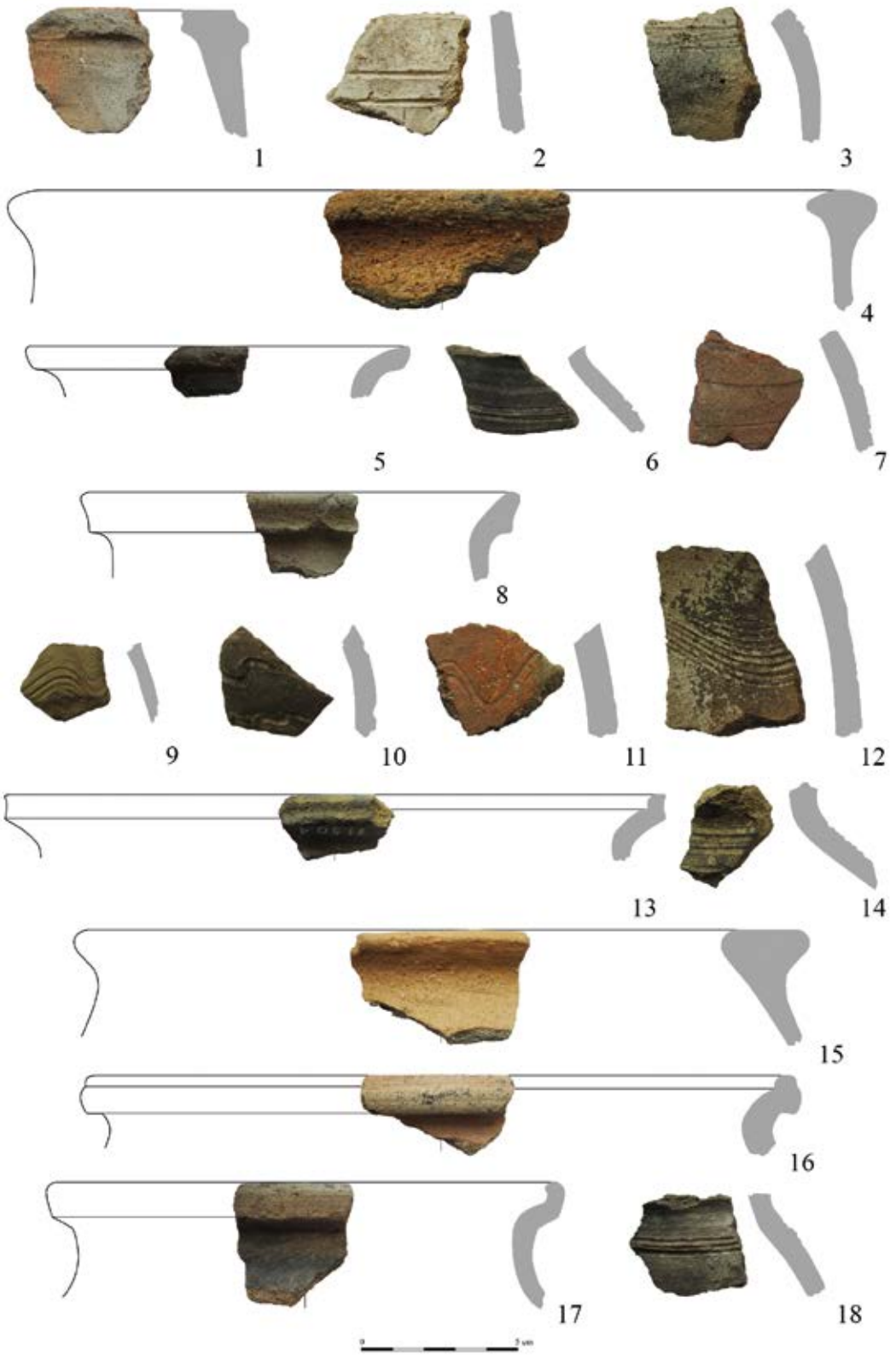

Fig. 6. Selection of 11th–14th-century finds from the study area. 1–3. Naszály-Felső-Grébicspuszta: Inv. No. KDM 71.20.1, 3, 5; 4. Naszály: Inv. No. KDM 71.42.23; 5–7. Naszály-Fényes-part: Inv. No. KDM 71.44.1, 3–4; 8. Szomód-Sóstó: Inv. No. KDM 70.9.23; 9. Szomód-Bocskahegy: Inv. No. KDM 71.48.5; 10. Szomód: Inv. No. KDM 71.63.9; 11–12. Szomód: Inv. No. KDM 71.49.3, 2; 13–14. Szomód: Inv. No. KDM 71.50.1–2; 15–18. Tata-Réti malom: Inv. No. KDM 71.40.1–3, 10 (©Zsóka Varga, ©Bianka Gina Kovács)

also known only from excavations. The oldest pitchers also appear in 13th–14th-century features. These variants are yellow, with a design of some imitating the white ware of Buda,[28] while others resemble grey pottery forms (e.g., with handles decorated with oblique incisions). The proportion of pottery cauldrons *(fig. 6. 1, 4, 15)* in all find assemblages is relatively low. Cauldrons were made from clay tempered with gravel or micaceous clay; their rims have a T-profile, with rounded inner and angular or rounded outer edges (Types B and D in Miklós Takács's classification).[29] The pieces the form of which could be reconstructed could all be assigned to Takács's Type IID2b (medium-deep cauldrons imitating ones made in metal).[30] The few fragments of cauldrons with inverted L-profile rims and nail impressions likely represent an early variant.[31] Another minor group within the pottery record is white cauldron fragments with a rim with an angular profile and rough surface[32] resembling the bottom of the vessels of 13th–14th-century white Buda ware;[33] these probably represent the youngest cauldron variant.

No metal finds have been recovered during the surface collecting trips. Excavated materials include agricultural iron tools (e.g., sickles and a ploughshare), as well as grave finds from the excavated cemeteries, mostly clothing accessories and gold, silver, and bronze jewellery.[34] A few modest clothing accessories (e.g., strap fastener and spur) have also been unearthed in the settlements.[35]

Archaeobotanical data from the period under study

Thus far, archaeobotanical evidence has only been obtained by a single excavation in the study area: samples were taken from 12th–14th-century contexts in Tata-Kossuth tér 16. (16 Kossuth Square). The aim of the archaeobotanical and historical ecological evaluation of the seed and fruit finds was to reconstruct the flora diversity of the period in order to learn about the life of the residents and the agricultural practices they followed. The samples taken during the excavation contained charred remains. No coeval samples are known from the area and wider surroundings of the settlement.[36]

Methods

In 2016, the samples were transported to the Department of Nature Conservation and Landscape Ecology of the Department of Environmental Sciences of the Szent István University[37] for further processing. After providing them with an ID for the processing, each sample was weighed and wet cleaned using a series of 0.5 mm, 1.0 mm, 2.0 mm, and 4.0 mm sieves.

After drying them gently, the seeds were separated from the other organic and inorganic remains using a ZEISS Discovery V8 stereo binocular microscope. Besides plant remains, the

[28] *Kovács 2018* 5, figs. 9–11, 36.
[29] *Takács 1996* 168–169.
[30] *Takács 2010* 139–144.
[31] *Takács 1996* 169, Abb. 16.
[32] *Kovács 2018* fig. 8.
[33] *Holl 1956* 180.
[34] See in detail in *Kovács – Líbor 2023.*
[35] *Kovács 2018* figs. 10–11.
[36] A small medieval archaeobotanical find assemblage comprising only a few seeds (including elder, jimson weed, and *Euphorbiaceae* [spurge] seeds) was also recovered during the 1972 rescue excavation led by Sarolta Szatmári at Tata-Fürdő Street. Máté Merkl has identified the species and concluded that their composition reflects anthropogenic influence in the area of the site; however, the sample was too small to draw further conclusions.
[37] Today Hungarian University of Agriculture and Life Sciences.

samples included inorganic (pottery, daub) and organic fragments (bone, snail shell, relatively many insect remains and cocoons; see *Table 1*). The selected seeds and produce were identified using seed identification handbooks and archaeobotanical studies[38] and checked against reference collections of recent seeds. Diaspora fragments were identified in general on species or subspecies level, depending on their condition; in some cases, only the *genus* could be determined, and some samples were too fragmented to be identified at all (these appear in the datasheet of botanical remains as 'indet.[ermined]').[39]

The quantitative assessment of the botanical macroremains started with introducing their basic data in an Excel sheet *(Table 2)*.[40] Next, we counted the number of species and seeds per sample and calculated the concentration indices in every sample, i.e., the ratio of plant remains (seeds and other macrobotanical materials) relative to the original weight of the sample, to make their species and seed contents comparable.

The identified plant species were classified as cultivated plants, weeds, and species of the natural environment; the following evaluation was made in accordance with the anthropogenic species division by Vera Árendás.[41]

In light of the species identified in the sample set, the assessment focused on the following categories:

- Crops: the species included in this category were cultivated, used as cereals, substitutes thereof, or garden vegetables; their grains and seeds were consumed;
- Weeds: according to our current knowledge, the species included here are typical of ploughlands, fallows, gardens, and trodden land (ruderal species);
- Spontaneous plants: charred diaspora remains of plant species from the one-time natural environment of the settlement; they only occur by chance, and there is no other explanation for their presence. These macroremains usually appear amongst or near cereal remain concentrations. Besides occasional occurrences, the evaluation considers their potential uses (e.g., wild fruits, medicinal plants, spices, etc.). Spontaneous plants represent important information on the one-time natural environment and climate.

The ecological division of weeds is the following:

- *Secalietea* = class of winter cereal weeds,
- *Chenopodietea* = class of segetal and ruderal weeds,
- *Polygeno-Chenopoietalia* = class of spring cereal weeds.[42]

The cereal composition analysis can provide valuable information on the quality of cultivation and the lifestyle of the residents; however, weeds are just as important because their presence and quantity hints at the skills and knowledge of the one-time farmers and helps clarify whether the cultivated species were winter or spring crops, and maybe even that how they were reaped.

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[38] Based on *Schermann 1966; Soó – Kárpáti 1968; Cappers – Bekker – Jans 2006*.

[39] We could not take photos of the identified seeds because of the defect of the microscope camera available at the department.

[40] The sheet enlists the Latin and English names of the identified species, the type and condition of the botanical remains, the ecogroup of their habitats, their family, biogeographical statuses, flora classifications, as well as data on their heights, life forms, possible drug effects, and counts per sample.

[41] *Árendás 1982* 6–7. The gist of the method developed based on Árendás' is to classify the plant finds into artificial categories of origin, where a plant may appear in multiple categories. These artificial categories describe the relationship between humans and the flora around them: cereals, fruits, grapes, fibre plants, oil plants, vegetables, medicinal herbs, dye plants, and decorative plants. When completed with data on relative frequency per specimen and species, this classification provides a reliable image of the agricultural practice and knowledge of the flora of the one-time archaeological culture, as well as the flora diversity in the period in focus.

[42] *Ellenberg 1974*.

A quantitative assessment was followed by a qualitative (ecosociological)[43] one based on the plant sociological and plant ecological system developed with consideration to the habitat requirements of plants. This system was developed by Stephanie Jacomet, Christoph Brombacher and Martin Dick (1989),[44] adapted to archaeobotanical finds by Friedrich Ehrendorfer (1973)[45] and Heinz Ellenberg (1974)[46] and, based on their works, to the flora of the Carpathian Basin by Attila Borhidi (1995). This analysis takes into account that the composition of plant communities might change with time.[47]

Charred wood remains, like the carpological material, were isolated from the samples by wet sieving; in the following phase, the fragments were dried at room temperature and assorted using a stereo microscope. Each find was given a separate identifier within the sample ID No. *(Table 3)*. The isolated anthracological samples were identified using a MicroQ-W(widefield) PRO camera with a measurement overlay software mounted on a Nikon Eclipse LV100 POL polarised light binocular microscope, based on the guide written by Károly Babos for conservators, a study by Pál Greguss on the anatomy of wood, *Dendrology* by László Gencsi and Rudolf Vancsura, and an identification webpage on the Internet.[48]

Sampling

Two charred grain concentrations (Features 12 and 18) and ash layers (in and around Feature 1) were observed and sampled during the excavation.[49]

Feature 1 was an external oven from the Late Árpád Age. Its floor was renewed two times. Sample 6 was taken from the ash layer (SE 30) above the central floor layer (or first renewal, SE 02; see *fig. 7. 1*), which, for some reason, had not been cleaned before the third floor (or second renewal, SE 03) was plastered onto it. The central oven floor layer included fragments of a large pot, while the upper one had some shards of a pottery cauldron, a large and two smaller pots, and a liquid container, perhaps a pitcher. All vessels could be dated to the Late Árpád Age (12th–13th century).[50]

An independent red clay or daub layer (SE 04) was found above Feature 1; it contained three bottom fragments of a pot *(fig. 7. 2),* each with a ca. 3 cm thick ashy layer inside. The samples taken from the three fragments were given separate IDs (Samples 3–5). Based on the pottery finds recovered from it, the red clay/daub layer could be dated to the 14th century.[51]

Besides the ovens, two round shallow depressions filled with grey and black ash (probably open fireplaces) were observed in the excavation *(fig. 7. 3).* We sampled the ashy fill of one (Feature 12), which contained plenty of charred grains of corn (Sample 1). It did not contain any find of chronological value but was likely created in the Late Árpád Age (13th–14th centuries)

[43] *Willerding 1983.* Thanatocoenology is the study of the ecological relations of excavated archaeobotanical finds to reconstruct the one-time botanical conditions in the site, including the habitats it consisted of, the related flora, and plant communities. The recovered botanical record is referred to as *thanatocoenosys* after Willerding's work.

[44] *Jacomet – Brombacher – Dick 1989.*

[45] *Ehrendorfer 1973.*

[46] *Ellenberg 1974.*

[47] *Borhidi 1995.*

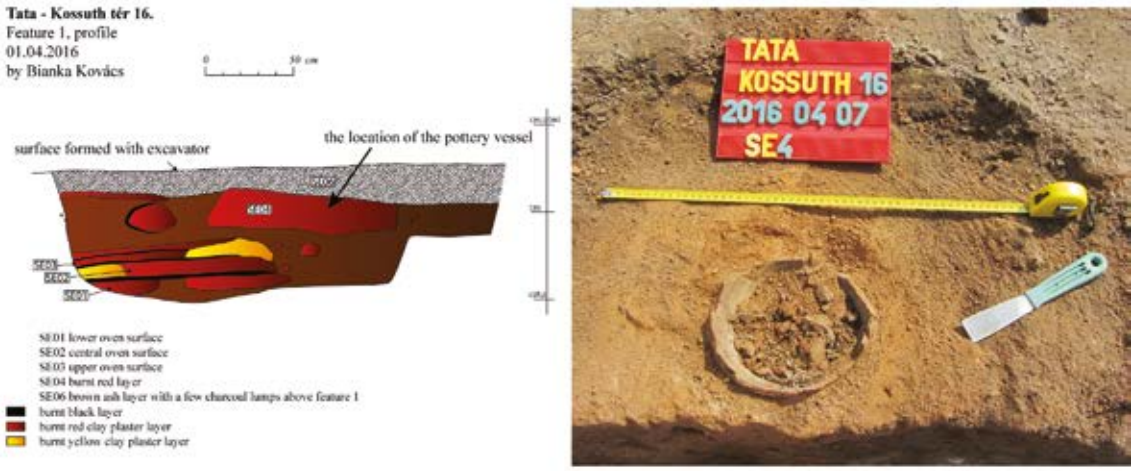
[48] *Babos 1994; Greguss 1959; Gencsi – Vancsura 1992; Schoch et al. 2004.*

[49] *Kovács 2018* 32–34, fig. 2.

[50] *Kovács 2018* 32. The finds from the first renewal (central layer) of the oven's floor (SE 02) were inventoried under Inv. No. KDM 2016.13.1.5–8 (Kuny Domokos Museum, Archaeological Collection, Tata), and those from the second renewal (upper oven floor layer, SE 03) under Inv. No. KDM 2016.13.1.9–21.

[51] *Kovács 2018* 33–34. The finds recovered from the clay or daub layer (SE 04) were inventoried under Inv. No. KDM 2016.13.4.1–154, 299–300; the Inv. No. of the pot's bottom fragment with the ashy fill is Inv. No. KDM 2016.13.4.152.

1



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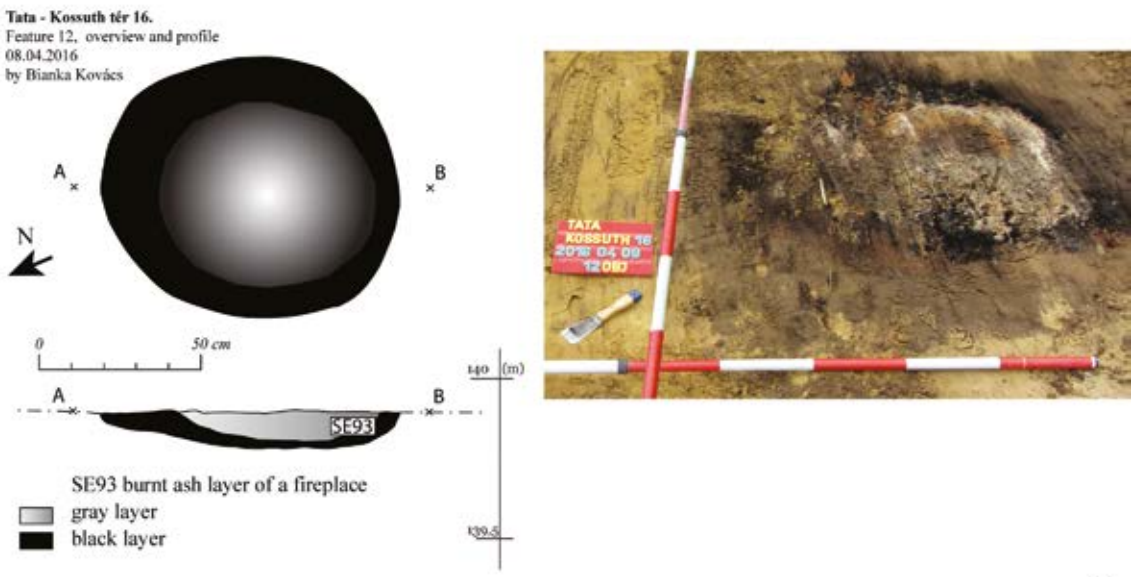


3

Fig. 7. Position of the findspots of archaeobotanical samples No. 1 and 3–6
(©Bianka Gina Kovács, ©Csilla Deminger)

Fig. 8. Findspot of archaeobotanical sample No. 2 and the metal finds recovered from the related feature (©Bianka Gina Kovács, ©Csilla Deminger)

because it started at the same depth as Feature 11, a pit with 13th–14th-century material only 0.4 m away.[52]

The last sample (Sample 2) was taken from Feature 18, a shallow pit with many metal objects in its fill *(fig. 8).* One of those was a slightly asymmetric medieval ploughshare[53] with a pile of corn on top.[54] Besides, the pit contained a fragmented coulter which, based on the cross-section of its stem, is also medieval,[55] and some relatively big iron fragments of perhaps a scythe in too poor condition to be classified to a type.[56] The small metal pieces in the assemblage could be identified as a four-part chisel set, a small bucket handle (some remains of the wooden bucket have likely also persisted corroded onto the ploughshare), an iron buckle, an iron hoop, four iron nails, fragments of an iron band, some small iron fragments and one of a serrated tool, perhaps a scratcher. This latter type first appeared in the territory of today's Hungary in the Late Árpád Age,[57] the oldest specimens coming from the archaeological record of villages destroyed during the first Mongol invasion.[58] Besides metal items, the fill of the pit contained many daub fragments with twig impressions, perhaps the remains of a nearby surface building. The size and content of the pit indicate that the objects were hidden there with intent and in a hurry; however, when that happened exactly cannot be determined because the assemblage only comprises metal finds, which, as the design of metal tools has always changed relatively slowly, have low dating value. The top of the feature was in level with the floor of the oven in the Árpád Age house only a few metres away; at the same time, the other 13th–14th-century features started 30-40 cm deeper, while Feature 29, dated to the 15th–16th centuries, ca. 30 cm higher. However, altitude alone is no convincing evidence in this case, especially as the top of the features outline a surface that was not flat but rose from the area of today's Kossuth Square in medieval times, just like today.[59] The 15th–16th-century owner of the plot was wealthy enough to drink from cups imported from Loštice (Czech Republik) and have a glazed tile stove in his house, which makes it unlikely that, in the case of an attack, he cared about hiding a bunch of agricultural iron tools. Therefore, the finds were likely interred sometime in the 13th–14th centuries, perhaps during the first Mongol invasion or after that, when the Csák kindred occupied the region.

Evaluation of the seed remains

Only two of the six wet-sieved samples, Samples 1 and 2, contained fruits and seeds.[60] Based on their findspots and the accompanying finds, both could be dated to the 13th–14th centuries. We attempted to reconstruct the one-time flora diversity, cultivation profile, and environment from the two samples.

Sample 1 contained 9,871 plant remains of 30 *taxa* – four times as much as Sample 2, which only contained 1,135 plant remains of thirteen *taxa (Table 2).* This proportion is characteristic of the species and seed concentration indices, too. The quantity of fruits and seeds varied by sample *(Table 1).* All plant remains were carbonised (charred), indicating that a relatively large quantity of seeds burned. Most were likely reduced to ashes, but some, having been heated in an oxygen-

[52] *Kovács 2018* 33.
[53] *Müller 1982* 418.
[54] *Kovács 2018* 34. The finds from Feature 18 were inventoried under Inv. No. KDM 2016.13.18.1–20.
[55] *Müller 1982* 434–435.
[56] All iron artefacts recovered during the excavation were in extremely poor condition, probably because sometimes the area was under permanent water cover for a relatively long period. The scythe was perhaps a long one, representing a variant that first appeared in the territory of the Kingdom of Hungary in the 14th century (*Müller 1982* 497).
[57] *Müller 1982* 533–534.
[58] E.g., *Dinnyés 2007* 51.
[59] *Kovács 2018* 34.
[60] Besides, Sample 5 contained a single *Chenopodium* sp. seed.

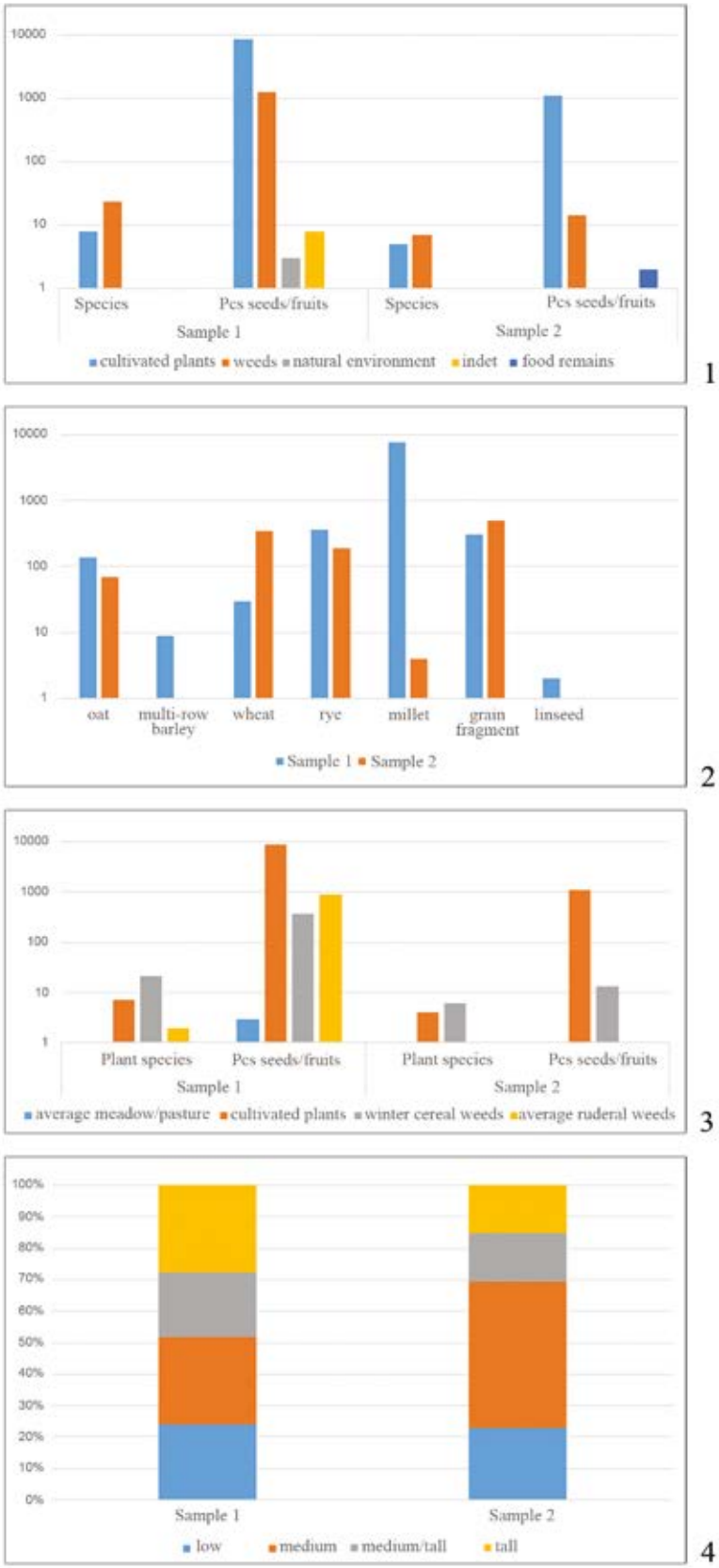


Fig. 9. Distributions of the archaeobotanical finds from Tata. 1. Anthropogenic distribution; 2. Species distribution; 3. Species distribution by habitat; 4. Species distribution by height (©Katalin Julianna Szilvási)

deprived environment, became gradually charred, which conserved them and protected them from the reducing activity of soil microorganisms while also leaving their identifying marks more or less intact. The best part of the sample consisted of cereal and cereal weed seeds, but some food remains (also all charred) were also identified. Perhaps the food had already been burnt during cooking and was dumped as waste to where it was found later.

In summary, the species diversity and quantity of the analysed material match the available medieval botanical record from the territory of today's Hungary.

Quantitative evaluation

The species identified include cultivated plants, weeds, and natural vegetation elements, which were gathered from the environment or got into the samples by chance *(fig. 9. 1).*

The species and seed number of cultivated plants in Sample 2 is much higher than in Sample 1 (8,581 seeds of eight species vs. 1,119 seeds of five species), and the numbers of weed species reflect a similar tendency: the weed diversity (including cereal and segetal weeds and ruderals) is exceptionally high in Sample 1 compared to Sample 2 (1,278 seeds of 23 species vs. 14 seeds of seven species). Natural vegetation elements only occur in Sample 1, and their number is exceedingly low (three seeds of a single species). Also, only Sample 1 contained non-identifiable (indet.) seed remains (8 pcs.), while exclusively Sample 2 included food remains (2 pcs.).

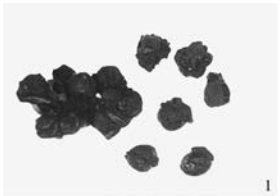
The cultivated plant remains allow one to learn about the economy and diet of the residents of the medieval village. As the sample abounded with them, even their order of importance can be estimated. Both samples contained cereal remains in relatively large quantities (the diasporas of which were exclusive in Sample 2). Sample 1 also comprised some fibre plant (flax, *Linum usitatissimum*) and breadseed poppy *(Papaver somniferum)* seeds (the latter does not appear on the diagram due to its low count).

The samples comprise various crop species in very diverse compositions and quantities *(fig. 9. 2).* Sample 1 is predominated by millet *(Panicum miliaceum)* with 7,745 seeds, followed by rye *(Secale cereal)* with 358 seeds, oat *(Avena sativa)* with 139 seeds, common wheat (*Triticum aestivum* subsp. *vulgare*) with 30 seeds, and multi(six?)-row barley (*Hordeum vulgare* ssp. *polystichum*) with nine seeds. The order is different, and some species (e.g., barley) do not occur in Sample 2. This sample is predominated by common wheat with 352 seeds and also contains 189 rye, 69 oats, and four millet seeds *(fig. 10).*

Qualitative (ecosociological) evaluation

The qualitative evaluation started with assorting and classifying the identified species based on their habitat requirements *(fig. 9. 3),* involving both species and the related diasporas in the analysis. It must be noted that some species (especially weeds) might appear in more than one habitat, while some can equally accompany winter and spring crops, segetal plants, and ruderals. As all weed seeds have been found among wheat, rye, and other cereal seeds, they were interpreted as related to them.

Accordingly, the number of winter cereal weeds is conspicuously high, likely bound up with the number of cereal seeds, and corroborates the image suggesting their preponderance. The identified species include annual yellow woundwort *(Stachys annua),* pearl millet *(Setaria glauca),* annual wall-rocket *(Diplotaxis muralis),* tufted or blue vetch *(Vicia cracca),* black medick *(Medicago lupulina),* common corncockle *(Agrostemma githago),* cockspur *(Echinocloa crus-galli),* common wild oat *(Avena fatua),* field cow-wheat *(Melampyrum arvense),* sweet yellow clover *(Melilotus officinalis),* maple-leaved goosefoot *(Chenopodium hybridum),* green or bristly foxtail (*Setaria viridis* or *Setaria verticillata*), wild radish *(Raphanus raphanistrum),* red clover







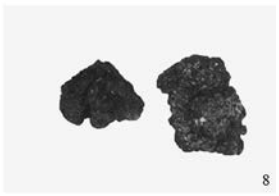
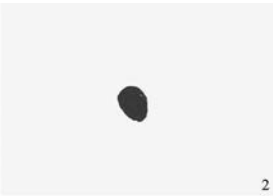



Fig. 10. Selection of cereals from the archaeobotanical: Sample 1: 1. Millet, 3. Rye, 5. Oat, 7. Wheat; Sample 2: 2. Wheat, 4. Rye, 6. Oat, 8. Grain porridge (©Katalin Julianna Szilvási)

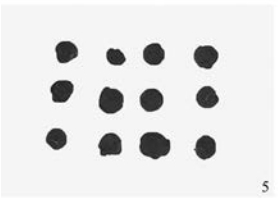




Fig. 11. Selection of weeds from the archaeobotanical: Sample 1: 1. Annual yellow woundwort, 2. Annual wall-rocket, 4. Maple-leaved goosefoot, 5. White goosefoot, 6. Annual meadow grass, 7. Linseed, 8. Breadseed poppy; Sample 2: 3. Common wild oat (©Katalin Julianna Szilvási)

(Trifolium pratense), marsh persicaria *(Polygonum mite),* lesser honeywort *(Cerinthe minor),* wild buckwheat *(Fallopia convolvulus),* hare's-foot clover or oldfield clover *(Trifolium arvense),* spear saltbush or common orache *(Atriplex patula),* whitetop or hoary cress *(Lepidium draba),* bird's rape *(Brassica campestris),* yellow mignonette *(Reseda lutea),* and littlepod false-flax *(Camelina microcarpa) (fig. 11).*

The distribution and quantity of the weed seeds are very different in the two samples. Sample 1 contains seeds of 21 species, while Sample 2 only includes six. Several species appear in both samples, including annual yellow woundwort, annual wall-rocket, and common wild oat. However, most species are not present in Sample 2, and the ones appearing there (bristly foxtail, whitetop, common corncockle, and field cow-wheat) are missing from Sample 1; in summary, the species distribution reflected by the two samples is highly dissimilar. As for seed count, almost all species in both samples have only a few seeds. The only exception is maple-leaved goosefoot, 325 seeds of which were isolated in Sample 1. It must be noted that this weed equally appears in winter and spring cereal communities (millet, spring wheat, spring barley, oat) and those of segetal plants like breadseed poppy *(Papaver somniferum)* and flax *(Linum usitatissimum) (fig. 11).*

The ruderals (weed communities specific to trampled land and azonal soils) in the samples come from areas affected by human activity, like ditches, roadside and embankments, fallows, pens, and the vicinity of buildings, where the soil is rich in nitrogen (perhaps even manured). Both identified ruderal species indicate habitats with average water availability. White goosefoot *(Chenopodium*

album) seeds were present in both samples (and with a conspicuously high count, 907 pcs., in Sample 1), while annual meadow grass *(Poa annua)* was missing from Sample 2 *(fig. 11).*

Natural vegetation elements were represented by three lady's mantle (also known as lion's foot, *Alchemilla vulgaris agg.*) seeds in Sample 1.

Evaluation of the results

The ecological distribution of the identified plant species confirms the results of the quantitative assessment, outlining a typical palaeo-ethno ecological community dominated by plants cultivated and used by humans and their weeds and some occasional species coming from the natural environment.

Millet, the most characteristic porridge cereal of the Middle Ages, makes up the bulk of Sample 1. All seeds are charred, and some have been baked into a conglomerate. The charred, cleaned millet seeds (with no glumellas and germs) were probably processed (as the germ breaks off them during husking) and cooked into a porridge, which got burnt; they were most likely hulled on the spot. Interestingly, Sample 2 only contained a few pieces of millet.

Two different caryopses (a round and an elongated) of hexaploid wheat, a common cultivated wheat species today, were present in Samples 1 and 2. These likely represent two different ecotypes or species, providing important evidence of early plant breeding. That they occur in both samples in similar numbers suggests that they were cultivated in the area instead of having been brought there and that the crop played an important role in local subsistence. They are likely the remains of wheat cultivated and processed nearby.

The oat remains in both samples are hulled, which indicates that they might have been intended for consumption. In contrast, all the multi(six?)-row barley seeds in Sample 1 had their glumellas on, suggesting they were cultivated for fodder.

Based on the archaeobotanical database of Hungary,[61] the identified species fit the image outlined previously about medieval agriculture. The proportion of the wheat and the rye in Sample 2 is 2:1, raising the possibility of the so-called 'mixed sowing' (*abajdóc, kétszeres* ['double'], *triticum mixtum:* a mixture of wheat and rye is sowed for a better yield), which was characteristic of medieval Hungary.

The many winter cereal weeds come from local cereal cultivation and processing. The spectrum includes both tall and low weed species, indicating that the crops were reaped low, probably with scythes *(fig. 9. 4),* and that the cleaning methods of the time (mainly winnowing and hand-sifting) were unsuitable for removing all unwanted seeds.[62] The common corncockle and wild buckwheat, appearing in Sample 1, were likely widespread and stubborn weeds; both are present, admixed with the remains of cultivated species, in the archaeobotanical record of every culture from the Neolithic to the Late Middle Ages. The common corncockle, a *Secalietea* species, is a weed of Mediterranean origin, where it was present in both plainlands and mountains; it has spread throughout the entire globe by today.[63]

The seeds of some medicinal and poisonous plants have also been identified in the archaeobotanical record of the site; the distinction between spices, medicinal herbs, and poisons was not as sharp as it is today. The breadseed poppy in Sample 1 was known as an oil-yielding

[61] *Pósa – Gyulai 2019; Gyulai 2010.*

[62] Before cooking them, the cereals were checked once more, grain by grain, to remove poisonous weed seeds and those that would add bad flavour to the food.

[63] Its population in the territory of Hungary had decreased significantly by today due to chemical control. Currently, the species is under nature conservation protection in the country (see Decree No. 13 of 2001 [May 9] of the Department of the Environment). *Soó – Jávorka 1951; Soó 1980.*

and a drug plant; its drug, opium, contains numerous alkaloids and has been in use for ages.[64] Common buckwheat germs contain saponin, a toxin affecting nerves and muscles; eating such cereals or feeding animals with them is very dangerous.[65]

Evaluation of the wood record (Table 3)

More than four hundred charcoal fragments were isolated in Sample 6, taken from the ash layer in the Late Árpád Age (12th–13th-century) oven. Based on their anatomy, all come from oak species (*Quercus* sp.). The size of the charred wood remains in Sample 1, taken from the 13th–14th-century open fireplace, ranged 8–20 mm; most could be identified as common alder *(Alnus glutinosa) (fig. 12)*.[66] Sample 2, collected from the fill of the 13th–14th-century pit, contained small charcoal fragments, of which three were suitable for anthracological analysis; based on their structure, all three could be assigned to the maple genus (*Acer* sp.). Sample 3, taken from the inside of a bottom fragment of a pot in a 14th-century layer, contained very tiny charred wood remains, unsuitable for identification due to their size. From the ash layer of Sample 4 (14th century), we were able to select small charred charcoal, of which eight remains were identified as belonging to the oak (*Quercus* sp.) genus. From Sample 5 (14th century), one remains was suitable for anthracological analysis and was identified as oak (*Quercus* sp.).

Altogether, five wood *taxa* were discovered and identified in the record. Of these, common alder *(Alnus glutinosa)* lives in wet habitats permanently affected by excess water and representing an environment rich in mineral nutrients. Among maples (*Acer* sp.) there are species that play a secondary role in maple-oak and hornbeam-oak forests, oak-elm-ash gallery forests, maple-ash ravine forests, beech forests, and montane alder galleries. The oak (*Quercus* sp.) genus also includes mesophilic species, dominant elements of the plant communities in our forests in wet riverside habitats and dry, warm southern slopes.

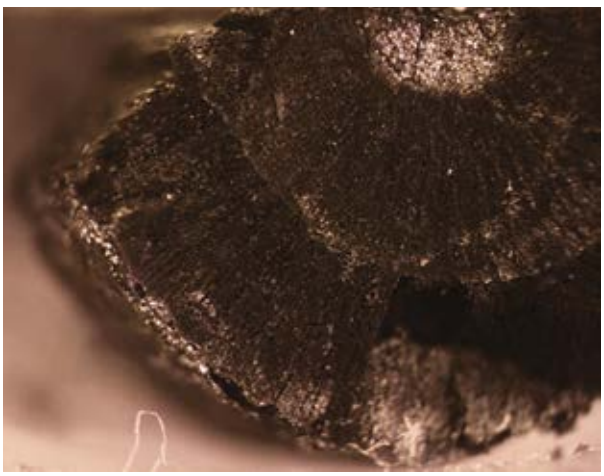


Fig. 12. Cross-section of common alder *(Alnus glutinosa)* from Sample 1 (ID 1.2). The size of the sample is 9 × 10 × 9 mm (©Máté Róbert Merkl)

Based on the distribution and habitat requirements of the identified *taxa,* the medieval residents of Tata likely obtained the wood they needed for everyday life from nearby natural resources, thus optimising energy investment.

[64] *Gyulai – Kenéz 2018* 82–84.

[65] *Danert et al. 1981*. Its toxins are ghitagoside and agrostemma acid. When not separated from cereal grains and ground, it caused the bread to have a bluish colour. In the case of severe poisoning, symptoms include stomach irritation, salivation, and vomiting, followed by circulatory failure, coma, and finally, death by respiratory paralysis. According to *Rapaics 1934,* it was not as abhorred in the old days as today: small quantities were baked in bread and made into *pálinka* (a kind of fruit brandy). Cereals contaminated with common buckwheat had to be cleaned before use, but this could not be done only by winnowing and sifting, and even sieving was only enough to reduce its quantity. This explains the relatively high incidence of common buckwheat seeds in cereal grain samples from archaeological periods.

[66] Based solely on anatomical characteristics, the possibility that the remains come from grey alder *(Alnus incana)* cannot be excluded either; however, according to our current knowledge, this species only appears in subalpine habitats, primarily in the Alps and the northern parts of Europe, which makes it likely that the wood is actually common alder, an autochthonous species in the area of the site.

Tata and its surroundings from the building of the castle to the end of the Middle Ages

Changes in the landscape and the settlements. The estates of Tata Castle

It is possible that the Lackfi family had a palace in the place of the later castle already at the end of the 14th century; however, the construction of the building complex with a well-designed, regular layout and four corner towers can be linked with Sigismund of Luxembourg, who obtained the territory in 1397 and had his castle built there by 1409. Sigismund frequently visited Tata, often also receiving foreign envoys there. The proximity of the royal court promoted the development of the area,[67] bringing about several changes.

Based on written sources, the estates of the castle formed a single block in the 15th century. Three charters (written in 1440, 1449, and 1459, respectively) are known from the time when the castle belonged to the Rozgonyi family; these enlist the settlements belonging to the castle. The two most significant of these were Ótata ['Old Tata'] and Újtata ['New Tata'], two market towns next to the castle. Besides, all three documents mention Szentiványhegye, Szőlős, Szomód, and Grébics – these could be the core of the estate. Kovácsi and Agostyán puszta ['puszta' meaning 'abandoned/deserted settlement'] also belonged to the castle in 1440, while Naszály, Szentkirály, Sztancs, and Szentgyörgypuszta only appear in the 1449 charter.[68]

Changes in the hydrological conditions of the area

Fundamental transformations took place in the hydrological conditions of the area during Sigismund's reign: Öreg-tó was likely created by impounding the Által-ér on his order as part of the construction of the castle complex. Current landmarks offer no help in determining the exact time of this work as the current dam was constructed only in the 18th century, within the frame of the water regulatory works designed by Mikoviny (mentioned above). Earlier hypotheses assumed that the lake might be Roman, but this seems unlikely as it appears in no source before the 15th century. Its earliest mention is in a letter by papal envoy Traversari, written in 1435; according to him, Sigismund 'went to Tata to fish and hunt, and had a large and splendid lake made for him for that purpose.' The lake appears in several documents after that, and later, Antonio Bonfini credited its construction to King Matthias.[69] Based on the Árpád Age finds discovered in the southern part of the lake during dredging works in 1972, the area had likely been inhabited before it was flooded.[70] The lake was more than a spectacle for the residents of the castle; it was also a fish pond. Fish ponds represented a profitable venture and a secure source of income that could match that of a landlord of a market town, while the maintenance costs were relatively low.[71] A few sources offer indirect data on late medieval fishing in the lake, sharing details like that great sturgeons were also kept there.[72] Besides, the impounding of the stream likely resulted in the emergence of new mill sites, too. Again, Bonfini provides evidence, according to whom, 'the running water stops down there in a lake about seven thousand steps wide. A row of nine mills stands along the stream. These all belong to the castle and cannot be separated from it

[67] As indicated by the presence in the market town of Ótata of diverse craftspeople (e.g., a goldsmith), clearly supplying the royal court. See *Schmidtmayer 2011* 200–202.
[68] *Schmidtmayer 2015* 240; *MNL OL DL* 13900; *MNL OL DL* 14284; *MNL OL DL* 15409.
[69] *Schmidtmayer 2011* 194; *Schmidtmayer 2015* 245–247.
[70] KDM Archaeological Data Archive 15–79.
[71] *Ferenczi 2008* 348–349.
[72] *Schmidtmayer 2011* 195; *Schmidtmayer 2015* 247.

Fig. 13. The mill between Tata and Naszály on Sámuel Mikoviny's map and the modern border between the two settlements on a cadastral map

even in time of war.'[73] However, the last statement is questionable as it supposes that the mills were situated within the walls of the castle, but another source from 1587, about a century later, explicitly says that 'all mills were situated outside the walls, so they built one within to secure supplying the soldiers even when the town is engaged in war.'[74] It is hard to believe that if more than one mill operated within the castle walls, the builders of the early modern fort walls did not take care of keeping them there, especially as the medieval moat was still open at the time (the mill mentioned in the 1587 document was also sited on the medieval walls).[75] Documents from the 15th century also mention mills in Újtata: King Albert donated two mills by the hot springs in Újtata (one of them next to the royal triple mill) to István Rozgonyi in 1439,[76] and a charter from 1443 also mentions a mill in Újtata.[77] The 1587 map of Tata Castle and its surroundings features three mills east of the castle, by the stream feeding the lake.[78] It is possible that at least some of the one-time mills in Újtata were sited on the stream fed by the springs in the territory of today's Angolkert [*Jardin Anglais*] because most 18th-century mills of the town are also situated there.[79] In 1502, Osvát Korlátkövi, castellan of Tata, had a mill built or rebuilt north of Naszály in an area belonging to Újtata at the time.[80] Albeit there is no precise description of the medieval borders of these settlements, we know that the early modern border between them was near the mill appearing between Tata and Naszály on the map by Mikoviny (mentioned above) *(fig. 13).* Thus, the mill mentioned in 1502 might also stood on the same spot.

[73] *Bonfini 1959* 144.
[74] *Bíró 1968.*
[75] The 2023 excavation in the area of the castle has confirmed the medieval origins of the walls of the mill; see *Bíró 1968* 314.
[76] *Körmendi 1968* 407.
[77] *Schmidtmayer 2015* 247.
[78] *Bíró 1968* 325. Lake Cseke in the Angolkert was constructed only in the 18th century.
[79] *Stegmayer 2017* fig. 1.
[80] *Schmidtmayer 2015* 241.

Roads in the 15th century

Thanks to the marshland between Tata and the Danube, the roads crossing Tata, and the right to charge a toll, both Ótata and, a little later, Újtata had become market towns already before the castle was built there. As mentioned above, the role of the main road along the Danube was taken over by the Buda–Bánhida–Győr route after the first Mongol invasion. While related 14th-century sources are scarce, many 15th-century documents mention roads around Tata. Several envoys and travellers used the road passing Buda, Tata, and Győr at the time of the reign of Sigismund of Luxembourg, and Sigismund's *itinerarium* also contains information on more than one road in the area. According to a statement by the town of Komárom in 1445, 'everyone is free and safe to pass' the road leading to Fehérvár through Tata and Környe. According to a 1447 document, the Tata–Komárom road crossed Billeg (where a merchant was stopped). Besides, another road along the eastern edge of the marshes connected Újtata and Almás; passing the latter, it crossed Neszmély and led to Esztergom. The paths of the roads north of Tata were probably similar to the ones appearing on Mikoviny's map. Many lesser roads connecting the settlements in the area branched off and completed the road network backboned by the primary ones mentioned in written sources.[81]

Archaeological data

Identifying the estates of the castle using archaeological methods is sometimes problematic because many late medieval settlements lay in built-up areas of current settlements, which limits research possibilities considerably. Such sites can usually be explored in small areas in context with land development and constructions. This is the case with the two market towns, Ótata and Újtata: we have barely any information on the latter; only a mostly destroyed cemetery suggests that it was likely situated northeast of the castle, with a Franciscan monastery or a parish church devoted to the Holy Mary was somewhere at the crossroads of today's Ady Endre and Bartók Béla streets, i.e., in the area of the Capuchin church. Based on available research results, Ótata was situated south of the castle, in the area of today's Kossuth Square. The body of archaeological evidence related to this medieval town is less thin: the relics of the church building unearthed on the square and the cemetery parts excavated in the nearby streets (Fürdő and Nagykert streets) outline the positions of the three ecclesiastical buildings mentioned by written sources (the Benedictine Abbey, the Parish Church of St. Coloman, and the Chapel of the Holy Mary).[82] Besides, remains of a medieval settlement have been identified at several places, the most significant being a late medieval building in Nagykert Street and some late medieval features next to Kossuth Square *(fig. 14)*.[83] These excavations also yielded abundant find material.

Of the one-time villages of the castle, Szentiványhegye, lay in the current territory of Tata; archaeological research has only been carried out in the area of its church. Naszály and Szőllős were likely situated where Naszály and Vértesszőlős are today. We have no archaeological data on either of them, but the orientation of the Reformed church of Naszály (towards the east and not fitting into the street work of the village) and the Catholic church of Vértesszőlős (also facing east)[84] raise the possibility of their medieval origin – in which case, the related settlements must have also been nearby. The situation might be similar with Agostyán, the church of which is

[81] For a detailed description of the local road network, see *Schmidtmayer 2011* 197–198.

[82] Some identifications are still under debate; see the entry of Ótata in the Data Archive at the end of the study.

[83] *Kovács – Líbor 2023* 229; *Kovács 2018*.

[84] While the current church of Vértesszőlős was only built in 1789–1792, a church is marked in the same spot on the respective map of the first Habsburg Military Survey.

Fig. 14. Medieval archaeological remains in the downtown of Tata (©Bianka Gina Kovács)

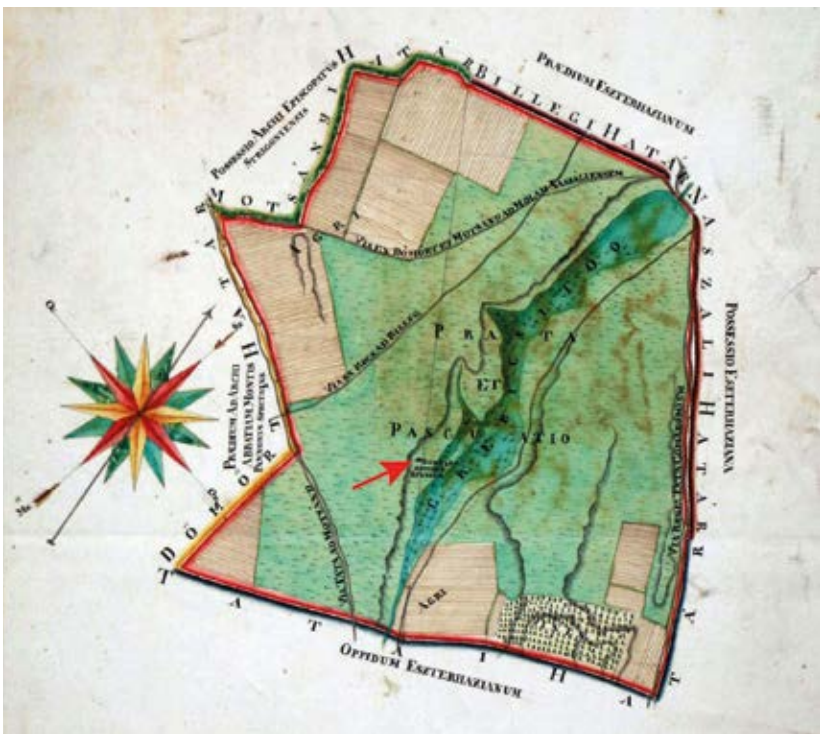


Fig. 15. Domanial map of Grébicspuszta from 1768 with the marking of a ruin church likely of medieval origin *('rudera antique ecclesie')* (source: Historical Collection of the Kuny Domokos Museum Inv. No. KDM 63.68.1)

situated on top of a small elevation and oriented east-west, with the sanctuary on the western side. According to 18th–19th-century maps, a church with a similar orientation also stood once in Dunaszentmiklós, the supposed place of the medieval Stancs village. However, in lack of archaeological research, the medieval origin of neither church can be confirmed even more as only the church of Agostyán appears in medieval written sources (mentioned in a charter in 1367).[85] Accordingly, there is no mention of the church of Kovácsi, but it was identified through archaeological research.[86] A multi-period site with a late medieval horizon has been registered on the southern outskirts of Szomód during a survey, but, as the collected find material is not available, this dating could not be confirmed.[87] The late medieval village was more likely in the built-up area of the current settlement.

After the wars of the Early Modern Period, some of the medieval settlements were not rebuilt at all or in a different place than before. The research of these settlements, usually situated on ploughlands outside the currently inhabited zones, progresses slowly due to the lack of land development projects in the respective areas; most of the known ones have been identified through surface find collecting surveys. The only exception is Kovácsi, where the settlement has yet to be unearthed, but the church, the graveyard cemetery, and the manor were explored in a planned excavation.[88] As the result of surface find collecting surveys, Grébics was located quite certainly, which the related toponym (Grébicspuszta, meaning 'deserted Grébics') corroborates. Albeit there is no mention of the church of Grébicspuszta, the ruins marked on the 1768 domanial map of the settlement perhaps belonged to that *(fig. 15).* The toponym Szentgyörgypuszta, marking a land in the administrative area of Környe today, gives a hint on the location of the medieval Szentgyörgy village; however, only Árpád Age sites have been registered there thus far. As 15th-century sources only mention the settlement as *puszta* [deserted] or land, it might be identified with some of the Árpád Age features.[89] Szentkirály is the only village that could not be identified convincingly thus far, and there is no data (e.g., a toponym) to help localise it. The data on the medieval settlements are presented in detail in the Data Archive at the end of this paper.

In summary, the position of the 15th-century settlements around the castle could largely be reconstructed *(fig. 16).* The outlined image matches the tendency observed country-wide and is also corroborated by both archaeological and written sources: the number of settlements in the 15th century was way lower than in the preceding ones. The agricultural innovations in the 13th–14th centuries brought about changes in society and led to a concentration of settlements and the emergence of a permanent settlement network throughout the Kingdom of Hungary; this was accompanied by a skyrocketing of the number of churches from the 13th century.[90] As the part referring to the Győr diocese is missing from the papal tithe register compiled between 1332 and 1337, our knowledge of the ecclesiastical relations of the study area is disappointingly incomplete.[91] However, another aspect must also be considered in the research of the area: by the 15th century, the inhabited zone in the marshland north of Tata seems to have shifted (or, better, retreated) to above ca. 120 m a.B.s.l. Based on the scarce written evidence available, researchers formulated a hypothesis that the frequency of floods and the extension of the flooded areas in the

[85] The data on the parishes of the Győr and Komárom deaneries, i.e., the area of the county south of the Danube, are almost completely missing from all 14th-century papal tithe registers; see *Györffy 1987* 440–441.

[86] *Petényi – Sabján 2003* 127–128.

[87] Julianna Kisné Cseh inspected Sites 2/2005 and 3/2005 in 2005.

[88] *Petényi 2010* 8–10.

[89] See the Szentgyörgy entry in the Data Archive at the end of this study.

[90] *Rácz 2019* 158.

[91] *Tóth 2013* 87.

Fig. 16. The position of Tata Castle and the settlements in its domain in the Late Middle Ages (©Bianka Gina Kovács)

territory of the country increased in the Late Middle Ages.[92] As part of that, the surface and water level of the marshes around Tata also grew, forcing the residents of several settlements (e.g., Sár village) to leave their homes for good. As a result, the settlements that had remained inhabited by the 15th century were mostly the ones that were rebuilt after the Ottoman occupation and still exist today.

General characteristics of the find material

Relatively large find material is only available from Ótata in the downtown of the current town; as for other settlements, mostly find collections from surface surveys offer some information *(fig. 17).* The bulk of the abundant find material recovered from the castle comes from early modern and modern contexts, but the number of medieval finds is also considerable (about 5000 fragments), which represents a reliable reference for the research of the nearby settlements. Pot fragments comprise the biggest part of the 15th–16th-century pottery record in both excavated assemblages and surface find collections. Most fragments come from yellowish, off-white pots tempered with coarse, often dark-grained sand and imitating types of the 'Austrian ware'; their shoulders are often adorned with incised line or roll-stamped patterns. The proportion of yellowish-off-white pottery is relatively high in the record of coeval sites in the area of the Vértes and Gerecse Mountains, appearing there already in the Árpád Age. Late medieval pottery kilns where such pottery was produced once were discovered in the eastern part of the Gerecse and the northern part of the Vértes mountains; besides, provenience research at the turn of the 19th and 20th centuries has discovered natural clay deposits at the eastern feet of the Gerecse and the southern feet of the Vértes, which yielded high-quality material that could be fired to a yellowish ceramic (so-called refractory). As the vessels recovered from the area in focus feature minor differences in shape and decoration compared to the ones produced by the known workshops, such pottery was likely also produced somewhere near Tata.[93] No pottery kiln or refractory clay mine has been discovered in the study area thus far, but according to ethnographic data, the oral tradition in Agostyán holds that the local potters had found such a mine in the forest, but the count did not allow them to exploit it, and the place was forgotten with time.[94] Even mid-19th-century sources note that the ploughlands of Agostyán are very clayey.[95] Based on all these, some of the pottery workshops around Tata might have easily been located in the territory of the medieval villages at the feet of the Gerecse Mountains (e.g., Agostyán and Baj).

A smaller part of the pots in the pottery record is red; the design of these vessels is more varied, albeit most are made from clay tempered with gravel. Some feature a band rim with often a lid groove, a rim variant known otherwise from the area of Lake Balaton and eastern Transdanubia,[96] but the bulging variant characteristic of the yellowish-off-white pottery is also frequent. The shoulders of many are decorated with incised line patterns. Clays rich in iron oxide, yielding red ceramic, represent lower quality than refractory clay; their deposits were scattered all over the country.[97] The analysed pottery record likely includes the products of more than one local workshop. Red pots sometimes bear a simplified version of the roll-stamped patterns known from yellowish-off-white pottery, suggesting that they were imitating that higher-quality ware.[98]

[92] *Rácz 2008* 33.
[93] For detailed information, see *Kovács 2021* 253–267; *Kovács 2022.*
[94] *Körmendi 1964* 28.
[95] *Fényes 1848* 174; *Pesty 1977* 57.
[96] See *Feld et al. 1989* 180, figs. 5–6.
[97] *Kresz 1960* 303.
[98] *Kovács 2021* 259–260.

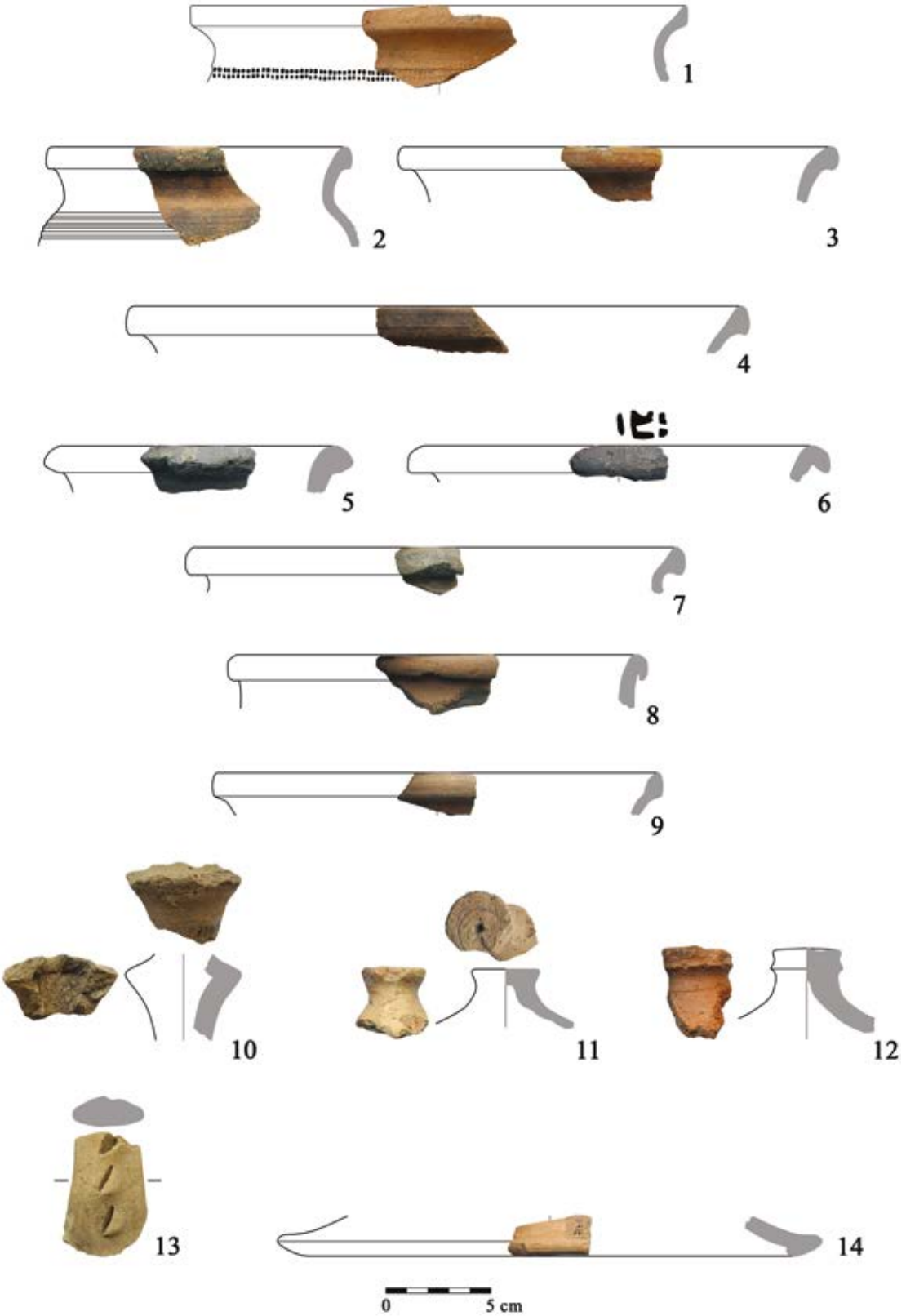


Fig. 17. Selection of 15th–16th-century finds from the study area. 1–14. Naszály-Grébicspuszta: Inv. No. KDM 71.4.1–8, 10–11, 13, 17. (©Zsóka Varga, ©Bianka Gina Kovács)

Lids also come in yellow and red pottery. The proportions of these two wares in the pottery record indicate that mainly local workshops, likely at least partly ones operating on the castle's own estates, supplied it with cooking vessels. A document from 1524 mentions that the potters in Deáki village supplied the kitchen of Sümeg Castle with vessels in exchange for tax relief.[99]

The third group of pottery consists of grey, usually graphitic vessels. More than a hundred such fragments have been identified in the pottery record of the castle, making up almost 20% of medieval pots. Their proportion in Ótata is way lower (1%); besides, a single fragment is known from Szentiványhegye and Grébics, respectively.[100] An average household probably had no more than one or two such pots. Earlier, this type was unequivocally interpreted as imported from Austrian workshops, but recent research results have raised the possibility that some were actually produced in the Kingdom of Hungary, near the western borders.[101] The material and quality of the grey vessels from Tata Castle are highly varied, and some do not contain graphite at all. While the provenance of the pieces has remained to be determined, all vessels have certainly arrived there as traded goods.

Tableware, including liquid containers and cups, also includes a yellow and a red group. Cups, however, show an even greater variety, reflecting the role the vessel type had in social representation. The pottery record of the castle comprises fine yellow and red cups with roll-stamp decoration, likely made in the Kingdom of Hungary,[102] as well as ones imported from distant towns like Loštice (Czech Republic), Enns (Austria), Siegburg (Germany), and Waldenburg (Germany).[103] No foreign cup is known from any of the castle's estates except for a Loštice-type cup from Ótata,[104] suggesting that the imported pieces did not get into the villages. Even higher-quality stamped ware made in the territory of the country is only known from a noble environment, the excavated material of the manor in Kovácsi.[105]

A considerable part of the find material obtained from Tata Castle consists of stove tiles. The high-quality flat and cup-shaped stove tiles found there can be linked with the presence of the royal court (of Sigismund of Luxembourg, Matthias, Vladislaus II, and Louis II),[106] but a few similar fragments are also known from the market town of Ótata.[107] Neither flat nor cup-shaped stove tile is known from any other settlement in the study area.

Metal finds were scarce both in and around the castle, and none came from surface find collecting surveys. The medieval artefacts found in the castle are connected with gastronomy (knife, fork, wine tap) and lightning (chandelier parts),[108] which cannot be compared to the find material of the market town. Naturally, knives also appear amongst the finds of Ótata, but those also include agricultural tools and clothing accessories (belt plates).[109]

The fragments of a few Venetian cups are the most exquisite glass pieces in the record of Tata Castle,[110] while the glass finds of the market town comprise mostly bottle and window

[99] *Holl – Parádi 1982* 110.
[100] Inv. Nos. KDM 81.233.1, KDM 71.4.4.
[101] *Feld 2008* 310–311.
[102] See *Kovács 2021* 267–270.
[103] Inv. Nos. KDM 68.20.603, 785, 1164, 1165, 1170.
[104] *Kovács 2018* 33, fig. 8.
[105] Inv. Nos. KDM 96.109.1, KDM 96.110.1, KDM 96.111.1, KDM 96.113.1.
[106] *B. Szatmári 1974*.
[107] *Kovács 2018* 34–35, fig. 8, 13.
[108] *B. Szatmári 1974; László – Schmidtmayer 2008* 21, 56.
[109] *Kovács 2018* 37, fig. 13.
[110] *B. Szatmári 1974* 46.

fragments.[111] Written sources mention more than one 'palace' and 'manor' in Ótata;[112] the find material recovered from a plot near the main square might have belonged to one of them.

There is one more artefact, the appearance of which amongst the finds of the market town is interesting. A carved bone plate fragment and a few potsherds were found in a small and shallow pit in the excavation of a plot next to Kossuth Square. A pit with late 15th–early 16th-century material cut through the related feature,[113] which, therefore, must be older. By its shape and decoration, the bone carving was once part of a 15th-century saddle, representing a type the oldest specimens of which were made in the first half of the 15th century, at the time of the reign of Sigismund of Luxembourg.[114] The decoration of the fragment includes vegetal motifs and the foot of an animal, perhaps a dragon. Similar saddles were often decorated with dragons; some believe their owners can be linked with the Order of the Dragon of Sigismund of Luxembourg.[115] We do not know the name of the one-time owner of the plot where the bone plate fragment was discovered; however, some artefacts in the find material of the market town can likely be connected with the castle and its noble guests.[116]

No archaeobotanical record dated to the period in focus is known from the study area.[117]

Summary

The paper comprises an attempt to reconstruct the changes the building of a castle induced in the landscape. The study area, Tata, and its surroundings were situated next to the *Medium Regni,* the central part of the medieval Kingdom of Hungary, and important major routes; this setting fundamentally determined the direction of the region's development. In the Árpád Age, the landscape was spotted with short- and long-lived villages, of which written sources only mention some. The archaeobotanical record of the period has allowed one to reach a basic understanding of the Árpád Age agrobiodiversity of the area of Tata, including several details of local agriculture on which documents remain silent. Cereal remains tell us about the range of cultivated species, their weeds, about the time of sowing (autumn), and the method of reaping (with scythes). The wood remains in the samples indicate oak forests and swamplands in the area. The pace of development increased only in the 14th century, partly because the estate became royal property then and partly due to societal changes induced by innovations in agriculture (the latter in accord with the processes taking place in other parts of the country at the time). As a result, the number of villages decreased, but the persisting ones became permanent. The castle was built in this setting in the early 15th century, bringing about even more changes in its surroundings. The most conspicuous ones, including the construction of the castle lake, concerned the hydrological conditions of the area. Based on the recovered find material, mostly the nearby workshops supplied the castle with everyday utensils; besides, some artefacts from the market town can be explained by the proximity of the royal castle. In summary, while the reconstructed processes fundamentally match the coeval tendencies in the country, the royal presence brought new, unique elements to the landscape and the archaeological record.

[111] *Kovács 2018* 35–37.

[112] See *Györffy 1987* 459 and porta registers (*MNL OL* E 158) at https://adatbazisokonline.mnl.gov.hu/adatbazis/dikalis-osszeirasok. [last accessed on 10. 10. 2023.]

[113] *Kovács 2018* 34, figs. 13, 15.

[114] *Somogyvári 2017* 10.

[115] *Tarcsay 2023* 33–36.

[116] Like in Visegrád, some noble court members probably had houses in Tata, too; even a written source mentions such a property of Pippo Spano (ZsO XIII. 567).

[117] Relatively big archaeobotanical samples were collected from the fill of the medieval moat of the castle, but all were taken from early modern and modern layers. Máté Merkl analysed this record.

Data Archive

This chapter enlists the important historical and medieval archaeological data on each investigated settlement, starting with Tata Castle and followed by the others in alphabetical order. The list does not include settlements that only appear in 13th–14th-century documents.

Tata Castle[118]

There are several overviews of the history of Tata Castle; the most recent ones are the PhD dissertation of Richárd Schmidtmayer and a brief survey in an architectural historical study by Olivér Gillich.[119] The following summary is based primarily on these works. At the end of the 14th century, likely from 1389, the area of Tata was the property of István Lackfi, who, according to the available sources, started to build his main residence or a side residence there.[120] Sarolta Szatmári believed that a single-wing palace stood in place of Tata Castle at that time; however, neither the results of the excavations led by her nor her arguments have provided irrefutable evidence supporting this theory.[121] Shortly after that, in 1397, the king (Sigismund of Luxembourg) accused István Lackfi of high treason, sentenced him to death, and confiscated his properties. Thus, the area became a royal property, where Sigismund had his castle built in no time: the oldest document he wrote from Tata is dated to 1409, which indicates the building complex was already standing at that time.[122] Tata Castle was likely given to István Rozgonyi, *comes* of Temes, as a benefice in the early 1420s; there is no written proof of the donation, only indirect evidence in a forged charter from 1426. After the death of Sigismund, the Rozgonyis had their right to Tata renewed by Habsburg Albert in 1439. During the civil wars in the 1440s, another branch of the Rozgonyi family surfaced from the internal conflicts of the kindred as the owners of Tata Castle. King Matthias renewed the lien of the Rozgonyis in 1458 and 1459, but the building complex became royal property again in 1472.[123] At the end of his reign, Matthias gave Tata to his son, John Corvinus, who entered with the barons and prelates into a contract stating that after the death of the king, he could only keep the castles of Pozsony (Bratislava, Slovakia), Komárom, and Tata if he pays 40,000 *forint*s to them. The new king, Vladislav II, confirmed this contract,[124] and Tata Castle became a royal property again shortly after, in 1493.[125] The parliament in Tata in 1510 is also connected to his reign; this event was exceptionally important in the life of the surrounding settlements.[126] The second building phase of Tata Castle can be connected with either Matthias or Vladislav II. It cannot be dated precisely; based on historical data, the construction works were carried out between 1472 and 1510. These did not alter the original layout of the building complex but only completed it.[127] This period, the 15th and the early 16th century, was the heyday of the castle.

After the Battle of Mohács, a military function was added to the formerly representative building. The Ottomans occupied it first in 1529, only to give it immediately to their vassal,

[118] IVO site ID No. 32378.
[119] *Schmidtmayer 2015; Gillich 2019*. Besides, among others, Sarolta Szatmári, the leading archaeologist of the excavations, also delved into the topic (see, e.g., *B. Szatmári 1974; B. Szatmári 1975; Szatmári-Bíró 1977; B. Szatmári 1979; B. Szatmári 1982*). For a detailed description of the early research history, see *Schmidtmayer 2015* 9–10.
[120] *Schmidtmayer 2015* 206.
[121] *B. Szatmári 1974* 50–51; *Gillich 2019* 59.
[122] *Schmidtmayer 2015* 36, 183.
[123] *Schmidtmayer 2015* 47, 99; *Gillich 2019* 53–54.
[124] *Neumann 2010* 66–67.
[125] *Schmidtmayer 2015* 109.
[126] *Neumann 2010* 78–79.
[127] *Gillich 2019* 62–63.

Szapolyai. During the 1543 military campaign, the Ottomans occupied the small forts in the region one by one, and the garrison of Tata handed over the castle without a fight; next, the Ottomans seriously damaged and left it. A longer Ottoman occupation started in 1558, which ended with the army of Eckhard Salm reconquering the castle in 1566. As the defensive facilities of the building complex were highly outdated at the time, an outer defence line comprising a rondel, bastions, and a moat was constructed around it (based on written sources) between the 1550s and 1586.[128] Independent of these constructions, the castle changed hands multiple times during the 16th century.[129] The building complex became ruined in the wars and no longer held an important role in the military conflicts of the following centuries.[130] The last Ottoman occupation lasted from 1683 to 1685.[131] After the wars, the castle and the estate became the property of the Esterházy family, who remained owners until 1945. The current look of the building complex is the result of 18th–19th-century transformations connected to the Esterházys.[132]

Initially, the castle was a side residence of the king for a long time. According to the available sources, Sigismund visited Tata twenty-five times during his life, and the castle was a venue of diplomatic events more than once.[133] When owned by the Rozgonyis, the Tata Castle was likely the main residence of the family.[134] King Matthias visited Tata less frequently than Sigismund: he only stopped there seven times to rest during hunts and travels, which indicates a decrease in the significance of the place. In the short time of John Corvinus's ownership, the castle could serve as the centre of the related estate; after that, when it became a royal property again, it became again a side residence of the king.[135] Vladislav II visited Tata quite often, altogether fourteen times, and the castle served as the venue of a parliament during his reign. The importance of the place decreased again at the time of Louis II, who, according to written sources, only visited the castle twice.[136]

The castle was first investigated, with relatively small trenches, by Endre Bíró in 1962;[137] however, the bulk of the information available on it comes from the systematic excavations led by Sarolta Szatmári in 1965–1972, focusing on the medieval building complex and its moat. Parallel with the excavations, the reconstruction of the castle also started. Szatmári published her most important findings in numerous studies[138] but the vast find material has remained unpublished. The most recent excavations in the area of the castle started in 2023; Mihály Giber and his team focused on the Ottoman Period gateway and mill. The results of the project are yet to be published.[139]

[128] *Buzás 2010* 93; *B. Szatmári 1974* 48; *Bíró 1968; Bíró 1979* 189.
[129] *Tóth 1998*.
[130] *Gillich 2019* 55, 64.
[131] *Bíró 1979* 199.
[132] *Gillich 2019* 57.
[133] *Gillich 2019* 53.
[134] *Schmidtmayer 2015* 208–214.
[135] *Gillich 2019* 54.
[136] *Neumann 2010* 78–79.
[137] The excavation was carried out in the context of water pipe network construction works. Endre Bíró opened six trenches to investigate the area concerned, including the row of pillars in front of the lakeside wing, the chapel, the southwestern wing, the moat, and the rondel. The fieldwork was scarcely documented (*Bíró 1963* 76; *Bíró 1970*).
[138] *B. Szatmári 1971; B. Szatmári 1974; B. Szatmári 1975; Szatmári-Bíró 1977; B. Szatmári 1979; B. Szatmári 1982*.
[139] Bianka Gina Kovács participates in the projects as a consultant.

Agostyán [1440: *Abosthyan*]

The settlement first appears in a perambulation in 1343 as the property of Miklós, son of Domonkos, and Pál Tulok, son of Péter. Pál Tulok is mentioned in multiple documents in the following period, and a 1352 charter reports that he had killed Miklós, son of Domonkos and entered into an inheritance contract with his son and widow. The ownership of the settlement remained disputed, concluding in a litigation in 1366, which ended in the division of the estate in 1367. The related charters report on meadows, pastures, forests, vineyards, a castle site, and a church. Documents from the rest of the century mention the settlement multiple times, always in the context of its ownership.[140] The Tulok family likely died out in the early 15th century, and the village became the king's property. After that, it is only mentioned in 1440 as one of the estates belonging to Tata Castle; Queen Elisabeth donated it to Kelemen of Újtata in the same year. The settlement appears in 1489 already as the property of the Kovácsi family.[141] According to the 1541 porta register, the village was still owned by a noble family and inhabited (the source mentions three houses and two new, six poor, and ten abandoned ones);[142] after that, it disappears from the sources. It was only resettled in the 1730s.[143]

No medieval settlement site is known in the territory of the recent village. Éva Vadász and Gábor Vékony found a medieval pottery fragment (amongst other finds) on Hárshegy on the southern outskirts of Agostyán;[144] besides, the collection of the Kuny Domokos Museum in Tata holds a medieval vessel collected on the site and donated to it.[145] The castle mentioned by written sources could not be located yet.

Grébics [1440: *Gerebech*, 1449: *Gerebich*, 1459: *Gerebech*]

Grébics first appears in documents from 1237–1240 as a neighbour of Tömörd and a dwelling of royal equerries. The 1284 and 1291 perambulations of Billeg and Mocsa, respectively, also mention the village. After that, it appears next only in a 15th-century document as an estate of Tata Castle.[146] Based on the 1541 porta register, it was still inhabited at the time (with four houses, seven poor, and two new ones, and two serfs);[147] it likely became deserted in the second half of the century. A manor stood in the place, Grébicspuszta ['deserted Grébics'] in the Modern Period,[148] and the related domenial map features a ruin marked *'rudera antique ecclesie',* perhaps the remains of the medieval church of the one-time settlement *(fig. 15)*.[149] This building does not appear anymore on later maps.

During a surface find collecting survey, Éva Vadász and Gábor Vékony registered in an elongated, about 800 m long spot the traces of a late medieval[150] settlement covering a hilltop on the outskirts of Naszály, along the dirt road connecting the northwestern corner of Lake Asszony and Felső-Grébics, south of the modern manor, along the southwestern bank of the wide Grébicsi víz ['Grébics Water'].[151] This site can likely be identified as the late medieval Grébics village.

[140] See *Tóth 2013* 89–90 for details.
[141] *Schmidtmayer 2015* 241.
[142] Porta registers (*MNL OL* E 158) at https://adatbazisokonline.mnl.gov.hu/adatbazis/dikalis-osszeirasok.
[143] *Fényes 1848* 174; *Pesty 1977* 55–57.
[144] Inv. No. KDM 71.33.24. The site is not registered in IVO.
[145] Inv. No. KDM 51.384.1. The vessel was not found upon checking the find material.
[146] *Schmidtmayer 2015* 240–242.
[147] *MNL OL* E 158, 95–107.
[148] *Fényes 1848* 191.
[149] *Schmidtmayer 2013* 55.
[150] KDM Archaeological Data Archive 158-69; IVO site ID No. 44649 Felső-Grébics-puszta 1 (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=44649.
[151] Inv. Nos. KDM 71.4.1–19.

They also found two other medieval sites, a 13th–14th-century and an Árpád Age one, at 800 and 1500 m distances in the north, respectively.[152]

Kovácsi birtok [1440: *Kowachy*]

The settlement first appears in written sources in the 14th century, the 1343 perambulation of Agostyán and documents from 1364, 1379, 1388, and 1389, in context with its owners, the Kovácsi family.[153] It is only mentioned in a 1440 charter as the propriety of Tata Castle. Csánki supposed that the village was partially owned by the castle and partially by a noble family; it is a question, however, if Tata's 'ownership' was actually only a legal claim.[154] Various members of the Kovácsi family also appear in 15th-century documents, the latest of which is dated to 1489, when the Kovácsi manor was seemingly pawned for some time by Mihály Újszászi, castellan of Komárom.[155] No 16th-century mention is known of the settlement, which disappeared completely from written sources after that.

The one-time Kovácsi was located at the Öregkovács-domb [Öregkovács Hill] on the eastern outskirts of the recent Baj village. Sándor Petényi unearthed there an Árpád Age round church with a 15th–16th-century manor house in its vicinity. The excavation did not cover the settlement surrounding the church, and the extent of the medieval settlement was not determined either.[156]

Naszály [1449: *Naztan*]

The first written mentions of Naszály are dated to the second half of the 13th century: the settlement appears in the 1269 perambulation of Sárföld and the 1284 perambulation of Billeg. It was the joint property of István *de genere* Csák and the abbey of Tata back then.[157] Later, in the mid-15th century, it is mentioned as an estate belonging to Tata Castle. In 1502, Oszkár Korlátkövi had a mill built above Naszály in the territory of Újtata;[158] this is the last mention of the settlement in the 16th century. It only appears again in the 1635 porta register as a newly (re)settled estate of the castle; half a household was recorded there in 1639, and four households in 1648.[159]

No archaeological site is known in the built-up area of the current settlement. Two Árpád Age sites were located west of it, along the Naszály–Grébicsi-vízfolyás (a stream), during surface find collecting surveys in 1968 and 2012.[160] Moreover, the 1968 surveys resulted in identifying several Árpád Age sites, with a ca. 300 m long settlement with 11th–14th-century find material and the traces of a relatively large stone building (perhaps a church) among them, at Almáspuszta on the northern outskirts of the village.[161]

For the sites around Grébicspuszta, see Grébics.

[152] IVO site ID No. 44651 Felső-Grébics-puszta 2; 44659 Billegi csatornaőrség, temető [Billegi channel guard, cemetery] (source: IVO database, https://www.oeny.hu/oeny/ivo).

[153] *Tóth 2013* 93–94.

[154] *Schmidtmayer 2015* 240–242, see also *Csánki 1985* 505.

[155] *Petényi – Sabján 2003* 129–132.

[156] *Petényi 2010* 8–10; IVO site ID No. 26736, Öregkovács-hegy (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=26736).

[157] *Györffy 1987* 443.

[158] *Schmidtmayer 2015* 241.

[159] Porta registers (E 158) at https://adatbazisokonline.mnl.gov.hu/adatbazis/dikalis-osszeirasok.

[160] IVO site ID No. 44637 Tatai út melléke 2, 80271 Nyúl-hegy.

[161] KDM Archaeological Data Archive 158-79. The six sites mentioned in the field diary have not been registered in IVO. The find material recovered from them is currently part of the collection of the Kuny Domokos Museum, under Inv. Nos. KDM 70.12.1–14, KDM 70.13.1–12, KDM 71.45.8–12, KDM 71.51.6–9, KDM 71.56.3–7, KDM 71.57.1–4, KDM 71.59.8–11, and KDM 71.62.7–9.

Ótata [1440, 1449: *Otata*, 1459: *Thata*]

Sarolta B. Szatmári and, more recently, Richárd Schmidtmayer summarised the medieval history of the settlement;[162] therefore, only a brief overview based on their work is presented here. The toponym 'Tata' first appears in the 1093 property register of the Abbey of Pannonhalma in context with the Benedictine abbey.[163] The earliest settlement core (in the area of today's Kossuth Square) could have emerged next to this abbey (somewhere in the area of today's Fürdő or Nagykert streets).[164] Due to excellent conditions, already two 'Tata' settlements, Ótata ['Old Tata'] and Újtata ['New Tata'], existed in the area in the 13th century; besides, Alsófalu and Felsőfalu were likely also in their vicinity.[165] All villages were the abbey's property until 1254 when the Csák kindred occupied the area of Tata. King Charles I obtained the area from them in an exchange of land in 1326.[166] A major figure of the period, Tamás of Csór, castellan of Csókakő, was donated a palace and a mill site in the settlement next to the Benedictine abbey.[167] Ótata was granted market town rights in the second half of the 14th century, likely between 1357 and 1387.[168] The area could be donated to the Lackfi family in the second half of the 14th century, who made it to their estate centre. After the family fell from favour in 1397, the estate became the property of Sigismund of Luxembourg, who had the castle, serving as a royal side residence, built there in a short time; this step – as indicated by the fact that from 1402, Újtata also appears in sources as a market town – fundamentally determined the later development of the region.[169] The settling of the Franciscan order shortly later, in the first half of the 15th century, also reflects the increasing importance of the town.[170] For about fifty years in the mid-15th century, the owner of the castle and its estates was the Rozgonyi family.[171] King Matthias took back from them the castle, together with Ótata and Újtata, in 1472, and it remained a royal property until 1526, save for a short period when John Corvinus owned it. That it was the venue of the parliament in 1510 also shows the importance of the castle and the settlement; this event also promoted the development of the market towns. This fruitful period ended in the mid-16th century, when, as a result of the devastation caused by the Ottoman army, the region became practically deserted, the Benedictine abbey and the Franciscan monastery ceased to exist, and life in the towns became reduced for many decades until their revival in the 17th century.[172] The last document to mention the two settlements is the 1541 porta register, where they appear as Tata (with 28 households, seven poor and twelve deserted ones, one owned by the overseer of the castle, seven *domus dominorum,* as well as a household and six poor ones owned by the abbey) and Tótváros (with 12 households, eight poor, five deserted, and four new ones, as well as four owned by the overseer of the castle).[173] Tata appears next in the 1635 porta register as occupied (with eight households, 27 serfs, and three deserted).[174]

[162] For a detailed history of the town, see *B. Szatmári 1979, Szatmári 2004*, and a recent work by Schmidtmayer *(Schmidtmayer 2011).*
[163] *F. Romhányi 2000* 66; *Schmidtmayer 2011* 192.
[164] *Szatmári 2004* 37.
[165] *B. Szatmári 1979* 139.
[166] *Schmidtmayer 2011* 192.
[167] *Györffy 1987* 459; *Tóth 2013* 94–95.
[168] *Szatmári 2004* 34.
[169] *Schmidtmayer 2011* 192.
[170] *B. Szatmári 1979* 167.
[171] *Schmidtmayer 2011* 192, 195–196.
[172] *B. Szatmári 1979* 148–150.
[173] *MNL OL* E 158, 95–107.
[174] Porta registers (*MNL OL* E 158) at https://adatbazisokonline.mnl.gov.hu/adatbazis/dikalis-osszeirasok.

The remains of the medieval Ótata are under the built-up area of Tata today. While systematic excavations were conducted in Tata Castle for decades, the market town was researched in only a few trenches of considerable size *(fig. 14)*.

The medieval parish church of Ótata was localised under Kossuth Square, the current main square of the town. While the attempt of Sándor Petényi in 1994 to find the ruins in test trenches remained unsuccessful,[175] Richárd Schmidtmayer excavated the area in 2015 and discovered the foundations of a late medieval church transformed into Baroque style, with some 17th–18th-century graves and a crypt around them. Based on written sources, this church, devoted to St. Blaise *[Balázs]* served the community populating the town after its devastation in the Ottoman Period. However, the original church building was a late medieval one with a polygonal sanctuary, which Schmidtmayer identified, based on its size and the lack of medieval burials around it, as the Chapel of the Holy Mary (a building appearing in several late medieval documents) instead of the medieval parish church.[176]

Archaeological monitoring was conducted in limited areas on a plot east of Kossuth Square, first by Sarolta Szatmári in 1974 and recently by Bianka Gina Kovács in 2016. The fieldworks brought Late Árpád Age and late medieval settlement features to daylight.[177] Settlement features have also been identified in another plot southwest of the main square,[178] while Sándor Petényi found an almost complete Late Árpád Age pot and medieval potsherds while monitoring gas pipe construction-related earthworks in the northeastern part of the square (at the start of Rákóczi Street) in 1994.[179] Simultaneously, Julianna Kisné Cseh unearthed fourteen graves at the Hősök Square-side end of Rákóczi Street. Traces indicating a cemetery there had also been found in Hősök Stuare before: according to a report from 1913, human bones and the remains of old Hungarian garments, hair pins, combs, and diverse jewellery items were discovered during the landscaping works carried out within the frame of the reconstruction of the place; regrettably, neither the finds nor any description or image of them have persisted.[180]

Also in context with the 1994 gas pipeline construction, Julianna Kisné Cseh unearthed an Árpád Age house and a furnace in Fürdő Street, north of Kossuth Square. Research had already been conducted earlier in plots of the street: in 1976, Sarolta Szatmári carried out an excavation under No. 16, bringing to light a section of a Roman road, plenty of 13th–15th potsherds, and a late medieval pot which was found upside down with the skeleton of a kitten within. Simultaneous research in Katona Street also yielded medieval pottery in abundance.[181]

Also, in 1976, a rescue excavation was carried out in the Wagner-fürdő [bath]; according to historical tradition, this building was originally the so-called Burgundia Mill of the Benedictine order.[182] However, the research did not identify any trace of medieval constructions there.[183] Fürdő Street is also important because, according to historical tradition, the Benedictine abbey was in the vicinity. Stone carvings and the gravestone of tailor Márton Szabó and his wife, with two skeletons underneath, were discovered during the construction of a cellar there in 1912. The Byzantine pectoral reliquary cross donated to the collection of the local museum had likely been also found there. Based on that, the area has been accepted to have been the place of the

[175] *Kisné Cseh – Petényi 2004* 12–13.
[176] *Schmidtmayer 2016* 268–269.
[177] *Kisné Cseh – Petényi 2004* 17; *Kovács 2018*.
[178] Tata, Kossuth tér 10/b.
[179] Inv. Nos. KDM 2017.3.1–9.
[180] *Kisné Cseh – Petényi 2004* 10–11. They were probably the remains of a modern cemetery.
[181] *Kisné Cseh – Petényi 2004* 18.
[182] *Rados 1964* 127.
[183] *Kisné Cseh – Petényi 2004* 17–18.

Benedictine abbey for more than a century.[184] Several unfurnished graves were disturbed on the plot while digging a lime pit in 1964; regrettably, only a short written report is available on the discovery.[185] To authenticate the site, Sándor Petényi opened exploratory trenches on the courtyard of the plot under No. 24, the opposite plot, and the street before the plot under No. 26. He only found modern features and find material, thus failed to confirm the location of the medieval abbey.[186]

During the construction of Május 1. Road in 1979, two houses were demolished on the plots under 34 and 36 Nagykert Street, revealing the detail of a graveyard cemetery with eighty graves. Based on the grave goods, the cemetery could have been in use already in the 11th century, but 13th–14th-century artefacts have also been recovered from the burials. About one in every three graves was a built one; the relatively high proportion of built graves is characteristic of the cemeteries of Benedictine abbeys, which raised the possibility that the Abbey of Tata could be near this site. Besides the graves, the excavation on the plots brought to light the remains of a relatively large (probably medieval) building and medieval pits.[187]

Several Árpád Age sites which cannot be connected with any settlement mentioned in written sources have been identified on the outskirts of Tata during surface find collecting and site authentication surveys: János László found an Árpád Age site north of the built-up area in 2009, while Melinda Koller discovered an Árpád Age, three 13th–14th-century, and a small Árpád Age and late medieval site in 2015–2016 during surface find collecting surveys on its northern outskirts.[188] Similar surveys yielded two more sites along the Fényes-patak[189] in 2020, as well as the scattered traces of a medieval settlement in the area of Asszony-tó [Lake Asszony] on the western outskirts of the town in 1968[190] and a late medieval site west of it in 2019.[191] Several Árpád Age settlement sites are known in the area of the industrial park on the southern and southwestern outskirts of the settlement; excavated features (the remains of an oven and a house) are known from one,[192] while two more were likely inhabited, even if with only low intensity, both in the Árpád Age and the Late Middle Ages.[193]

The dredging works of Öreg-tó in 1972 also brought to light Árpád Age finds in the southern shore zone around the estuary of the Által-ér. At least a part of these were certainly washed and

[184] See *Kovács – Líbor 2023* 233 for details.
[185] KDM Archaeological Data Archive 97–73.
[186] *Kisné Cseh – Petényi 2004* 13–14.
[187] *Kovács – Líbor 2023.*
[188] IVO site ID No. 73465 Mocsai úti-dűlő, 90111 Mocsai úti-dűlő II, 90113 Komáromi-útmenti-dűlő, 90115 Mikoviny-ároktól DNy-ra, 90117 Mikoviny-ároktól ÉK-re; 92047 Réti-major (source: IVO database, https://www.oeny.hu/oeny/ivo).
[189] IVO site ID No. 97331 Fényes-patak I, 97333 Fényes-patak II (source: IVO database, https://www.oeny.hu/oeny/ivo).
[190] *Kisné Cseh – Petényi 2004* 18.
[191] IVO site ID No. 95127 Miklósi-határ (source: IVO database, https://www.oeny.hu/oeny/ivo /lelőhely?azon=95127).
[192] IVO site ID No. 54102 Hereföldek, 59796 Site 1/1998, 64374 Bánhidai úti dűlő I, 64382 Bánhidai úti dűlő II, 73469 Halasi-tó, 90107 Káposztás-völgy, 34594 Tervezett ipari park [Future Industrial Park] Site I. lelőhely, 34595 Tervezett ipari park [Future Industrial Park] Site II, 34598 Tervezett ipari park [Future Industrial Park] Site IV, 34659 Tervezett ipari park [Future Industrial Park] Site V, 34664, Tervezett ipari park [Future Industrial Park] Site IX. Árpád Age sites were registered during the survey in the early 2000s, but more recent surface find collecting surveys did not confirm the presence of this horizon at 64378 Kisles II and 64380 Kisles I (source: IVO database, https://www.oeny.hu/oeny/ivo).
[193] IVO site ID No. 34597 Tervezett ipari park [Future Industrial Park] Site III, 34660 Tervezett ipari park [Future Industrial Park] Site VI, 34661 Tervezett ipari park [Future Industrial Park] Site VII, 34662 Tervezett ipari park [Future Industrial Park] Site VIII (source: IVO database, https://www.oeny.hu/oeny/ivo).

deposited there by water, but it cannot be excluded either that the area had been inhabited before having been flooded during the construction of the lake.[194] In a rescue excavation in 1968, Éva Vadász and Gábor Vékony found a few early medieval potsherds at the lagoon south of the lake,[195] and in 1969, Gábor Vékony also collected some medieval fragments in the area of Pálma Szálló [Hotel Pálma] by Cseke-tó [Lake Cseke], east of Öreg-tó.[196]

Stancs [1449: *Stanych*]

The name of Stancs first appears in charters in the 13th century. The settlement was the property of Bors *comes*, who, according to a 1225 confirmation charter by King Andrew II, donated his vineyard there to the Cistercian Abbey of Borsmonostor. Shortly later, before 1233, Bors *comes* sold the village to the Csák kindred. Based on 13th–14th-century documents, the settlement was situated between Agostyán, Szomód, Almás, Neszmély, and Tardos;[197] today Dunaszentmiklós occupies these parts. The name 'Szentmiklós' first appears in charters at the end of the 14th century both as a personal name (1382, 1838: Mihály Szentmiklósi) and as a toponym, referring to an illegally taken ploughland of the Benedictine Abbey of Tata (1382, 1383: *Zenthmiklosfeulde*). However, according to the respective sources, this land lay within the borders of Tata at the time,[198] which makes its identification with Stancs village questionable, especially as the latter is mentioned in its original name amongst the estates of Tata Castle even in the 15th century.[199] There is no available information on the later history of the settlement.

Julianna Kisné Cseh localised the only medieval site known in the current built-up area of Dunaszentmiklós during a surface find collecting survey in 2006. The site lies in the southwestern part of the settlement, on top of a ridge along a former watercourse west of Tatai Road.[200] The present church of the village was built in the early 20th century, but an east-west oriented church building is marked in the area of the current cemetery both on the maps of the Habsburg Military Surveys and a cadastral map.[201] It was perhaps the church mentioned by Elek Fényes, built by the Germans resettling the village in the 1730s;[202] its orientation, however, raises the possibility of its medieval origin.

In 1870, a hoard from perhaps the time of the first Mongol invasion was found in the area, likely on the outskirts of the settlement. It comprised two Kyiv-type pectoral crosses, two processional crosses, and a cross base, most of which could be dated to the 12th century. The finds are kept in the collection of the Hungarian National Museum.[203]

Based on the above, there likely was a medieval settlement in the place of the built-up area of today's Dunaszentmiklós, and that settlement is probably identical to the medieval Stancs village mentioned in several documents.

[194] KDM Archaeological Data Archive 153–79.
[195] KDM Archaeological Data Archive 100–73.
[196] KDM Archaeological Data Archive 99–73.
[197] *Györffy 1987* 405; *Tóth 2013* 89; *PRT I* 778; *PRT II* 496; *Csánki 1985* 516.
[198] *Tóth 2013* 90, 95–96.
[199] *Schmidtmayer 2015* 240; *MNL OL DL* 14284.
[200] *Kisné Cseh 2006* 11; IVO site ID No. 56180 (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=56180).
[201] First Habsburg Military Survey (1782–1785), Second Habsburg Military Survey (1819–1869), cadastral maps (19th century). Source: maps.arcanum.hu, last accessed on 30.01.2023.
[202] *Fényes 1848* 182–183.
[203] *Lovag 1994* 191, II-5, 6, 13, 19.

Szentgyörgy [1449: *Zenthgewrg*]

The toponym first appears in 14th-century sources: King Sigismund donated his estate called Szentgyörgyteleke to palatine István Lackfi in 1389.[204] It was enlisted amongst the estates of Tata Castle in the 15th century,[205] but it was no longer mentioned later; it was likely deserted already in the 15th century.

The settlement was likely situated somewhere on the outskirts of Környe, in the land called Szentgyörgypuszta today. Surface find collecting and authentication surveys in the 2000s and 2010s have identified several Árpád Age settlements in this area, north of the modern farmstead[206] and in the territory of the industrial park.[207]

Szentiván [1440, 1449: *Zenthiwanhegye*, 1459: *zenthIwanhege*]

The Szentiván toponym first appears in a land exchange charter by King Charles I confirming that the king exchanged four of his castles and their domains in the Vértes area (Gesztes, Csókakő, Csesznek, and Bátorkő) for two castles and the related estates of the Csák kindred in Tolna County. Szentiván is mentioned there amongst the king's possessions, as it likely belonged to Gesztes at the time.[208] In the 15th century, the settlement was mentioned as an estate of Tata Castle; it likely merged with the town as it does not appear in later sources.[209]

Ákos Kiss started rescue excavations in 1956 in the context of the expansion of a stone quarry on Kálvária Hill in the southern part of Tata. Later, Alán Kralovánszky and, after him, Endre Bíró continued the fieldwork, revealing the foundations of a late medieval three-nave church, the sanctuary of which has been built into the still-standing chapel refurbed by Jakab Fellner. They also unearthed several 15th–16th-century graves southwest of the church building (the quarry later destroyed that area) and partial houses in the western zone of the investigated area. As the documentation of their fieldwork went missing, Sarolta Szatmári and Sándor Petényi conducted an authentication excavation on the site in 1994, confirming that the layout reconstruction of the church was correct and bringing more late medieval graves to daylight.[210] The church was identified as the Church of St. John the Baptist, the parish church of the village of Szentiván.[211]

Szentkirály [1449: *Zenthkyral*]

The toponym only appears in the 1449 charter, and no further information is available on it. It likely merged with Tata later.[212]

Identifying the settlement is impossible as there is no known land with a similar name in the administrative area of Tata. It was likely one of the Árpád Age sites on the outskirts of the town.

Szomód [1440, 1449, 1459: *Zmold*]

The name of the settlement appears first in a 1225 charter where King Andrew II confirms that Bors *comes* donated land to the Abbey of Borsmonostor. The abbey was given land and a meadow

[204] *Tóth 2013* 94; *Schmidtmayer 2015* 206.
[205] *Schmidtmayer 2015* 240–242.
[206] IVO site ID No. 73017 Szentgyörgypusztai temető, 28845 Közép-dűlő, 73021 Közép-dűlő (source: IVO database, https://www.oeny.hu/oeny/ivo).
[207] IVO site ID No. 90101 Liszkai-dűlő, 59482 Szentgyörgypuszta-Rikkantó, 59481 Szentgyörgypuszta-Kövecses dűlő, 57958 Ipari Park [Industrial Park] Site 1/2005, 57963 Ipari Park [Industrial Park] Site 5/2005 (source: IVO database, https://www.oeny.hu/oeny/ivo).
[208] *Tóth 2013* 94; *Schmidtmayer 2015* 226.
[209] *Schmidtmayer 2015* 240–242.
[210] *Kiss 1957* 48; *Kiss 1958* 52; *Bíró 1959* 69; *Petényi – Szatmári 1997* 111.
[211] *Schmidtmayer 2011* 195.
[212] *Schmidtmayer 2015* 242.

next to the *grangia* and the orchard they established, as well as a mill next to the manor of the Abbey of Tata, a mill site, and a forest. Shortly after, still before 1233, Bors *comes* sold the estate to Pós of the Csák kindred. A charter dated 1237–1240 mentions the village as a neighbour of Füzitő, while the 1269 perambulation of Sár mentions it as the joint property of Ugrin, son of Pós, and the provost of Majk. The settlement had many owners in the 14th century: it was the joint property of Tamás and Péter, sons of Farkas son of Frank Szécsényi of the Kancsics family,[213] while in 1349, it appears again as owned by the provost of Majk, while in 1364, it was already a possession of palatine Miklós Kont.[214] It was listed amongst the estates of Tata Castle in the 15th century.[215] The village was still inhabited during the census made for the 1541 porta register (with six households, fifteen poor and four abandoned ones, as well as one belonging to the overseer);[216] it became abandoned likely when the whole region was deserted shortly later, as the 1570 tax register of the Esztergom *sanjak* enlists it already as deserted.[217] Mátyás Bél mentions the fish pond of the village and a mill sited on it and connects the ruins in the area to King Matthias.[218] According to the description by Elek Fényes, the pond had already been drained in the mid-19th century.[219] Frigyes Pesty believes that the settlement had its own parish church from 1660.[220]

A medieval site was found east of the built-up area during the 1968 surface find collecting survey; the 2008 test excavation there brought to light features of an Árpád Age settlement, likely destroyed during the first Mongol invasion.[221] Another site was also identified on the eastern outskirts of the recent village during the 1968 survey,[222] while both that and the 2005 inspection yielded traces of several medieval settlements along the Árendás-patak south of the built-up area,[223] including an Early Árpád Age and a 12th–13th-century site on the northern bank of the westward-flowing watercourse.[224] László Ferenczi believes that the Cistercian *grangia* and mill, mentioned in 13th-century charters, must be somewhere in the vicinity of the two latter sites.[225] The remains of the late medieval village are probably under the current village; however, the archaeological evidence of that has yet to be found.

Szőlős [1440, 1449, 1459: *Zewles*]

A Szőlős village in Komárom County appears already in 13th-century sources, but it cannot be the settlement in the focus of our study as it was situated north of the Danube. The Szőlős in question only appears in charters in the 15th century and exclusively in context with the estate

[213] *Györffy 1987* 456–457.
[214] *Csánki 1985* 154.
[215] *Schmidtmayer 2015* 240–242.
[216] *MNL OL* E 158, 95–107.
[217] *Fekete 1943* 172.
[218] *Bél 1989* 80–81.
[219] *Fényes 1848* 187.
[220] *Pesty 1977* 213.
[221] *Kisné Cseh 2009* 298–299; IVO site ID No. 60254 Tókút (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=60254).
[222] IVO site ID No. 63560 Bocska-hegy (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=63560). The site is registered as late medieval, but the inventoried find material is Árpád Age and 18th-century (Inv. No. KDM 71.48.3–6).
[223] IVO site ID No. 63574 Árendás patak III, 50990 Site 1/2005, 50992 Site 2/2005, 50994 Site 3/2005 (source: IVO database, https://www.oeny.hu/oeny/ivo). The archaeologist, specialised in prehistory, who identified the sites reports on a late medieval horizon on Sites 2 and 3/2005; this could not be confirmed due to a lack of find material.
[224] IVO site ID No. 63590 Szomódi-vízfolyás, 63594 Sóstó 2005 (source: IVO database, https://www.oeny.hu/oeny/ivo). The latter is registered as a late medieval settlement, but its find material is Árpád Age (Inv. No. KDM 70.9.23–25).
[225] *Ferenczi 2010* 128, figs. 4–5.

of Tata Castle. Its name indicates that it was a dwelling of royal service people.[226] Based on the 1541 porta register, the settlement was still inhabited then (with eight households, six poors, five deserted, and a new one),[227] but became abandoned during the Ottoman Period, and the 1570 Ottoman tax register mentions it as already deserted.[228] Mátyás Bél reports that the abandoned village had been resettled by Slovaks seventy years before he collected data on the region (that is, around the mid-17th century),[229] while Frigyes Pesty believes that the repopulation started around 1670, and the place had been deserted before that.[230]

Only one medieval site is known in the area of the current village: sewer pipe construction works disturbed a west-east oriented grave in front of 15 Széchenyi Street. The grave finds included a grape bunch pendant earring, based on which the archaeologist inspecting the discovery dated the feature to the 10th century.[231]

Remains of an Early Árpád Age cemetery were unearthed during the construction of Motorway M1 on the western outskirts of the village. No excavation could be conducted on the site, as the archaeologists inspecting it could only observe disturbed graves with an east-west orientation and collect two S-terminalled braid rings, based on which they suspected that a relatively small cemetery had been destroyed in the area.[232]

Several Árpád Age sites have been registered along the Által-ér on the southern outskirts of the current village. Some were partially excavated, but the recovered find materials have yet to be evaluated.[233]

During a site inspection in 2005, Julianna Kisné Cseh registered a settlement site with Árpád Age and late medieval horizons on the northern outskirts of the current village in Homoki-dűlő, on the southern bank of the small stream arriving from Lake Barabás and discharging into the Által-ér.[234] No related find material was found in the collection of the museum, and the identification of the site as Szőlős village mentioned by medieval documents is highly doubtful.

Újtata [1440: *Wytata*, 1449: *Vytata*]

The medieval history of the settlement is intertwined with that of Ótata; therefore, its high points are presented there.

The late medieval Újtata was probably situated somewhere in the area of today's Tóváros district of Tata. However, this area has not been explored at all, and no medieval features are known from there. Sarolta Szatmári excavated a child's grave on Ady Endre Street (the main street) in 1970,[235] and there are some accounts of graves that have been disturbed during the construction of Fényes Áruház (a shopping centre), but these were destroyed without professional

[226] *Schmidtmayer 2015* 241.
[227] *MNL OL* E 158, 95–107.
[228] *Fekete 1943* 183.
[229] *Bél 1996* 105.
[230] *Pesty 1977* 216.
[231] *Vadász 1971* 82; IVO site ID No. 50536 M1 autópálya [Motorway M1] (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=50536).
[232] *Vadász 1971* 82; IVO site ID No. 50532 M1 autópálya [Motorway M1] (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=50532).
[233] IVO site ID No. 50546 Pusztaremeteség, 57966 Tüskés 1, 57961 Vasútvonal mente 1, 57964 Vasútvonal mente 2, 57962 Felső-Réti-föld 1, 101292 Vasútvonal mente 4. Excavated sites: 50538 M1-es műút 2, 57959 Tüskés 2, 59695 Vasútvonal mente 3, 70123 Hosszú-dűlő.
[234] IVO site ID No. 51009 Site 9/2005. The site is registered to Tata, but its polygon is marked in the administrative area of Vértesszőlős (source: IVO database, https://www.oeny.hu/oeny/ivo/lelőhely?azon=51009).
[235] Based on a drawing found amongst the personal notes of Sarolta Szatmári.

excavation and documentation.[236] Based on the above, the Franciscan monastery or the parish church devoted to the Holy Mary could have been standing once in the area. Two 15th-century potsherds got into the museum's collection from the courtyard of the Capuchin church and convent north of the Fényes Áruház;[237] according to local tradition, the Capuchin monks arrived in Tata in 1734 and built their convent near the one-time Franciscan monastery. The data collection published by Adolf Mohl includes a report on that in 1882, the start of the Budai-utca (Budai Street, today: Ady Endre Road) between the Capuchin church and Menich's pharmacy was dug up in preparation of the planting of trees, and "vast foundations were discovered" during the works.[238] The described area today is the place in front of Fényes Áruház. East of that, in the courtyard of the Vaszary School, the remains of a building with a polygonal ending but not oriented east-west were discovered; these were largely destroyed later during the construction of the one-time barracks and the school.[239] Richárd Schmidtmayer believes the remains may have belonged to the modern Chapel of St. Joseph.

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[236] *Szatmári 2004* 37.
[237] Inv. no KDM 81.244.1–2: side fragment of a yellow pot and a red, pierced pitcher handle fragment.
[238] *Mohl 1906* 92–94.
[239] KDM Data Archive Inv. No. 2024.25

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	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Total (kg)
Feature no.	12	18	1	1	1	1	
Stratigraphic unit	SE-85	SE-44	SE-04	SE-04	SE-04	SE-30	
Date of sampling	08.04.2016.	13.04.2016.	07.04.2016.	07.04.2016.	07.04.2016.	08.04.2016.	
Pre-processing weight (kg)	0.93	0.406	0.568	0.564	1.136	1.362	4.966
Description of sample	cereal and ash in a fireplace	cereal and ash in a ploughshare	ash layer	ash layer	ash layer	ash layer	
Dating	Late Árpád Age (13th–14th century)	Late Árpád Age (13th–14th century)	14th century	14th century	14th century	Late Árpád Age (12th–13th century)	
Accompanying finds							
Charcoal	Charcoal (0.5–30 mm): 6 g	Charcoal (small, max d=7 mm): 157 g		Charcoal (small, 1–5 mm): 0.01 g	Charcoal (small, 1–5 mm): 0.5 g	Charcoal (small, 2–20 mm): 2 g	
Weight of charcoal powder and sand		354 g					
Weight of daub, no charcoal			11 g	24 g	25 g	75 g	
Weight of seed and daub fragments		22 g					
Pottery vessel fragments (2 side, 1 bottom)			3 pcs.				
Pottery vessel fragment (side and bottom)				1 pc.	2 pcs.		
Great ramshorn (Planorbarius corneus) shells						1 pc.	
Bone (fishbone?)					1 pc.		
Daub fragments						85 g	
Calcined bone fragments (5, 20 mm)						2 pcs.	

Table 1. Processed soil samples from Tata, 16 Kossuth Square. (©Katalin Julianna Szilvási)

Latin name	English name	Remain type	Condition	Habitat ecogroup	Family	Habitat/ distribution
Avena sativa L.	oat	nude caryopsis (*caryopsis nuda*)	charred	9.1.	*Poaceae* (grasses, *pázsitfűfélék*)	-
Avena sativa L.	oat	hulled caryopsis (*cum caryopse corticata*)	charred	9.1.	*Poaceae* (grasses, *pázsitfűfélék*)	-
Agrostemma githago L.	common corncockle	seed	charred	9.3.	*Caryophyllaceae* (pink/carnation family, *szegfűfélék*)	Eurasian
Alchemilla vulgaris agg.	lady's mantle, lion's foot	acorn	charred	8.2.		Euro-siberian
Avena fatua L.	common wild oat	nude caryopsis (*caryopsis nuda*)	charred	9.3./9.2.	*Poaceae* (grasses, *pázsitfűfélék*)	Eur-asian-(Mediterranean)
Brassica cf. campestris L. (syn. Brassica rapa L. subsp. campestris)	bird's rape	seed	charred	9.3.	*Brassicaceae* (mustards/crucifers/ cabbage family, *káposztafélék*)	European-Mediterranean
Camelina microcarpa Andrz.	littlepod false-flax	seed	charred	8.3./9.3.	*Brassicaceae* (mustards/crucifers/ cabbage family, *káposztafélék*)	Eurasian-continental
Cerealia (Secale/ Triticum/Hordeum)	cereals	caryopsis fragment (szemtöredék)	charred	9.1.	*Poacea*e (grasses, *pázsitfűfélék*)	
Cerinthe minor L.	lesser honeywort	nutlet	charred	8.2./9.3.	*Boraginaceae* (borage/ forget-me-not family, *borágófélék*)	Pontic-Mediterranean
cf. Atriplex patula L.	spear saltbush or common orache	seed	charred	9.2./10.1./ 10.3.	*Amaranthaceae* (amaranth family, *disznóparéjfélék*)	European circumpolar-(Mediterranean)
Chenopodium album L.	lamb's quarters, goosefoot, melde	seed	charred	10.2./9.3./ 9.2.	*Chenopodiaceae* (goosefoots, *libatopfélék*)	Eurasian-(Mediterranean)
Chenopodium hybridum L.	maple-leaved goosefoot	seed	charred	9.2./9.3.	*Chenopodiaceae* (goosefoots, *libatopfélék*)	Eurasian-(Mediterranean)
Diplotaxis muralis (L.) DC.	annual wall-rocket	seed	charred	9.3./10.3.	*Brassicaceae* (mustards/crucifers/ cabbage family, *káposztafélék*)	Eurasian-sub-Mediterranean
Echinocloa crus-galli (L.) P. B.	cockspur	nude caryopsis (*caryopsis nuda*)	charred	9.2./10.1.	*Poaceae* (grasses, *pázsitfűfélék*)	cosmopolitan
Fallopia convolvulus (L.) A. Löve	wild buckwheat	nutlet	charred	9.3.		Eurasian-Mediterranean
Hordeum vulgare L. ssp. polystichum (cf. tetrastichum)	multi-row barley	hulled caryopsis (*cum caryopse corticata*)	charred	9.1.	*Poaceae* (grasses, *pázsitfűfélék*)	-
Lepidium draba L.	whitetop, hoary cress	seed	charred	9.2./9.3./ 10.2.		Eurasian-Mediterranean
Linum usitatissimum L.	flax, linseed	seed	charred	9.1.	*Linaceae* (lenfélék)	-
Medicago lupulina L.	black medick	seed	charred	8.2./9.2./ 9.3.	*Fabaceae* (legume family, *pillangósvirágúak*)	Eurasian-Mediterranean
Melampyrum arvense L.	field cow-wheat	seed	charred	9.3.		European-(Mediterranean)
Melilotus officinalis (L.) Pall.	sweet yellow clover	seed	charred	8.2./9.3.	*Fabaceae* (legume family, *pillangósvirágúak*)	Eurasian-Mediterranean

Table 2. Archaeobotanical remains from Tata, 16 Kossuth Square. s=summer-flowering; w=winter; per=perennial; s/w=summer/winter; w/per= winter/perennial (©Katalin Julianna Szilvási)

Height	Classification of Flowering Plant	Effects	Sample 1		Sample 2		Total
			Count	Note	Count	Note	
medium/ tall	s	Source of iron, manganese, and zinc. Sedative, diuretic, anti-rheumatic. It can also be used as a bath. It reduces uric acid.	137		68		205
medium/ tall	s	Source of iron, manganese, and zinc. Sedative, diuretic, anti-rheumatic. It can also be used as a bath. It reduces uric acid.	2				2
medium	w				1		1
medium	per		3				3
tall	s		1		5		6
tall	s		5				5
short	w		1				1
			307		601		908
medium	per		1				1
medium	s	Source of vitamin C	1				1
medium	s		907		1		908
medium	s		325				325
short	s		1		2		3
tall	s		2				2
medium/ tall	s		1				1
medium/ tall	s		9				9
medium	per	To improve spleen and liver function and purify blood. External use: for face.			1		1
tall	s	Prevents arteriosclerosis and blood clots. For constipation and rheuma. Softens skin.	2				2
short	s		10				10
short	s	Poisonous			2		2
tall	w		5				5

Latin name	English name	Remain type	Condition	Habitat ecogroup	Family	Habitat/ distribution
Panicum miliaceum L.	millet	nude caryopsis (*caryopsis nuda*)	charred	9.1.	*Poaceae* (grasses, *pázsitfűfélék*)	Eurasian
Papaver somniferum L.	breadseed poppy	seed	charred	9.1.	*Papaveraceae* (poppy family, *mákfélék*)	-
Poa annua L.	annual meadow grass	caryopsis nuda (csupasz szemtermés)	charred	10.2.	*Poaceae* (grasses, *pázsitfűfélék*)	cosmopolitan
Polygonum cf. mite	marsh persicaria	seed	charred	2.3./8.1./9.2./ 9.3./10.1.	*Polygonaceae* (knotweed family, *keserűfűfélék*)	
Raphanus raphanistrum	wild radish, white charlock, jointed charlock	seed	charred	9.3./10.2.	*Brassicaceae* (mustards/crucifers/ cabbage family, *káposztafélék*)	
Reseda lutea L.	yellow mignonette	seed	charred	9.3./10.2.	*Resedaceae* (*rezedafélék*)	South-Eurasian-Mediterranean
Secale cereale L.	rye	nude caryopsis (*caryopsis nuda*) fragment	charred	9.1.	*Poaceae* (grasses, *pázsitfűfélék*)	-
Setaria lutescens (Weigel) Hubbard (syn. S. glauca)	yellow foxtail	nude caryopsis (*caryopsis nuda*)	charred	9.2./9.3.	*Poaceae* (grasses, *pázsitfűfélék*)	cosmopolitan
Setaria verticillata (L.) R. et Sch.	bristly foxtail	nude caryopsis (*caryopsis nuda*)	charred	9.2./9.3.	*Poaceae* (grasses, *pázsitfűfélék*)	cosmopolitan
Setaria viridis (L.) PB./ verticillata (L.) R. et Sch.	bristly foxtail	nude caryopsis (*caryopsis nuda*)	charred	9.2./9.3.	*Poaceae* (grasses, *pázsitfűfélék*)	Eurasian
Stachys annua L.	annual yellow woundwort		charred	8.1./9.2./ 9.3.	*Lamiaceae* (mint/ deadnettle/sage family, *árvacsalánfélék*)	sub-Mediterranean-European
Trifolium arvense L.	hare's-foot clover, oldfield clover	seed	charred	9.3.	*Fabaceae* (legume family, *pillangósvirágúak*)	Eurasian-(Mediterranean)
Trifolium pratense (L.) Kelch	red clover	seed	charred	8.2./9.3.	*Fabaceae* (legume family, *pillangósvirágúak*)	Eurasian-(Mediterranean)
Triticum aestivum L. subsp. vulgare (Vill.) MacKey	wheat	nude caryopsis (*caryopsis nuda*)	charred	9.1.	*Poaceae* (grasses, *pázsitfűfélék*)	-
Vicia cracca L.	tufted vetch, cow vetch, blue vetch	seed	charred	9.3./8.1.		European circumpolar
Cereal semolina porridge	semi-coarse semolina (d=7 mm)	fragment	charred			
Indet.	not determinable	fragment	charred	diverse	diverse	
Total (remains)						
Total (species)						
Seed concentration						
Proportion (Sample 4/1)						

Continuation of Table 2.

Height	Classification of Flowering Plant	Effects	Sample 1		Sample 2		Total
			Count	Note	Count	Note	
medium	s		7745	of that 10 pcs. burnt into a conglomerate	4		7749
tall	s	Main ingredient is morphine (pharmaceutical industry). The most powerful analgesic. Codeine: not a drug, but has harmful effects when used long-term. Cough suppressant (paralyses). Narcotine: relieves bronchospasm, does not paralyse. Papaverine: antispasmodic. For stomach cramps, kidney stones, intestinal spasms, menstrual cramps, gallstones. In the past the immature poppy head was given to children for calming them down and put them to sleep, but it is harmful!	1				1
short	w		1				1
			1				1
			1				1
medium	w/per		1				1
tall	s/w		358		189		547
medium/ tall	s		4				4
medium	s				1		1
medium	s		6				6
short	s	Its tea is effective against respiratory diseases. In the past it was used for epileptic seizures and colds.	7		1		8
short	s		1				1
short	w		1				1
medium/ tall	s/w		30	of that 24 oval and 6 round	352	of that 337 oval and 14 round	382
tall	per		1				1
					2		2
			8	+ 14 g seed fragments		+ 22 g daub and seed fragments	8
			9 886		1 230.00		11 116
			30		13		
			10613.98		2795.57		
			32.26		23.01		

Sample No.	ID	Type	Latin name	English names	Count	Note
1.	1.	Charcoal		charcoal	1346	Assorted small fragments.
	1.1.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 19 × 8 × 6 mm, examined section size 11 × 6 × 6 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.2.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 10 × 9 × 9 mm, examined section size 7 × 8 × 9 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.3.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 20 × 5 × 5 mm, examined section size thin section 10 × 5 × 5 mm, diffuse-porous, without heartwood. Alternate *phyllotaxis* (discernible bud remain). Sample condition: good.
	1.4.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 12 × 9 × 5 mm, examined section size 9 × 9 × 5 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.5.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 17 × 9 × 7 mm, examined section size 9 × 9 × 5 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.6.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 12 × 6 × 6 mm, examined section size 8 × 6 × 6 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.7.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 20 × 8 × 3 mm, examined section size 11 × 8 × 3 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.8.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 16 × 5.5 × 5.5 mm, examined section size 9 × 5.5 × 5.5 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.9.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 8 × 6 × 4 mm, diffuse-porous,aggregate rays. Sample condition: good.
	1.10.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 10 × 5 × 5 mm, thin section 4 × 5 × 5 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.11.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 9 × 6 × 6 mm, diffuse-porous,aggregate rays. Sample condition: good.
	1.12.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 8 × 6 × 5 mm, diffuse-porous, aggregate rays. Sample condition: good.
	1.13.	Charcoal	*Alnus glutinosa*	common alder	1	Sample size 16 × 8 × 4 mm, thin section 10 × 5 × 4 mm, diffuse-porous, aggregate rays. Sample condition: good.
	2.	Charred caryopsis	*Panicum miliaceum*	millet	8	
	3.	Charred caryopsis fragment	*Cerealia*	cereal	2	
	4.	Charred seed fragment	*Chenopodium sp.*	goosefoot	5	
2.	1.	Charcoal	*Charcoal*	charcoal	27	Small piece.
	1.1.	Charcoal	*Acer sp.*	maple	1	Sample size 1 × 2 × 2 mm, diffuse-porous, pores widely spaced with frequent twin vessels. Sample condition: good.
	1.2.	Charcoal	*Acer sp.*	maple	1	Sample size 1 × 3 × 2 mm, diffuse-porous, with twin vessels. Sample condition: good.
	1.3.	Charcoal	*Acer sp.*	maple	1	Sample size 1 × 2 × 1 mm, diffuse-porous, with twin vessels. Sample condition: good.
	2.	Charred caryopsis fragment	*Cerealia*	cereal	94	Small fragments.
	3.	Charred caryopsis	*Triticum aestivum*	common wheat	1	
	4.	Iron fragment		iron fragment	8	

Sample No.	ID	Type	Latin name	English names	Count	Note
3.	1.	Bone fragment		bone fragment	2	
	2.	Daub		daub	8	
	3.	Snail shell fragment		snail shell fragment	2	
	4.	Seed	*Portulaca oleracea*	common purslane, little hogweed	1	Perhaps contamination.
	5.	Charcoal		charcoal	12	Small piece.
	6.	Metal sheet fragment		metal sheet fragment	1	
4.	1.	Daub		daub	5	
	2.	Bone fragment		bone fragment	4	
	3.	Iron fragment		iron fragment	2	
	4.	Charcoal		charcoal	34	Small pieces with oak remains amongst them.
	5.	Eggshell fragemnt		eggshell fragment	1	
5.	1.	Daub		daub	13	
	2.	Charcoal		charcoal	110	Small, only a few mm; based on cross- and radial sections, mostly oak.
	2.1.	Charcoal	*Quercus sp.*	oak	1	Sample size 1 × 2 × 0,2 mm, ring-porous. Sample condition: good. Too small for species identification.
	3.	Bone fragment		bone fragment	4	
	4.	Charred seed fragment	*Chenopodium sp.?*	goosefoot	1	Highly fragmentary; based on size and shape, perhaps a goosefoot species.
6.	1.	Charcoal		charcoal	426	Assorted small fragments with many bark fragments; mostly oak.
	1.1.	Charcoal	*Quercus sp.*	oak	1	Sample size 6 × 4 × 2 mm, examined section size 5 × 4 × 1 mm, ring-porous, earlywood and latewood are easy to distinguish. Sample condition: good.
	1.2.	Charcoal	*Quercus sp.?*	oak	1	Sample size 9 × 3 × 2 mm, thin section 4 × 3 × 2 mm, ring-porous, earlywood and latewood are easy to distinguish. Sample condition: good.
	1.3.	Charcoal	*Quercus sp.*	oak	1	Sample size 10 × 3 × 1 mm, thin section 8 × 3 × 1 mm, ring-porous, earlywood and latewood are easy to distinguish. Sample condition: good.
	1.4.	Charcoal	*Quercus robur*	oak	1	Sample size 10 × 3 × 1 mm, thin section 5 × 3 × 1 mm, ring-porous, earlywood and latewood are easy to distinguish. Sample condition: good. A single tree ring is discernible on the section.
	2.	Daub		daub	30	
	3.	Bone fragment		bone fragment	2	
	4.	Fish scale		fish scale	1	
					2171	

Table 3. Wood remains from Tata, 16 Kossuth Square. (©Máté Róbert Merkl)

ANTAEUS 39 (2023) 187–225

LÁSZLÓ FERENCZI – TIBOR ÁKOS RÁCZ

PEST COUNTY AND DABAS DISTRICT IN THE MIDDLE AGES A MULTIDISCIPLINARY AND GEOSPATIAL INVESTIGATION INTO THE PROBLEM OF SETTLEMENT DESERTION IN CENTRAL HUNGARY

Zusammenfassung: Die Studie befasst sich mit der Bewertung historisch-topographischer und archäologischer Daten auf GIS-Basis, mit besonderem Fokus auf der Verwaltungsregion Dabas im Komitat Pest. Die historisch-topographischen Datenbanken ermöglichen eine besonders detaillierte Rekonstruktion des Siedlungsnetzwerks ab der Árpádenzeit einerseits, und einen langfristigen, diachronen Vergleich hinsichtlich der spätmittelalterlichen und frühneuzeitlichen Epoche andererseits. Den historischen Kontext beleuchten wir anhand der archäologisch-topographischen Daten, die uns aus diversen Quellen (systematische Feldstudien, archäologische Ausgrabungen in Verbindung mit Immobilienanlagen, bzw. Forschungsarbeiten mit der Anwendung von Metalldetektoren) zur Verfügung stehen. Der erste Teil der Arbeit konzentriert sich auf den Vergleich der Daten, die uns aus verschiedenen historisch-topographischen Namensregistern des Komitats Pest (genauer gesagt des östlich der Donau liegenden Bereichs des Komitats) vorliegen, bzw. auf eine umfassende Bewertung der Siedlungshierarchie und der Entvölkerung von Siedlungen basierend auf GIS-Analysen. Im zweiten Teil der Arbeit erörtern wir am Beispiel der Verwaltungsregion Dabas die lokale Dynamik der Siedlungen anhand der aktuell vorliegenden, archäologisch-topographischen Forschungsarbeiten und des reichhaltigen archäologischen Fundmaterials, das im Rahmen von Feldbegehungen, bzw. systematischen Untersuchungen mit Metalldetektoren zutage gefördert wurde. Im Einklang mit der Tradition der archäologisch-topographischen Fachliteratur Ungarns, konzentrieren wir uns auf eine moderne Verwaltungseinheit als Subjekt unserer Forschung, die in diesem Fall der Kreis Dabas ist. Ergänzend zu den oben beschriebenen Untersuchungen, stützen wir uns auch auf die Untersuchung der uns aus mittelalterlichen Urkunden zur Verfügung stehenden topographischen Daten (mit besonderem Fokus auf den Grenzbezirken, bzw. den Straßen- und Siedlungsnetzwerken) und deren umweltbedingten Zusammenhängen. Auf Grundlage verschiedenster (historisch-topographischer, kartographischer, umweltbedingter und archäologischer) Daten und der GIS-basierten Analyse besagter Daten behandeln wir die Frage des Siedlungsverfalls und der Siedlungshierarchie im Mittelalter mithilfe eines interdisziplinären und ebenenübergreifenden (Mikroregion und Komitat) Ansatzes, bzw. analysieren das Phänomen der Streusiedlungen und Siedlungsentvölkerung in komplexer und langfristiger Hinsicht.

Keywords: geospatial analysis, archaeological topography, settlement hierarchy and desertion, metal detector surveys, Árpád Age, Early Medieval and Late Medieval Period, Pest County, Hungary

Historical topographical research

The starting point of our topographic study is György Györffy's historical topographical gazetteer of Árpád Age settlements (identified from historical documents),[1] which also includes concise introductions to the Árpád Age/early medieval[2] settlement history of each county.

[1] *Györffy 1998*.

[2] In this study, the period dating from ca. 970–1301 (the reign of the Árpád dynasty) is referred to with two interchangeable terms. In Hungarian scholarship, this phase of the Middle Ages is traditionally referred to as 'early medieval'; in international scholarship, however, the term 'high medieval' is commonly used.

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Some of Györffy's observations are worth summarising here briefly. He concluded that the 1241 Mongol Invasion caused great destruction in the settlement network in Pest County and that the subsequent second invasion in 1285–1286 also decimated the population. Consequently, many early medieval settlements became abandoned, and the remaining population fragments migrated to the other side of the Danube (that has been assumed based on 'twin' settlements, i.e., ones with identical names). Györffy also noted that estimating the magnitude of the demographic and settlement changes is problematic, difficult, or nearly impossible since both archaeological and historical records are fragmentary, and the available corpus of medieval documents, which survived from before 1241, does not allow a fine-scale reconstruction. Nonetheless, he estimated the rate of desertion based on the income registers of the Diocese of Vác (dating from 1185 and 1318, respectively) to be around 75%.[3] Furthermore, he argued that large-scale resettlement did not take place in Pest County since the topography was not suitable for the construction of stone castles (carried out within the frame of a comprehensive campaign initiated by King Béla IV in different parts of the Kingdom of Hungary) and also because of the not-so-peaceful circumstances of settling due to the presence of a Cuman population in the southern parts of the Danube–Tisza Interfluve, with centres around Kecskemét. The Cumans were invited by the king to settle depopulated areas in the region (in the final decades of the 13th century) as a protective measure against possible future attacks.

Some of these assumptions are, however, hypothetical. Györffy's calculations based on the two diocesan registers might be arbitrary, as he has taken for granted an organic, continuous, 100% population growth rate between the two dates. He ignored spatial variations, except for the area of Gödöllői-dombság [Gödöllő Hills], where, as he noted, the settlement network could have remained relatively dense (at least archival sources dating from the first half of the 14th century indicate that).[4] As for the average population per settlement, he estimated the average household number of the villages in Pest County to be around twenty. However, that was based on a few examples only, mentioned mostly in late 13th-century charters: Rákoscsaba – 18 households (1267), Csőt – 18 households (1222), (Káposztás)Megyer – 25 households (ca. 1273), and Szentdienes – 10 households (ca. 1273).[5] Some of these settlements were part of ecclesiastical estates with higher-than-average populations, and three of them appear to have been depopulated already in the 14th century, unlike many other, which prevailed but with smaller populations than before. Overall, Györffy's estimations were found to be exaggerated.[6] Early 16th-century tax conscriptions provide a lower estimate,[7] and the average household number per village was perhaps also lower in the Árpád Age.

As for the later medieval period (14th to early 16th centuries), the available historical topographical dictionary of toponyms[8] is less systematic and thorough as in the case of the Árpád Age. A full survey of the respective data was not accomplished; expecting that would be unrealistic considering how massive the body of documents from this period is.[9] Besides, the problem of late 13th–early 14th-century desertion (in context with the Mongol Invasion and the related socio-economic changes) received more attention from historians and archaeologists than the later desertion waves related to economic changes in the 14th and 15th centuries and

[3] *Györffy 1998* 503–504.
[4] *Györffy 1998* 503–504.
[5] *Györffy 1998* 507.
[6] *Vékony 2001.*
[7] *Maksay 1990.*
[8] *Csánki 1890.*
[9] However, later works *(Bártfai Szabó 1938; Bakács 1982)* provide additional data.

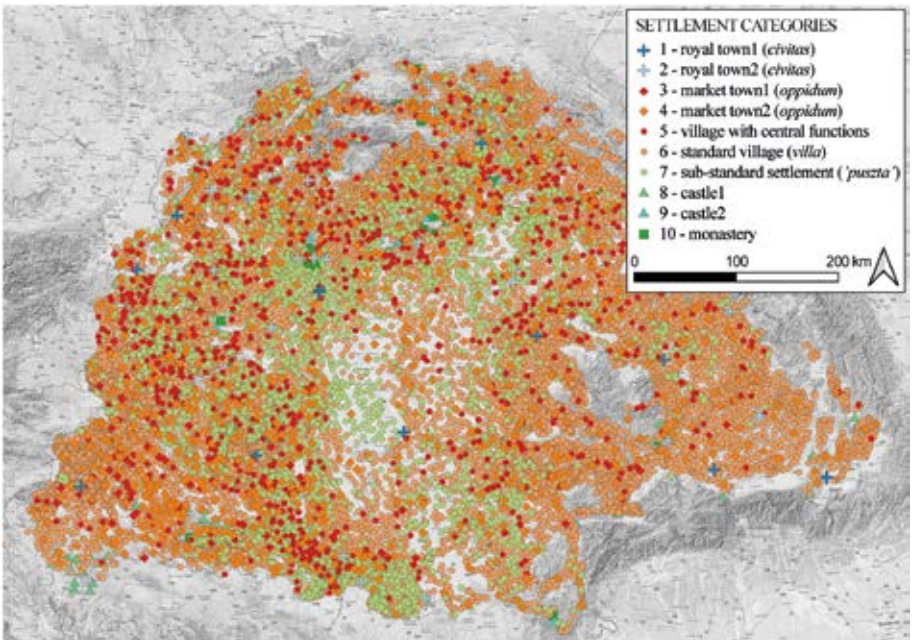

Fig. 1. Engel's system of settlement classification (©László Ferenczi after *Engel 2001*)

the destruction caused by the Ottoman wars in the 16th century.[10] The relatively more abundant Late Middle Age and Ottoman Era source material, however, allows for studying more complex processes that influenced the desertion and development of settlements: the documents of the Ottoman administration concerning taxation, military campaigns, or colonisation programmes and the various conscriptions produced by the municipal administration can be used to reconstruct internal migration. These aspects remain largely out of the scope of Árpád Age sources.

Incorporating data from these two historical-topographical gazetteers, Pál Engel compiled a digital settlement-historical database focusing on the Late Medieval Period and the early 16th century.[11] The core dataset (or starting point) of his data collection was Ottoman Period tax conscriptions, including both Ottoman and Hungarian tax records dating mainly from the mid-16th century or later. The advantage of these records for topographical reconstruction is that they provide a comprehensive, systematic view as they cover most parts of the country. Nonetheless, relying on tax conscriptions means implying a practical socio-economic filter, as only settlements with a reasonable number of taxable inhabitants, i.e., ones with an income reaching the minimum tax base were conscribed. This means that even these records were selective and do not cover every element of the former settlement network. Engel completed Hungarian data using Ottoman registers (*defter*s). Furthermore, he consulted cartographical sources and included locational data and toponyms also of those settlements that appeared on the maps of the Habsburg Military Surveys and on other 19th-century cadastral maps. He applied a classification with categories from 1 to 11 *(fig. 1),* where, in addition to castles, monasteries, towns, and market towns, he determined three types of rural settlements: villages with centrality functions (category 5: with market rights or customs), category 6: regular/standard villages, and category 7: the ones that

[10] Seminal works on the problem of settlement desertion have been published already in the 1930s, focusing mainly on demographic perspectives but also on political and socio-economic phenomena (the impact of pauperization; expansion of allodial lands; shifts in economic regimes). Cf. *Juhász 1936; Szabó 1938; Elekes 1955; Maksay 1958; Makkai 1966; Neumann 2003*. For a brief summary of the different phases of settlement desertion in Medieval Hungary in English, see *Kiss 2019* 96–100.

[11] *Engel 2001.*

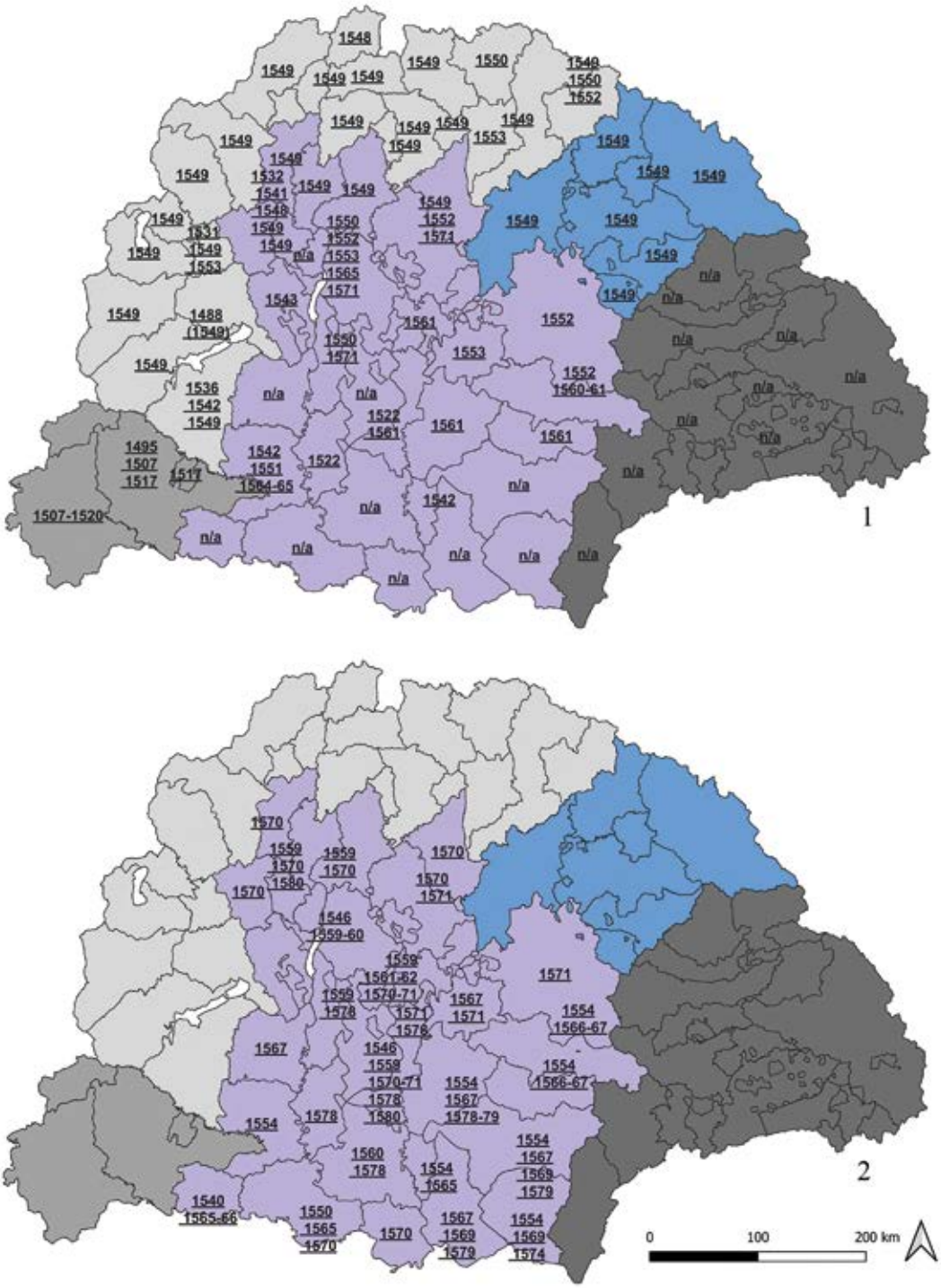

Fig. 2. 1–2. The spatial coverage of Hungarian and Ottoman tax records (with dates) in Engel's database (©László Ferenczi after *Engel 2001*)

did not appear in the tax records but could be identified as medieval or early modern settlements documented in some other sources (e.g., *defter*s, medieval charters, maps) and/or discussed by György Györffy or Dezső Csánki. Unfortunately, the digitization of the data of Hungarian tax conscriptions[12] and Ottoman *defter*s has remained incomplete. Demographic data (household

[12] *Maksay 1990.*

	19th century	16th century	14th–15th centuries	Early 11th–14th centuries
	Lipszky 1808 ('puszta/praedium')	*Engel 2001*	*Csánki 1890*	*Györffy 1998*
cat. 5	2	14	14 (100%)	14 (100%)
cat. 6	8	91	76 (83%)	74 (81%)
cat. 7	27	94	68 (72%)	66 (70%)
Total		198	200	ca. 200

Table 1. Concordance of settlement names/settlements belonging to different categories [cat. 5, 6, and 7] listed in the gazetteers published by *Engel 2001, Csánki 1890* and *Györffy 1998*

numbers) *(fig. 2. 1–2)* were added as attributes of settlement points only in a few counties and certain regions. In addition to the categorical classification of settlements, this is also relevant as proxy data for evaluating settlement hierarchy.

Overall, these three databases provide a comprehensive and *longue durée* view on the structure and development of the settlement network. Engel's retrogressive approach to the reconstruction of the late medieval settlement network (starting with later records and cartographical sources) is feasible considering the fragmentary or mosaic nature of the earlier data (mostly charters). The toponyms recorded in 16th-century conscriptions were instrumental for linking medieval placenames as accurately as possible with modern cartographical sources and the settlement network as we know it presently. A similar, retrogressive topographical analysis has been routinely applied in the published volumes of archaeological topographical registers, also incorporating data from historical topographical works.[13]

At first glance, the number of inventoried settlements is roughly similar in the works of Györffy, Csánki, and Engel. However, when cross-checking their data, one finds about twenty to thirty names from both the Árpád Age and the Late Medieval Period which do not show up in Engel's list. In fact, the three lists overlap only partially *(Table 1).* The underlying changes do not necessarily mean that the respective settlements were abandoned in connection with the population decrease. Apparently, it is very difficult to interpret the context of these transitions or changes precisely. Apart from demographic change, local population movements/relocation/settlement contraction occurred. The locations of disappearing placenames are problematic, unless the relations can be clarified based on cartographically documented micro-toponyms (which occasionally preserve them), or through a careful analysis of perambulations (which may provide detailed topographic information). In a few instances, where such documents were available, the approximate locations of these 'disappearing' settlements could be identified by Györffy. Conspicuously, names with a *'-telke'* ['plot of…'], or *'-földe'* ['land of...'] suffix often appear in this group,[14] indicating most probably dispersed (farmstead-like) settlements in connection with land clearing and soil amelioration/fertilisation *(terra fimata).* The disappearance of these names from later records is likely explained by the process of settlement contraction during the transition between the Árpád Age and the Late Medieval Period,[15] resulting in more compacted settlement structures, as also confirmed by archaeological excavations of rural sites.

[13] For Pest County, see *MRT 7; MRT 9* and *MRT 11.*

[14] Such as, e.g., *Teka-földje*, *Reg-telek*, *Bökény-földe*, *Tornyos-telek*, *Vernel-telke*, and *Albert-földe,* which are all situated north of the study area; see *Györffy 1998,* passim.

[15] There have been different interpretations put forward by *Györffy 1961* and *Mező 1996,* which have been briefly summarized by *Kristó 2003,* and more recently discussed in *F. Romhányi – Laszlovszky 2021.*

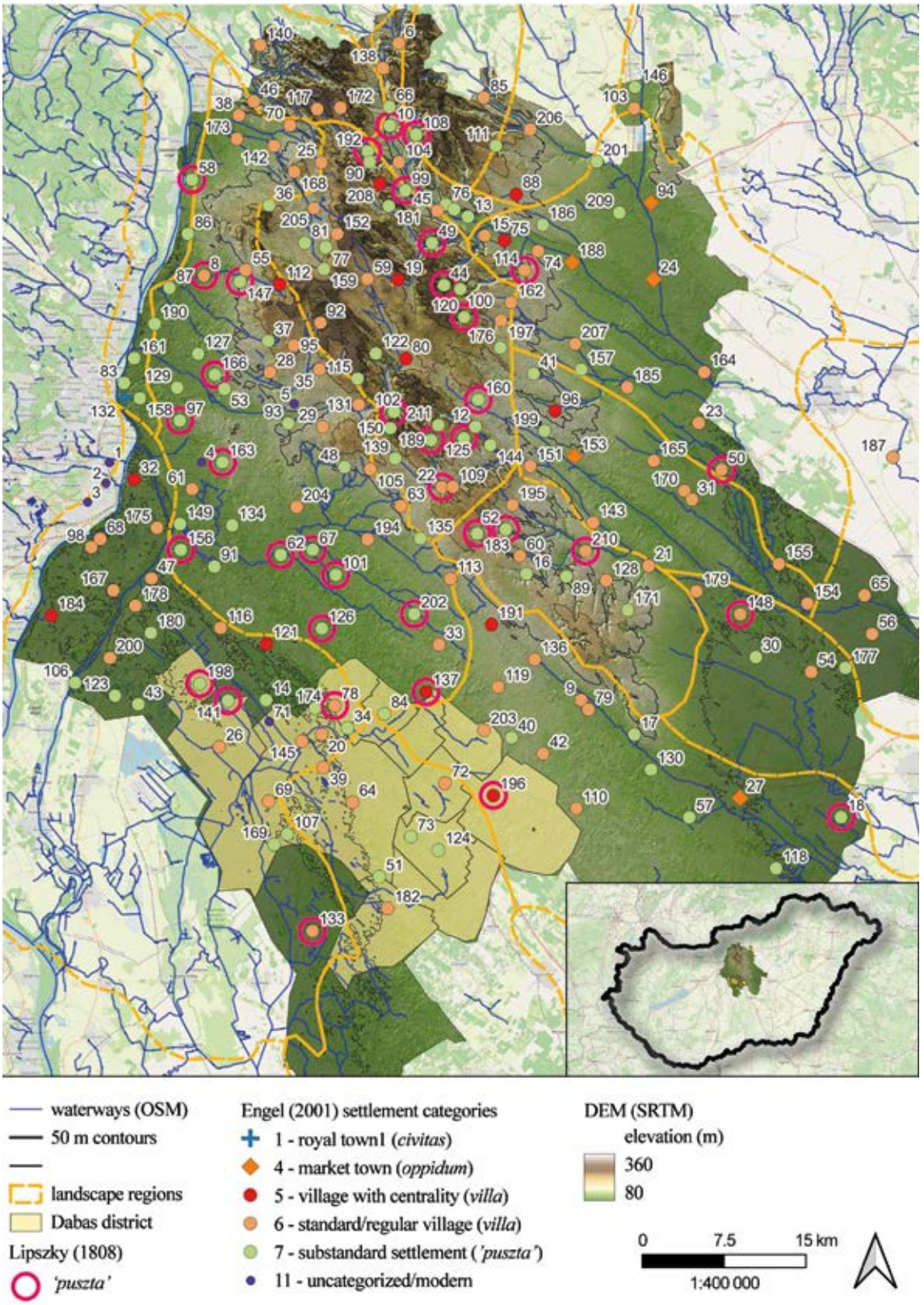
waterways (OSM)
50 m contours
landscape regions
Dabas district
Lipszky (1808)
'puszta'
Engel (2001) settlement categories
1 - royal town1 (civitas)
4 - market town (oppidum)
5 - village with centrality (villa)
6 - standard/regular village (villa)
7 - substandard settlement ('puszta')
11 - uncategorized/modern
DEM (SRTM)
elevation (m)
360
80
0 7.5 15 km
1:400 000

Fig. 3. Engel's system (after *Engel 2001*) of settlement classification, illustrated by the example of Pest County. Settlements marked as [cat. 5, 6, and 7] and referred by *Lipszky 1808* as *praedium/puszta* (after *Györffy 1998*) 1. Budapest-Rákosliget; 2. Budapest-Kispest; 3. Budapest-Budatétény; 4. Budapest-Budafok; 5. Budapest-Albertfalva; 6. Acsa; 7. Ákosmonostor; 8. Alag; 9. Alberti; 10. Almás; 11. Ancstelke; 12. Apáti; 13. Aszó; 14. Babád; 15. Bag; 16. Bénye; 17. Bercel; 18. Besenyő; 19. Besenyő; 20. Besenyő; 21. Bicske; 22. Bille; 23. Boldogasszonykáta; 24. Boldogfalva; 25. Bottyán; 26. Bugyi; 27. Cegléd; 28. Cinkota; 29. Csaba; 30. Cseke; 31. Csekekáta; 32. Csepel; 33. Csév; 34. Csíkos; 35. Csíktarcsa; 36. Csomád; 37. Csömör; 38. Csörög; 39. Dabas; 40. Dános; 41. Dány; 42. Dány; 43. Délegyháza; 44. Diód; 45. Domony; 46. Duka; 47. Dunaharaszti; 48. Ecser; 49. Egerszeg; 50. Egreskáta; 51. Eső; 52. Farkasd; 53. Farkashalom; 54. Félegyház; 55. Fót; 56. Füzesmegyer; 57. Gerje; 58. Göd; 59. Gödöllő; 60. Gomba; 61. Gubacs; 62. Gyál; 63. Gyömrő; 64. Gyón; 65. Györgye; 66. Györke; 67. Halom; 68. Háros; 69. Hartyán; 70. Hartyán; 71. Hartyán Új-. ; 72. Hernád; 73. Hetény; 74. Hévíz; 75. Hévízgyörk; 76. Iklad; 77. Iklad; 78. Inárcs; 79. Irsa; 80. Isaszeg; 81. Ivacs; 82. Jánoshida; 83. Jenő; 84. Kakucs; 85. Kálló; 86. Káposztáskesző; 87. Káposztásmegyer; 88. Kartal; 89. Káva; 90. Kér; 91. Kerekegyháza; 92. Kerepes; 93. Keresztúr; 94. Kishatvan; 95. Kistarcsa; 96. Kóka; 97. Kövérfölde; 98. Lak; 99. Liget; 100. Liget; 101. Lőb; 102. Locsod; 103. Lőrinci; 104. Mácsa; 105. Maglód; 106. Majorlak; 107. Mántelek; 108. Megyer; 109. Mende; 110. Mikebuda; 111. Mindszent; 112 Mogyoród; 113. Monor; 114. Monostor; 115. Nándor; 116. Némedi; 117. Némedi; 118. Nyárasapáti; 119. Nyáregyháza; 120. Nyír; 121. Ócsa; 122. Ökörtelek; 123. Ordasháza; 124. Örkény; 125. Oszlár; 126. Pakony; 127. Palota; 128. Páand; 129. Párdi; 130. Páty; 131. Pécel; 132. Pest; 133. Peszér; 134. Péteri; 135. Péteri; 136. Pilis; 137. Pótharasztja; 138. Püspökhatvan; 139. Püspöki; 140. Rád; 141. Ráda; 142. Rátót; 143. Ság; 144. Sáp; 145. Sári; 146. Selyp; 147. Sikátor; 148. Sőreg; 149. Soroksár; 150. Sukoró; 151. Süly; 152. Szada; 153. Szecső; 154. Szele; 155. Szelefarnos; 156. Szentdienes; 157. Szentegyed; 158. Szentfalva; 159. Szentjakab; 160. Szentkirály; 161. Szentlászló; 162. Szentlászló; 163. Szentlőrinc; 164. Szentlőrinckáta; 165. Szentmártonkáta; 166. Szentmihály; 167. Szentmiklós; 168. Szentmiklós; 169. Szentpéter; 170. Szenttamáskáta; 171. Szentvid; 172. Szilágy; 173. Sződ; 174. Szodakháza; 175. Szőlős; 176. Szörény; 177. Szőrös; 178. Taksony; 179. Tápiószentmárton; 180. Tárnok; 181. Tas; 182. Tatárszentgyörgy; 183. Tete; 184. Tököl; 185. Tótalmás; 186. Tótfalu; 187. Tótkér; 188. Tura; 189. Túz; 190. Újbécs; 191. Újfalu; 192. Újfalu; 193. Újszász; 194. Üllő; 195. Úri; 196. Vacs; 197. Valkó; 198. Vány; 199. Várak; 200. Varsány; 201. Varsány; 202. Vasad; 203. Vatya; 204. Vecsés; 205. Veresegyház; 206. Versegd; 207. Zsámbok; 208. Zsidó; 209. Zsidótelek; 210. Zsiger; 211. Zsira (©László Ferenczi)

In addition to the perspectives discussed above, it is worth exploring the concordance of the three settlement lists in more detail, focusing on Engel's three categories of rural settlements. His list includes 211 entries from Pest County, of which – besides the royal towns, the market towns, and the unclassified settlements of pre-modern origin – 198 entries represent the three above-mentioned categories. The level of concordance between these lists (or rather their differences) can be explained by multiple factors, including primarily data taphonomy (the lack of archival documents dating from earlier periods), but also administrative changes (i.e., shifting county borders; note that we did not check the available volumes of Györffy and Csánki for the counties adjacent to Pest) and different settlement historical processes. Villages with centrality functions [cat. 5] were visibly the most stable nodes of the settlement network, as all fourteen of them were referred to throughout the 11th–16th centuries. Only two, Vacs and Pótharasztja seem to have degraded into manors/dispersed settlements in the Modern Period[16] *(fig. 3);* this is perhaps because the landscape and the settlement conditions were less than favourable in Dabas district in the southern parts of Pest County (see below) and, therefore and because of the Cuman neighbours in the south, it was a generally less densely settled area.

In contrast, in the case of [cat. 6] and [cat. 7] settlements, the match between Engel's data and the earlier settlement historical evidence is only partial (ca. 70–80%). The relatively lower number of [cat. 6] settlements (regular villages) documented in the Árpád Age and late medieval records is due perhaps not just to data taphonomy but also to that some settlements had been

[16] According to the categorisation in *Lipszky 1808*.

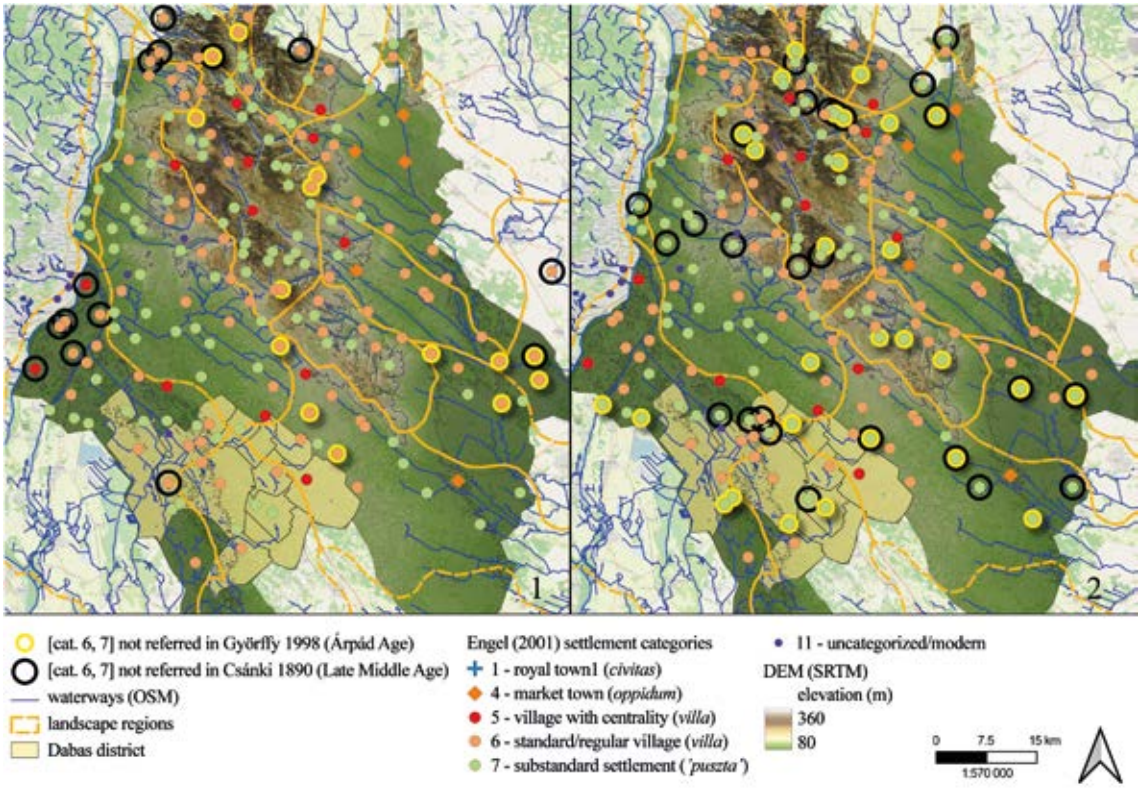

Fig. 4. 1–2. [cat. 6] and [cat. 7] settlements. The ones that do not appear in earlier sources are highlighted *(Györffy 1998; Csánki 1890)* (©László Ferenczi)

established relatively late, during the 13th century or later *(fig. 4. 1),* thus do not appear in Árpád Age or later sources and, consequently, were not included in Györffy's or Csánki's registers. When mapping this concordance or difference, the distribution of [cat. 6] settlements may also indicate the issue mentioned above (administrative changes along county borders, i.e., variation in the affiliation of settlements between different counties).

The lesser agreement (70–72%) in the case of [cat. 7] settlements may generally indicate changes of more substantial kind with regard to this category *(fig. 4. 2).* This suggests also other factors at work; however, one should be careful and keep in mind also that this category is arbitrary, representing a mix of different settlements which did not qualify as 'regular' taxpaying villages, including, e.g., dispersed and temporary settlements, farmsteads, manors, and potentially also degraded, transformed, deserted, and abandoned settlement sites.[17] In earlier sources, some may appear as 'regular' villages, which may suggest, indeed, their desertion or degradation into this 'substandard' category. Nonetheless, such diachronic interpretations can very rarely be underpinned with evidence, for most charters tend to use rather general terms *(possessio)* when referring to a settlement or 'village' and avoid using clearer categories, such as *villa, terra,* or *praedium*.[18]

Only fourteen references dating before the 16th century and specific to *praedium*s could be found in the works of Györffy and Csánki on Pest County. Gedéd (1469) and Szentgyörgy (1426) are not included in Engel's list; they became most likely abandoned and their names vanished. Bag (1430), Besnyő/*Bessenyeweghaz* (1434) – not the 'Besenyő' in Dabas district, but the other

[17] In the database, Engel describes this category generally as *'puszta'* ['abandoned/deserted land'], which may refer to agricultural farms (as on maps) and abandoned/uninhabited settlement sites.

[18] This is partly due to changing trends in terminology in the sources; see *Szabó 1966* Chapter 3, *'A villától a possessióig'* ['From the *villa* to the *possessio*'].

one near Cegléd – , Csaba(rákosa) (1267), Gubacs (1267), Némedi/Nevegy appear later as [cat. 6], and Bercel (1482), Diód (1417), Iklad (1422), Liget (1422), Soroksár (1403), Székely (1388), and Vasad (1440) as [cat. 7] settlements.[19] Some medieval documents specifically refer to deserted/abandoned settlements as well. Györgye, Szele, and Tura are known to have been temporarily deserted during the Mongol Invasion;[20] Zádog/Tatárszentgyörgy (1385) and Vány (1359) are mentioned as deserted in the 14th century, while Babli (1406), Besnyő (1410), Kér (1422) and Szentegyed (1449) were described in the 15th century[21] as *'habitatoribus/edificiis destituta', 'possessio deserta',* or *'terra vacua'*. Györgye, Szele, Tatárszentgyörgy and Vány are known to have been resettled, (documented later as [cat. 6] settlements), Babli completely vanished, while Besnyő, Kér, Szentegyed and Vány could be classified as [cat. 7]. Apparently, it is possible to collect other references, mostly from the Late Medieval Period,[22] which complement these data and illustrate better the diverse composition of Engel's [cat. 7] (*praedium*-type or else), as well as the diverging settlement historical trajectories ('external' vs 'internal' desertion) in the Árpád Age and the Late Medieval Period. However, a more comprehensive historical-topographical analysis is beyond the scope of this study and our interpretation of [cat. 7] settlements focuses on the spatial analysis of Engel's data (site concentrations and different topographical parameters).

The large-scale concentration of [cat. 7] settlements on the Great Hungarian Plain raises intriguing questions. In fact, the whole landscape of the Danube–Tisza Interfluve seems to have been populated predominantly by settlements classified as [cat. 7] based on 16th-century tax records *(fig. 1)*. How far the 16th-century settlement network (consisting predominantly of substandard settlements) could be determined by environmental factors (the steppe character of the Great Hungarian Plain with its variety of fluvial and aeolian landforms, including dunes, saline marshes, etc.)? How the so-called 'dilatory development' of the macro-region influenced it? This development was affected by historical and socio-economic factors, including the presence of Cuman ethnic elements since the late 13th century, a belated urban-economic development in the 15th century and, lastly, external factors: wars, epidemics, environmental change/climate deterioration, and the Ottoman conquest. In this context, it is particularly interesting to see that this broad settlement-historical image might also be reflected by pollen cores, which indicate decreasing cereal pollen concentration rates and increasing deforestation from around 1350–1450 to around 1450–1550,[23] hinting at environmental or anthropogenic 'degradation'.[24] In addition, cartographical and archival records also suggest that land-use patterns could have changed fundamentally by that time towards a heavy reliance on animal husbandry. This is consistent with arguments formulated by other disciplines about other regions of the Great Hungarian Plain (see the qualitative and quantitative analyses of historical or archaeozoological data).[25]

The 'meso'-scale view of Pest County shows localised concentrations of [cat. 7] settlements, which might be explained by specific local factors. The largest number of substandard settlements appears in two micro-regions: the Pesti-hordalékkúpsíkság (Pest alluvial plain) and the Gödöllői-

[19] *Györffy 1998* 510, 517, 513, 518, 527; *Csánki 1890* 25, 27, 30, 31, 33, 34, 37.

[20] Cf. *Wolf 2018* 122–123. Its impact is typical to the sites along the major salt transportation route from Szolnok to Pest.

[21] *Györffy 1998* 563; *Csánki 1890* 25, 30, 34.

[22] *Tringli 2001* 102–110.

[23] Cf. *Törőcsik – Sümegi 2019* 258–260.

[24] Another aspect of this change is the more intensive erosion and deposition of aeolian landforms due to settlement desertion and changing land-use patterns (extensive animal husbandry and increased deforestation), which could be documented also archaeologically, in soil profiles illustrating the accumulating and overlapping layers of sand that cover agricultural soils and loess. See *Lóki – Schweitzer 2001; Nyári – Rosta 2009; Nyári – Kiss 2005; Nyári et al. 2014; Knipl 2013.*

[25] *Pinke et al. 2016; Pinke et al. 2017; Csippán – Ferenczi 2020; Ferenczi 2021.*

dombság. Notably, most settlements there appear to have retained their character in later centuries, as they were mapped as *praedium* by Lipszky in 1808. In other words, the settlement hierarchy in these micro-regions seems to have remained generally unchanged since the 16th century. One may argue that these [cat. 7] settlements represent a group whose substandard/dispersed character originates from the Medieval Period. However, in other micro-regions in the south (the Pilis–Alpári-homokhát [Pilis–Alpár sand ridge], the Monor–Irsai dombság [Monor–Irsa-Hills], and the Gerje–Perje-sík [Gerje–Perje plain], a few settlements qualifying as [cat. 5 and 6] villages according to 16th-century records also became *praedia* (according to Lipszky); thus, they possibly became abandoned/were degraded sometime between the 16th and the 18th centuries, indicating a more subtle change in the settlement network in those areas.

In addition to the Pesti-sík (Pest Plain) and the Gödöllői-dombság, a concentration of [cat. 7] settlements can also be observed in the Ócsa–Dabas district, and different explanations may apply to each cluster. In the Pesti-sík, south-southeast of the market town of Pest, the concentration is likely connected to the emerging significance of Pest, a market town that started to play an important role in international cattle trade already in the 15th century.[26] The peri-urban space could be tailored gradually to suit the needs of animal husbandry by converting deserted medieval settlement sites to pastures.[27] In the case of the Gödöllői-dombság, concentrations of [cat. 7] settlements can be observed around the headwaters of local streams, in areas of relatively poor-quality soils, whereas a stable network of villages existed in the lower areas in their vicinity. In this case, [cat. 7] settlements most likely represent dispersed farmstead-type sites marking a land-use pattern that suited the local landscape. In the case of the Ócsa–Dabas district, the landownership context might have been the most relevant factor behind the observed concentration as the Premonstratensian monasteries in Ócsa and Csút, founded in the 13th century, introduced an economic regime focusing on self-sustenance. This regime was based on manorial units situated closest to the abbey site and operated by the community. The concentration of [cat. 7] settlements around Ócsa may reflect the application of this model.[28]

Paleoecological and historical ecological investigations of the Ócsa peat-bog provide an outlook on how this model fitted the landscape. A waterlogged area extends along the dunes of the Danube–Tisza Interfluve and at the border of the Duna menti síkság (Danubian Plain). According to 18th-century maps, an extensive network of lakes and marshes stretched towards the west from Ócsa, Inárcs, Kakucs and Dabas, between Bugyi, Sári, Gyón, Kunszentmiklós and Dömsöd. For the greater part of the year, this region could be approached only by boat, and one could travel between the various little islands at Bugyi and Ürbő in the direction of Kalocsa. Climate historical changes significantly influenced this landscape, causing periodical floods and the expansion of aquatic habitats. The Ócsa peat-bog is the northernmost element of this system, where palaeoenvironmental sampling and multiproxy analysis of malacological, botanical, pollen, radiocarbon, and geochemical samples from Ócsa-Selyemrét have revealed a gradual decrease in the extent of the surrounding forests between the Late Neolithic and the Early Bronze Age (probably indicating extensive pastoralism), accompanied by soil erosion, as a result of which the siltation of the bog intensified.[29] Although the most recent part (including the medieval) of the pollen sequence is missing due to modern peat extraction, medieval written sources have documented the management of wet meadows for hay transport and flood protection

[26] Cf. *Ferenczi 2021.*

[27] See, e.g., *Sárosi 2016.*

[28] However, according to *Mezey 1963,* this was an unlikely option with regard to the lands around Gyón, donated in 1264 to Csút/Csőt (in the vicinity of Ócsa), taking into account the generally declining economic potential of the model. Only that can be established that the sites listed in the document were not settled later.

[29] *Kustár et al. 2016.*

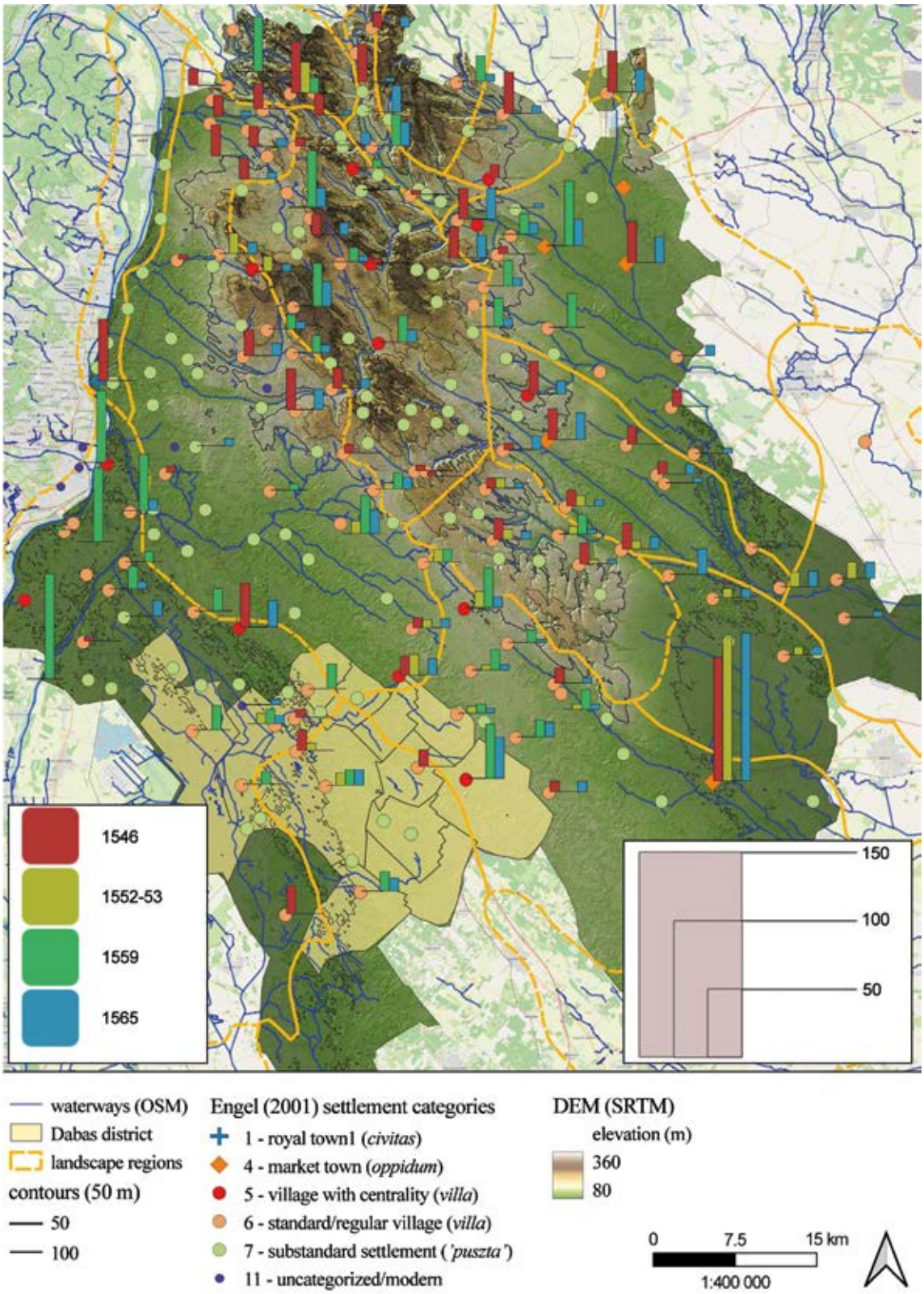

Fig. 5. Demographic data based on *Engel 2001,* complemented with data from *Maksay 1990* (©László Ferenczi)

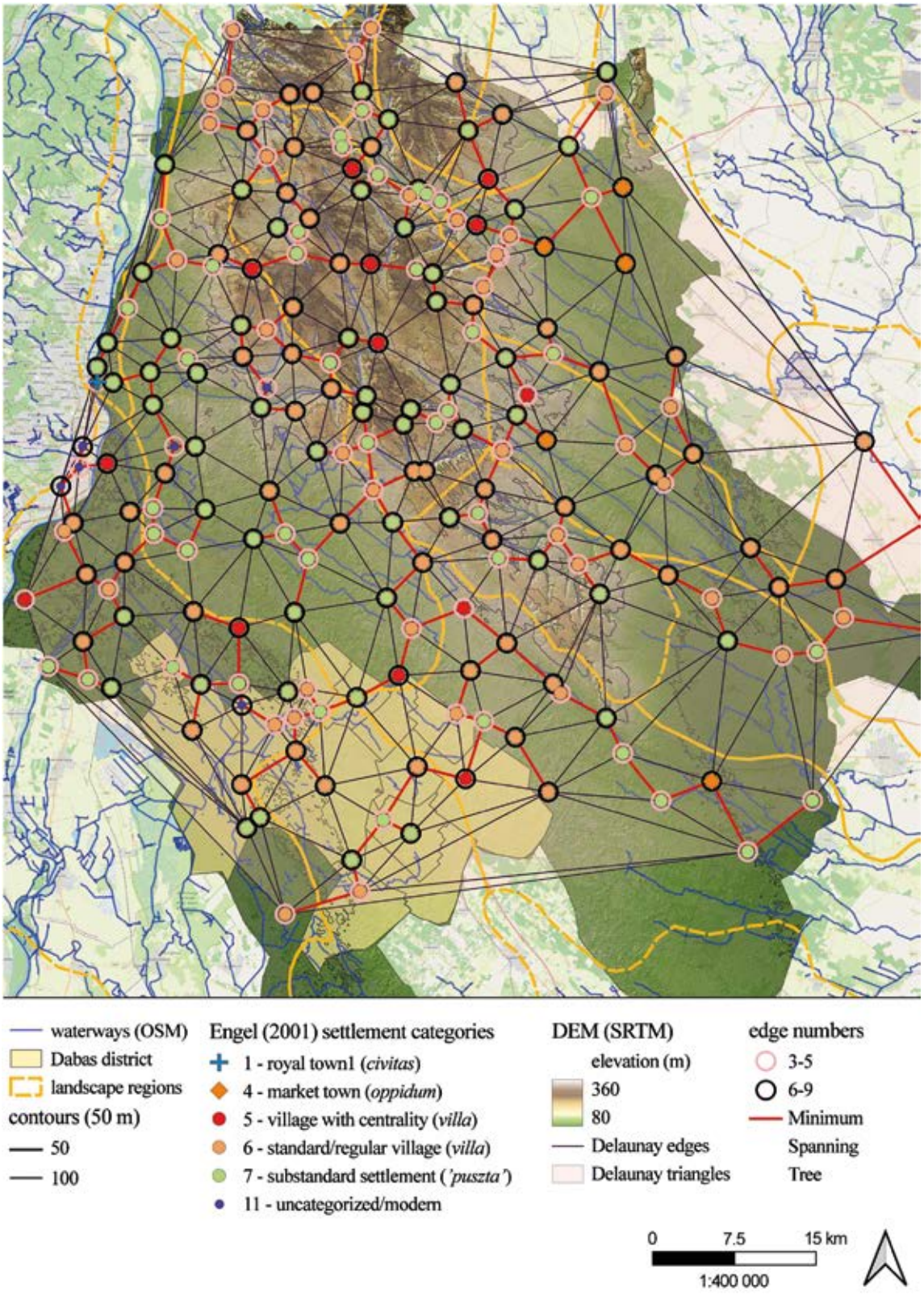

Fig. 6. Connectivity of settlements, modelled using Delaunay triangulation and minimum spanning tree algorithm to illustrate relative neighbourhood. Note also the relatively high edge numbers (connectivity) of [cat. 5] settlements, their position in the network, and vicinity to landscape boundaries (©László Ferenczi)

measures. Only in the early 19th century was a network of artificial channels (including the 150 km long Duna-völgyi-főcsatorna [Danube Valley Main Channel]) created, draining these lands and significantly changing their character. Ethnographic data and geographical toponyms from before that date, i.e., the Early Modern Period, still hint at the continuation of pastoralism there.[30]

In addition to the above-described socio-economic and environmental factors, the distribution pattern of [cat. 7] settlements (and partly the underlying problem of settlement desertion and abandonment) has to be viewed in the context of also other components of the settlement network, particularly the demographic pull factor and the centrality function. The centrality function and the topographical connectivity of certain settlements could have been an important factor in keeping population numbers stable, whereas the population of other settlements could more easily decline in periods of crisis. This dynamic 'resilience' is illustrated by both the tendentiously more stable (or even slightly increasing) number of households recorded in market towns and [cat. 5] settlements *(fig. 5)* and their modelled connectivity *(fig. 6)*. The mapped demographic data from various Ottoman Period registers from 1546–1565 show that population numbers remained relatively unchanged only in the peripheral zones of the Gödöllői-dombság and the Hatvani-sík. In contrast, in the southern parts of Pest County (mentioned above), the demographics of extant villages were very close to the state of collapse at that time (even the population of [cat. 5] settlements was low, see Pótharasztja and Vacs), whereas the population of one of the most important market towns in the region, Cegléd, kept slightly rising. This may be a marker of the impact of the Ottoman wars, namely that internal migration into the market towns intensified[31] while, at the same time, the lesser settlements around them became depopulated. Furthermore, spatial patterns of demographic data also indicate that settlements along major roads had a more stable population. In addition to demographics, the connectivity model – based on a mapping of the settlements as nodes according to the number of nearest neighbours – also shows connections with settlement status: [cat. 5] settlements with some sort of centrality function (and higher household numbers) typically have a higher number of links (i.e., are better connected in the model).

The micro-regions (natural landscapes) of Dabas district

Micro-regional classification and boundaries *(fig. 7)* are based on an arbitrary grouping of ecotopes and landscape fragments, while it is rather difficult to provide a clear definition that incorporates the different physical, biological, and cultural aspects of the landscapes. Consequently, micro-regional boundaries are fuzzy, representing transitional zones between ecotopes. Dabas district is situated at the converging boundaries of four such micro-regions *(fig. 8),* whose geomorphology and landscape character are very diverse despite the similarities in their morphogenesis (formation processes, including surface erosion and accumulation): the Csepeli-sík [Csepel Plain], the Pesti-hordalékkúpsíkság, the Pilis–Alpári-homokhát, and the Kiskunsági-homokhát [Kiskunság sand ridge]. Their boundaries do not comply with strict categorical definitions based on the homogeneity of their geology, hydrological conditions, or land cover, as each comprises a mix of heterogeneous landscape features. The district (*járás* in Hungarian) of Dabas as an administrative unit (formerly *Pesti közép járás, Alsódabasi járás*) is dissected by the Pleistocene valley of the Danube in a few kilometres-wide band, characterised by low-lying wetlands, ridges and scarps, marshes, dunes, and bogs and lakes, all shaped by fluvial influences. Such landscape elements – historically referred to as *'turján'* – extend in the south as far as Solt.

[30] *Sára 2018* 38; *'Borjújárás', 'Bika-rét'* and *'Bitófás-dűlő'* translate as 'calves path', 'bull-meadow', and 'gallows tree-field' (i.e., with pollarded trees).

[31] Cf. *Blazovich 1985* 85; *Dávid 2013* 255–256; *Mészáros – Hausfatter 1974* 219; *Pánya – Rosta 2015* 249.

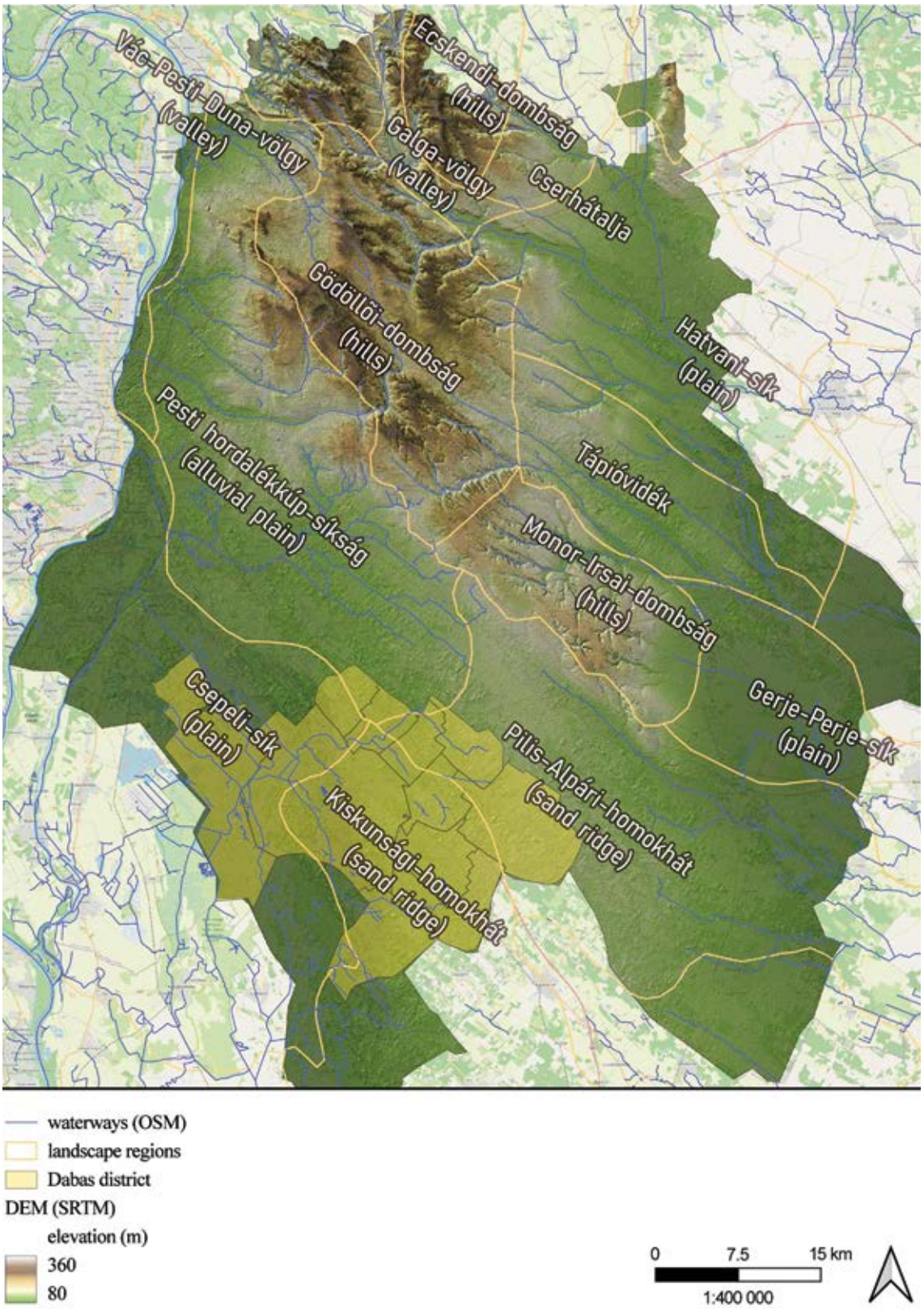

Fig. 7. Micro-regional boundaries in Pest County (©László Ferenczi)

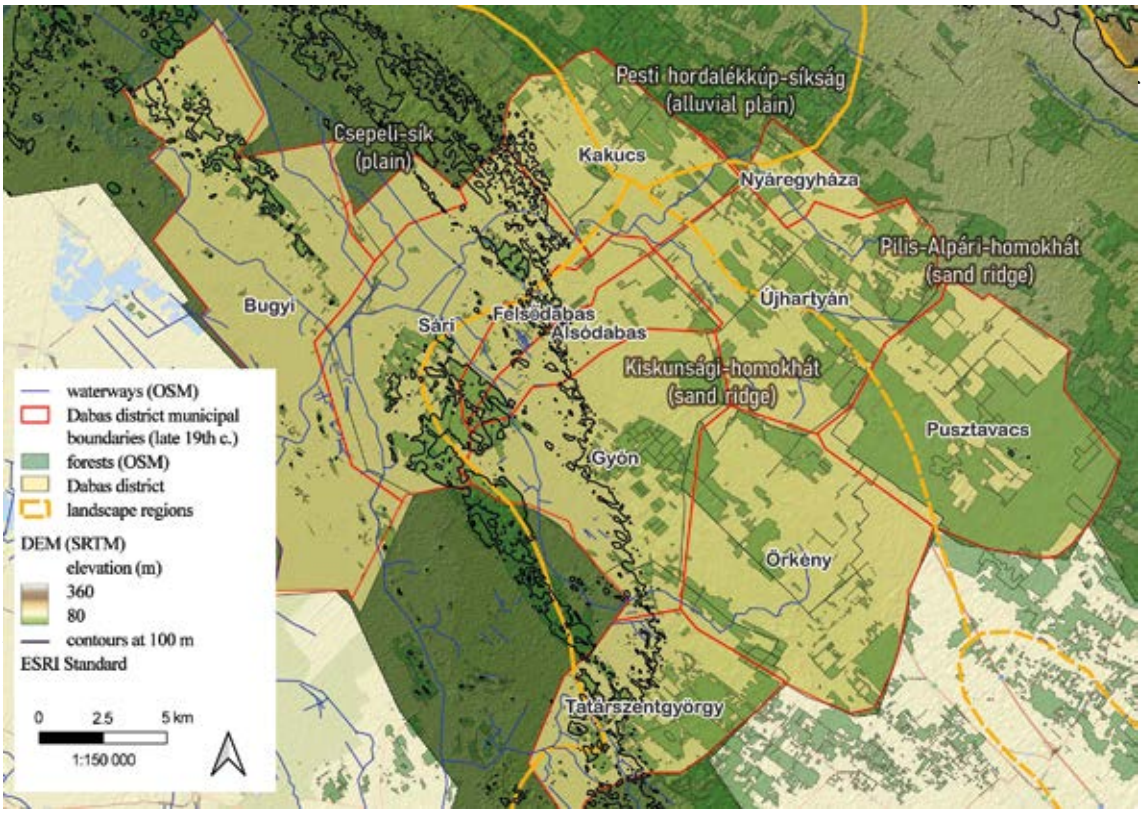

Fig. 8. Micro-regional boundaries and administrative/municipal boundaries in the study area (Dabas district) (©László Ferenczi)

Archaeological surveys

Systematic archaeological topographical investigations began with the preparation of the volumes of Archaeological Topography of Hungary; however, this programme was terminated in the 1990s, covering only some area of the county (northern and north-western parts, including the districts of Aszód, Gödöllő, Buda, Szentendre, Szob, and Vác).[33] Parallel to that, Katalin Irásné Melis[34] published a comprehensive inventory of archaeological sites within the administrative/municipal boundaries of Budapest, which has become considerably outdated. Since then, there have been attempts, in the form of multidisciplinary studies combining historical topographical data with the results of archaeological surveys, at getting a better understanding of the medieval settlement development in the region;[35] however, the scope of these surveys was rather local, did not have the resources of the Archaeological Topography project, and focused on different neighbouring regions of the Danube–Tisza Interfluve. Reconstructions of the medieval settlement network in Pest County did not look into landscape conditions or natural-environmental factors in detail. Thematic archaeological topographical works focused mostly on ecclesiastical topography and castles[36] and did not employ a holistic approach in the research of settlement networks. At the same time, the increasing role of development-led archaeology ensured a constant accumulation of archaeological data; besides, it also proved that our knowledge on the archaeological topography

[32] *Janata 2018.*
[33] *MRT 7; MRT 9; MRT 11.*
[34] *Irásné Melis 1983.*
[35] See *Bálint 1998; Bálint 2006; Pánya – Rosta 2015; Pánya 2022; Rosta 2014; Sárosi 2016.*
[36] *Tari 2000; Kovács 2022.*

of the area still has considerable gaps. For example, the evaluation of the Árpád Age material excavated in the path of the then-future motorway M0 allowed specifying the characterisation of dwelling structures and settlement forms.[37]

Our first survey in Dabas district took place in September 2008 upon public request. Since the early 2010s, there has been a growing demand from the general public to be actively involved in archaeological fieldwork. According to legislative changes introduced in 2015–2016, archaeological metal detector surveys can only be carried out under museum control; therefore, many museums organised 'friendly' metal detectorists (enthusiastic about working together with museum professionals) into active teams which provide valuable assistance in identifying and exploring sites. Since then, we have been conducting field surveys on a regular basis with the help of volunteers from the region, partly in addition to planned excavation projects. Our Community Archaeology Programme aims, in particular, to validate field data obtained by volunteers on archaeological sites, with a priority on highly vulnerable sites prone to surface erosion related to agricultural cultivation or illegal looting.[38] Systematic field surveys have been carried out formerly in the Ócsa Landscape Protection Area,[39] a natural geographic unit comprising the northern fringes of Dabas district. At present, all major medieval archaeological sites there have been identified and mapped, and the region has been systematically surveyed. Altogether, 87 sites in Dabas district could be dated to the Middle Ages. With the help of volunteers, forty new sites have been discovered, and the spatial data concerning the previously identified ones have been validated through intensive fieldwork *(fig. 9)*. These surveys allow us to draw general conclusions about the medieval inhabitation of the region, including the density and intensity of sites. One can assume that the discovery of any potentially unidentified site will not significantly alter the overall image of the settlement topography as outlined today.

Apparently, the relatively small area of the administrative district of Dabas and the number and distribution of archaeological sites within are insufficient for a quantitative spatial analysis; therefore, one has to look further to put the archaeological topographical results in context. Relying on the inventory of registered archaeological sites (using the archival database of the Hungarian National Museum), a zone-based statistical evaluation of the elevation values of site polygons (obtained from digital elevation models) representing different site groups classified as medieval (Árpád Age/Early Medieval, Medieval, or Late Middle Age)[40] has been carried out *(fig. 10)* to illustrate differences between the micro-regions in Pest County, focusing on vertical displacement, which has been studied already in other regions of the country. Data from the different plain regions in Pest County has confirmed the tendency observed elsewhere, namely that late medieval settlements were generally located on higher grounds compared to Árpád Age sites; however, in the region of the Gödöllői-dombság, this pattern could not be detected due to the entirely different character of the landscape. Furthermore, using a point pattern analysis method (hub distance measurements; *fig. 11*), it could be demonstrated that Árpád Age sites were typically closer to [cat. 7] settlements; this should be taken into consideration as another spatial parameter when characterising [cat. 7] settlements and thinking about diachronic processes which could have played a role in shaping their spatial distribution.

[37] *Rácz 2019a*.

[38] *Rácz 2019b* 150–151.

[39] *Füredi – Rácz 2021.*

[40] This categorisation is also applied in the volumes of *MRT*. 'Medieval' may refer to sites with an uncertain chronological position based on surface finds and which span over the two phases of the Medieval Period.

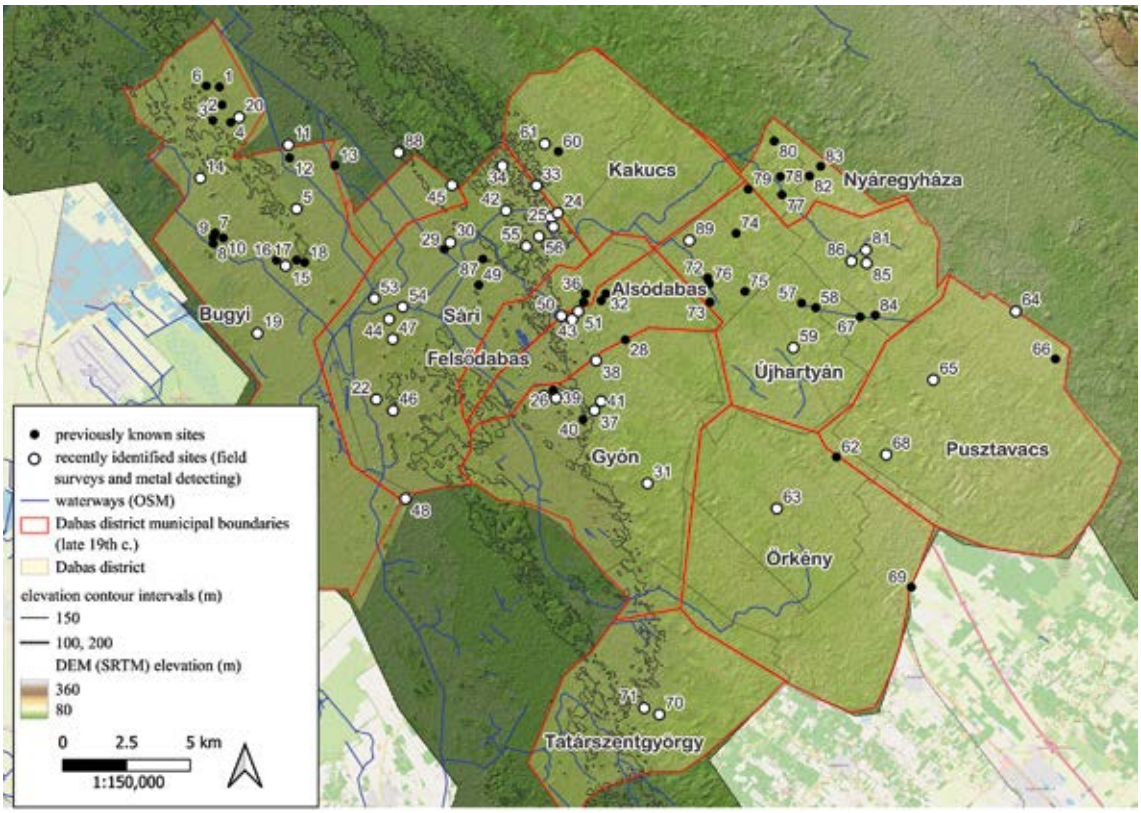

Fig. 9. Distribution of medieval sites (previously inventoried vs newly discovered) in Dabas district. 1. Bugyi-Alsóvány 1; 2. Bugyi-Alsóvány 2; 3. Bugyi-Alsóvány 4; 4. Bugyi-Alsóvány 5; 5. Bugyi-Erdőalja-dűlő; 6. Bugyi-Felsővány 1, Széles-föld; 7. Bugyi-Kender-földek 1; 8. Bugyi-Kender-földek 2; 9. Bugyi-Kender-földek 3; 10. Bugyi-Kender-földek 5; 11. Bugyi-MOL 3 Kálmán-domb; 12. Bugyi-MOL 5; 13. Bugyi-MOL 6; 14. Bugyi-Páskomi-dűlő; 15. Bugyi-Telek-puszta 2; 16. Bugyi-Telek-puszta 3; 17. Bugyi-Telek-puszta 4; 18. Bugyi-Telek-puszta 5; 19. Bugyi-Ürbőpuszta; 20. Bugyi-Vány; 21. Dabas, Belső-dűlő; 22. Dabas-Berény-dűlő; 23. Dabas-Csikós-puszta 1; 24. Dabas-Csikós-puszta 2; 25. Dabas-Csikós-puszta 3; 26. Dabas-Dabas 3; 27. Dabas-Dabas 4/1; 28. Dabas-Dabas 5; 29. Dabas-Dabas 7/1; 30. Dabas-Dabas 7/3; 31. Dabas-Esső falu; 32. Dabas-Felső Székes-dűlő; 33. Dabas-Felsőbesnyő, Besnyő falu; 34. Dabas-Felsőbesnyő, Zsolnai-tanya; 35. Dabas-Fertályos-földek 1; 36. Dabas-Fertályos-földek 2; 37. Dabas-Gyón; 38. Dabas-Gyón, Csiga-sziget; 39. Dabas-Gyón, Pap-hegy; 40. Dabas-Gyón, Telek-dűlő 3; 41. Dabas-Gyón, Telek-dűlő Templom-domb; 42. Dabas-Hosszúhát-dűlő; 43. Dabas-Közép-domb; 44. Dabas-Mántelek; 45. Dabas-Nagyturján-Városzsiget; 46. Dabas-Olaj-hegy; 47. Dabas-Pasztyérik-hegy; 48. Dabas-Pipiske-hegy; 49. Dabas-Sári vadászház; 50. Dabas-Szennyvíz-telep; 51. Dabas-Templom-domb Fertályos-földek; 52. Dabas-Templom-dombtól keletre; 53. Dabas-Vaczlau-hegy; 54. Dabas-Varjú-rét; 55. Dabas-Vencelkei-dűlő; 56. Dabas-Venczelkei-dűlő 2; 57. Hernád-MOL 1; 58. Hernád-MOL 2; 59. Hernád-Telek-dűlő; 60. Inárcs-Rákóczi utca; 61. Inárcs-Szent György-templom; 62. Örkény-Euroring mellett 1; 63. Örkény-Templom-domb; 64. Pusztavacs-Dánszentmiklós, Tetves-halom; 65. Pusztavacs-Hunyadi-tér, középkori templom; 66. Pusztavacs-MOL 1; 67. Pusztavacs-MOL 4; 68. Pusztavacs-Nagy-rét; 69. Táborfalva-Kőhalomtól északra; 70. Tatárszentgyörgy-Szelecky-tag; 71. Tatárszentgyörgy-Zádogegyháza; 72. Újhartyán-Hosszú-földi erdő 4; 73. Újhartyán-Kese-pereg; 74. Újhartyán-M5 autópálya, útdíjfizető; 75. Újhartyán-MOL 10; 76. Újhartyán-MOL 4; 77. Újhartyán-Nyáregyházi út 1; 78. Újhartyán-Pótharaszt 5; 79. Újhartyán-Pótharaszti patak 2; 80. Újhartyán-Pusztatemetői határ; 81. Újlengyel-Kosztolányi-Gudmon-dűlő; 82. Újlengyel-M5 4/28; 83. Újlengyel-M5 4/3; 84. Újlengyel-MOL 3; 85. Újlengyel-Nádi-dűlő; 86. Újlengyel-Vatya; 87. Dabas-Ménteleki u. 2.; 88. Ócsa-Kincses-hegy; 89. Újhartyán, Kántor-földek (©László Ferenczi, ©Tibor Ákos Rácz)

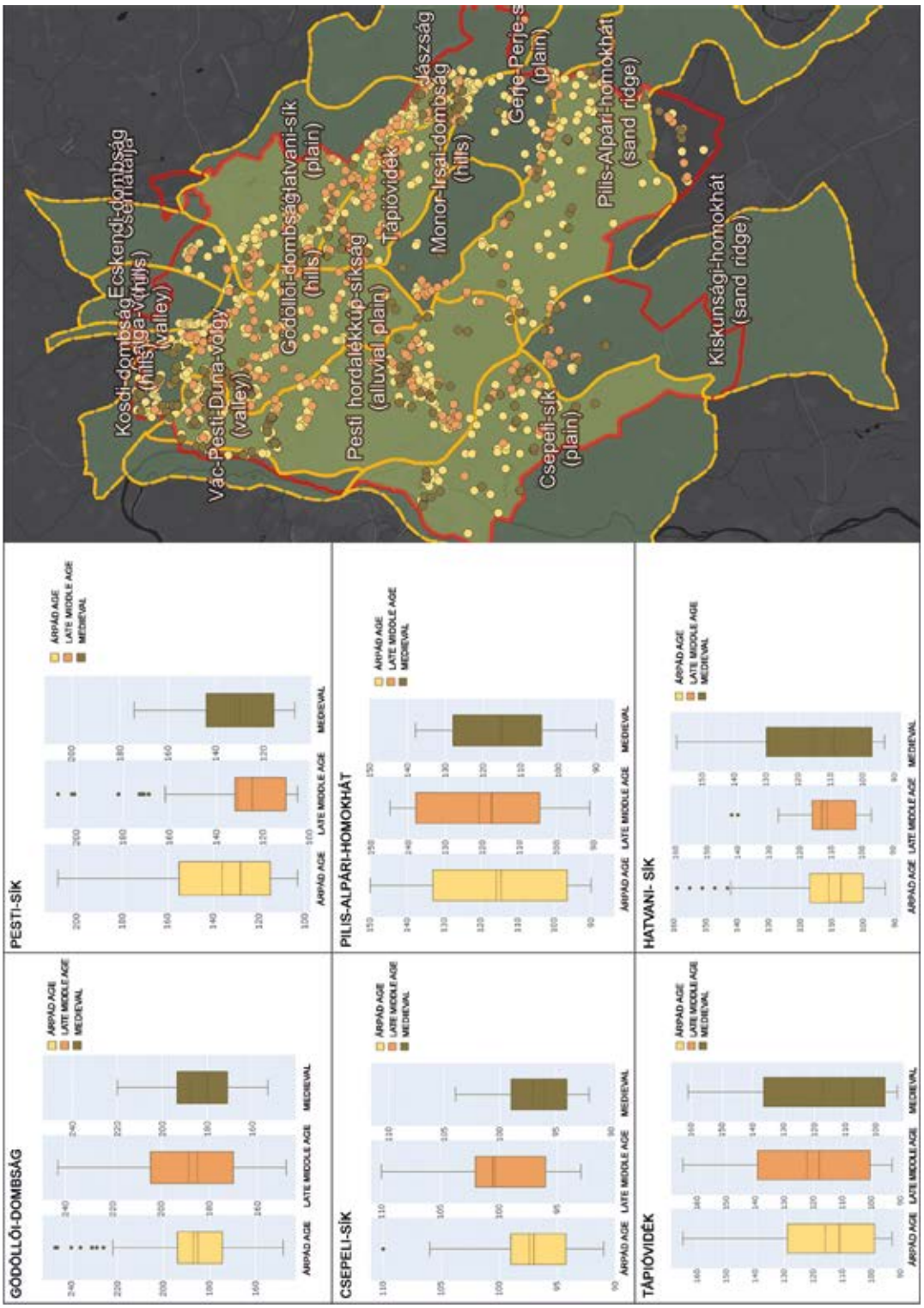

Fig. 10. Elevation-based evaluation of Árpád Age and late medieval settlements in the different micro-regions of Pest County (©László Ferenczi)

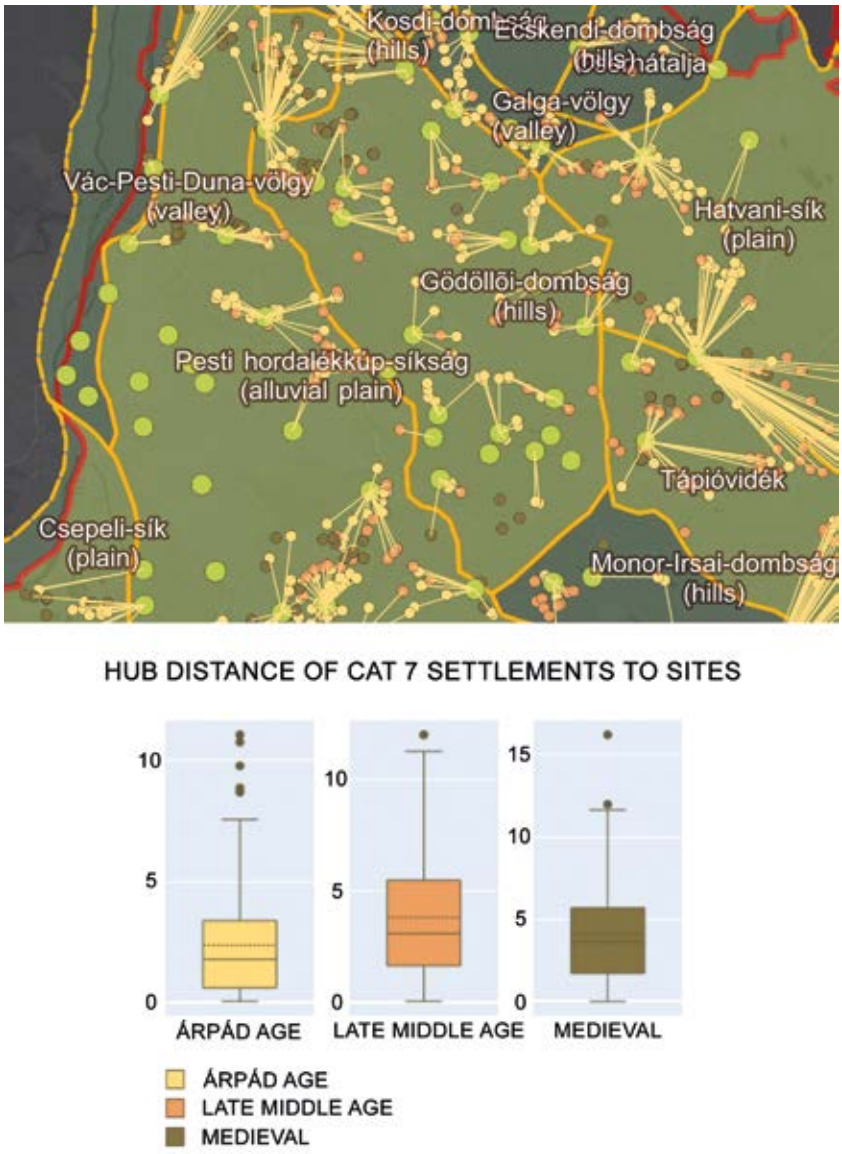

Fig. 11. Hub distance analysis between [cat. 7] settlements and archaeological sites, showing a shorter average distance in the case of Árpád Age sites (©László Ferenczi)

Topographical data on medieval roads and settlements in the district of Dabas

In the Medieval Period, Dabas district was not a coherent historical or administrative unit. There is no information in the sources on towns, market towns, castles, or monasteries within this area. Without exception, the settlements under study are villages or smaller farmsteads representing the three categories discussed above. Besides, they belonged to different landholdings (royal, ecclesiastical, or secular domains), where the legal and social status of the inhabitants differed. From material culture's point of view, it is an intriguing question whether such differences can be detected through a quantitative analysis of small finds (metal finds in particular).

Apparently, there are fundamental problems with interpreting the historical and archaeological records, mainly due to issues with representativity, data fragmentation, and taphonomy. The earliest phase of the settlement network is only partially documented in written sources. Only about a dozen settlements appear in available pre-13th-century sources concerning the district.

By the 13th century, however, the settlements had gone through considerable changes (contraction due, e.g., to the impact of the Mongol Invasion) and some locations had not stabilised yet. Hardly anything but archaeological information is available on the period before the Mongol Invasion. Until recently, most of this information came from field surveys focusing on surface collecting of pottery sherds, a method typically implying considerable problems concerning the precise dating of said sherds; in other words, it has been difficult to establish a detailed chronology based on surface pottery finds. This is exactly why metal detector surveys and collecting metal finds can be particularly important, as they may provide a means for specifying the dating of a site.

Despite the large amount of archaeological data collected thus far, we still consider the settlement network of the Árpád Age obscure. As elsewhere in the country, small, dispersed farmsteads and temporary/short-lived settlements characterised the 10th and 11th centuries. Surface surveys have detected these as scattered, low-intensity sites (in terms of the number of surface finds). The relatively high number of such sites (compared to the late medieval horizon) is also a well-documented phenomenon, associated with shifting cultivation, a characteristic of the agricultural exploitation strategy in this period.[41] The identification of the surface traces of these early settlements requires meticulous work. In contrast, on late medieval settlement sites, one can collect hundreds of metal artefacts and a huge amount of pottery, which makes it generally much easier to make reliable or accurate inferences concerning their location and dating using surface archaeology than in the case of earlier sites. Evidence from the Ócsa Landscape Protection Area in the northern part of Dabas district[42] has demonstrated that during the period following the Hungarian Conquest, small settlements appeared in places suitable for habitation/agricultural cultivation, as indicated by a minimal amount of pottery and metal artefacts.

In the 13th century, the settlement network became transformed due to social, economic, and climatic changes.[43] Larger settlements consisting of interconnected households emerged, as reflected by the diversity represented by larger and smaller sites (including villages and hamlets/farmsteads/manors), some of which had settlement nuclei around their church. These larger settlements can be described as stable villages, and they also appear in the written sources, albeit their names and owners are mentioned with varying frequency. In Dabas district the names of 23 medieval settlements and possessions have been documented (Besnyő, Bugyi, Cibakháza, Csíkos, Dabas, Esső, Foglár, Gyón, Hartyán, Hernád, Hetény, Inárcs, Kakucs, Mántelek, Örkény, Ráda, Sári, Tatárszentgyörgy, Tördemic, Vacs, Vány, Vatya, and Zádog). In most cases, their locations could be identified by metal detector surveys carried out with volunteers, and it was also possible to reconstruct the medieval road and settlement network connecting them *(fig. 12)*. In total, eleven medieval churches are known in Dabas district, six of which were identified by fieldwork. All excavated ones were found to have existed in the 13th century.[44]

Mapping the medieval settlement network involves problems related to the reconstruction of the road system. While settlements can be identified with a high degree of certainty based on archaeological surveys and finds, roads cannot. Accordingly, any reconstruction must be based on inferences relying on the topographical context. As mentioned above, a significant part of this natural landscape has been characterised by sand hills, marshes, and peat bogs, which were unsuitable for permanent habitation in medieval times and difficult to cross. Upon studying the maps of the Habsburg Military Surveys, it becomes apparent that all transport routes avoided

[41] *Szabó 1966* 30–31; *Laszlovszky 2008* 67–68; *Rácz 2019a* 156–159. Such a settlement/site (and practice) from the study area (Némedi/Nevegy) is mentioned in the canonization trial of Saint Margaret in connection with the household of a lesser noble who, allegedly, lived in poverty; see *Laszlovszky 2010* 114–118.

[42] *Füredi – Rácz 2021.*

[43] *Laszlovszky 2008; Laszlovszky 2018.*

[44] *Tari 2008; Rácz 2014.*

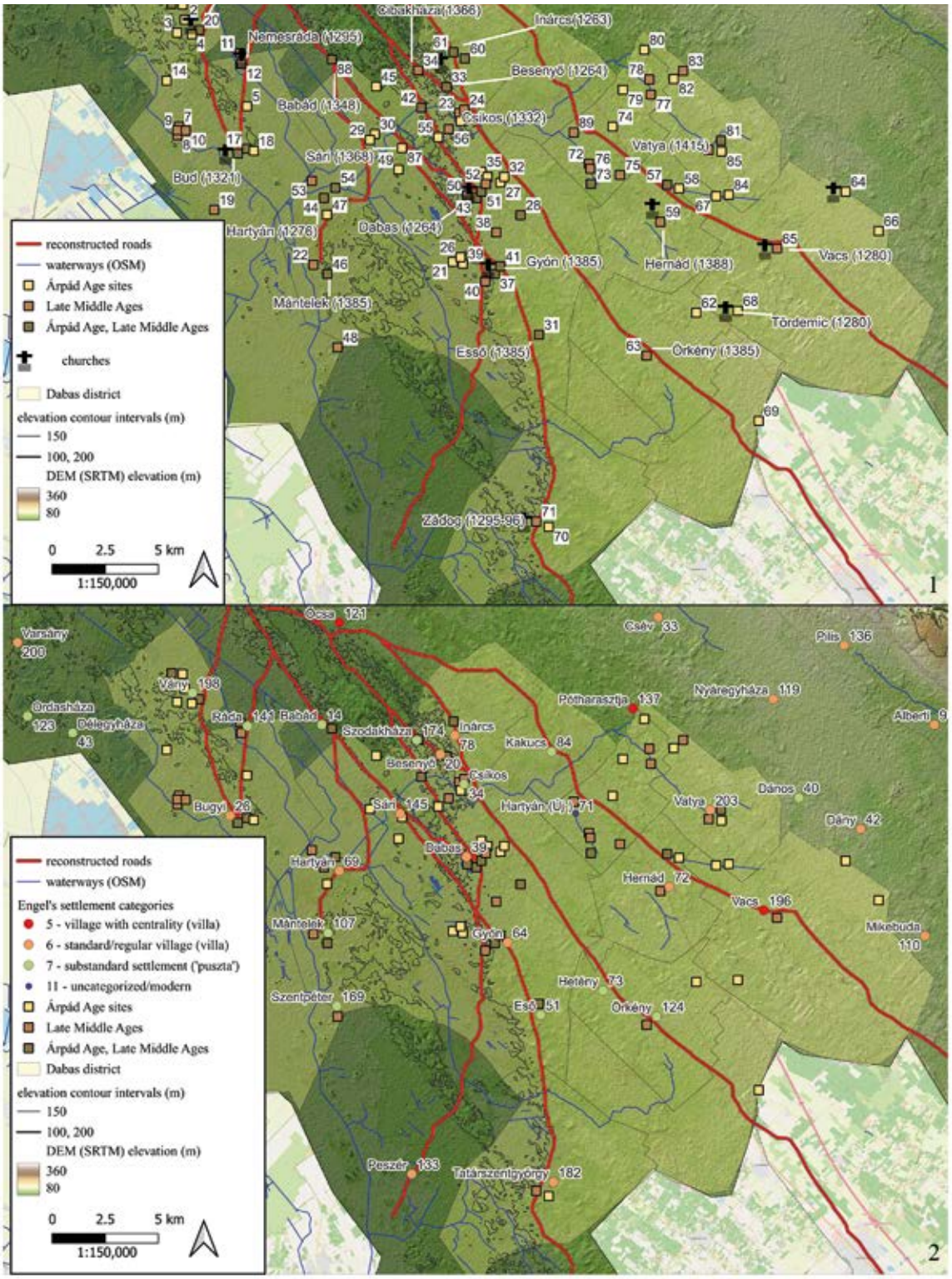

Fig. 12. Reconstruction of the medieval settlement network (Árpád Age and late medieval settlements, churches, and roads) in Dabas district, based on 1: Documents and 2: Archaeological finds (©László Ferenczi, ©Tibor Ákos Rácz)

these parts of the terrain. Some roads on these maps most likely had a medieval origin, which can be confirmed in some cases through references in medieval documents or indirectly, by the location of the medieval settlements and churches aligned with them.[45] Several radial roads ran south-east of Pest, connecting the settlements in the region and further south-east. Their importance varied; some roads connected distant centres, such as Kecskemét and Szeged, while others were of local or regional importance. Medieval perambulations tend to mention the direction of the major roads, which helps identify them. However, it is beyond the scope of the present essay to provide a very detailed reconstruction of the road network, as the geographical limits of such an investigation would necessarily reach beyond the study area and would require a more thorough evaluation of available cartographical and historical sources. Instead, we focus here on the information obtained from medieval documents.

One of the most important contemporary sources is a charter of King Béla IV from 1264, in which he donated the lands of Gyón, Taton, and Kemej to the Premonstratensian monastery of Csút/Csőt.[46] The donation was renewed by King Stephen V in 1272.[47] Both charters describe the borders of the villages north of Dabas district and list the villages south-east and south of them, which makes it possible to identify the orientation of the roads within the district precisely.

(1) The most northerly was the main road leading from Fonchol towards the village of Tölgy *(ex inferiori parte ipsius Fonchol incidit in viam magnam, per quam itur ad villam Thulgh).* The Árpád Age village of Tölgy lay outside Dabas district, within the modern day-boundary of Nagykőrös;[48] it is known from field surveys and has a very rich archaeological heritage, indicating its importance in the period. It does not appear in later documents, and its boundary merged with that of Nagykőrös. Intermediate stations along this road are not mentioned in the document, but its endpoints suggest that it ran somewhere in the vicinity of Hernád, Vatya, Vacs, and Törde mic in the direction indicated. This road is not identical to the one leading from Pest to Kőrös via Pótharaszt, but the two roads possibly joined near Vacs.

(2) According to the same perambulation, the road to Szeged *(qua via itur in Zeged),* known today as the Old Highway (*Öreg országút*)*,* was located south of the route described above. It went through Örkény to Kecskemét and from there to Szeged. As its name indicates, it was a superior road of national importance. There are hardly any settlements along its path, presumably because it connected the major centres by the shortest possible route. It is still in use today, starting from Ócsa and running between present-day Inárcs and Felsőbesnyő, bypassing Dabas from the north-east and joining the main road (Route 5) near Hernád below Dabas. Modern manuscript maps call it *via postalis versus Kecskemét*. Its route is clearly indicated on the maps of the First Habsburg Military Survey and probably corresponds exactly to the late medieval route. This road bypasses Dabas and Hernád, which were both relatively important in the Middle Ages; Besnyő and Csíkos were accessible by a branch, and only Inárcs and Örkény were actually crossed. In the 13th century, its northern section presumably did not follow the route east of the marshes, which is still in use today, but went through the marsh, bypassing the Árpád Age villages of Taton and Besnyő.[49]

(3) Based on the data of the 1264 charter, a ‘major road’ (*magna via*) was situated southwest of the Szeged Route. It is mentioned twice in the charter, once at the northern border of the

[45] See *Stibrányi 2008; Szilágyi 2014; Pánya – Rosta 2015; Pánya 2022.*

[46] *MNL OL DL/DF* 208789; *Bártfai Szabó 1938* 10–11; *Bakács 1982* 48–51; *Györffy 1998* 519; *Füredi – Rácz 2021* 128–131.

[47] *MNL OL DL/DF* 248411.

[48] *Novák 2015* 40, 78.

[49] *Füredi – Rácz 2021* 131.

estate *(...cca magnam viam, qua vadit de Pezen et Dobos...)* and once at the southern *(ad viam que venit de Pezer et Babas).* The 1368 division of Besnyő also mentions the road to Dabas, which passed through the settlement.[50] It appears in the 1817 map by József Decsy as the road from Ócsa to Dabas.[51] Its position can be reconstructed very accurately from that: it led from medieval Ócsa through the present-day landscape protection area, passing by the Árpád Age settlement of Kemej and the late medieval Cibakháza towards Besnyő and Dabas, and continuing to Peszér.

(4) Finally, one may assume that there was a road junction at Dabas because, in addition to the southern road to Peszér and the Szeged road running straight towards south-east, one could also go in the direction of the medieval villages of Gyón, Esső, Zádog, and Baracs further south. Today, this road of medieval origin connects Dabas with Tatárszentgyörgy, which was founded relatively late.

(5) Furthermore, another road of local interest also reached Dabas from the western side of the Ócsa *Nagyturján* [Big Marsh], starting from Némedi/Nevegy via Babád and Sári. This road matches perfectly the relevant section of the present-day Route 5, the main road between Alsónémedi and Dabas. The locations of Babád and Sári are also known.[52] The last two routes are not mentioned in medieval documents; their paths could be reconstructed based on the location of medieval sites and the indications of modern maps.

(6) The same can be said about the north-south roads reconstructed in the western part of Dabas district; however, their exact localisation is highly problematic. The path of the Nevegy–Babád–Sári–Dabas road could have branched off at Babád towards Hartyán and Mántelek in the south. The most important settlement in the western part of the district was Bugyi (the medieval Budimátyásfölde). The position of archaeological sites in the area suggests that probably two roads connected Nevegy and Bugyi, one through Vány and the other through Nemesráda. The roads on the maps of the First Habsburg Military Survey connect two archaeological sites that correspond to the two church sites.

In the next part, the description of the settlements connected by the roads follows the same topographic order, from north to south:

Along the northern road (1), the medieval site of Vatya, in the territory of today's Újlengyel, became famous a few years ago for a medieval 7,000-piece metal hoard; besides, metal detectorists recovered a number of other medieval metal finds from the area of the village. The perimeters of the site were delineated by subsequent fieldwork campaigns.

Hernád was first mentioned as a noble village in 1388,[53] while another document from 1409[54] mentions its church dedicated to the Holy Cross. As demonstrated by our field survey results, it was mostly likely of late medieval origin, as no Árpád Age finds were discovered in the area. In February 2014, an intensive field survey was carried out there, and the extent of an extremely rich settlement was defined (Site ID No. 85641).[55] Prior to the fieldwork, our metal detectorist community had already recovered a large amount of metal finds, including a Roman gold ring and two medieval gold coins, from the territory of the village.[56] The site is on the outskirts of present-day Hernád, northeast of motorway M5, in an irregular, rectangular, large field bounded by dirt roads. The finds were concentrated on two ridges; the depression between them could

[50] *MNL OL DL/DF* 41755; *Bártfai Szabó 1938* 82–83; *Bakács 1982* 238–239.
[51] *Decsy 1817; Füredi – Rácz 2021* 134.
[52] *Füredi – Rácz 2021* 127–128.
[53] *MNL OL DL/DF* 45014; *Bakács 1982* 280–281.
[54] *MNL OL DL/DF* 42972.
[55] Identification number in the Central Register of Archaeological Sites in Hungary.
[56] *Bózsa 2021; Kálnoki-Gyöngyössy 2015.*

have been a lake or a bog in medieval times. On the northern ridge, surface remains of several late medieval dwellings (indicated by patches of charcoal flakes) could be observed on the degraded surface, in a row, alongside each other. On the southern ridge, 160 m northeast of the motorway, building rubble and bone fragments indicated the site of a church and a graveyard.

Vacs was mentioned first in 1280, when it appeared together with Tördemic *(terram Och vocatam prope Poudharasta similiter et terram Turdemech inibi existentem).* In 1284, King László IV issued a charter near Vacs.[57] In 1415, it is mentioned together with *Vathya*.[58] The medieval marketplace may have been next to the medieval church ruins of present-day Pusztavacs. Until 2023, the Gothic church tower was not listed in the public register of monuments.

Tördemic, mentioned in the 1415 charter as *praedium Thwredemez*/*Thjurademez,* can be identified as the Árpád Age site of Pusztavacs-Nagy-rét[59] on the southern periphery of today's Pusztavacs. It is mentioned together with Vacs, which makes the identification probable. The previously uncultivated parcels of the Pusztavacs-Nagy-rét forest have been subject to repeated logging and stumpage since 2015, resulting in significant soil disturbance. The site was discovered by museum-friendly metal detectorists, who also identified the traces of the church on an elevated part of the ground. In 2017, metal detectorists discovered there a virtue bowl and several other significant artefacts.[60] The locations of some houses were also identified after clearing off the wood. Only Árpád Age finds were found at the site.

Starting from north, the first medieval settlement along the road to Szeged (2) is Inárcs. It appears in the sources in 1263, when King Stephen the Younger elevated Paul, Thomas, Feney, and Omb to the rank of *iobagiones castri* in the village *(villa)* of *Inarch*.[61] The site is located on the outskirts of present-day Inárcs, partly within the Ócsa Landscape Protection Area, occupying several adjacent mounds in an area of 1,100 by 700 m.[62] The extent of the site was determined by consecutive field surveys. It is a multi-period site, and unusually large. It is divided roughly in the middle by the medieval road running north-north-east to south-south-west. The nucleus of the settlement was on the mound east of the road, now with a ruined church and a graveyard, while surface finds became increasingly sparse with distance in all directions. Another find cluster was discovered west of the medieval road; it represents the south-western quarter of the site, where mostly Árpád Age sherds and a few pieces of 14th–15th-century pottery were found. In addition to pottery fragments, some archaeological features were visible in the growing wheat there. The church of the settlement has been known for a long time and was excavated[63] but the archaeological site has only been registered recently.

The village of Besnyő *(Bessenew),* first mentioned in the 1264 perambulation, is situated about 1600 m south of the church of Inárcs, in the territory of Felsőbesnyő, now part of Dabas. Several related mentions are known from the 14th century. In 1329, the nobles of Pilis and Bicske[64] acquired a part of Besnyő from Jakab, son of Barnabás. In 1368, the estate was divided in two parts owned by several landowners.[65] In 1468, parts of Besnyő were administered together with

[57] *MNL OL DL/DF* 261478; *Györffy 1998* 561–563; *Bakács 1982* 355.
[58] *MNL OL DL/DF* 10362; *Bakács 1982* 355; *Wach cum possessione Wathya vocata in territorio possessionis Wach habita*.
[59] Site ID No. 98791.
[60] *Herbst 2021.*
[61] *MNL OL DL/DF* 105832; *Györffy 1998* 521–522; *Czagányi – Kulcsár 1995* 91–93; *Füredi – Rácz 2021* 127.
[62] Site ID No. 33310.
[63] *Tari 2008.*
[64] *MNL OL DL/DF* 41755; *Bakács 1982* 144.
[65] *MNL OL DL/DF* 41755; *Bártfai Szabó 1938* 82–83; *Bakács 1982* 238–239.

parts of Vány.[66] The village is located 3 km south-east of Kemej,[67] which is also mentioned in the 1264 charter and has been identified by field surveys. Based on charters, modern maps, and surviving toponyms, the location of the village is clear. The site was identified by metal detector volunteers and authenticated by fieldwork.[68] Both Inárcs and Besnyő are multi-period sites, also including prehistoric and Sarmatian settlement remains. The Early and Late Árpád Age settlements are clearly distinct within the site. As Árpád Age settlements are characterised by a high degree of mobility, the 13th-century settlement names cannot be connected unequivocally with the discovered settlement traces. Metal finds indicate that a relatively intensive settlement existed there before the foundation of the Hungarian state; it was located on the north-western perimeters of the site complex. The related find material includes not only pottery fragments decorated with incised wavy lines but also coins dating from the period between the reigns of King (Saint) Stephen I and King Coloman. The late medieval village occupied the south-eastern part of the site. The distance between the Árpád Age and the late medieval parts of the settlement is about 600 m. The late medieval site covers an area of 1600 by 650 m, of which the settlement core is 500 by 220 m. In addition to pots, fragments of jugs and bottles were found there, while cup-shaped stove tiles and pieces of glazed pottery were collected on the hilltop. The Szeged road led east of the settlement core, and the Ócsa–Dabas road passed through it.

South-east of Inárcs and Besnyő, the road passed by Csíkos, which was mentioned first in the 14th century as the property of nobles from Inárcs: in 1332, the sons of Deme, Lazar, and Fene of Inárcs ceded a third of Csíkos *(Chykus)* to Farkas' son Pál.[69] The estate did not appear later, but in 1427, a field and meadow called *Chykos*, extending from the great road to *Chykoswth*, were mentioned near the church of St. George of Inárcs.[70] The name *Csíkos* has survived to the present day. The deserted lands of Csikós, south of Inárcs, on dry land surrounded by a swampy peat bog from the south and west, appear on the maps of the First and Second Habsburg Military Surveys. Sporadic medieval finds have been uncovered there on three adjacent sites[71] during metal detector surveys in recent years. One site contained only medieval coins and no pottery. Judging from the quantity of finds and the scarcity of written mentions, the settlement probably did not exist for long.

Further south, no other medieval settlements were situated next to the road to Szeged until it reached Örkény, one of the least-researched settlements in Pest County from an archaeological point of view. Only three sites from its administrative area are listed in the official register, all of which were reported in 2014. The 1385 perambulation of Esső mentions *Ewrken,* but it is uncertain whether it was actually inhabited. Since 15th-century documents refer to it as *possessio,* it was most likely a village,[72] and in 1424[73] and 1490,[74] it was the property of the queen. In September 1951, a treasure of 51 Friesach *denarii* and six H199 *bracteate* were found there in a pot.[75] No medieval sites were discovered in the area, but during a survey campaign in 2019, a stone wall and human skeletal remains were identified in the centre of the settlement (the highest point of Örkény, on the broad top of a hill), indicating the site of the church. The wall remains were most likely part of a medieval church (or a mansion).

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66 *MNL OL DL/DF* 16689; *Bártfai Szabó 1938* 253.
67 Site ID No. 98908.
68 Site ID No. 98855.
69 *Györffy 1998* 514.
70 *Bakács 1982* 393.
71 Site ID Nos. 99037, 99039, 99041.
72 See *Szabó 1966*.
73 *MNL OL DL/DF* 39284; *Bakács 1982* 384.
74 *Bártfai Szabó 1938* 298.
75 *V. Székely 1984* 254; *Tóth 2007* 85.

After the desertion of the Árpád Age settlements of the Csút/Csőt monastic estate, the only late medieval settlement in the marshy terrain of the present-day Ócsa Landscape Protection Area was Cibakháza. In 1366, a piece of land was described in the land division of Besnyő as 'adjacent to Szodakháza *(Zudakáza)*'.[76] Further references from the 14th century are also known.[77] The settlement was situated along the shortest route from Ócsa to Besnyő, which also connected Kemej with Ócsa and Besnyő. The toponym appears on the maps of the First and Second Habsburg Military Surveys as *Czibak háza puszta* and *Czibakpuszta;* it is situated in today's Ócsa Landscape Protection Area, west of Channel XXV, immediately south-east of the Zsolna farm, stretching over a relatively small area on a small, only 380–400 m long and about 200 m wide ridge[78] where 13th–16th-century pottery fragments and metal finds were collected. However, the metal finds suggest that a settlement or cemetery existed there already in the 10th century. There was no organic relationship between the 10th- and the 13th–16th-century settlements. The placename with the suffix *'-háza'* ['house of…'] implies the inhabitation of the area and the development of a plot there in the 13th–14th centuries. The settlement did not grow into a regular village.

Dabas was also mentioned in 1264 for the first time, in connection with the road crossing it. Since 2007, the medieval settlement[79] and its church[80] have been regularly excavated,[81] and the results provide an excellent picture of the development and structure of the settlement.

Gyón is an exceptionally large Árpád Age and late medieval site,[82] situated on the south-eastern perimeters of present-day Dabas. It was first recorded in the 1385 perambulation of Esső. The settlement has been known for a long time. A Mongol Period treasure was uncovered there in 2012,[83] and a few years later, field surveys were conducted in its territory in connection with the looting of the site, resulting in retrieving a considerable amount of finds. The church and the graveyard,[84] now at the centre of modern-day Dabas, were also disturbed by sand mining. Here, too, surface surveys (including metal detector surveys) were carried out, yielding late medieval metal artefacts.

Esső and Zádog were both situated within the territory of today's Tatárszentgyörgy, which was established only in the 15th century. Both could be identified relatively easily. First, the perambulation of Esső *(Essew),* ordered by Queen Elizabeth on 1 September 1385,[85] describes its boundary that stretched eastwards from a hill called *Halom* [mound] between Gyón and Esső, reached a small hill, and proceeded further to the east, towards the *Wakonfaya* forest and two boundary signs near *Thywys* [shrub], and then to another boundary mark separating Gyón, Esső, and Örkény. From there, it followed the road to Örkény, went southwards between Örkény and Esső to *Irtvány* [clearing], where boundary marks separated Örkény, Bene, and Esső. Here, the border turned between a pine and the *Ivantarya* hills towards a meadow called *Geneken*, bordering the abandoned church of Zádogház in the west, and then above the village of Peszér to a hill with Cuman pots underground *(in quo magnam anforam comanicalem subterrassent),*[86] which was the boundary between Esső and Zádogegyház. Turning northwards from there, the

[76] *Bártfai Szabó 1938* 80; *Bakács 1982* 231; *Füredi – Rácz 2021* 131.
[77] *Bártfai Szabó 1938* 88; *Bakács 1982* 246, 294–295.
[78] Site ID No. 98771.
[79] Site ID No. 54543.
[80] Site ID No. 34326.
[81] *Rácz 2013; Rácz 2014; Rácz – Németh 2021.*
[82] Site ID No. 34324.
[83] *Nagy – Rácz 2016.*
[84] Site ID No. 54548.
[85] *Bakács 1982* 275; *Czagányi 1990* 41–43.
[86] On the use of such objects as boundary marks, see *Györffy 1921.*

boundary reached first Méneskút and next, the land of Peszér, then crossed a long ditch to the shrubs called *Rekettye* and, following an old road in the vicinity of Szentpéter and Mántelke, went back to the starting point. In 1407, the village was mentioned several times in connection with the incorporation of the land of István Kakas, son of Miklós Gyáli into the estates of Gyál and Esső *(Essew).*[87] The medieval village was identified by metal detector surveys.[88] Archaeological finds indicating its location were found at *Puszta Felső Esső,* which appears in the map of the Second Habsburg Military Survey west of Örkény and south of Gyón. In the maps of the First and Second Habsburg Military Surveys, the road from Gyón to Tatárszentgyörgy passed through Esső.

The site of Zádog is indicated on the map of the Third Habsburg Military Survey as *Puszta templom dűlő* [deserted church field], as it is also called today. The first reference is from 1295–1296 when noblemen from Zádog testified concerning the possession of Zajcsföld.[89] According to the charter from 1385 (mentioned above), it had already been deserted by then. A small monument was erected next to a dirt road on the presumed site of the church, but the archaeological site was not authenticated and registered until recently. Field surveys were carried out there in the autumns of 2020 and 2021. Typical 13th–14th-century finds were collected, including ceramic sherds and large quantities of metal objects. An Árpád Age church and cemetery were identified close to the late medieval village. The site of the early church was indicated by stone rubble and human bone remains. Several Friesach *denarii* were also found nearby, perhaps from a disturbed Mongol Period hoard.

Sári was situated on the road from Nevegy and Babád, southwest of Besnyő, north-west of Dabas, next to the marshes of the Sárvíz, from which the village took its name. In 1368, it was mentioned in context with the partition of Besnyő.[90] Like Gyón, its boundary has merged into that of Dabas. Today, the site of the village is covered by the modern settlement; it is most probably situated in the area of Méntelek Street,[91] where late medieval settlement traces and remains of a cemetery of unknown date have been discovered.

Hartyán borders Sári from the west and Bugyi from the east. Already in 1276, it was the land of the nuns of *Nyulak szigete* ([Island of Rabbits]; today's Margaret Island in Budapest): *'villas Harquiian et de Foglhar cum pertinentiis earundem'*.[92] Its boundary was described in 1386 in a land dispute between the nobles of Bugyi and the nuns.[93] Its northern boundary was 'three arrow shots away' towards Bugyi and in the east, and three boundary markers at a great distance separated the lands of the nuns, Sári, and Dabas. In the south, further boundary markers could be seen by a long ditch, also at a great distance, the lands east of which belonged to Dabas, while the ones west of it to the nuns. At last, further south, the land of the nuns bordered Ürbő. To the west, 5,000 paces away, the perambulation mentions the *Kun* [Cuman] road reaching the border of Bugyi again. This southern part is the disputed land, the exact location of which cannot be determined, as the document does not mention any surviving/related toponym.

According to military survey maps, an extensive swamp with islands (Hosszú-sziget, Ugró-sziget, Nagy-szál-sziget, Nagy-sziget) stretched between Bugyi and Sári; its eastern side was bordered by smaller and larger sand hills (Vaclav-hegy, Olajos-hegy, Juhász-hegy) where archaeological sites have been identified, including Hartyán,[94] with Árpád Age and late medieval finds. An Árpád Age coin and a handle cover plate of a medieval knife have been found on the

[87] *MNL OL DL/DF* 99608; *Bakács 1982* 336–337.
[88] Site ID No. 99051.
[89] *Györffy 1998* 563.
[90] *MNL OL DL/DF* 41755; *Bártfai Szabó 1938* 82–83; *Bakács 1982* 238–239.
[91] Site ID No. 54541.
[92] *MNL OL DL/DF* 942; *Györffy 1998* 520.
[93] *Bártfai Szabó 1938* 97–98; *Bakács 1982* 276.
[94] Site ID No. 99065.

adjacent Pasztyérik-hegy [Pasztyérik Hill],[95] and the village most likely extended over these hills, too. These locations – a string of ridges – are very likely marking the path of a route to the south. Today, the Duna-völgyi-főcsatorna is the only reminder of the once marshy landscape.

Újhartyán ['New' Hartyán] is located northeast of Dabas, right next to motorway M5, thirteen kilometres east of Hartyán. The people of Hartyán appear in 15th-century documents, for instance, acquiring an estate in Hernád,[96] but there is no written record of the entire settlement being relocated. A large amount of late medieval pottery fragments were found in Újhartyán, Kántor-földek, so the relocated village can be precisely identified archaeologically. They settled there sometime in the late Middle Ages, and at the same time, the Árpád Age settlement of Hartyán withered away and was seemingly replaced by Mántelek.

Mántelek appears in the 1385 perambulation of Esső north-west of it and west of Gyón. According to the 1386 perambulation of Hartyán, the area between Bugyi and Sári, south of Babád, was clearly occupied by Hartyán; therefore, Mántelek is to be located further south. However, the identification is difficult because the area south of Sári is now called Mántelek, and the name Hartyán does not appear in the area where it was located according to the 1386 document. The relative position of the two villages is uncertain; moreover, in early research, the Hartyán site was mistaken for Mántelek. However, based on the above, Mántelek is more likely located in the area of the Berény-dűlő[97] or Olaj-hegy[98] medieval sites.

Foglár was mentioned together with Hartyán in 1276 without a precise reference to its location.[99] No later reference is known; the name might be an occupational placename but is also known to have been a personal name. The settlement may have been situated somewhere in the northern part of the area between Bugyi and Sári.

Ráda first appeared in documents at the end of the 13th century,[100] and it was frequently mentioned later, for example, in 1322,[101] 1332,[102] 1434[103] and 1490.[104] The medieval Ráda lay in the administrative area of today's Bugyi and can be identified with MOL Site ID No. 3,[105] as supported by the toponym Nemesráda, which can be localised there and was also given as a site name for the neighbouring prehistoric settlement in the 1980s. Maps of the Habsburg Military Surveys have recorded the name as *Ráda puszta* [abandoned Ráda]. Together, Bugyi-MOL Sites no. 3, 5, and 6 may be the relic of the medieval village, with the most intensive settlement part being on Site 3. The central part of the site covers a relatively high hill with a north-south ridge which locals call by Kálmán-hegy [Kálmán Hill] after its owner. Dirt roads run northwest–southeast on both sides of the hill. The most intensive part of the site lies between the roads, extending over a large area. Early Árpád Age finds are completely missing from the whole site, and only scattered finds and small potsherd clusters mark presence in the second half of the Árpád Age. The toponym 'Ráda' was formed from a personal name without suffixes, which is typical for the 10th–12th centuries. According to available data, the origin of the village goes back to the 12th century. Large fragments of stone, mortar, and human bones on the hilltop indicate the former medieval church; late medieval metal artefacts were also found there in considerable quantities.

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[95] Site ID No. 99087.
[96] *MNL OL DL/DF* 42972; *Bártfai Szabó 1938* 125; *Bakács 1982* 339.
[97] Site ID No. 99029.
[98] Site ID No. 99083.
[99] *MNL OL DL/DF* 942; *Györffy 1998* 517.
[100] *MNL OL DL/DF* 1563; *MNL OL DL/DF* 86950; *Györffy 1998* 554.
[101] *Györffy 1998* 554.
[102] *Györffy 1998* 554.
[103] *MNL OL DL/DF* 12611; *Bártfai Szabó 1938* 166–167; *Bakács 1982* 410.
[104] *Bártfai Szabó 1938* 299.
[105] Site ID No. 41243.

Vány was mentioned first in 1277 as *villa*.[106] In 1359 and 1368, it was described as deserted, *'Ecclesiam desertam et terram vacuam ac habitatoribus destitutam Wayn vocatam'*.[107] We do not know whether it was deserted due to the Mongol Invasion; the suffix *'-egyháza'* [church of…], which would imply that, is not attached to its name. The village repopulated in the 1360s. In 1368, half of Vány became the property of Egyed, son of Tamás Bessenyei.[108] In 1468, it was mentioned together with part of Besnyő.[109] The surviving toponym supported its identification. Its church was situated on a small outcrop, and the remains of an Árpád Age settlement were detected around it. In its wider surroundings, an area of approximately 2 by 2 km, previous archaeological research had identified several small Árpád Age settlements. The fusion of these may have resulted in the emergence of Vány in the 13th century.

Bugyi appeared first in 1321 as *Budymatheusfolua,* acquired by Miklós, count of Temes, together with other properties;[110] later on, it appeared as *Bod, Bud, Bady, Budy,* and *Bwgh*.[111] For many years, it belonged to the district of Solt in Fejér County. In 1507, it became part of Pest County. Ráda and Vány may have been deserted in the early Ottoman Period, but, according to Ottoman *defter*s, Bugyi was still inhabited in the 16th century. Rich late medieval material was collected from the area of the Telekpuszta II site[112] at the southern fringes of the present-day settlement in several field survey campaigns. Another group of medieval sites is located in Kenderföldek, immediately southwest of Bugyi. The settlement was thus divided into several parts by its owners. Ráda, Vány and Bugyi were villages of the lower nobility, but the sources also mention serfs.[113] The scatter of surface finds and the separation of the settlement areas also point to divided estates in the Late Middle Ages.

Late medieval documents mention some settlements which could not be identified yet as *terra* and *praedium*. Kakucs was located east of Inárcs and Besnyő. It was first mentioned in 1456 as a *praedium,*[114] but its location is unknown. It is uncertain whether Kuzna, Borzsva and Baracs *(terra Kuzna, terra Burzwa, terra Boroch),* mentioned in the 1264 charter as laying west of the perambulated property, have ever been inhabited. Based on their topographic setting, the Árpád Age sites Dabas 7/1[115] and 7/3[116] could be potential candidates to be identified with them. We do not have any information on Kindkőrös either *(terra Kyndkeurus).* Blasius de *Hethen*, a judge in Pest County, appeared in 1322[117] in a document, suggesting that *Hetény* may have been a village then, although it was mentioned later, in 1409, as *terra,*[118] south of the church of Hernád *(Harnad).* The toponym did not survive on maps, and its location has not been identified. This may be because the present-day Hernád is south of the medieval Hernád and has perhaps destroyed the traces of medieval Hetény.

[106] *MNL OL DL/DF* 975; *Györffy 1998* 563.
[107] *MNL OL DL/DF* 69244; *Bártfai Szabó 1938* 75; *Bakács 1982* 218; *MNL OL DL/DF* 98069; *Bakács 1982* 236.
[108] *Bártfai Szabó 1938* 82.
[109] *MNL OL DL/DF* 16689; *Bártfai Szabó 1938* 253.
[110] *MNL OL DL/DF* 76293; *Bakács 1982* 125.
[111] *Czagányi 2000* 76–100.
[112] Site ID No. 59779.
[113] *Czagányi 2000* 100–108.
[114] *Bártfai Szabó 1938* 212.
[115] Site ID No. 34335.
[116] Site ID No. 34337.
[117] *MNL OL DL/DF* 86950; *Györffy 1998* 521.
[118] *MNL OL DL/DF* 42972; *Bártfai Szabó 1938* 125; *Bakács 1982* 339.

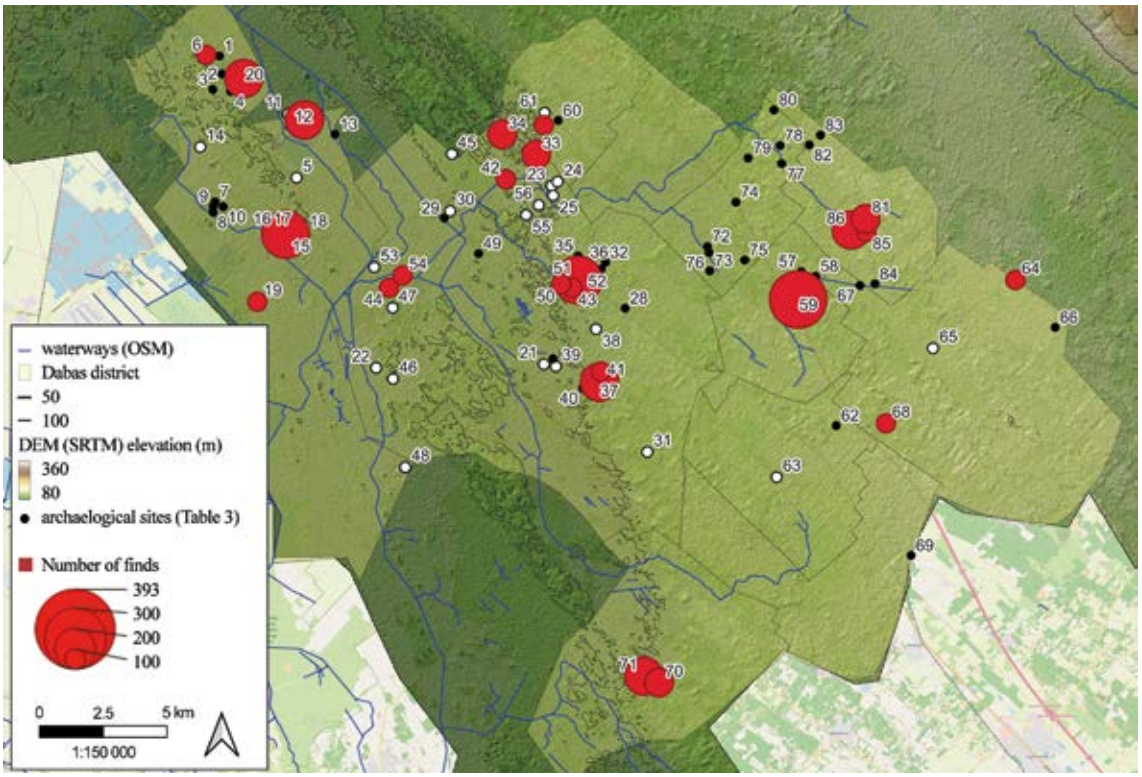

Fig. 13. Quantity of metal finds collected at different sites in Dabas district
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Preliminary observations concerning the finds and their distribution

In addition to historical and settlement geographical data, some conclusions could also be drawn from the find material. It is important to note that, similarly to historical sources, this evidence is also biased due to uneven sampling. At Dabas, Inárcs, and Bugyi, the field surveys were more systematic than at other settlements; additionally, there have been several preventive and research excavations in medieval Dabas. Therefore, the body of archaeological information obtained about the western part of the study area (Dabas district) is more comprehensive. Some sites, such as the Árpád Age villages of Tördemic or Bugyi, could be systematically investigated because of their geographic characteristics, while others (e.g., Vacs and Örkény) were inaccessible due to lying on built-up land.

By mapping the quantity of medieval metal finds (only from the field surveys, not from excavations), an archaeological picture of the medieval settlement pattern was outlined *(fig. 13)*. It is important to stress that this reflects the late medieval state of inhabitation in the first place, as the number of metal finds dated to the Árpád Age is much less significant. Despite chronological and distribution biases, this picture can be used (with some reservations) as a quantitative indicator of settlement hierarchy. Hernád is probably not the most important village in terms of find number, but it has been, fortunately, unaffected by looting, and its area could be systematically investigated for years by museum-friendly metal detectorists.

Comparing the numbers of Árpád Age pottery sherds and metal finds, the intensity of occupation seems to be roughly even throughout the study area except for the Kiskunsági-homokhát, where it seems far less intensive.[119] Interestingly, this contrast did not disappear during the Late Middle

[119] The reason for this is not yet known. It may be related to the phenomenon of later sand movement, covering the traces of medieval sites. This is confirmed by archaeological evidence, see *Nyári – Rosta 2009.*

Ages. However, the Árpád Age settlements are not evenly distributed: site clusters with empty areas between them could be observed, for example, around Vány, Bugyi, and Dabas. These scattered Árpád Age settlements later fused into single villages. The most intensive settlement traces and the richest Árpád Age find material were obtained from Dabas, Besnyő, and Inárcs, settlements of a cluster on the fringes of the marshy landscape of the Nagyturján in the Csepeli-sík. Besnyő was very intensive in the early Árpád Age; in addition to 10th-century clothing accessories, 11th-century coins and a gilded bronze strap-end with a lion depiction[120] testify to the flourishing of the settlement at the time of the foundation of the Hungarian state. The late medieval settlement is situated a few hundred metres away. It was much poorer, yielding only common finds. Both the finds and the written sources indicate that the village of Inárcs existed before the Mongol Invasion. The majority of the obtained finds date from the 13th–15th centuries, but the settlement was already significant from the Middle Árpád Age. A nobleman may have worn the gold-plated bronze mantle clasp with a dragon's head in the late 13th–early 14th century, which was found with a metal detector on the territory of the village.[121]

The importance of the village of Tördemic on the border between the Pilis–Alpári-homokhát and the Kiskunsági-homokhát is highlighted by special finds including a virtue bowl, a star-shaped mace with twelve spikes, and a large quantity of coins dated to the second and last third of the 12th century.[122] Based on surface finds (mainly pottery and coins), it was a short-lived settlement, which was likely established around the Middle Árpád Age and had been depopulated by its end or the beginning of the 14th century at the latest. The situation here is as fortunate as in Hernád: the site has been accessible for surface surveys and was not affected by construction or illegal treasure hunting.

If both excavation and field survey data are taken into account, the richest settlement and the centre of the region in the Árpád Age and the late Middle Ages was clearly Dabas. From the Árpád Age through the Late Middle Ages to the Ottoman Period, Dabas developed, grew, and prospered. Its importance is illustrated best by excavation results. The 11th–12th-century objects found in the cemetery (gold S-terminalled rings, objects associated with the Rus', and some coins of King (Saint) Stephen I, Peter Orseolo, and King Andrew I) are indicative of the beginnings of the settlement and the elite status of its inhabitants.[123] Pit-houses dated to the middle Árpád Age were found in the area west of the modern settlement.[124] The finds obtained by metal detector surveys include a Limoges saint figure and a gilded bronze ornament with openwork decoration, which may hint at the prominence of the site, suggesting that the village had wealthy residents and connections to distance trade. Systematic excavations have been carried out in the core area of the 13th–14th-century settlement, revealing two dozen residential buildings containing hundreds of household utensils, weapons, relics of religious devotion, and a coin hoard with gold florins.[125] The late medieval village of the local nobility (Dabasi family)[126] occupied several neighbouring mounds. Among the buildings was a timber-framed house with a basement, built around the end of the 15th century and destroyed by fire in the mid-16th century. It yielded the most important objects typical of late medieval noble households.[127] The central role of Dabas was due to its topographic location at a road junction, where a few other villages, such as Gyón and Sári, formed a sort of agglomeration in medieval times. Later, Sári was incorporated into Dabas, and its area

[120] *Füredi – Rácz 2021* 140.
[121] *Füredi – Rácz 2021* 142–143.
[122] *Herbst 2021.*
[123] *Rácz – Németh 2021.*
[124] *Rácz 2013.*
[125] *Rácz 2014.*
[126] Cf. *Tringli 2001* 135.
[127] *Rácz 2021.*

was built up; thus, the medieval site cannot be studied today. As for Gyón, it extended over a large area, like Dabas, and began to develop from the end of the Árpád Age. A small coin hoard from the years of the Mongol Invasion[128] was found there, while in the Late Middle Ages, the settlement had a church with an intensive settlement around it. Future excavations might reveal more information about its later history and fate.

On the Árpád Age site, preceding the late medieval village of Zádog, surface finds indicated a possible Mongol Period hoard. The late medieval site is characterised by common finds scattered over a large area; its church, pinpointing its centre, has been identified.

The village of Vány prospered in the second half of the Árpád Age. According to available documents, it was a village in the late 13th century, which became depopulated in the 14th century, most likely due to transformative socio-economic processes triggering internal migration.[129] In the Late Middle Ages, its role was taken over by Ráda, as indicated by important finds there, including imported foreign artefacts, weapons, a seal stamp, and gilded bronze objects. The pottery finds show that the settlement was intensively used; besides, the site includes a church.

If one disregards the historical data and tries to draw conclusions about the villages based only on archaeological remains, the medieval settlement of Hernád could be considered the other regional centre besides Dabas. A huge collection of late medieval artefacts has been obtained from Hernád, including hundreds of special items, prestige objects, and gold finds. However, not this makes the assemblage so significant but the fact that it was possible to retrieve from there a series of artefacts, i.e., several specimens of certain artefact types, which provide an in-depth view of the material culture of the late medieval population. There is no sign of inhabitation in the Árpád Age, but an intensive late medieval settlement could be identified, which became depopulated during the Ottoman Period. The gilded openwork bronze artefacts, silver signet rings, cloth clasps with figural decoration, and other special ornaments reflect the material culture of the local nobility.

Apart from Dabas and Hernád, the villages of Ráda and Bugyi were also of great importance. In the social hierarchy of settlements, the villages of the local nobility were more prominent, and this seems to be well-reflected by their find material, which appears in similar intensity and reflect their similar importance. This record includes gold jewellery, candle holders, book covers, textile seals, ornate silver clothes clasps and, less frequently, weapon finds, indicators of the medieval noble household and way of life. With regard to this context, one has to note the general difficulty of connecting material evidence with social hierarchy. It is often problematic to attribute above-average quantity and/or quality of finds (e.g., imports, special finds, etc.) to higher social strata;[130] however, in the case of Dabas the archaeological and settlement-historical data convincingly corroborate the point.

As reflected by their find material, the villages of Csíkos, Örkény, Vatya, Cibakháza, Hartyán, Esső, and Mántelek were much poorer. However, one of the largest late medieval coin hoards in Pest County comes from the area of Vatya. Judging by the quantity of finds, the settlement of Csíkos was not particularly long-lasting. The most important find from the area of Örkény is a Mongol Period coin hoard, apart from which there are only very uncertain traces of the late medieval settlement. Cibakháza is characterised by a few typical late medieval finds scattered over a small area, the remains of probably a Middle Age farmstead.

[128] *Nagy – Rácz 2016.*
[129] See *Tringli 2001* 103–104.
[130] *Ferenczi – Sárosi – Zatykó 2023.*

Conclusions

In the analysis of historical topographical data related to the area of Pest County in the Middle Ages, as available in historical topographical gazetteers, the rural settlements could be classified into different categories based on quantitative and qualitative parameters (household number, ownership, and centrality functions). The distribution of the sites representing these categories reflects regional patterns: there is a notable difference between the plainland area and the Gödöllői-dombság. Besides, remarkably, the structural differences in the late medieval settlement networks of the different micro-regions seem to have prevailed into the 19th century, as reflected by cartographical data. By applying point pattern analysis techniques to archaeological topographical databases of medieval sites, it was possible to link historical settlement data and archaeological data and argue that a group of settlements recognised as 'substandard' according to 16th-century tax records may outline patterns of desertion (deserted Árpád Age sites). It is conspicuous that a concentration of these settlements is evidenced in the estate of the Premonstratensian monasteries of Ócsa and Csút, which can be explained, on the one hand, by the particular socio-economic context related to the estate management model of the monastic estate and on the other hand, to the process of settlement contraction which resulted in the formation of a (demographically and) economically stable agglomeration of settlements around Dabas (Gyón and Sári), a town situated at the intersection of major roads and also at the boundaries of micro-regions. The systematic analysis of small (metal) finds has also revealed hierarchical differences between late medieval settlements/sites. Overall, these observations shed light on the late medieval settlement hierarchy, influenced by different social, economic, and environmental factors. To some extent, the archaeological differences detailed above reflect clearly the categorical differences between 'standard' villages and substandard settlements.

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ANTAEUS 39 (2023) 227–253

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VELEG, A MEDIEVAL VILLAGE IN THE CSÓKAKŐ CASTLE DOMAIN (FEJÉR COUNTY, HUNGARY)

Zusammenfassung: Im Rahmen eines 2022 gestarteten Forschungsprojekts werden die im 13. Jahrhundert errichtete Burg Csókakő und die Siedlungen der Burgherrschaft (Burgkomitat Fejér, Ungarn) einer historischen und archäologischen Forschungsanalyse unterzogen. Während dieser Arbeit haben wir die zerstörten und positionell noch nicht bestimmten Siedlungen der Burgherrschaft mit extensiver Feldbegehungen identifiziert, weitere großangelegte Prospektionen wurden unternommen. Wir haben die noch vorhandenen Elemente der Landschaftsnutzung, wie z. B. die Lage der in den schriftlichen Quellen erwähnten Fischteiche und Mühlen im Gelände festgelegt, und uns mithilfe von zerstörungsfreien Untersuchungen die möglichst vollständige Vermessung der Überreste des zerstörten gebauten Vermächtnisses (Kirchen etc.) zum Ziel gesetzt. Die vorliegende Studie erläutert die komplexe Untersuchung, bzw. die Ergebnisse besagter Untersuchung, die sich auf eine der kleineren Siedlungen der Burgherrschaft und deren mittelalterliche Standortbedingungen konzentriert.

Keywords: Csókakő castle domain, village site, historical sources, non-destructive survey, Middle Ages, Fejér County, Hungary

The Csák kindred *(genus),* one of the most powerful kindreds of the era, built Csókakő Castle – together with several other castles in the vicinity – on a southern slope of the Vértes Mountains in the second half of the 13th century. Its owners in the 14th–16th centuries included the king and potent nobilities like the Rozgonyi, the Kanizsai, the Nádasdy, and the Bakics families. The Ottomans occupied it in 1543–1544, and it remained under their rule, except for the few years of the Long Turkish War (1593–1606), until 1687; the castle had a military function until the end of the 17th century.[1]

The vicinity of the regional centre, Székesfehérvár (no more than 25 km away), was decisive in bestowing Csókakő with a key strategic, historical, and economic position in the Middle Ages and the Ottoman Period, as were the important military and trade routes that ran near the castle. The pilgrimage road from Western Europe to Jerusalem, connecting Győr and Székesfehérvár, ran in its western foregrounds[2] and a busy sideway engirding the Vértes Mountains also passed under the castle. These circumstances influenced, in addition to its role in the region, life in the settlements of the castle domain.

The Csókakő Castle was especially valuable for its aspect and significant domain, which several sources refer to from when it belonged to the Rozgonyi and the Egervári-Kanizsai families. The domain was surveyed sixteen times between 1430 and 1522; it comprised a total of 32 villages

[1] For more on Csókakő Castle, see, e.g., *Hatházi 2010*; on the research between 2014 and 2017, *Hatházi – Kovács 2019*.

[2] The exact path is unknown; it cannot be excluded that largely matches that of Route 81 (*Hatházi 2010* 27).

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Fig. 1. The Csókakő castle domain. Unidentified settlements: Apátfája, Apostol (Sós), Kankuta (after *Engel 2020* and *Bocsi 2007*)

and partial estates in Fejér and Veszrém counties, some of which included fish ponds, mills, toll stations, and manors.[3] For example, in 1459, the Csókakő domain comprised fifteen estates, one partial estate, eight *predia,* four toll stations, three fish ponds, and a manor house.[4] About 16-28 estates belonged to it at a time; their number changed continuously *(fig. 1).*

Several early publications include written sources concerning the domain; recently, Zsófia Bocsi surveyed them.[5] A good proportion of the related settlements are known: many have been identified by field surveys,[6] detecting even the ruins of the churches of some.[7] Besides, Gábor Hatházi and Máté Stibrányi have carried out significant landscape archaeological research in the area.[8]

A new project, entitled *Castles, Settlement System, Material Culture, 1300–1700 – Complex Micro-Regional Research on the History, Landscape History, and Archaeology of Transdanubia*[9],

[3] *Bocsi 2006* 51–60; *Bocsi 2007; Hatházi 2010* 117–119. Another mention has been discovered since these publications (containing fourteen); see footnote 35.

[4] *Bocsi 2006* 51.

[5] *Károly 1893; Károly 1899* 286–354; *Seidel 2005 [1898]* (see footnote 18); *Bocsi 2006; Bocsi 2007.*

[6] *Stibrányi 2015* 47, 87.

[7] *Stibrányi 2015* Pl. 30–31, 74, 109–110.

[8] *Hatházi 2010; Stibrányi 2015* chapter 4.

[9] National Research, Development and Innovation Office / Hungarian Scientific Research Fund (NKFIH / OTKA) K 143099, 2022–2026. Principal investigator: Gyöngyi Kovács. The research in Fejér County is carried out within the framework of a cooperation agreement between the HUN-REN RCH Institute of Archaeology and the King St. Stephen Museum in Székesfehérvár.

Fig. 2. Survey map showing the location of Nagyveleg, i.e., the medieval Veleg village
(Map: ©Zsóka Varga)

was launched in late 2022 to investigate the vanished and not yet identified settlements of the castle domain (e.g., Csala, Fornaszentmiklós, Igar, and Kér), by extensive field collecting surveys. Besides, intensive field collecting surveys will also be conducted in the areas of the one-time villages, e.g., Boldogasszonykápolna, Kerekszenttamás, Tímár, Veleg, Sárkány, Orond, and Dinnyésméd. The project aims also include identifying the persisting elements of medieval landscape use, such as the fish ponds and mills mentioned by written sources, as well as applying non-destructive methods to survey, to the possible extent, the remains of the destroyed built heritage elements (churches etc.) in the study area,[10] reconstruct the former settlement structure of some villages, and identify medieval and early modern roads.

In the following, some results of the research on the history and remains of the medieval village of Veleg, conducted in Nagyveleg-Faluhely-dűlő, one of the project's focus areas, are presented.

Nagyveleg is situated in the southern foregrounds of the Vértes Mountains, west of Csókakő. It lies at a distance of mere 12 km from Csókakő and 6 km from Mór, a small town *(fig. 2).* The site of the medieval village of Veleg stretches over now unbuilt lands, marked on archival and current maps as 'Faluhely', on the southern outskirts of the current village *(fig. 3).* Today, the area around the modern village is covered by diverse size forest patches, but, according to the respective map of the First Habsburg Military Survey (1782–1785), the settlement was completely enclosed by

[10] E.g., *Stibrányi – Klembala 2021* on geophysical research of churches in Fejér County.

Fig. 3. Survey map of Nagyveleg-Faluhely-dűlő

forests at the end of the 18th century.[11] Some medieval sources also imply vast forests in the area. The Veleg Stream runs in a valley west of the village. A NW–SE-directed section of Route 81, the road crossing Mór, also runs close to the village; as mentioned, its path probably largely matches that of the medieval main road. The forest road of most probably medieval origin, connecting Mór and *Welek* (as marked on the map of the First Habsburg Military Survey), does not exist anymore; its line can be recognized in the path of the main streets of Nagyveleg *(fig. 4. 1)*.[12]

The sources on the completely decayed one-time church of the settlement include a map and 19th-century descriptions; based on them and surface findings, its place could be identified at the north-western edge of the site. The destroyed settlement was repopulated in 1758; a map made shortly after that, in 1769,[13] marks its church as ruined *(rudera),* while the building is no longer marked on later maps, including the First Habsburg Military Survey and a cadastral survey in 1883 *(fig. 4. 1–2)*.[14] An informant of Frigyes Pesty still mentioned the ruins in the mid-1860s, recalling times 65 years before.[15] The residents of the village kept scavenging the wall remains for bricks, and the relic became interred for good probably at the turn of the 18th and 19th centuries; the earthquakes in 1810 and the years before must have accelerated this process, as they seriously damaged several settlements in the Mór Valley, including Veleg.[16]

[11] An interesting addition: The 67 km^2 continuous forest surrounding Nagyveleg at the end of the 18th century became fragmented by the mid-20th century, with the patches covering a mere 16 km^2 (see *Wallrier 1942* 40).

[12] See *Stibrányi 2015* 95; short sections of the medieval road are still visible on the outskirts of the village.

[13] Lajos Nagy mentions a map from 1769 *(Mappa possessionem Vellek representans),* on which in the area of Faluhely-dűlő is marked the ruins of church (as *'rudera'*); see *Nagy 1966* 178.

[14] Cadastral maps of the Habsburg Empire; https://maps.arcanum.com/hu/map/cadastral/?layers=3%2C4&bbox=2015424.0256997363%2C6000197.094940836%2C2018646.3241733832%2C6001348.42767938) [last accessed on 10. 10. 2023.].

[15] According to the description of the place by the village clerk in 1865, '14 acre arable land in the southern part of the village called Faluhely by the locals; 65 years before the ruins of a church could be seen there; serfs were made to dig up the land around it, and they found many skulls there'. And 'In the southern part of the current village, there is a ploughland called Faluhely, which belonged to the manor before it was redistributed and became a 12 acre ploughland of the village of Veleg in 1861. A village could be there earlier, too, but even the oldest only remember the ruins of a church and that the residents quarried many cartloads of bricks where the church once stood. The remains of a row of cellars can still be seen in the western part of this former village'; *Párniczky 1977* 292–293, see also *Stibrányi 2015* 76–77.

[16] *Kiszely 2010;* http://www.foldrenges.hu/index.php?option=com_content&view=article&id=125:foeld-rengesek-a-vertesben&catid=33&Itemid=7 [last accessed on 10. 10. 2023.].

Fig. 4. 1. Veleg on a map of the First Habsburg Military Survey (1782–1785); 2. Veleg and Faluhely on its outskirts on an 1883 cadastral map (Cadastral Maps of the Habsburg Empire, ©Arcanum)

Veleg in written sources

Lying on the border of Fejér and Veszprém counties, Veleg, a village west of the medieval Mór and Tímár, was one of the westernmost (although not the remotest) permanent lands *(pertinencia)*[17] of the Csókakő castle domain.[18]

The village first appears relatively early in the charters compared to other estates of the domain. In the Árpád Age, it was mentioned (together with several other villages) as the estate of the Csák kindred, the rulers of the area at the time, in the 1228 and 1231 wills of Miklós Csák *(de genere Chak),*[19] the younger brother of the late Archbishop of Esztergom, Ugrin Csák.[20] It was then mentioned as obtained property bestowed on the firstborn son, Izsák, by his mother (the first wife of Miklós Csák), to whom it was a morning gift.[21] Veleg is not listed in the will amongst the ancient lands of the Csák kindred, but it was a royal estate donated to them in a coeval charter from 1230, where King Andrew II confirmed the decisions of his son Béla (later King Béla IV), who took his father's donations of land on review, approving some and taking others back from the rewarded. Miklós Csák had a chance to claim back some of his estates in Fejér County during the related royal committee hearing; as a result, he lost five villages but could keep two, one of them Veleg.[22]

The name of the village originates from a Slavic personal name, Velek,[23] who was likely the founder or first owner of the settlement. A leader named Velek appears in several chapters of the *Gesta Hungarorum* by Anonymus; according to the story, he followed Álmos, the first leader of the Magyar conquerors, from the Old Homeland, and also served Árpád later.[24] While the *Gesta* is best considered a literary work that contains no relevant information on the era of the Hungarian Conquest, it certainly holds interesting additions to our knowledge on the time of its writing: the figure of Velek likely refers to the emerging Csák family.[25] Onomastic research by Katalin Fehértói pointed out that the village must have been established in the early 13th century at the latest, as 13th-century sources include many variations of the name *(Velk, Velec, Velek, Veluc, and Veluqu);* the earliest mention is the one in Anonymous's *Gesta*, discussed above.[26]

Following the 13th-century charters on the dealings of the Csák kindred, the village appears in written sources only two centuries later. In 1430, it was a royal estate and part of the domain of Csókakő Castle; it was a lifetime donation as *honor,* i.e., an acknowledgement of his merits (practically a kind of service property) by King Sigismund I to István, comes of Temes County, son of László Rozgonyi.[27] Albeit the village has not been mentioned in written sources for two

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[17] The extended and revised version is under publication. *Bocsi in press.*

[18] The first overview of the history of the castle and the castle domain was written by János Károly, Canon of Székesfehérvár, in 1893 (*Károly 1893; Károly 1899* 286–354). This work was completed by the survey on the castle and the castle domain (reorganised in the 17th century as part of the Mór domain) by Ignác Seidel, the overseer of the Mór domain; see *Seidel 2005 [1898].*

[19] '*Velgh*': *MNL OL DL* 88083; *Györffy 1987* 414.

[20] Originally, the kindred, which both Anonymus and Simon Kézai originated in their *gesta*s from Előd, a leader of the Magyar conquerors, dwelled in the area of the Vértes Mountains; see *Szentpétery 1937* 41, 99; *Anonymus 2003* 38, 88; *Szentpétery 1937* 166; *Karácsonyi 1900* 291–292; *Györffy 1987* 325.

[21] *'Welg'*: *MNL OL DL* 61129 (1231); *Fejér 1829* 227–230; *Nagy 1885* 53; *Karácsonyi 1900* 311; *Károly 1904* 444–445.

[22] *'Welg'*: *MNL OL DL* 61127 (1230); *Fejér 1829* 204–206; *Ipolyi – Nagy – Véghely 1876* 24–26; *Nagy 1885* 51–52; *Károly 1899* 224.

[23] *Kiss 1978* 454.

[24] *Szentpétery 1937* 101–106; *Anonymus 2022* 89–92.

[25] See the introduction by György Györffy in *Anonymus 2003* 12–13; *Kristó 2002* 49–58.

[26] *Fehértói 2004* 820–821.

[27] *MNL OL DL* 12306. For more on the same period of Csókakő Castle and its domain, see *Bocsi 2006.*

centuries, the results of the most recent archaeological research indicate that the Mongol Invasion (1241–1242), the event which caused the largest trauma in the life of the medieval Kingdom of Hungary, inflicted relatively little damage on this area.[28] First King Albert in 1439,[29] while later, his widow, Queen Elizabeth, reinforced the privilege of donating Csókakő Castle and its domain as one that can be inherited to István Rozgonyi and his son, János.[30] Besides, the village of Veleg is listed as an estate of the Csókakő castle domain in about a dozen other 15th-century documents, including land donation charters and their reinforcements, ones ordering the registration of ownership, and ones reporting that it has been done.[31]

A 1493 common estimation *(aestimatio communis),* written on the occasion that the Csókakő and Vitány castles were pawned, sheds light on what the estate usually mentioned simply as 'Veleg estate' included.[32] The document comprises a detailed list of all lands classified according to actual land use and the quantity and size of the related plots, thus outlining their value by common estimation (as it was the custom of the time). The following entries were listed as part of the 'Veleg estate': a stone church with a graveyard,[33] four inhabited plots *(sessio populosa),* eight out-of-village plots *(sessio campestra),* half a royal ploughland,[34] twenty-four scythe lands *(falcastrum),* and ten royal ploughlands of forest and shrubbery where sheep can be grazed.[35] In comparison, Apostol, the least populated village of the domain in that time, included two inhabited, three abandoned, and eleven out-of-village plots, while Mór, the most populated settlement, comprised 48 inhabited and eight abandoned plots and seven out-of-village plots. Veleg had the smallest arable land and Mór the biggest, extending to six royal ploughlands. The natural environment determined the size of the scythe lands, too: Veleg, amidst vast forests, had 24 scythe lands worth of grasslands, while Mór, a town situated on a plain rich in arable land, had exceedingly large, extending to 400 scythe lands.

The real advantage of Veleg became manifested in the total area of forests and shrubberies, which, extending to ten ploughlands, were the second biggest of the castle domain (with even the

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[28] *Wolf 2018,* especially 124–126.

[29] *MNL OL DL* 13408; *Károly 1899* 303–304, the full text of the charter *ibid*. Charter no. LXXXI, 547–549.

[30] *MNL OL DL* 19214, *MNL OL DL* 56803, *MNL OL DL* 88159, *MNL OL DL* 88893, *MNL OL DL* 88914; *MNL OL DL* 13466, *MNL OL DL* 88167; *Károly 1899* 303–304, published in Charter no. LXXXI, 547–549. *Károly 1899* Charter no. LXXXII 549–553 publishes the full text of the charter on the actual registering (*MNL OL DL* 13466) with faulty dating.

[31] For a detailed description of the 15th-century of the Csókakő Castle domain, intertwined with that of the Rozgonyi family, see *Hatházi 2010,* especially 52–64, 88–90; *Schmidtmayer 2012; Schmidtmayer 2014.* As for the latter, it must be noted that the data concerning Veleg is mentioned incorrectly in footnote 14 because the respective charter (*MNL OL DL* 13466) mentions the village as an estate, not a partial estate. For more on the Csókakő castle domain, see *Bocsi 2007.*

[32] The settlement appears in 13th-century charters as *Welg.* In 1430, it was mentioned as *Weleke*, while in 1439, as *Weleg* or *Welegh*. Some documents refer to it as Nagyveleg (*Nagyhwelgh, Nagywelgyh,* or *Nagywelegh*); that these do not mention a separate Veleg indicates that the two names were interchangeable in the Middle Ages, marking the same village; see *Csánki 1897* 356. Kisveleg first appears as abandoned only in 17th-century documents, only in pair with Nagyveleg.

[33] It must be noted here that this is the first written mention of the church of Veleg as it was not included in the 1332–1337 papal tithe register of eligible settlements (those with a parochy and a church) in the territory of the Kingdom of Hungary.

[34] A ploughland is a piece of land that can be ploughed with a single plough in a year. It is approximately 150 royal acres or 126.6 ha. *Bogdán 1978* 150, 161.

[35] *MNL OL DL* 19214. *'Item possessione Weleg cum ecclesia lapidea sepulturam habente ac sessionibus populosis quatuor, sessionibus campestralibus octo, terris arabilibus ad medium aratrum regale, pratis ad falcastra vigintiquatuor, silva usuali et rubetis, ubi eciam pecora eorum pascuntur, ad iugera regalia decem se extendentibus.'*

third, belonging to the village of Tímár, not being bigger than six ploughlands). Only Sárkány[36] in the Bakony Mountains had bigger forests and shrubberies (eleven ploughlands), but half of these were closed off for hunting.[37] Forests were diversely utilised in medieval times: they were hunting grounds and their wood was exploited for fuel and timber; village people foraged diverse foods there to complete their diet and gathered various raw materials, while landlords had their livestock fed there (pig farming, which heavily relied on pannage in the forests, had become a lucrative business by the Late Middle Ages).[38]

The residents of Veleg were mentioned in charters (and often by name) since the 15th century. The name of the neighbouring village, Tímár *(Thymar),* appears in the documents of several prolonged litigations, where their neighbours are also often mentioned.[39] Besides, dwellers from Veleg are mentioned in papers related to a feuding (power display): in 1482, serfs from villages of the Csókakő castle domain (including Veleg) felled and hauled away trees from the forest in Barc of the Crusaders of Székesfehérvár at the instigation of György Kanizsai and his wife, Klára Rozgonyi, the owners of the castle at the time.[40] A few mentions of village officials are known from the early 16th century. For example, in 1493, Bertalan, Balázs, and Gáspár from Veleg were amongst the ones invited to the probate ceremony of the estates of Csókakő Castle;[41] the latter is probably identical to the judge of servitors mentioned in a 1508 and a 1511 document.[42]

The Rozgonyi line broke with the death of the last son, István, in 1492, and after that, the immense fortune – including Csókakő Castle – was passed down through the female line. At the end of the Middle Ages, the domain changed hands more and more often between the Egervári, Kanizsai, Bakics, and, finally, the Nádasdy family, but this did not seem to affect daily life much.[43] Veleg remained one of the smallest villages in the domain, with a sparse population. Only two taxpaying serfs were registered there in 1515,[44] and the 1521 census recorded ten abandoned plots in the village.[45] Due to the low number of inhabitants, Veleg was registered jointly with the neighbouring Tímár in the 1524–1528 *nona census,*[46] albeit it had its own judge, a certain István Méhes, in 1526 and 1527.[47] The 1528 *urbarium* by Lukács Csopaki, a new judge of the village who had just moved from Sárkány then, mentions four houses again.[48]

The sources fell silent when Székesfehérvár and its surroundings came under Ottoman rule in 1543. An Ottoman garrison was established in Csókakő Castle, and the villages of the domain

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[36] Today Bakonysárkány.

[37] *MNL OL DL* 19214.

[38] *Saláta 2009*, especially 231–234; *Hegyi 1978; Zatykó 2021.*

[39] A few examples: Péter Velegi is mentioned as a neighbour in 1437 (*MNL OL DL* 106442; *Érszegi 1971* 217); in 1445, members of the Tímári family, including Antal, canon *(custos)* of Eger, and his brothers, Simon, Benedek, and József, attempted to assert their right to certain plots in Tímár and Veleg, which they had been donated in the previous year by István Rozgonyi, Comes of Temes County. The charter, dated 29 September 1445, is published in *Károly 1904* 687–693, Charter no. LXIV. Furthermore, a charter dated to 1469 reports on the possessions (gifted to her as morning gift and engagement present) of Erzsébet, widow of Józsa Tímári, in Tímár and Veleg, when she sold these for 110 gold florins to János and Renold Rozgonyi, the owners of Csókakő Castle (*MNL OL DL* 106664; *Érszegi 1971* 237). In 1486, András, Bertalan, and László Velegi were questioned as neighbours to the village in a public hearing related to Tímár (*MNL OL DL* 106665, details published in *Károly 1893* 127–131).

[40] *MNL OL DL* 106687; *MNL OL DL* 106697; *Károly 1896* 372; *Érszegi 1971* 248; *Ribi 2021* 267.

[41] *MNL OL DL* 19960.

[42] *MNL OL DL* 106728; *Károly 1896* 306; MNL OL DL 106736; *Érszegi 1971* 251–252.

[43] *Hatházi 2010* 89–106.

[44] *MNL OL DL* 26164.

[45] *MNL OL DL* 37007.

[46] *MNL OL DL* 26319.

[47] *MNL OL* E 156 – a. – Fasc. 004. – No. 041.

[48] *MNL OL* E 156 – a. – Fasc. 004. – No. 041; *Bocsi 2007* 61, Table 4.

Fig. 5. Nagyveleg-Faluhely-dűlő. The site in the spring of 2023 (Photo: ©Gyöngyi Kovács)

became subject to double taxing; information on their daily lives does not appear in documents after that. The village is mentioned in a 1662 *urbarium* as *Kis- és Nagy-Veleg* [Small and Big Veleg], both abandoned and used by tenants.[49] The village became re-settled in 1758.[50]

The research of the settlement site

In spring 2023, field walking surveys were carried out in the Faluhely-dűlő *(fig. 5)* on the eastern bank of the Veleg-patak (Veleg Stream) in the southern fringes of the recent village, an area that had been identified as the site of the medieval Veleg village.[51] Most of the surveyed area was freshly ploughed or covered with newly sprouting crops, providing excellent or at least good visibility.[52]

Applying identical or at least comparable methods of data and find collecting was a primary concern during the field survey to support geoinformatical processing and the statistical evaluation of the find material. Therefore, the designated area was surveyed in linear north-south

[49] *MNL OL* E 156 – a. – Fasc. 004. – No. 043/b; *Seidel 2005 [1898]* 57–58; another *urbarium* from the end of the 17th century mentions the residents of Csesznek as tenants of the two Veleg villages (Kisveleg and Nagyveleg), both of which remained inhabited during the Ottoman occupation (*MNL OL* E 156 – a. – Fasc. 006 – No. 055, p. 38, translation published in *Károly 1893* 87–92). The villages are mentioned in the 1692 and 1702 registers, i.e., after the reconquest of the occupied lands, as abandoned villages (*Károly 1899* 224).

[50] *Seidel 2005 [1898]* 63; *Párniczky 1977* 292–293.

[51] Zsuzsanna Lencsés has identified the site in an authentication inspection in 2022. It was introduced in the Central Register of Archaeological Sites of Hungary as Nagyveleg-Faluhegy, ID No. 98851.

[52] Bianka Gina Kovács, Gyöngyi Kovács, Csilla Zatykó, and Zsuzsanna Lencsés participated in the field survey.

tracks with 25 m spacing; all findspots were recorded with a handheld GPS, and the finds were packed separately from every 25 m section of every track,[53] thus projecting a 25 × 25 m grid onto the 120/150 × 180 m survey area and recording the find scatter and its intensity accordingly. The survey probably did not include the whole area of the one-time settlement as the northern part was closed off for a solar panel park, and the find scatter, albeit its intensity gradually decreased towards that, did not run out completely until the border of the studied area. The find scatter also continued to the edge of the surveyed area in the south, where thick shrubs followed the valley of the stream, preventing us from finding the limits of the settlement in that direction. The eastern edge of the one-time village could easily be followed, while in the west, the find scatter continued under the plots and gardens of the recent settlement. In summary, the find scatter indicates that the central part and most of the peripheries of the medieval Veleg village were surveyed.

Evaluation of the collected surface finds

The systematic find collecting campaign yielded altogether 519 pottery, two knife, five bone, three daub, a roof tile, and two brick fragments. In addition, 39 sherds were recovered from outside the sampling track; these are considered stray finds *(fig. 6. 6–7, 9, 16; fig. 7. 13–16; fig. 8. 11–13).* Most fragments could be dated to the 11th–16th centuries; of the rest, two are prehistoric, and two are modern. About 10% of the find material could only be dated as 'medieval' as they did not bear any traits that would help specify their chronological position. Altogether, 9% could be dated to the three centuries of the Árpád Age, while 14th–15th-century, late medieval fragments comprised the bulk (65%) of the find material. In addition to the 'traditional' chronological categories, 3% of the find material could be dated to the 13th–14th, 2% to the 12th–14th, and 1% to the 15th–16th centuries. Only 1% of the recovered finds could be dated precisely, to the 14th century, and another 9% to the 15th century.

Most Árpád Age (11th–13th-century) potsherds are red, while some are brown or yellow. Other sherds are grey due to secondary burning during use; the original colour of the latter could not be identified. The sherds came from pots and mugs but no cauldrons. They were all coiled and made on a slow wheel; the coils can still be recognised on many. They were made of clay tempered with coarse sand, fine gravel, and, in several cases, crushed limestone. Originally, the pots had simple band rims of about 14–19 cm in diameter; the mouth of the only mug was 11 cm wide. Some side fragments bear incised wavy lines, the detail of a perpendicular spiral, or cogwheel patterns *(fig. 6. 1–4)*.

The 13th–14th-century record contains more yellow pieces and also includes red and grey fragments. The vessels were tempered with coarse sand or fine gravel. Pots in this group have more diverse rims, with usually a profiled rib on the outer side of the lip *(fig. 7);* their mouth ranges between 14 and 23 cm in diameter. A grey rim fragment is a clear 'Austrian' ware imitation with four incisions on its bulging rim *(fig. 7. 11);* it has numerous analogies in the territory of the *Medium Regni*. Recent research has revealed that such ware was possibly produced there;[54] previously, all 'Austrian' pieces were considered imports.[55] The relics of this period also included the fragment of a flat lid or lamp *(fig. 7. 17);* it was red, with a 13 cm mouth and a 10 cm base. Reduction-fired, grey variants of this type (also from 'Austria') had been arriving in the territory of the kingdom since the 13th century;[56] this red piece was likely a local imitation.

[53] For more about the method, see *Mesterházy 2013; Berta 2022* 88–90.
[54] *Bárdi 2014* 71–73; *Feld 2008* 310–311.
[55] *Holl 1955* 163–174, 184; *Bertalan 1998.*
[56] *Holl 1963* 343.

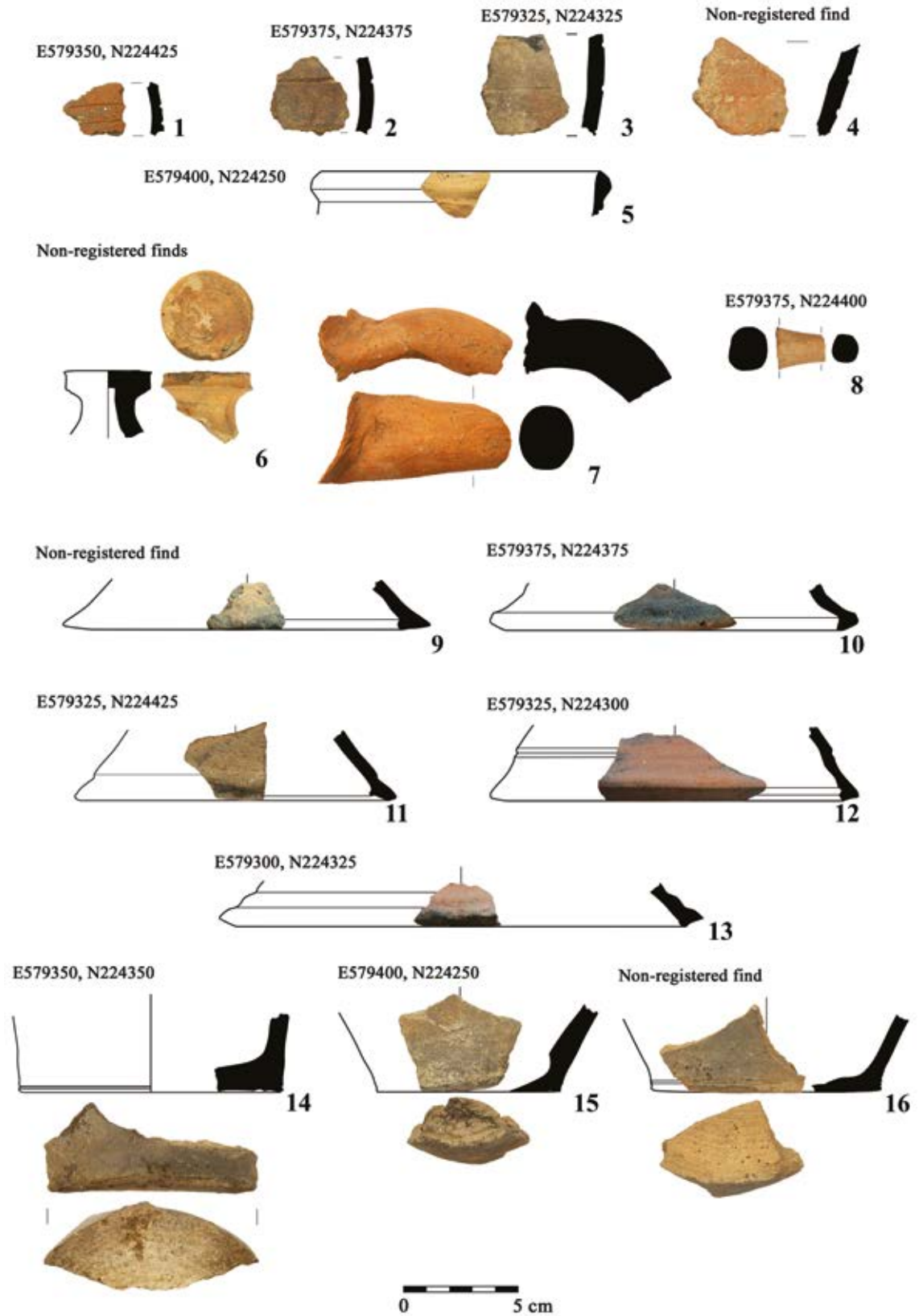

Fig. 6. Nagyveleg-Faluhely-dűlő. Medieval pottery finds with the coordinates of the respective cells of the find collection documentation grid: 1–4: Árpád Age fragments; 5, 7. Late medieval liquid containers; 6, 9–13. Late medieval lids; 8. Fragment of a (footed) pot; 15. Vessel base as removed from the potter's wheel; 14, 16. Base of a wheel-thrown pot (Photos: ©Péter Hámori, drawing: ©Zsóka Varga)

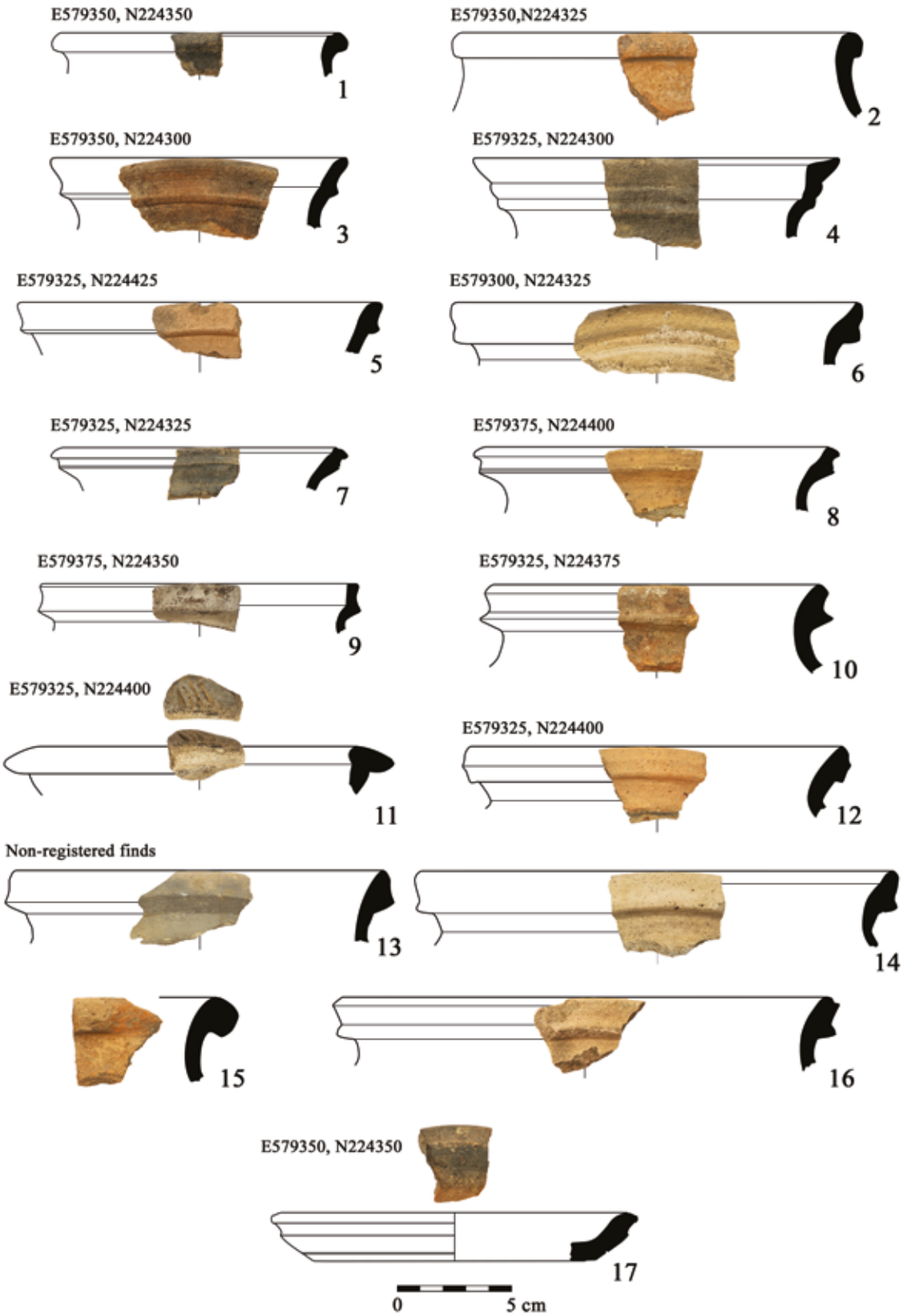

Fig. 7. Nagyveleg-Faluhely-dűlő. Medieval pottery finds with the coordinates of the respective cells of the find collection documentation grid: 1–16. 13th–14th-century pot rims; 17. Lamp(?) fragment (Photos: ©Péter Hámori, drawings: ©Zsóka Varga)

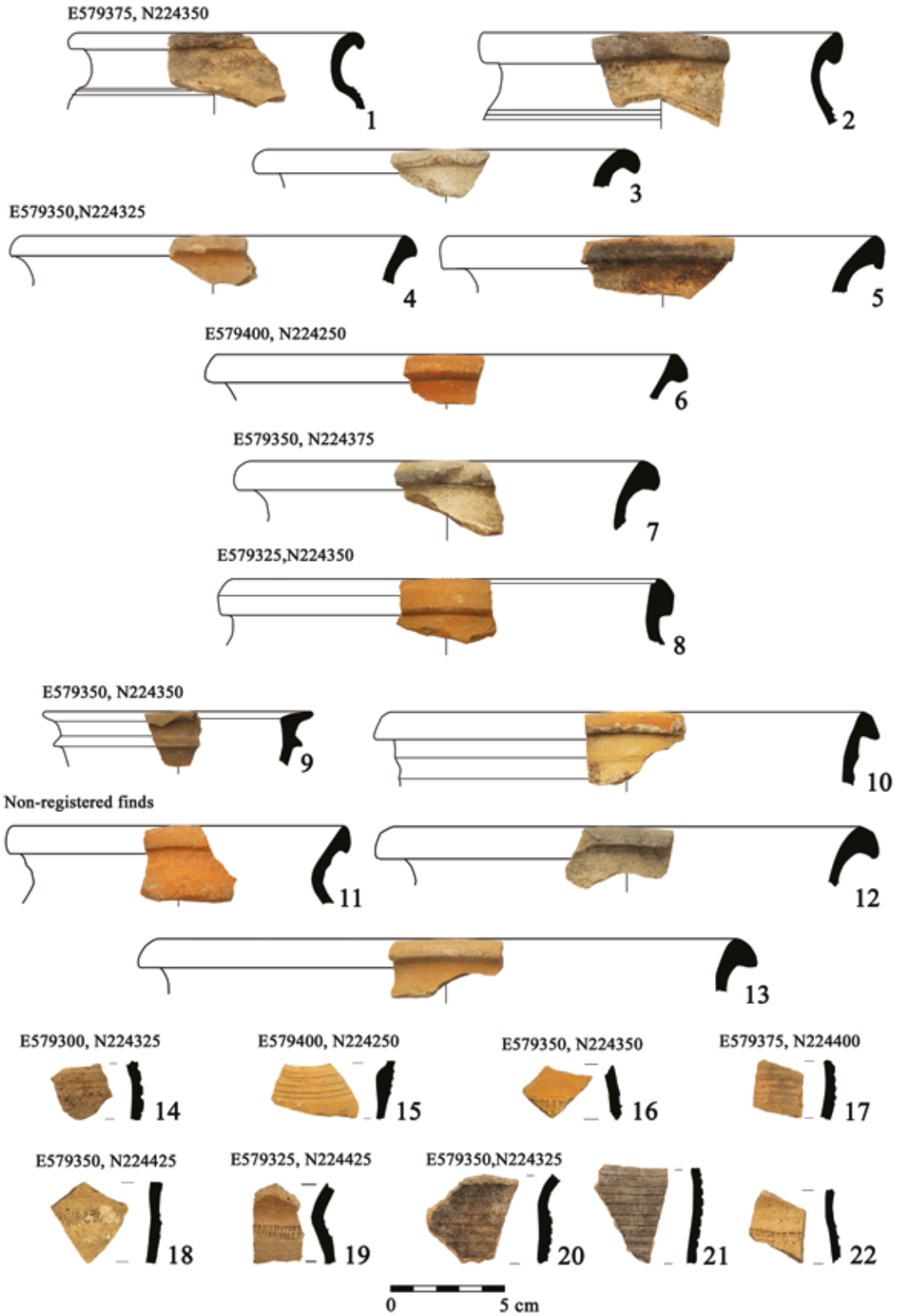

Fig. 8. Nagyveleg-Faluhely-dűlő. Medieval pottery finds with the coordinates of the respective cells of the find collection documentation grid: 1–13. 15th–16th-century pot rims; 14, 16–22. Decorated pot side fragments; 15. Decorated side fragment of a liquid container
(Photos: ©Péter Hámori, drawings: ©Zsóka Varga)

The largest group, late medieval (14th–16th-century) pottery, included mostly thin-walled, wheel-thrown pieces. Among them, the colours of the previous periods recur: the sherds include yellow, pink, red, and grey pieces. Their dating could be specified based on local analogies of the rim profiles and the decorations of the vessel body. Yellow pots were usually made of clay tempered with medium coarse or coarse sand, which often contained dark grains, while some had fine gravel temper. Their rims most commonly imitate 'Austrian' forms: the everted, bulging, slightly collared type is also characteristic of the coeval pottery recovered from nearby sites *(fig. 8. 1–7, 10–13).*[57] Most rims could be classified as variants of this basic type, and different rim solutions were rare (see, e.g., *fig. 8. 9*). Pots had mouths between 12 and 23 cm in diameter. The typical decorations of the vessels' sides include slight ribbing or profiled ribs, incised line bundles, and rolled stamp patterns on the shoulder *(fig. 8. 14, 16–22).* Some bottom fragments are uneven *(fig. 6. 15),* but most feature cut marks where they had been separated from the fast wheel *(fig. 8. 14, 16);* their diameters range between 8 and 12 cm. Pots include a pink and a pale red variant, with designs and tempering akin to yellow pottery; their colour is likely the result of some difference in the applied firing method or their place in the pottery kiln. Samples from a similar ware in the record of Csókakő Castle have been subjected to petrographic analysis, which has revealed that the pale red and yellow pots were made of identical material.[58] Besides, the collected surface pottery finds include red pots with gravel temper and other rim variants, e.g., band rims with a lid groove *(fig. 8. 8),* which was typical of the regions of the Bakony Mountains[59] and east Transdanubia[60] in the 15th–16th centuries.

The assemblage contained only a few fragments of yellow and red conical lids with retracted rims, 14–16 cm in diameter, with a knob of about 4 cm in diameter *(fig. 6. 6, 9–13).* The marks of having been cut off the potter's wheel are clearly visible on most knobs. The number of identified liquid containers is low; all were made of finely tempered clay and, save for one piece, fired to yellow. The only rim fragment is ribbed *(fig. 6. 5).* Many side fragments bear incised line bundles the shoulder *(fig. 8. 15)* or a broad-brush painted red line pattern on the body. Analogies to the latter are known from Csókakő Castle,[61] as well as Székesfehérvár[62] and its surroundings.[63] The only handle fragment is red and gravel-tempered *(fig. 6. 7),* representing a type also found in the area's pottery record, including the castles in the Vértes Mountains.[64]

In summary, the pottery record fits well amongst the find materials of coeval sites in the region,[65] thus featuring several similarities with the pottery obtained from Csókakő Castle. The 15th-century ceramic vessels have good analogies in Csókakő, and the similarity will likely extend to the finds of other centuries as the processing of the find material progresses. Probably, the workshops of the wide area supplied Veleg with pottery in the first place, while the imported distance types (which appear in the record of the castle) did not get there.

[57] *Kovács 2022.*
[58] *Kovács 2023* 61; *Kreiter – Viktorik – Máté 2022.*
[59] E.g., *Bakay – Kalicz – Sági 1970* fig. 6. 2–3, fig. 35. 27–28, fig. 39. 23.
[60] E.g., *Siklósi 1982* fig. 1; *László 2014* Tab. 4. 1; *Feld et al. 1989* 180, figs. 5–6; *Gerelyes – Feld 1986* 174.
[61] *Kovács 2023* fig. 9.
[62] *Siklósi 1983* Abb. 4.
[63] *Berta et al. 2023.*
[64] *Kovács 2014* Abb. 15. 6; *Kovács 2023* 62.
[65] E.g., *Siklósi 1983; Siklósi 1993; Berta et al. 2023.*

Database and chronological classification of the field survey finds

The GPS tracklogs and points were downloaded from the handheld GPS devices after the field survey. Artefact count was summarized in every 25 × 25 m cell of the survey grid, and the chronological data was connected to these units. The finalised database contains the coordinates of the survey grid cells (x and y coordinates in HD72 projection, EPSG: 23700) and the chronological data as presented below.

In the chronological classification of the survey finds,[66] the traditional period or age-dependent temporal framework was abandoned, and a probability-based approach was implemented. The main aim was to estimate and express the chronological value of the sherds and assess its uncertainty. The Middle Age was divided into hundred-year-long 'artificial' periods (centuries), which were used as base units in the evaluation.[67]

The surface finds collected during the field survey in cells of a 25 × 25 m grid were classified into smaller sub-groups based on their chronological values estimated by specialists. Then, the probability value (on the scale of [0;1]) was defined of every sub-group within a collection unit (cell) per century. The sum of the probability values within every sub-group was 1, their distribution implying the chronological accuracy of the respective subgroup. Well-datable sub-groups with a probability value of 1 fell only in one artificial 'century', while ones with a low chronological value got 0.25 probability values, falling in four different (4×0.25=1) artificial 'centuries'.

Temporal changes in the field survey find material

The collected 516 medieval artefacts were divided into three major categories based on expert judgement. Sub-groups with 0–0.33 probability values were considered low (ca. 3–5 'centuries'), those with 0.33–0.66 probability values medium (ca. 2 'centuries'), while the ones with [1] probability values high chronological value. Based on the chronological framework developed for the site, altogether 1,197 probability values were attributed to the 516 collected artefacts. As for the distribution of the finds between the different probability categories, roughly 27.9% (334 pcs.) fell in the low, 67.8% (812 pcs.) in the medium, and only 4.2% (51 pcs.) in the high range *(Table 1).*

The proportion of the different categories in the different temporal units shows a more complex picture. Low-value finds (with a 0–0.33 assigned probability value) in the 12th–15th centuries represent the general pottery of the Middle Ages, which also highlights the problems emerging in context with the separation of the finds of the early centuries.

Probability value	11th	12th	13th	14th	15th	16th	Total
0.2	98	50	50	50	50	0	298
0.25	9	9	9	9	0	0	36
0.4	0	48	48	0	0	0	96
0.5	0	0	16	354	342	4	716
1	0	0	0	4	47	0	51
Total	**107**	**107**	**123**	**417**	**439**	**4**	**1197**

Table 1. Probability distribution and sherd count by 'century'

There is a slight increase between the 12th and 13th centuries and a significant one between the 14th and 15th centuries in the number of medium-value types (with a 0.33–0.66 assigned value). Most high-value pieces were classified to the 14th and 15th centuries *(Table 2).*

[66] Chronological classification by Bianka Gina Kovács, analysis by Gábor Mesterházy.

[67] *Bevan et al. 2012; Crema 2012; Crema 2015; Mesterházy – Füzesi in press.*

Probability value	11th	12th	13th	14th	15th	16th	All
0.2	91.59	46.73	40.65	11.99	11.39	0.00	24.90
0.25	8.41	8.41	7.32	2.16	0.00	0.00	3.01
0.4	0.00	44.86	39.02	0.00	0.00	0.00	8.02
0.5	0.00	0.00	13.01	84.89	77.90	100.00	59.82
1	0.00	0.00	0.00	0.96	10.71	0.00	4.26
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Table 2. Probability distribution per 'century'

Both the overall count and the chronological uncertainty of the Árpád Age (11th–13th century) finds is significantly lower than the late medieval (14th–16th centuries), although 12th–13th-century medium-value finds clearly outline a distinct Árpád Age settlement on the site. The slightly elevated number of medium-value finds in the 13th century implies a distinct find horizon marking the transitional period between the Árpád Age and the Late Middle Ages.

The majority of the collected material could be dated to the 14th–15th century with medium or high probability.

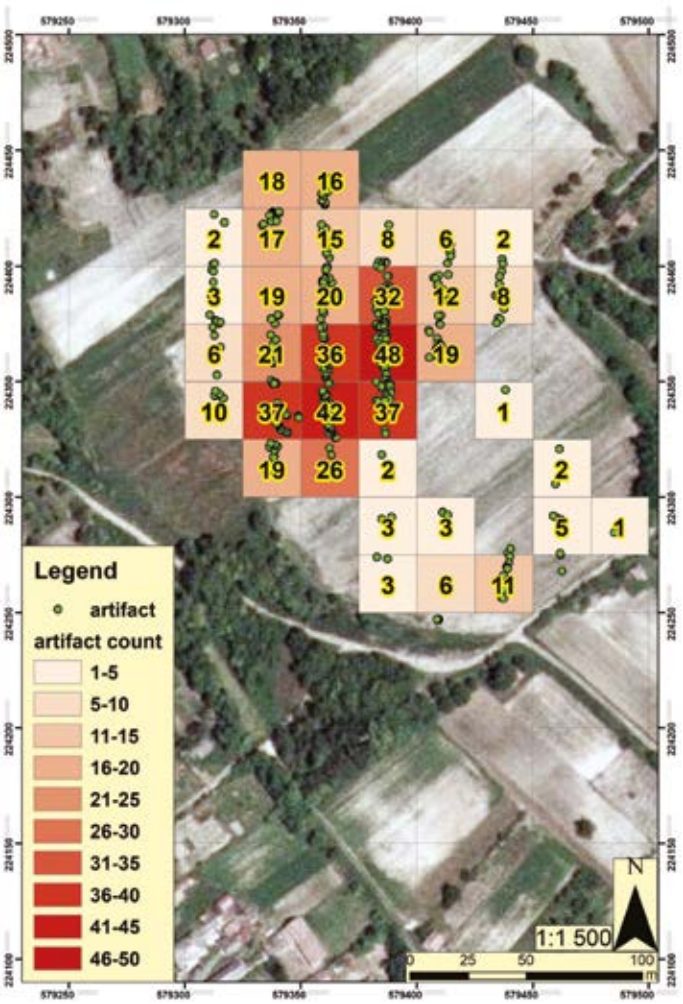

Fig. 9. Artefact density and scatter in the survey area (©Gábor Mesterházy)

Spatial changes in the scatter of the find material collected in the field survey

The 11th–12th-century finds concentrated in an area of about 100 m around the church. Two small gaps were observed in the scatter of medium-value finds of this period, which younger, 13th-century artefacts filled.

A scarce scatter of finds of this period could also be observed in some peripheral areas in the southeastern part of the site. The immediate vicinity of the church was quite empty at the time, containing only a few low-value sherds. The find scatter reflects a significant expansion of the settlement in the 14th and 15th centuries, with high-value 15th-century artefacts concentrating in the centre of the site *(fig. 9; fig. 10. 1–4; fig. 11. 1–2).*

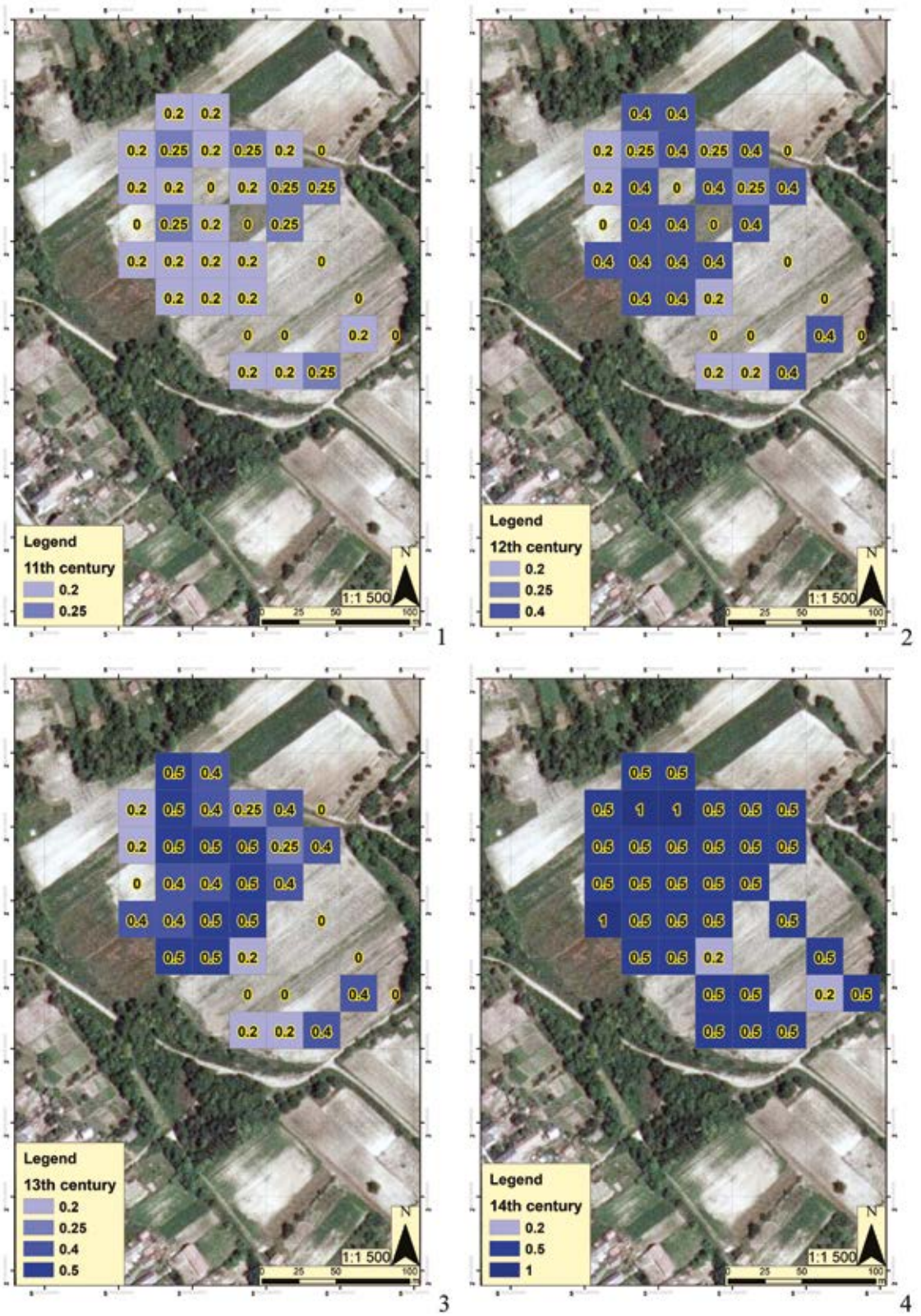

Fig. 10. Probability values of the collected artefacts: 1. 11th century; 2. 12th century; 3. 13th century; 4. 14th century (©Gábor Mesterházy)

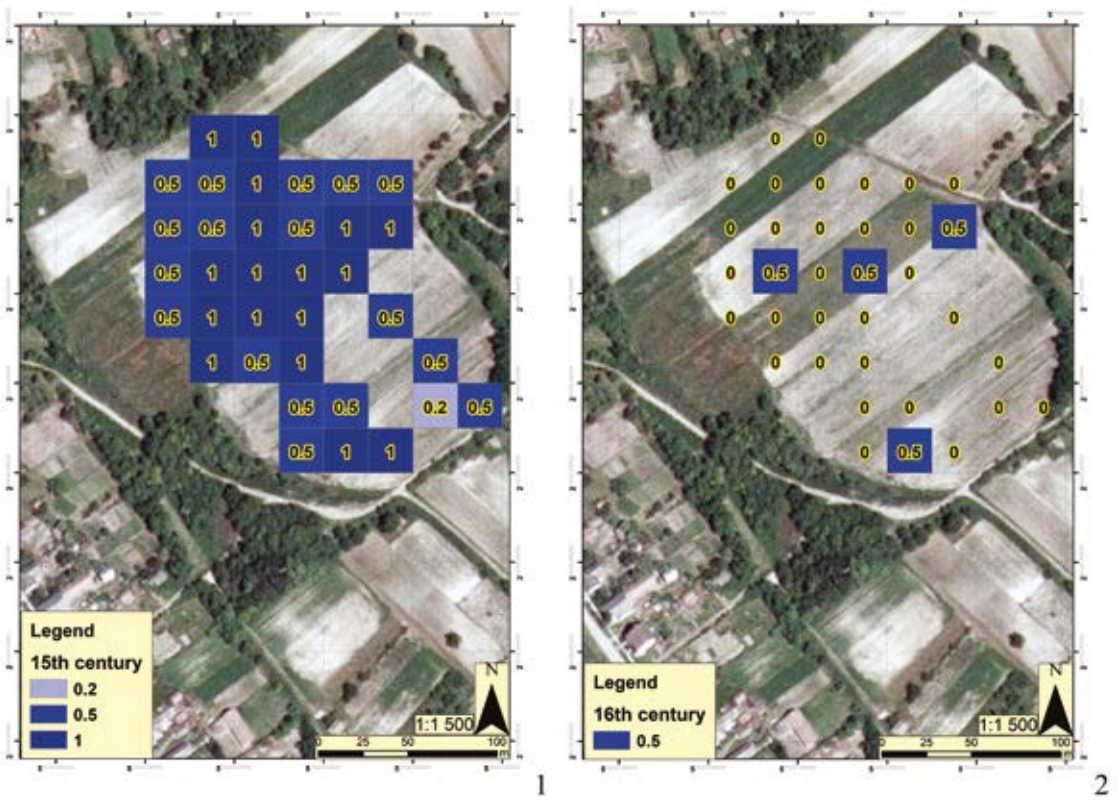

Fig. 11. Probability values of the collected artefacts: 1. 15th century; 2. 16th century (©Gábor Mesterházy)

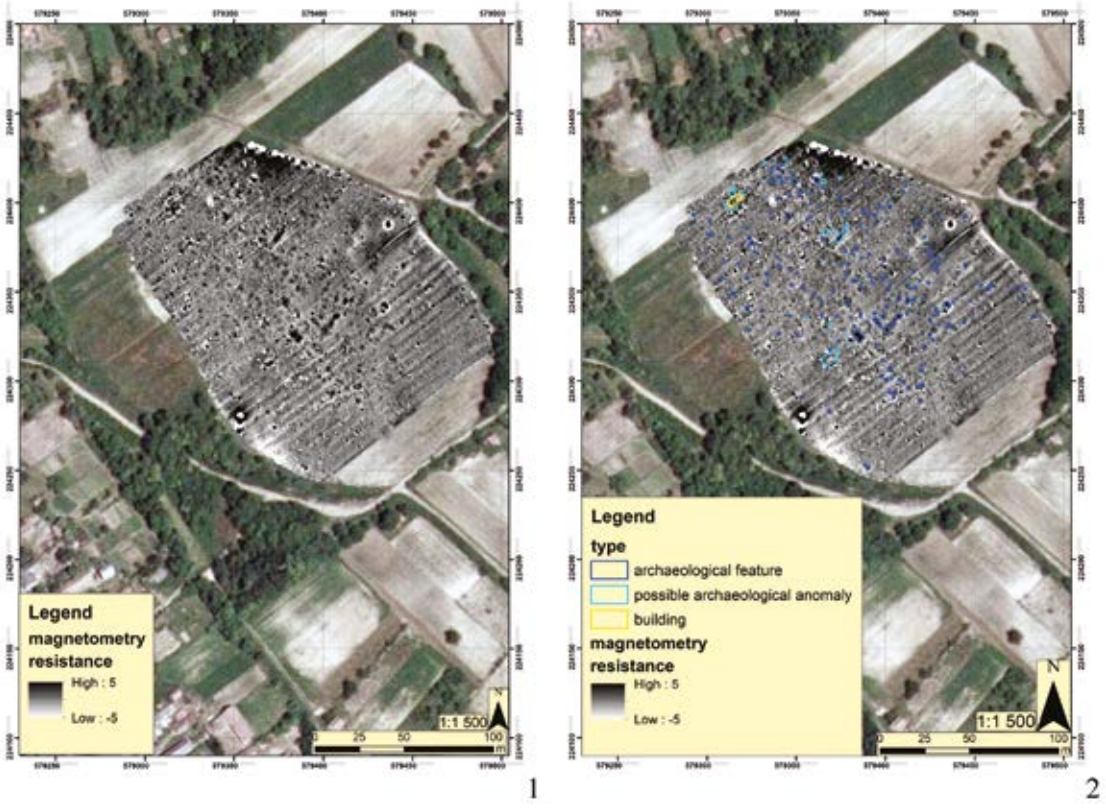

Fig. 12. 1. Magnetometer image of Nagyveleg-Faluhely-dűlő (by Gábor Mesterházy); 2. Magnetometer image of Nagyveleg-Faluhely-dűlő and interpretation (©Gábor Mesterházy and Mihály Pethe)

Geophysical research

A complex geophysical methodology integrating diverse analytic methods was applied in the research of the medieval village of Veleg to identify archaeological phenomena on the settlement site.[68] Magnetometer survey was carried out in the whole area of the Faluhely-dűlő, while the higher north-western part where the church once stood was georadar surveyed. (*fig. 12. 1–2; fig. 13*) The focus area is divided into several plots, all ploughed at the time, providing optimal survey conditions. In the following, the applied methods and the results are presented in detail.

Magnetometer survey

The magnetometer survey was conducted with a SENSYS MXPDA five-channel fluxgate gradiometer equipped with an RTK-DGPS system for georeferenced measurements. Altogether, 24,730 m^2 of the site were surveyed.[69]

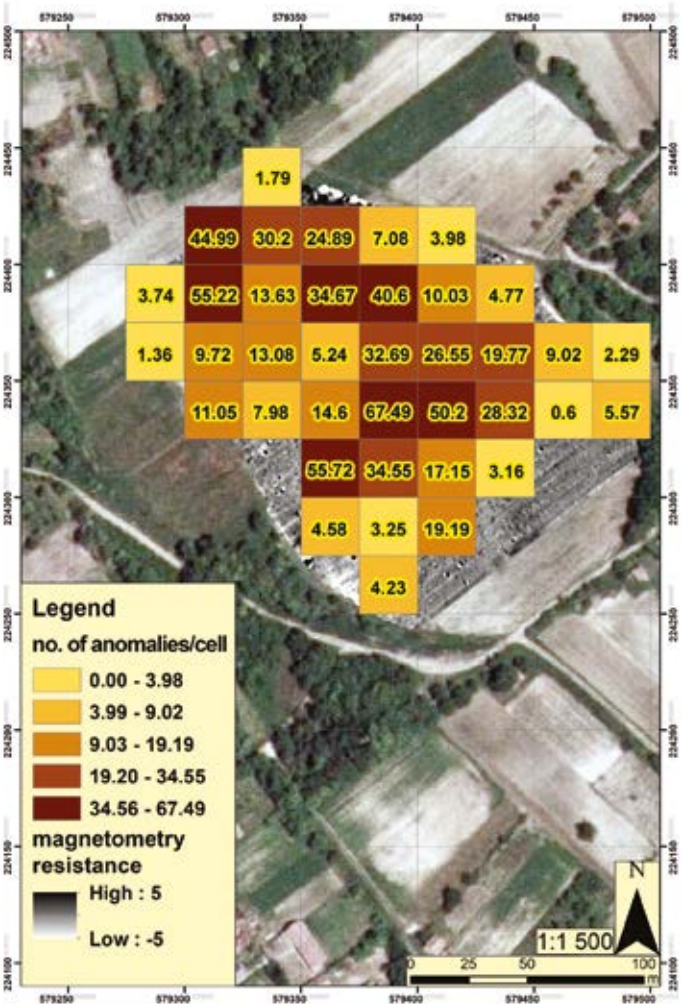

Fig. 13. Distribution of magnetic anomalies in the cells of the 25 × 25 m documentation grid (©Gábor Mesterházy and Mihály Pethe)

[68] The geophysical surveys followed the protocol as described in *Schmidt et al. 2016*.

[69] Raw data were processed by geophysicist Mihály Pethe, and the results were interpreted by Mihály Pethe and Máté Stibrányi.

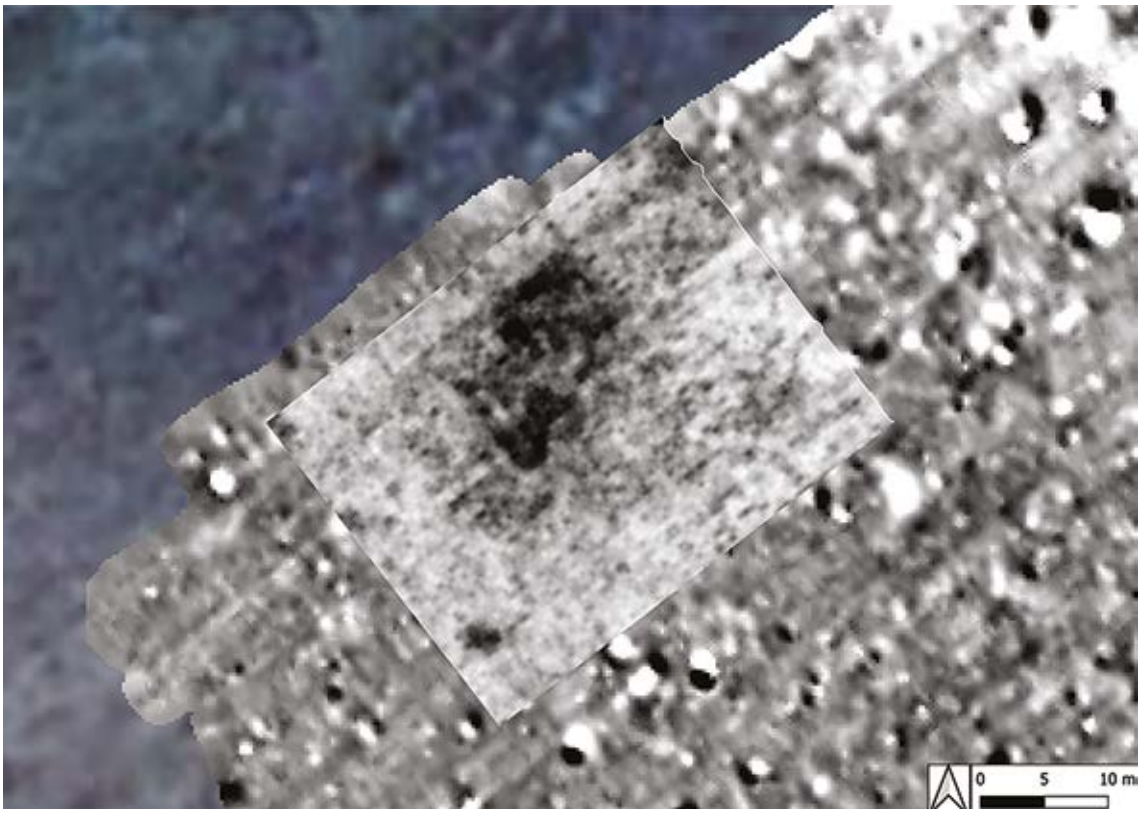

Fig. 14. Georadar depth profile at -0.4–0.7 m (©Zsombor Klembala and Máté Stibrányi)

The intensive anomalies at the north-western edge of the survey area could unambiguously be identified as marking the place of the one-time church, and even some walls appear on the image as negative signals; however, the image alone is insufficient for reconstructing the floor plan of the building. South-east of that, almost all of the survey area is densely covered in anomalies indicating archaeological phenomena, with a concentration on the small elevation south-east of the church *(fig. 12. 1–2).* Metallic noise, a characteristic of medieval settlement sites, was quite strong throughout the survey area, while two relatively big anomalies indicated large subterranean structures, perhaps semi-sunken pens. No ditches or ditch systems referring clearly to the Árpád Age occupation or revealing details about the inner structure of the settlement could be observed in the survey image *(fig. 13).*

Georadar survey

The georadar survey was conducted with an ImpulseRadar CO4080 pushed single-channel dual-frequency device with a dipole antenna with ultra-wideband frequencies centred around 400 and 800 MHz. The 800 MHz range allowed investigating the ground to a maximum depth of 1.5 m, the 400 MHz to 2–2.5 m; the survey was taken in a grid of parallel and perpendicular tracks with 0.5 m spacing. Measurements were taken at every 2.5 cm along the track. The data were visualised in a three-dimensional model built from depth profiles.[70] The main perimeter points of the survey area were recorded with a Leica VIVA GS08plus geospatial survey station.

[70] Raw data were processed by geophysicist Zsombor Klembala, and the results were interpreted by Zsombor Klembala and Máté Stibrányi.

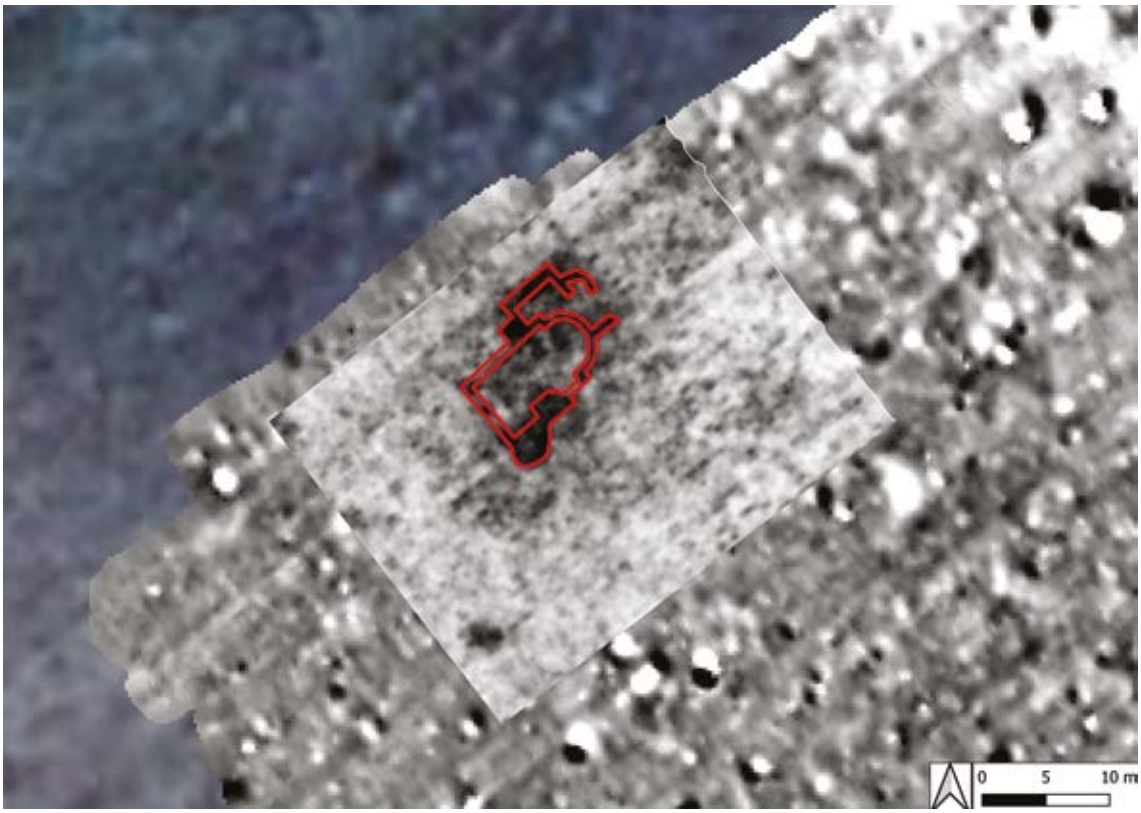

Fig. 15. Georadar depth profile at -0.4–0.7 m with interpretation (©Zsombor Klembala and Máté Stibrányi)

The results have revealed that the church has been preserved relatively well under the surface *(figs. 14–15),* despite its walls having been quarried for building material and the remains being prone to erosion and the harmful effects of agricultural activity in the area: the wall remains appeared already on the -0.30 m depth profile. The profiles clearly outlined a 10 m long (with the sanctuary) and 6 m wide building with a semicircular apsidal end and the foundation of the altar positioned at the centre of the sanctuary. A 6 m long and 4 m wide sacristy or side chapel was attached to the sanctuary in the north, extending over the end of the sanctuary towards the north. The massive, 2.5 × 2.5 m foundation on the south-western side of the church could belong to a tower. The church wall does not appear on the survey image.

Summary

The medieval Veleg village was part of the domain of Csókakő Castle in the area of Mór. Based on historical sources, the village was founded before the 13th century, i.e., before Csókakő Castle was erected; its first mention is dated 1228. Throughout its history, Veleg was one of the smallest villages of the domain with few taxpayers, whose homes (in varying numbers) were scattered in an area of merely 2.16–2.7 ha. The number of taxable homes and serfs does not indicate the number of residents.[71] It must be kept in mind that only a small part of the land of the village was suitable for cultivation (the sources mention half a royal ploughland), but it stood amidst vast forests and had the second biggest forests in the castle domain. The frequent changes in the

[71] Cf. *Hatházi 2010* 118.

ownership of Csókakő Castle and its domain did not significantly influence life in the settlement, shaped fundamentally by its contacts with the nearby Mór and the needs of the residents of the castle. The village had its heyday in the 14th and especially in the 15th century (simultaneously with the castle). Its church was mentioned in a common estimation in 1493. It even had its own judge in 1526 and 1527. Veleg was likely destroyed in the early 16th century, at the start of the Ottoman occupation; it is mentioned as abandoned in 17th-century documents and was rebuilt and the area re-settled next to the medieval settlement site in the 18th century.

Based on pottery finds, the residents of the village used vessel types common in the region. The find material collected in the surveys was evaluated independently of the available historical data, the probability-based approach applied in the dating of the individual stray finds making the uncertainty of the dating perceivable. Uncharacteristic Árpád Age potsherds without any feature that may help specify their chronological position were dated to the 11th–13th centuries; therefore, one of the maps includes an '11th century' category despite no written source points to any settlement existing in the area of the site at that time. Historical and archaeological data equally enable that the first village was founded in the 12th century, likely towards its end. The relatively large quantity of the 14th–15th-century finds recovered from the site is in accordance with the abundance of written sources related to the coeval history of the village.

One of the main streets of today's Veleg (Móri Street) largely follows the path of a medieval road passing at the north-western fringes of the Faluhely-dűlő; based on that, the one-time road turned northwards probably on the north-western fringes of the medieval village, near the church.[72] The instrument-aided and geophysical surveys of the site resulted in identifying the church, clarifying its extent, and reconstructing its floor plan. According to 19th-century descriptions, the small, apsidal church building was at least partially built of bricks.[73] Its size – 10×6 m, with an attached sacristy or side chapel of 6 × 4 m – suggests that it was unlikely built before the late 14th century,[74] and most probably after the 1420s when the land was a possession of the Rozgonyi family in 1430–1496 (the church is not included in the papal tithe registers in 1332 and 1337, only appearing in documents first in 1493, which corroborates this dating). However, only excavations could specify its chronological position. Besides the church building, the magnetometer survey revealed several anomalies that indicate a settlement in the area of the site, but their character and position did not allow outlining house sites, plots, or a street network. The reconstruction of the internal structure of the settlement was probably hampered by the destruction caused by intensive agricultural activity.

Both historical data, the find material, the size of the church, and the mention of the church in a document at the end of the 15th century point to the village having its heyday in that century, in the decades when the Rozgonyi family owned these lands. The scarce 16th-century written record reports on the slow decay of the village in the shadow of Ottoman rule.

[72] See also *Stibrányi 2015* 95.

[73] *Párniczky 1977* 292.

[74] According to Alán Kralovánszky, the usual floor area of 11th–12th-century churches is around 33 m^2, while of those built in the 13th–14th centuries 65 m^2; see *Fügedi 1981* 392. However, it is unclear whether the related calculations included the area of the sanctuary or not; *Tari 1995* 153–159. The church of Veleg extended to 60 m^2 without and 84 m^2 with the side chapel.

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ANTAEUS 39 (2023) 255–278

KÁROLY BELÉNYESY

SPACES AND SHAPES. POSSIBILITIES OF THE RESEARCH OF HISTORICAL LANDSCAPES WITH LIDAR AND ALS SURVEYS

Zusammenfassung: Im Zusammenhang mit der Erforschung mittelalterlicher Regionen kann heute bei weitem nicht mehr nur von jenen Phänomenen gesprochen werden, die über einen ausschließlich landschaftsbildlichen Charakter verfügen, sondern auch über die zusammenhängenden Netzwerke dieser Phänomene, ein System, das wir im Sinne einer Paraphrase des Ökosystems mit Recht als eine Art Anthroposystem bezeichnen dürfen. Hier muss erwähnt werden, dass die forschungsbegleitenden und traditionell auf visueller Beobachtung basierenden Vermessungs- und Datensammlungsmethoden in technischer Hinsicht in ein neues Zeitalter getreten sind. Die Überreste anthropogener Einwirkungen und siedlungsgeschichtlicher Netzwerke konnten und können gerade aufgrund dieser technologischen Neuheiten entdeckt, erläutert und damit interpretiert werden. Trotz Algorithmen, Punktwolken und 3D-Modellen ist jedoch der Gegenstand der Forschung weiterhin unverändert. Die Nutzung von LiDAR, oder mit anderem Namen ASL-Technologie könnte die Aufdeckung der historischen Ebenen menschlicher Intervention in der Landschaft und damit das Verständnis der Wechselwirkung zwischen dem Menschen und seiner natürlichen Umgebung zu neuen Höhen verhelfen.

Keywords: historical landscape, geoinformatics, archaeological topography, landscape characterisation, algorithm-based analysis in archaeology

Similarly to the introduction of any new research method, the emergence of the LiDAR or ALS-based analysis of the historical landscape requires developing new terminology and revising already existing terms. Therefore, it is worth to start this paper with a few thoughts about its subject. While overviewing the overwhelmingly abundant literature on the possibilities, international trends, and methods of the characterisation of the historical landscape is beyond the scope of this study, one shall examine the factors determining the meaning of the concept.[1]

According to subsection 1 of section 120 of Act C of 2023 on Hungarian architecture, 'partially built-up landscapes developed jointly by humans and nature, which comprise built and natural cultural heritage elements that are important from a historical, culture-historical, cultural monuments', artistic, scientific, or technological point of view and form a homogenous topographical unit that can be delineated must be considered historical landscapes and placed under monument protection.'

[1] When discussing the concept of historical landscape, the fundamental work by Michael Aston must be mentioned; besides, in Hungarian research, the volumes of the Archaeological Topography of Hungary *(MRT)*, where terrain features considered elements of the historical landscape, have been included at an early point of research, serve as a point of reference *(Aston 1985, MRT 4)*. For diverse conceptual and methodological approaches to the topic, see *Bruno – Thomas 2010,* in the context of the Carpathian Basin, *The Carpathians 2013,* while for an overview of the possibilities of Hungarian research, *Zatykó 2015*.

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The subsection illustrates well that landscape and its historical layers escape rigid definitions and narrow concepts; no wonder this element has always been the most challenging to fit into heritage protection regulation. It is an outlier amongst archaeology and cultural monument management concepts and has evaded better and less successful attempts to define it. Our planet is deeply affected by anthropogenic effects, and, seen in the perspective of tens of thousands of years, the proportion of virgin areas is extremely low. Whether a distant, centuries-old forest or a crowded urban environment, the landscape around us is far from being untouched but in continuous change. It has its own history with layers and inner contexts and, accordingly, archaeology.

The archaeology of the landscape

The landscape is not an archaeological site in the traditional meaning of the concept as it can be approached, characterised, and described only through some of its characteristic and discernible elements, the investigation of which allows one to analyse the historical landscape. However, some elements of the past landscape (dams, earthworks, burial mounds, traces of cultivation, channels or the remains of the one-time road network) cannot be 'excavated'; thus, their research requires a unique methodology. Instead of delving into the traditional methods of cadastral surveying (discovery, observation, surveying, and description), this study focuses on alternative sensing methods.

Correct classification of available visual information requires the research of the historical layers and inner contexts of the landscape. Simply put, we can only work with what we see; what we fail to observe remains hidden from research. Regardless of the method of data collecting, only those elements become part of the historical landscape we consider to be, independent of whether they really are. Therefore, despite aiming for objectivity, this approach remains highly subjective, even if the one applying it has years of experience in the field or data processing. The researcher is always a factor in the process of interpretation, filtering actively (on field surveys or field collecting trips) or passively (when analysing aerial photos or the results of other geospatial surveys) the information a landscape holds. Searching for the elements of the historical landscape is a kind of clue-tracking, as sometimes the shape, the structure, or the raw materials of a dam, a road, or an earthwork is the key to answering a question about the origin, dating, or function of that particular terrain feature. Whether a tumulus field, a mine, an earthwork, or the special traces left behind by agricultural activity (ploughed fields, plot systems, and farmyards), landscape archaeologists – like trackers – examine the particular phenomenon under study in the context of its ecosystem, while being aware that the reasons behind landscape formation between the Neolithic and Late Medieval times are region- and period-specific.

Yet, the particular identified features can only be interpreted properly as a system, i.e., in the context of each other, and revealing the connections between visible features and those that had vanished from sight by today is an inescapable part of this process. Whether some burial mounds beside a Roman villa farm, the remains of which are hidden from the naked eye or the relation between the ramparts and the settlement part on a Bronze Age fortified settlement, the traces one can detect in the landscape today are all remains of a complex network defined by diverse factors. Therefore, the question is not whether it is worth collecting and analysing such elements, even with a predictive approach, but whether it is possible to recognise patterns unique to a period or a function in the ever-changing landscape. Another important question is, how can we identify in the recent landscape the elements that may belong together; therefore, the quantity of relevant and authenticable data points suitable for analysis is key for structural mapping of the network of complex spatial and temporal relations within the landscape.

Fig. 1. 1. Riegl VP-1 VUX LiDAR laser scanner;
2. Riegl VP-1 VUX LiDAR laser scanner mounted on a helicopter

Objectivity, perceptibility, patterns, and network

Modern remote sensing methods have been used for some time in the research of historical landscapes; accordingly, archaeologists are generally familiar with the LiDAR technology as well.[2] The acronym is short for a term which basically describes the essence of this method: Light Detection and Ranging. It involves a special kind of data collecting, practically scanning the designated area with millions of laser pulses emitted by devices mounted to a drone, helicopter, or plane flying at low altitudes *(fig. 1)*. Accordingly, the method is often referred to by another acronym, ALS, short for 'Airborne Laser Scanning', which is even more accurate. The current precision laser devices and integrated GPS systems are sophisticated enough to ensure high precision independent of the type of carrier. As the laser scanner emits a huge quantity of beams per second, enough reach the surface even in the densest forest to obtain reliable information about the terrain hidden under the canopy (or other kind of vegetation) – sweeping the surface like the light that filters through the leaves in an old beech forest. This method lets one digitally remove the noise vegetation represents from the data set and create a topographical map of the designated area *(fig. 2)*.[3]

Laser beams do not penetrate the ground but are suitable for collecting data about the surface with a few-decimetre accuracy, which, when being processed with special algorithms, allow one to make visible the variety of surface forms and features that cannot be perceived on the spot. In many cases, the diverse surface forms imply what is under them; these signs are important for the broad view rather than only their micro-environment because these tiny anomalies point to large

[2] *Doneus – Briese 2011; Briese et al. 2012; Juhász – Neuberger 2016; Bertók – Gáti 2014; Gáti 2017.*

[3] *Chase – Chase – Chase 2017;* see also the works of the recently and prematurely passed Damien Evans (e.g., *Evans 2013; Evans 2016;* as a co-author *Cohen – Klassen – Evans 2020*), and for a short popular-scientific overview in Hungarian, *Belényesy 2022*. Besides, several European countries have systematic databases of LiDAR surveys. No such database is available in Hungary yet, but the databases of, e.g., Austria, Denmark, Slovena, Belgium, and Slovakia are free to access. More information at https://landscapearchaeology.org/lidar-data/.

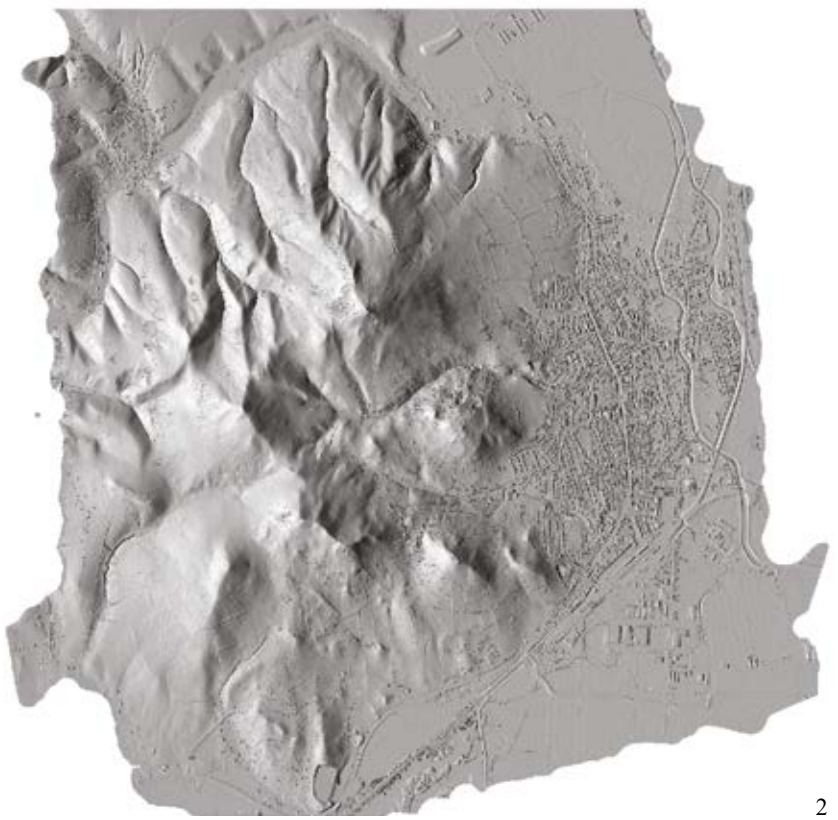


Fig. 2. 1. Sátoraljaújhely and its surroundings on a satellite image by Google Earth (taken on 28. 09. 2022.);
2. Digital terrain model (DTM) of Sátoraljaújhely and its surroundings (with the vegetation removed)

systems, without knowing which some layers of the historical landscape remain un- or barely interpretable. Such anomalies may indicate one-time plots, ploughlands, house sites, cemeteries, buildings, villages, roads, fortifications, and channels *(figs. 3–5)*.

The processing of aerial and satellite images yielded impressive results in the case of non-forested areas and some particular types of archaeological phenomena (e.g., Roman *villa*s, earthworks, certain types of burial ground); with the application of the LiDAR/ALS technology, new lands became available for research. Albeit aerial photogrammetry offers a variety of models,[4] the LiDAR/ALS technology may bring new possibilities (compared to traditional aerial photography) for the virtual isolation and presentation of the diverse layers of the landscape, as well as for predictive modelling, which involves the automatic recognition and prediction of recurring patterns. With the millions of points recorded during a survey, the landscape can be described and, thus, measured, and the clusters of points reflecting a particular characteristic or determinable attributes can be classified into distinct categories. Therefore, syncing the scanner and the processing software and finetuning them according to the aims of the particular research is pivotal. The goal is to recognise and show as many physical features on the surface as possible, whether the subject of the survey is a prehistoric burial ground, an earthwork, a medieval church, or a battleground. But what is the real use of all that?

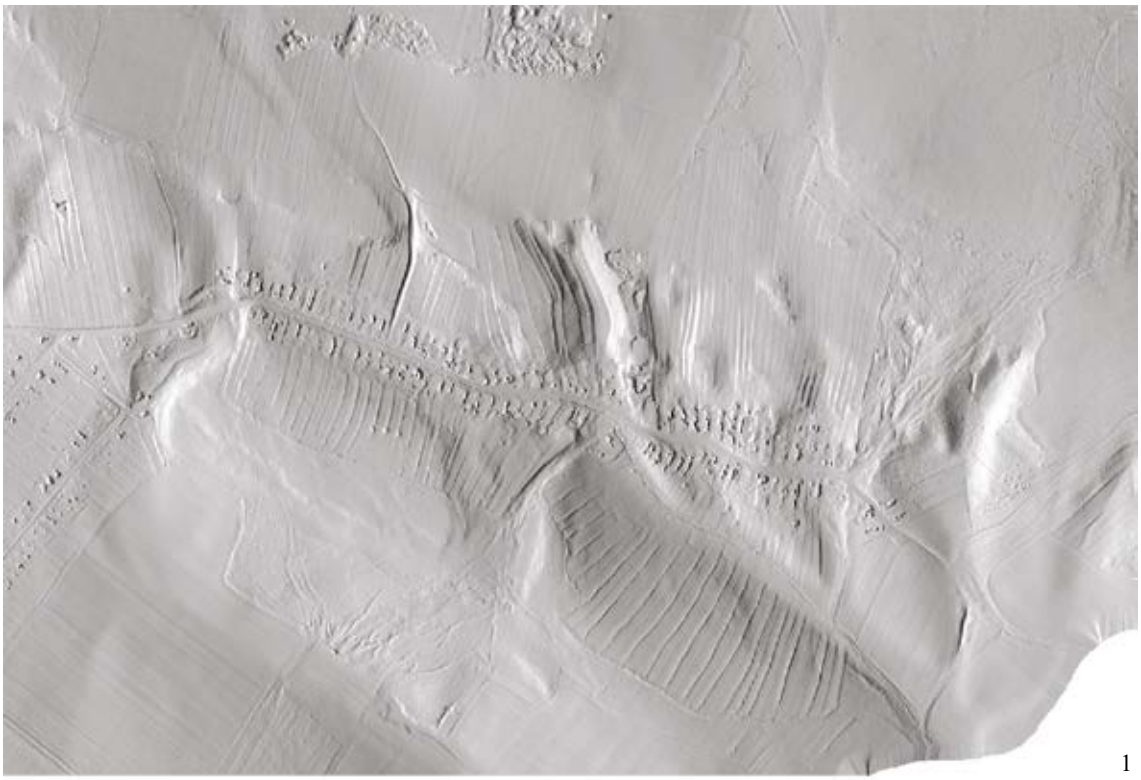
The primary expectation set against this method is to capture the changes in the historical landscape and present certain elements – ramparts, ruins, and other surface anomalies – in as good quality as possible. However, scanning is superobjective, which means everything perceivable is measured without any previous consideration. As a result, the raw body of measured data comprises all elements (and their connections) of the historical landscape in their complexity, reflecting all layers and periods merged into a single one. A raw scan contains all perceivable phenomena, and it is a task for researchers to select the significant ones. Two approaches can be tried in the selection process, i.e., the analysis of the extraordinarily complex raw picture *(fig. 6. 1–2)*.

The multitude of data points or point cloud[5] (with the professional term) is suitable for separating the layers, that is, the phenomena of 'historical' interest researchers seek within the obtained body of data. The question is, what 'historical' phenomena are, and how do we label them? One time-consuming but effective way is to isolate and analyse every atypical surface phenomenon one by one. Another possibility is a kind of reverse engineering, when one starts with the elements, connections, and interactions of the historical landscape and removes everything else by omitting first the recognised modern influences and then going back layer by layer, like in an archaeological excavation, removing everything that is modern or belongs to an era different from the one in focus. This ensures that one gets to the original, important details and can properly evaluate the studied historical layers.

The keywords in both cases are modelling and the possibilities of distinguishing between recognised patterns. Identifying a characteristic landmark opens the way to reconstructing the original landscape and the historical environment it incorporates. Such a reconstruction also raises the information value of other archaeological sources, historical maps, and coeval written sources because the information they carry possibly adapts to the original landscape. Some phenomena that, at first sight, seem not particularly significant represent great help in this work as they may

[4] *Verhoeven 2011; De Reu et al. 2013; Balogh – Kiss 2014; Szabó 2016* 66–75.

[5] The point cloud, in this case, is the 'raw' multitude of geospatial data points (actually often resembling a cloud) recorded during a survey. Diverse models can be built from these points of the survey zone. Archaeology usually only uses the data describing the surface; thus, other points retrieved from, for example, houses and trees are considered noise and removed from the cloud during processing. To facilitate their separation, special algorithms can be used that automatically filter out and isolate the points that are unnecessary or noise.



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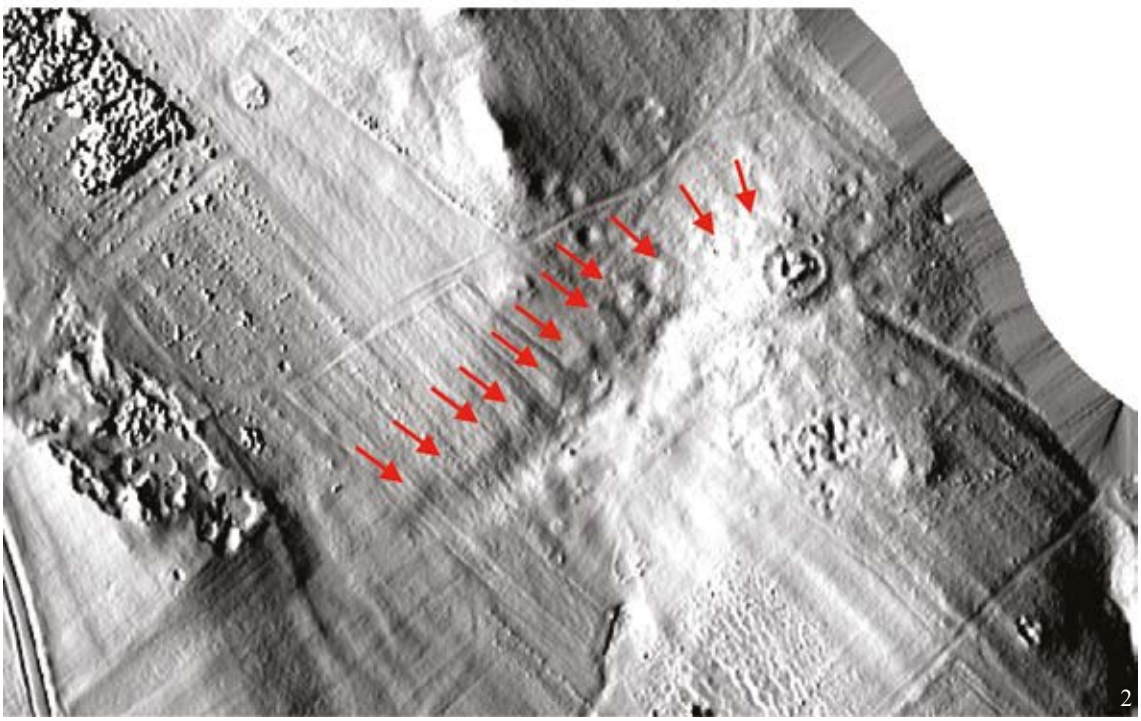

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Fig. 3. 1. Historical settlement structure of Lókút. The system of plots and cattle ways is easy to identify;
2. Row of houses along the ‘main street’ southwest of the church in the medieval village of Felső-Pere

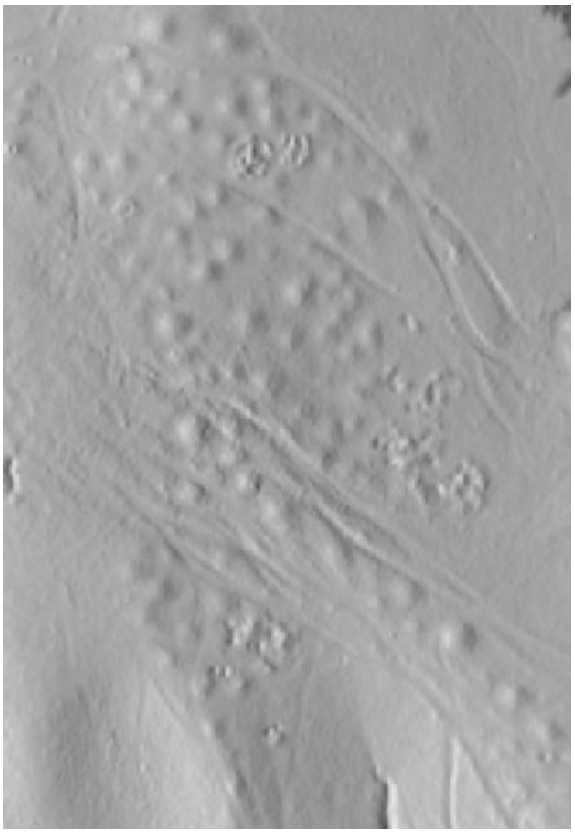

Fig. 4. Detail of the tumulus field at Ugod-Katonavágás II

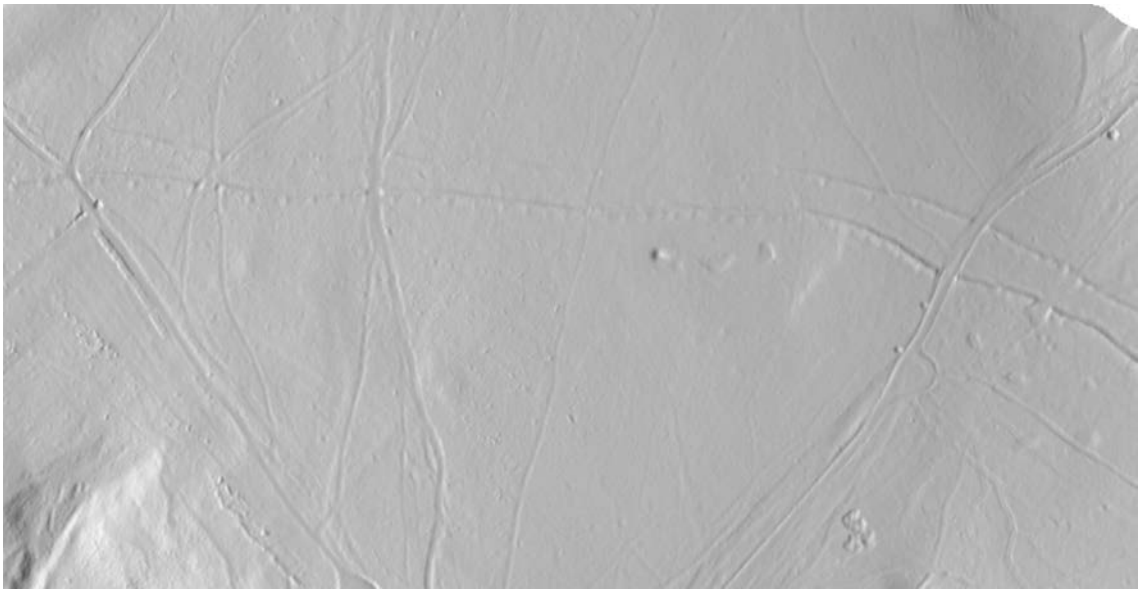

Fig. 5. Two ramparts of the probably Bronze Age fortification system known as ‘the Podmaniczkys’ Road’ and the unique articulated structure of the inner side of the earthwork identified on the LiDAR survey image of Nagy-Somhegy in Bakonybél

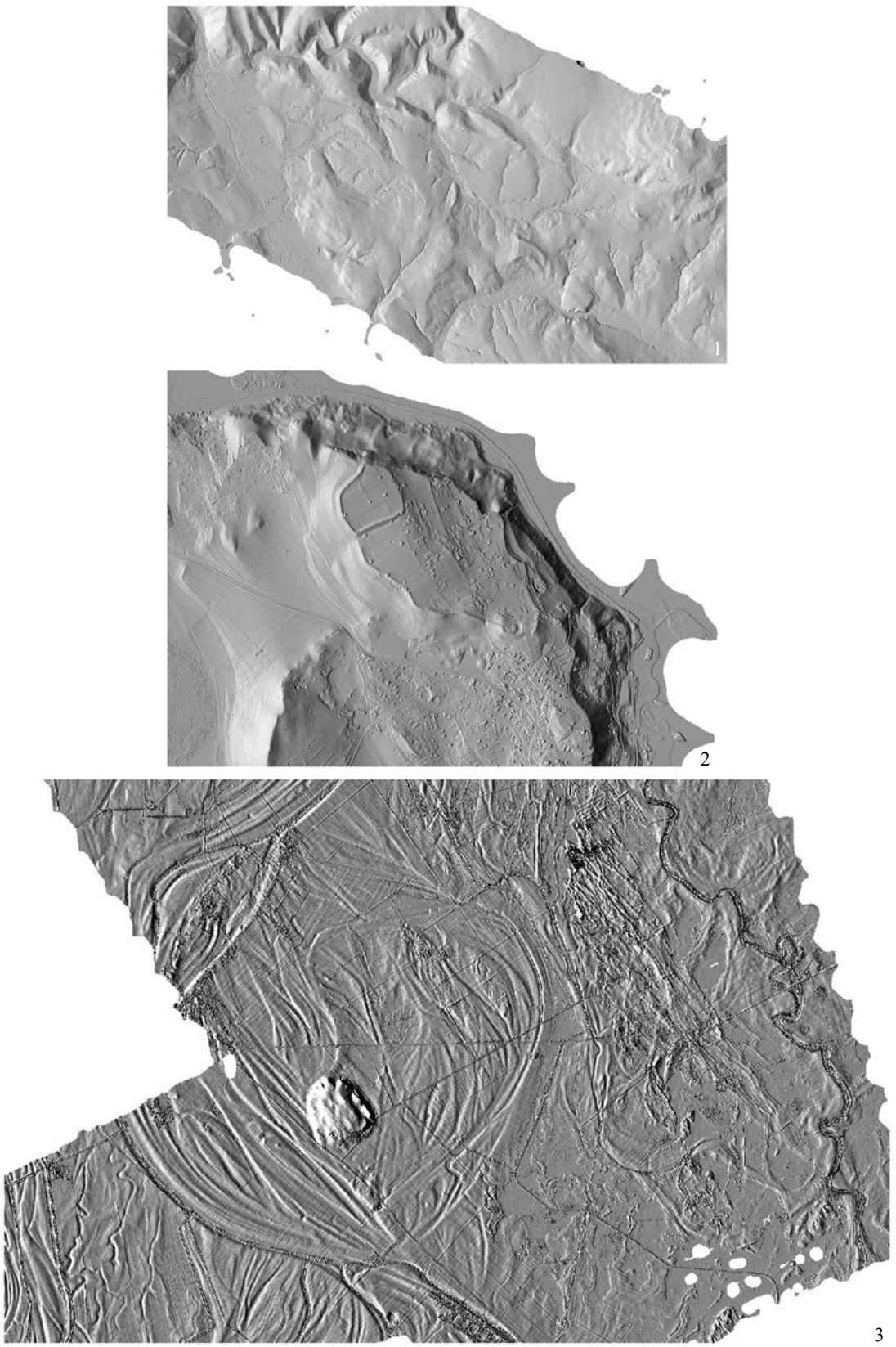

Fig. 6. 1. Grey-shaded digital terrain model (DTM) of Bakonybél and its surroundings (with the vegetation removed); 2. Grey-shaded digital terrain model (DTM) of a detail of the Tihany Peninsula with the Iron Age hillfort and settlement centre (with the vegetation removed); 3. Grey-shaded digital terrain model (DTM) of Solt-Tételhegy (with the vegetation removed)

be especially important when interpreting past events. Such a phenomenon can be a road, an embankment, settlement phenomena, and one-time beds of streams and other watercourses that have vanished by today or become less characteristic elements of the landscape *(fig. 6. 3)*.

The historical environment, like the ecosystem of the natural environment (discussed above), can be described as an anthropogenic network with many internal connections. The arrangement where the roots of the trees, the mycelium interlacing the soil, the insects and the animals of the forest act in a symbiosis as a living system can be projected to the anthropogenic environment, too; therefore, by identifying some details, one may improve its understanding of the whole anthroposystem. The differences in the analysis of the two systems lie only in the ways of perception and selection.

Limitations of the LiDAR/ALS technology and considerations in planning a survey

Like with any technology, the keys to success with LiDAR/ALS surveys are adequate research questions, a well-tailored survey method, and accurate planning. The carrier type and the capacity of the scanner are also important. As the emission rate (pulse/second) of the scanner is not constant, the scanning frequency must also be determined after the survey area has been delineated, and with consideration to the intended use as an industrial, environmental management-related, or an archaeological analysis may require different resolutions. Many factors may influence the optimal resolution, including the character and size of the survey zone, the terrain features/landmarks to be surveyed, the time of surveying, and the vegetation. In the vegetation period, low altitude and high frequency give better results, while in other parts of the year – from the falling of leaves to the time when fog shrouds the landscape even at daytime and snow has not fallen yet or just before spring – quite the opposite, higher altitude and lower frequency may be expedient. With an archaeological survey, if the scanner is set to an (average) 600 or 400 kHz frequency, the altitude must be around 170–200 m.[6]

A basic characteristic of the LiDAR/ALS method is that at every setting, higher pulse density comes with lower signal levels, i.e., either one retrieves more but less reliable data (due to less energy) or the opposite, less but more accurate.[7] Obviously, the greatest challenge to overcome when making a survey is vegetation because of the significant data loss due to the diverse layers of the canopy of the trees and the various layers of the vegetation underneath. Albeit vegetation is part of the landscape, it represents unnecessary data (noise) in a survey intended for archaeological use; in this case, scanning on the highest setting does not represent a viable solution due to the characteristic of the method as described above (many less reliable vs few more reliable data points).

When planning a survey, not only the characteristics of the vegetation and the must of securing a suitable signal strength must be taken into account, but also the limiting factor of the terrain and the manoeuvrability of the carrier. It is important how manoeuvrable the carrier (in our case, a helicopter) is at optimal cruising speed: when the terrain is extremely rugged, survey distance

[6] The presented surveys were made with a Riegl VP-1 VUX LiDAR scanner and realised within the frame of the '*Védett kulturális és természeti örökség távérzékelési technológiai kutatási centrumának létrehozása, új méréstechnikai módszerek és dokumentációs eljárások kidolgozása*' [Development of a remote sensing technology research centre for protected cultural and natural heritage and new survey and documentation protocols] GINOP-2.1.1-15-2015-00695 project.

[7] Low energy levels can affect data quality significantly: reduced signal strength results in weaker return signals which may be inaccurate, especially in areas with low reflectivity or dense vegetation. Besides, they may struggle penetrating dense vegetation and have a shorter effective range and, occasionally, fewer return signals. All these contribute to an incomplete point cloud with gaps, inaccuracies, and relatively high noise.

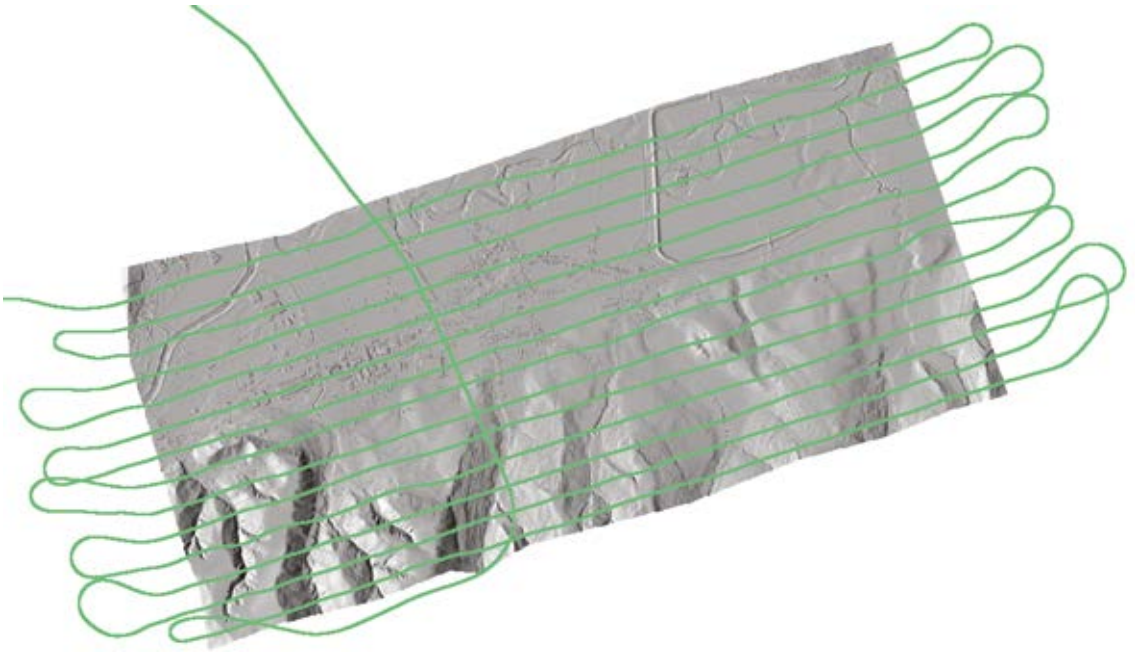

Fig. 7. Survey zone of the Battle of Segesvár with the flight track

decreases when approaching or flying over a steep slope, and the swath (i.e., the width of the coverage area) of the LiDAR scanner decreases with it. Therefore, an experienced pilot may 'pull up' the plane, which results in the scanner emitting pulses in directions other than vertical, which causes insufficiently low data density at the foot of the slope. Therefore, the pilot must be careful to keep the plane (and, thus, the mechanical axis of rotation of the scanner) horizontal at all times, partly to ensure equal data density and to prevent the scanner from being unnecessarily exposed to the effects of acceleration *(fig. 7)*.

The flight direction is also crucial; at 20 knots (ca. 7 kph) or higher air motion, the planned footprints must be parallel with the direction of the wind to make holding the path easier for the pilot. When the wind is lower, the most important consideration in planning may be efficiency, that is, optimising the turning path. For example, when the survey zone is rectangular, the turning paths must be planned to parallel the long sides so less of the precious operating time is spent on turning. No data is collected during turning, but the manoeuvre cannot be swift as the scanner is still onboard, and its mechanism must be protected from the effects of acceleration. One must also take account of the main directions when planning the survey of a linear phenomenon (a ditch, an embankment, etc.) and avoid perpendicular paths.

Besides, one must also consider the building density of the survey zone, the peace of the residents, the discomfort caused by noise load, and discomforts caused by systematic flying.

In summary, one base pillar of successful research is careful preparation, that is, a well-designed flight plan that serves as a base for a remote sensing permit request. A flight plan incorporates many other considerations, too, regarding bandwidth settings, angle range, the GPS antenna, the synchronisation of the control measurements on the ground, and the possible effects of fog or a snow-covered surface.

The 170 km path needed to survey an area of approximately 50 km^2 can be covered in about 1.5 hours; however, the obtained results will only be suitable for processing if the survey runs according to an adequate plan. Based on trajectory data, the data set, and the data obtained from permanent geodetic points of reference in Hungary, the accuracy of the data obtained is about 20–30 cm. However, the inner consistency of the data points within the set, which is far more

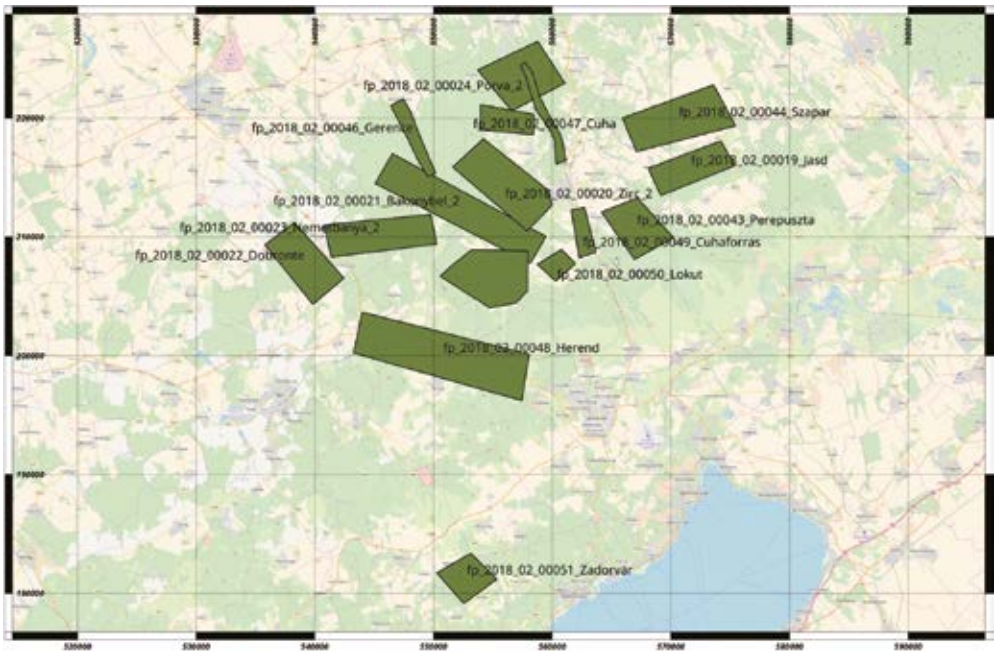

Fig. 8. Designated survey zones in the Bakony Mountains

important for research, is way higher, with a precision of under 1 cm per data point. Conclusively, it is easy to see that not accuracy but resolution is decisive in the quality of a dataset because if only a few pulses/m^2 reach the surface, the retrieved data will be way less than if the number of pulses is ten times higher to start with *(fig. 8)*.

Data visualisation

Data visualisation is the answer to the demands of observing and making visible because only the archaeological phenomena that can be visualised are significant for research. However, one must be aware of the characteristics of the technology when forming expectations and understand that the visually readable rendering and the one suitable for analysis are not necessarily identical – the latter may be best compared to the methodology and terminology of ultrasonography (instead of 'traditional' archaeological data collecting methods like field survey or aerial photography). Evaluating the visual rendering (image) might be a challenge, even for an experienced researcher.

Anthropogenic influence can be revealed by filtering the immense quantity of obtained raw data using various methods and algorithms. A real milestone in the development of this field was the publication of a particularly useful handbook by Žiga Kokalj and Ralf Hesse on ALS data processing and visualisation, with descriptions of some characteristic types of phenomenon and how to perceive them and which tools are available for data processing.[8]

More data has yet to be collected to compile a comprehensive handbook about the archaeological LiDAR/ALS surveys of the Carpathian Basin; however, a structured archaeological and/or landscape historical analysis of the available isolated datasets might serve as a basis and proper impetus for the preparation of overviews of particular micro-regions. In the following, previous surveys and, through their examples, important 'partial' results are presented.

[8] *Kokalj – Hesse 2017.*

Zirc-Tündérmajor

The surveys carried out in the Bakony Mountains cover hundreds of square kilometres. Besides obtaining a set of systematically collected data from large areas, this survey also demonstrated how sensitive the LiDAR/ALS method can be – as illustrated below through the example of tumuli, a characteristic feature type in the landscape.

In many cases, burial mounds are visible to the naked eye; thus, they can be identified and surveyed. However, the condition and prospects of the tumulus fields differ highly. The ones in densely forested areas are usually relatively intact, endangered only by local forestry works; in contrast, others lay on ploughland or in built-up areas. Accordingly, tumuli are easy to identify in a forest but almost impossible to identify in a cultivated area. However, the LiDAR/ALS survey can detect and make visible anomalies which are barely possible or impossible to observe on the field; therefore, the primary goal of the research in the Bakony Mountains was to explore these perishing or already vanished tumulus fields. The analysis of the microtopographic patterns has revealed the presence of often unknown burial mounds in an advanced state of decay on the outskirts of several modern settlements and pointed out many invisible details of the known fields. The former result is extremely important because not only were new tumulus fields identified, but direct information was also obtained on how endangered they are. The significance of that is easy to comprehend, considering that if a burial mound is almost completely eroded away and hardly visible on the surface, the burial chamber at its centre is probably exposed to the harmful effects of agriculture, and the burials or the grave finds can be near or already scattered on the surface, which requires immediate action.

Another important result of this survey was obtaining complex topographical information on large areas surrounding the tumulus fields; now, we can see the whole, well-defined tumulus field with a complex connection network of clusters of diverse size burial mounds. This overview of their inner system might open a new chapter in the research of tumuli regarding their chronology and the related communities and burial rites. Moreover, the relationship between close tumulus fields and their broader environment can now be analysed in a wider context, a single homogenous base survey, that is, the historical landscape. Based on the above, one can conclude that the LiDAR/ALS technology can bring key changes and a new approach to both research and heritage protection.

The study area near Zirc, a long-known archaeological site, was promising. The eroded burial mounds are situated within the perimeters of the town, at the fringes of the built-up area, thus clearly in danger. The illustrations of the paper presenting the results of the survey are, at the same time, chapters of the research history of the area and demonstrate the conspicuous advantages of a tangible representation of the landscape and the terrain forms as compared to the simple 'double' contour line[9] marking the perimeters of the site on a map of the Archaeological Topography of Hungary and the Central Register of Archaeological Sites in Hungary. The survey proved that a tumulus field can be identified even in a 'noisy' environment affected by large-scale anthropogenic activity and completed the existing body of related information with new details. As a result, we are certain today that the burial mound cluster is part of a larger system or burial ground, elements of which, in a part stretching long toward the residential area of today's Zirc, became actually identified and, thus, eligible for protection, by this survey *(figs. 9–10)*.[10]

[9] Double (or rather, multiple) site polygons are a feature of the Central Register of Archaeological Sites in Hungary (IVO). It is the result of the unique data management within the system where preventing data loss is a priority and reflects a characteristic of archaeological data collecting, namely that sites may appear on the surface with dissimilar find scatters due to intensive agricultural activity, faulty data recording, or revision. Accordingly, each polygon is recorded independently of the rest, marking the extent of the site at a certain time and reflecting on this characteristic of the applied data-collecting methods.

[10] *Belényesy – Wolf 2024.*

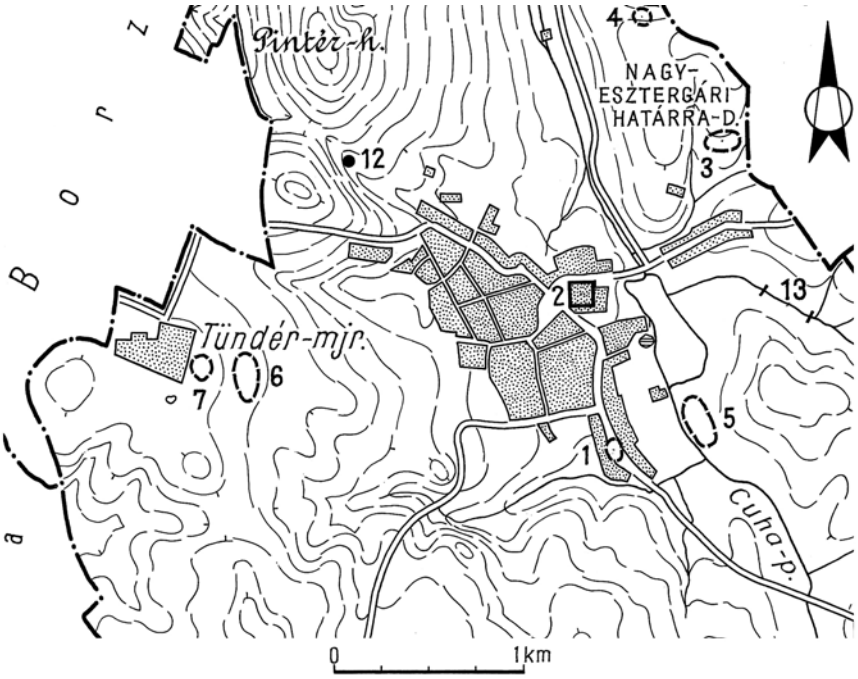

Fig. 9. Zirc-Tündérmajor. Site perimeter polygons on a map of the *MRT 4* 264.

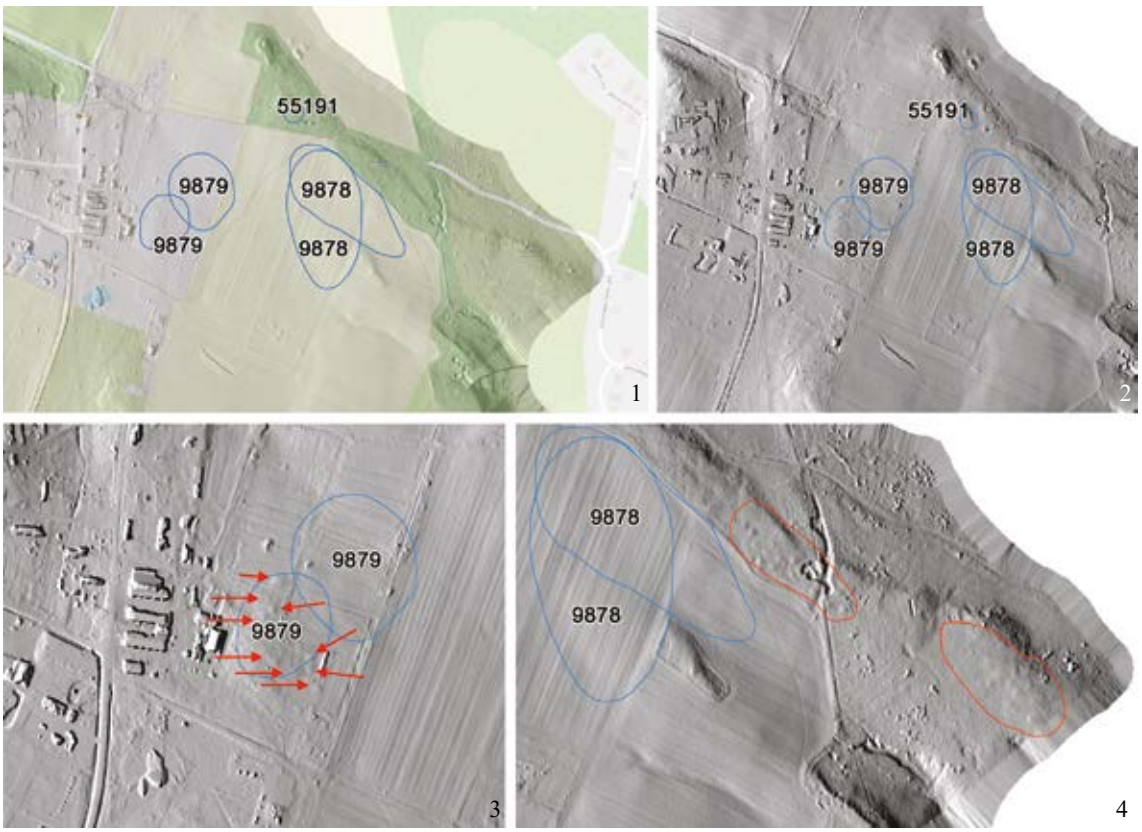

Fig. 10. Zirc-Tündérmajor. 1. Site perimeter polygons from the Central Register of Archaeological Sites in Hungary on a topographic map; 2. Site perimeter polygons from the Central Register of Archaeological Sites in Hungary on a LiDAR image; 3. Known and delineated tumulus field (IVO ID No. 9879). The smaller polygon on the south marks the tumulus field comprising several damaged, eroded mounds. Two tumuli in the south-east are situated outside the registered perimeters; 4. New tumulus fields (red marks), each with ten mounds. The eastern field probably continues towards the area of Zirc

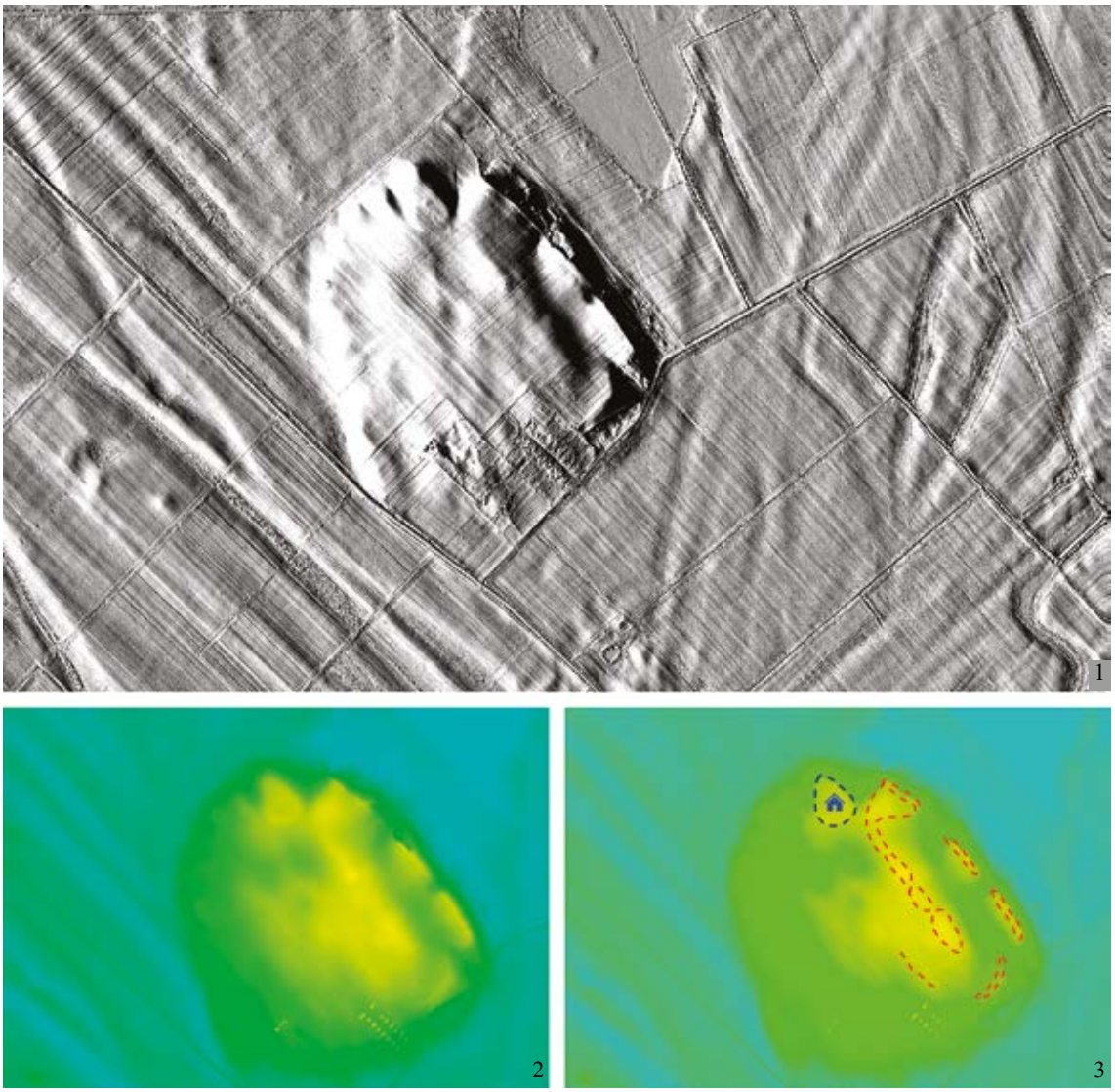

Fig. 11. 1. Grey-shaded digital terrain model (DTM) of Solt-Tételhegy (with the vegetation removed); 2. Colour digital terrain model (DTM) of Solt-Tételhegy (with the vegetation removed); 3. Interpretation of the colour DTM of Solt-Tételhegy with markings of the presumed anthropogenic features, including the separate block of the medieval church in the eastern part

Solt-Tételhegy

This site has been subject to intensive investigations and partially excavated. Aerial photography was a crucial part of the survey; combined with recent excavations and a geophysical survey, several historical layers of the plateau could be revealed. One of the most important results of this complex research programme was the identification of a medieval settlement and a system of fortifications on the northern side of Tételhegy.[11] The LiDAR scan corroborated the image compiled from archaeological data; however, some features that appear in the aerial images are not present in the LiDAR terrain model. For example, while the isolated block of the church, the ovoid ditch enclosing it, and some connected elements of the fortification on the northern slope of the hill are clearly discernible, even conspicuous, the southern fringes of the medieval settlement are almost invisible. The intensive ploughing of the area in question, which accelerated the filling of the ditch, can only partially explain this phenomenon *(fig. 11)*.

[11] About interdisciplinary research, see especially *Szentpéteri 2010*.

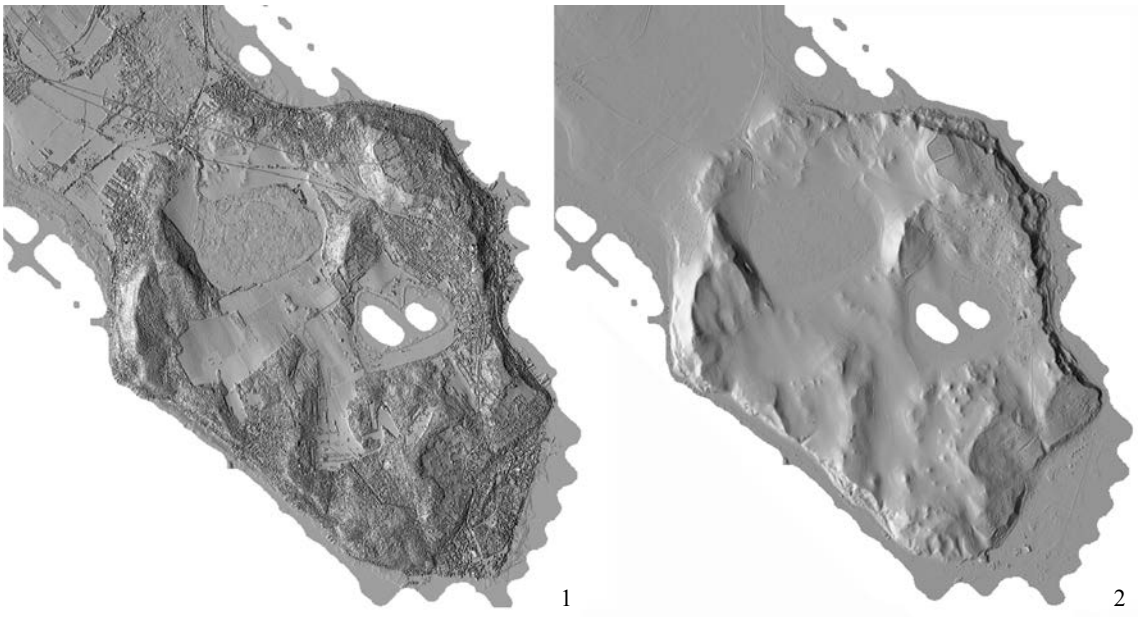

Fig. 12. 1. Digital surface model (DSM) of the Tihany Peninsula (with vegetation); 2. Digital terrain model (DTM) of the Tihany Peninsula (with the vegetation removed)

In contrast, the fortifications at the edge of the plateau of Tételhegy are in fairly good condition. It would be evident to identify these persisting sections as parts of the one-time (probably prehistoric) fortifications protecting the hilltop; however, this hypothesis has to be proven archaeologically. A deeper analysis of the LiDAR-based digital terrain model represents a possibility for a more detailed evaluation because the surface inside the clearly visible edges of the plateau is far from even: the eastern part is definitely higher than the western and southwestern and is articulated in a north-south direction. The rampart (bearing anthropogenic characteristics) is in good condition on the eastern and north-eastern edge of the plateau and turns at the south-eastern corner. The earthwork is interrupted at two points; it cannot be excluded that the two gaps on the eastern side and at the south-eastern corner, respectively, are the remains of the original entrances (gates?). A minor turn in the related part of the rampart may corroborate this theory but does not represent conclusive evidence because of the use of the slope in modern times. A clearly discernible earthwork, running parallel with the rampart on the eastern slope of the hill, connects the line of the south-eastern corner and the oval enclosure of the medieval church; it is crossed by the medieval double ditch, which appears as a marked anomaly and could be identified on aerial images. The results of the micro-terrain analysis suggest that the centre of the plateau and the zone aligned with the rampart system on the eastern slope rise considerably above their surroundings. Based on the relative position of the earthworks, this area, akin to the ovoid block of the medieval church, forms a topographically distinct unit within the plateau.

Many of the detected anomalies are well-visible; they represent a firm base for drawing more general conclusions. By accepting that the detected micro-terrain features (anomalies and zones) like that of the medieval church are marks of historical anthropogenic activities stemming from similar causes and see them as some kind of indicators, the presence of extensive active zones (from a settlement-historical point of view) can be presumed in the area of the earthworks of the eastern slope and the small elevation in their foreground and on the north-eastern side of the valley north-east of the small promontory of the medieval church *(fig. 11)*.[12]

[12] *Belényesy in print.*

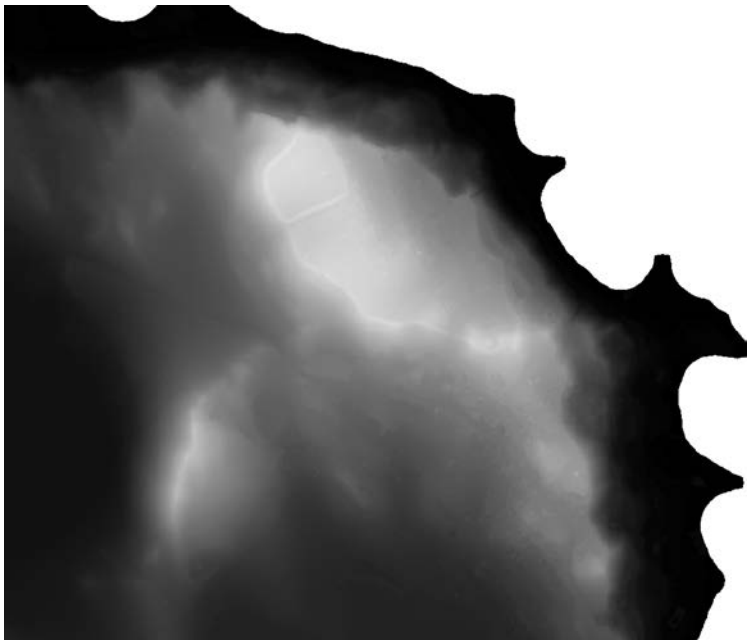

Fig. 13. Analysis of the elevations on the north-eastern side of the Tihany Peninsula. The signals of the high altitude and habitable zones of the Iron Age hillfort and the inner parts have been amplified

The survey of the Tihany Peninsula outlined a similar picture. The analysis of the micro-terrain features of the higher parts of the plateau (suitable for settling) has revealed that the signs of the Iron Age fortified settlement and the medieval anthropogenic zones (that is, the blocks of the prehistoric hillfort and the medieval monastery) form homogenous but clearly distinct, light clusters in the filtered data set. This characteristic pattern differs markedly from the environment, allowing one to suppose that it indicates, like in the previous case, areas which are active from a settlement-historical point of view *(figs. 12–13).*

Segesvár (Sighişoara, Romania), battlefield

The LiDAR technology and strategy applied in the survey of the area where the Battle of Segesvár, the clash concluding the Hungarian Revolution and War of Independence of 1848–1849, took place, do not differ from the method used in the research of any archaeological site – primarily because the goal, reconstructing the historical landscape, was also identical.

The reconstruction of the coeval landscape allows one to place the battle, which took place on 31 July 1849, in its original context *(fig. 14. 1).* The survey brought to light new details and circumstances which might improve our understanding of how the events unfolded, for example by making visible the riverbed changes of the Nagy-Küküllő (Târnava Mare, Romania), identifying the vanished one-time causeway leading to the castle of Bún (Boiu, Romania), and detecting the traces of supposed cannon fires that showered on the field north-east of Fehéregyháza (Albeşti, Romania) and the Hungarian lines somewhat east of Monostorhegy *(fig. 14. 2–4).*[13]

The presented examples illustrate excellently that the historical landscape is not only the sum of characteristic terrain features but a complex network incorporating them. Accordingly, the research of the historical landscape is a kind of archaeological topography where visual observations and data collecting occur on a new, higher technological level. But even if relying on algorithms, point clouds and three-dimensional models, the focus of the research remains the same: detecting traces of human activity in the landscape.

[13] *Belényesy – Kuszinger – Kulcsár 2021.*

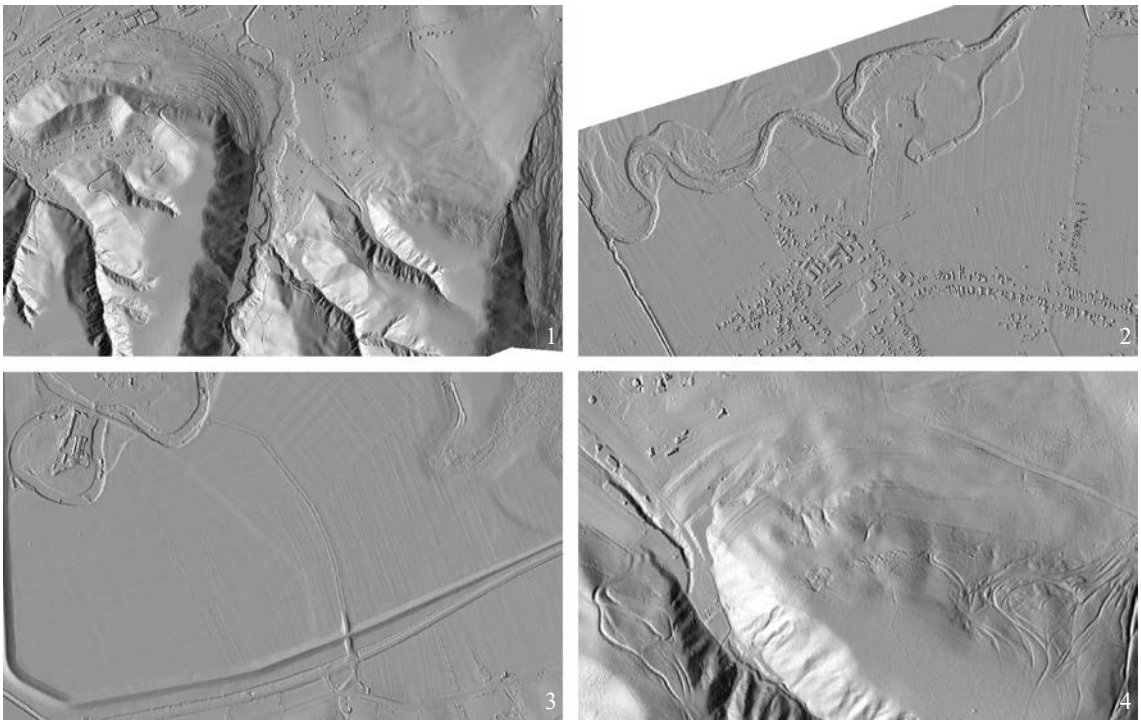

Fig. 14. 1. Southern part of the battlefield at Segesvár (Sighişoara, Romania) on a LiDAR survey image; 2. Riverbed changes of the Nagy-Küküllő north-west of Fehéregyháza (Albeşti, Romania); 3. Road with a slightly broken line at the centre of the digital terrain model. Fehéregyháza (Albeşti, Romania); 4. Supposed position of the Hungarian lines on the LiDAR survey image. Fehéregyháza (Albeşti, Romania)

Possibilities for development

As maintaining the objectivity represented by a 'raw' point cloud during processing (that is, isolating the historical layers and transforming them to the visual range) is crucial, this task cannot be burdened on the researcher working with the data set alone but algorithms that may be more precise and can transform terrain features into mathematical formulas and analyse them must also be applied. This way, not only the particular features but also their connections may be revealed and evaluated. Algorithms can do more than merely remove the vegetation: domestic and international examples demonstrate that by using them, one can reconstruct authentic historical landscapes even in areas with extensive plough fields today or heavily affected by forestry. However, such a reconstruction first requires determining the unique characteristics of the possible anthropogenic effects that may influenced the landscape, and the traces of which are still present there, even if in a highly varied stage of perishing. Every terrain feature – a mound, a pit, a depression, an embankment, a dam, a road, or a building – can be broken down to a top point or line (in the case of line features), a bottom point or line, and a slant (the slope of every elevation, depression, and rampart).

By observing simple geometric forms like circles, straight lines, and right angles formed by lines, one can develop processing routine types, which facilitate creating models that can be part of settlement-historical interpretation and highlight the terrain features one is looking for. More complex features can be detected by introducing such routines, which break down every terrain feature into a combination of simple geometric forms. In short, by describing the unique characteristics of the terrain forms we are looking for and translating these descriptions to mathematical formulas, series belonging to terrain features with a settlement-historical relevance might be isolated and identified even in point clouds comprising millions of data points.

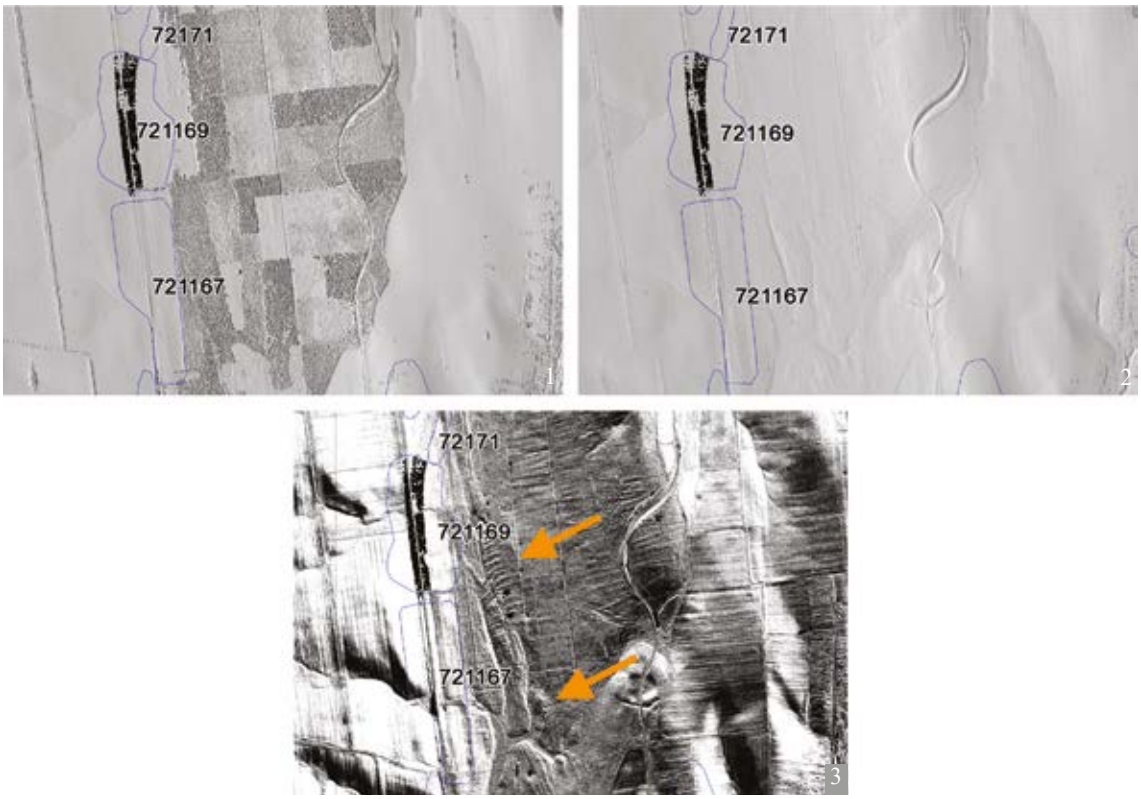

Fig. 15. 1. Digital surface model (DSM) of Gamás-Vadépuszta and its surroundings (with vegetation); 2. Digital terrain model (DTM) of Gamás-Vadépuszta and its surroundings (with the vegetation removed); 3. Pseudo-shaded terrain model of Gamás-Vadépuszta and its surroundings. Arrow marks the amplified signals of the small plots and the centre of the medieval settlement

That would be the next level, but certainly not the last: the world of data transformation, interpolation, signal amplification and attenuation offers countless possibilities for detecting historical layers.

Gamás-Vadépuszta

A site that became known for recent excavations was chosen to illustrate the difference between 'traditional' data processing and algorithmic distortion and the advantages of algorithm-based evaluation.[14] The digital surface and terrain models of the survey of the wider area of the preventive excavations preceding the construction of Road 67 demonstrate excellently the possibilities of LiDAR/ALS technology *(fig. 15. 1)*. The long, north-south directed main street of Felsőmocsolád village and the houses accompanying it on both sides are clearly discernible in the south-eastern corner of the digital surface model. The diverse textures of the forests bear no archaeological significance; they mark differences in land use and, perhaps, forestation. The forest patches are usually rectangular, and the anomalies east of the perimeters (as registered in the IVO database) of Site ID No. 72167 indicate an old road. Some line structures are clearly visible outside the forested area, but there is no general characteristic that would help distinguish between modern and old structures.

A system of more line structures could be detected on the shaded digital terrain model presenting the surface without vegetation *(fig. 15. 2)*. Some of the lines clearly mark the borders between differently used pieces of land, ditches, recent streets, embankments, and roads that run

[14] *Belényesy 2020.*

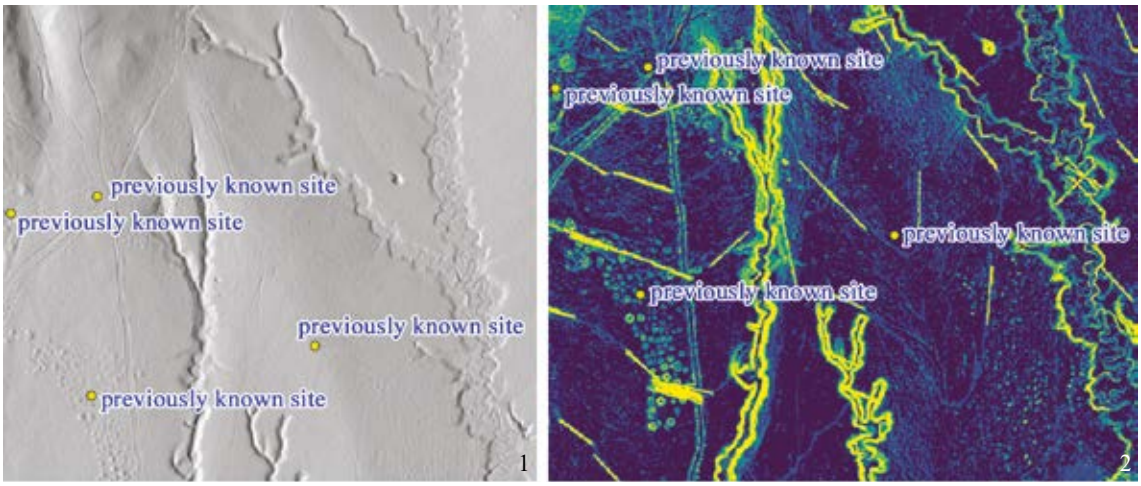

Fig. 16. 1. Digital terrain model (DTM) of Bakony-Százhalom and its surroundings;
2. Cluster analysis of Bakony-Százhalom and its surroundings

in a cut through a terrain form. A regular pattern could be observed east of Site ID No. 72169 and north of a modern forest road: the traces of a former fence and part of the edge of a plot are visible somewhat north-northeast of the big eastern turn of the northern road that runs in the cut. Otherwise, the valley is characterised mainly by north-south oriented line structures (aligning with the direction of cultivation).

The edges, lines, and arheic areas appear highlighted on the pseudo-shaded map of the survey zone, which 'amplifies' micro-anomalies *(fig. 15. 3)*.[15] The rather expressed regular pattern east of Site ID No. 72169 marks one-time plots on the hillside. The 'dark spots' – depressions – within the plots align with the plot system and mark, as the field investigations have confirmed, a former (perhaps medieval) row of cellars. On the same map, a medieval settlement appears south of the plots and cellars on and around a small elevation and the bank of the local stream. Most anomalies on the map are edges, marking the main plough direction and its changes. Traces of small plots can be observed on both sides of the road running in a cut at the eastern edge of the picture. Features indicating division, fences, or stone accumulations may also suggest former plots which were considerably bigger than the ones in the current settlement of Felsőmocsolád.

Bakony, the so-called Százhalom [Hundred Mounds]

The Százhalom, a tumulus field in the Bakony Mountains *(fig. 16)*, is a particularly interesting case study, through which the marked differences between the 'normal' and pseudo-shading of a digital terrain model can be illustrated and also how by joining these differently shaded models in a cluster analysis on general settings a new and unique image or pattern of the tumulus field can be obtained.

The examples presented above reveal the possibilities of complex LiDAR/ALS data processing, which offer several prospects for development. The digital environment allows one to model and analyse, besides complex settlement systems and anthropogenic networks, the traces of artificial and natural effects like floods, changes in vegetation cover, or the aftermath of natural disasters.

[15] For more about the pseudo-shading method and the history of its development, see *Kuszinger 2015*. The method was developed within the frame of the realised within the frame of the '*Védett kulturális és természeti örökség távérzékelési technológiai kutatási centrumának létrehozása, új méréstechnikai módszerek és dokumentációs eljárások kidolgozása*' [Development of a remote sensing technology research centre for protected cultural and natural heritage and new survey and documentation protocols] GINOP-2.1.1-15-2015-00695 project.

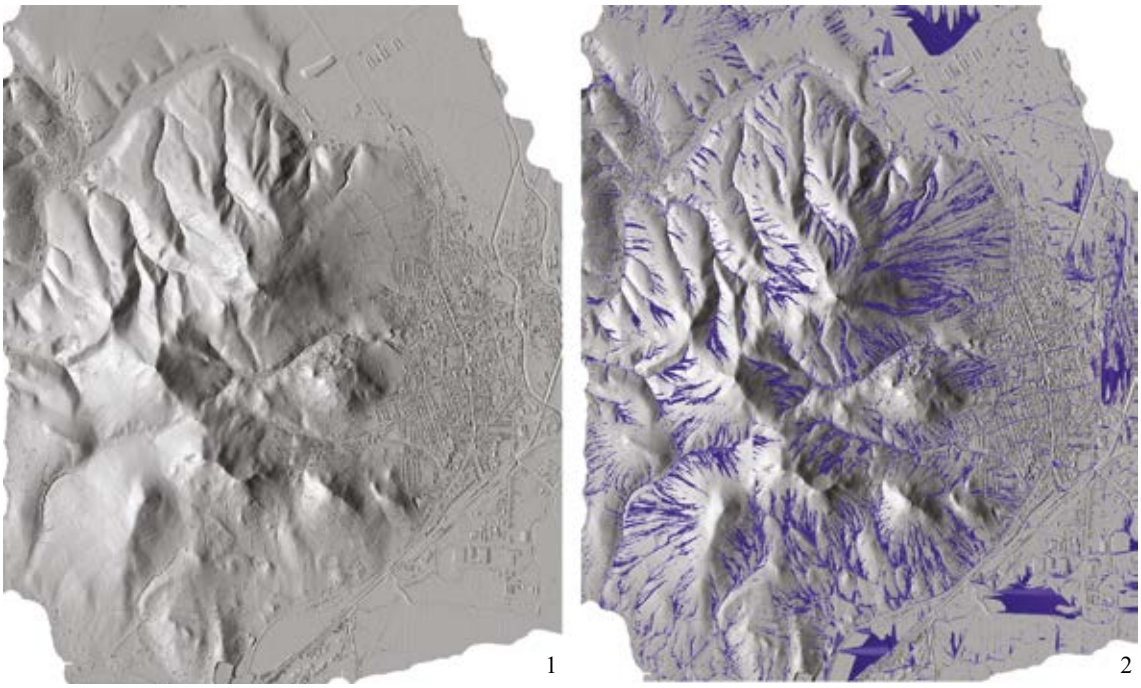

Fig. 17. 1. Digital terrain model of Sátoraljaújhely and its surroundings (with the vegetation removed); 2. Drainage analysis in the digital terrain model (DTM)

In many cases, the broader environment of other networks, ones behind a particular terrain feature or landscape wound (mines, lime kilns, roads, burial mounds, dams, fish ponds, and more) is also worth mapping as they may contribute to determining the specific land use patterns and industrial or trade networks of a particular era *(fig. 17)*.[16]

However, it is also worth going beyond determining diverse filters and processing routines and applying these to the survey zone. Albeit the study by Kokalj and Hesse is a piece of fundamental literature on visualisation tools and the related analytic possibilities, it is perhaps less detailed regarding the unique patterns of particular archaeological features. And yet, determining the archaeological features and the anthropogenic effects connected with them and describing the recurring patterns is the key to progress, to reaching a new level where the authentication of the visual elements and their correlations on field is accompanied by compiling a 'pattern book' of the related features and feature types. Eventually, this would take us to build a new methodology where visually or mathematically described patterns are automatically detected; however, today, in lack of large-scale LiDAR/ALS and field survey campaigns, this path can only be pointed out rather than taken.[17]

Conclusions

Generally, the demand for the application and benefits of impressive high-tech research methods like LiDAR/ALS is no question. However, this technology is much more than a new and spectacular way of data visualisation. It must be understood that the possibilities and sensitivity of the related instruments (for example, a laser scanner) are currently far above any other

[16] *Risbøl – Gustavsen 2019.*

[17] For such initiatives in international academic literature, see *Berganzo-Besga et al. 2021; Guyot – Lennon – Hubert-Moy 2021; Canedo et al. 2023.*

we possess, but that does not mean that 'conventional' survey methods must be abandoned – 'traditional' archaeological topography and the new technology are not in conflict, and the new possibilities urge for changes in the applied methodology. By joining LiDAR/ALS scanning and the identification of the features on the field, running combined analyses of the obtained data, and building a comprehensive database, archaeology could create a GIS-based base map of the anthropogenic landscape, which integrates archaeological data and their connections and contexts, thus providing an analytic tool that points beyond the cartographic approach.

Another important conclusion is that the fate of the still identifiable and important heritage elements of the historical landscape depends on human actions. Despite the changes in land use patterns and the activities wearing the historical landscape, information can still be obtained on several features that were thought to be lost forever, and organising the available body of information would be essential – it is not an accident that not only national LiDAR/ALS programmes have been initiated in several countries, but the need for worldwide campaigns is also on the agenda.[18]

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[18] *Fisher et al. 2022.*

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