

GEOARCHAEOLOGICAL SURVEY OF BRONZE AGE FORTIFIED SETTLEMENTS Kakucs Archaeological Expedition – KEX 2

ÁKOS PETŐ¹ – GÁBOR SERLEGI² – EDINA KRAUSZ³ – MATEUSZ JAEGER⁴ – GABRIELLA KULCSÁR²

The Bronze Age Research Group of the Hungarian Academy of Sciences, Research Centre for the Humanities, Institute of Archaeology is studying the Bronze Age settlement history of the Danube Valley in central Hungary. Extensive and intensive field walks, geophysical surveys, soil coring and archaeological excavations have been performed within the framework of the program through wide-ranging scientific collaboration with other institutions.⁵ The interdisciplinary examination of the fortified settlement at the Kakucs-Turján mögött site began in 2013 within the framework of a Hungarian-Polish-German cooperation program. The varied archaeological research has been supplemented with a new series of investigations. The goal of the surveys performed through geoarchaeological and soil mapping has been to understand the relationships between the site formation process and the stratigraphy of the site.

In the methodology of understanding archaeological sites, more and more emphasis has been put on so-called non-invasive or minimally invasive procedures in recent years in Hungary. These provide qualitative data on the horizontal and vertical extent of the former human settlements as well as their characteristics, functions and utilization either prior to archaeological excavations or in addition to them.

For only a tiny percentage of sites identified on the basis of field walks and aerial or satellite images is there an opportunity for archaeological excavation. It seems that there will be no change in this in the near future, and this is not even necessarily the primary goal of modern archaeological research. It is possible for us to generate a more precise image of the extent and characteristics of the internal fabric of the sites on the basis of geophysical surveys, extensive and intensive field walks and geoarchaeological (soil) mapping.

Networks of Bronze Age sites are being studied presently in Hungary and in several regions of the Carpathian Basin based on multilevel site reconnaissance methods used in archaeology and the international experience from previous micro-regional research.⁶ In Central Hungary similar investigations are ongoing in several micro-regions, including the valley of the Cikola Watershed, the area of Százhalombatta and the Benta Valley, the Kajászó area, the vicinity of Solt and the Kakucs region.⁷

¹ Hungarian National Museum, National Heritage Preservation Center and Szent István University, School of Agricultural and Environmental Sciences, Department of Nature Conservation and Regional Ecology

² Hungarian Academy of Sciences, Research Centre for the Humanities, Institute of Archaeology, Budapest

³ Western Hungary University, School of Forestry Engineering, Department of Habitat Studies, Sopron

⁴ Adam Mickiewicz University, Poznań and Institute of European Culture, Gniezno, Poland

⁵ The research has been supported by the Hungarian Academy of Sciences, the National Cultural Fund and the Polish Research Fund.

⁶ These include, for example, the [BORBAS](#) and the [BAKOTA](#) projects, the “[Living in the Bronze Age Tell Settlements](#)” programs in Romania, and Vrábľe/Verebely in Slovakia.

⁷ Amongst others: Earle, T. – Artursson, A. – Polányi, T. – Vicze, M.: Rapid Assessment of Bronze Age Settlement Studies in the Benta Valley, Hungary: A Micro-regional Approach. *Ősrégészeti Levelek* 12 (2010 [2012]), 84–93; Earle, Timothy – Kristiansen, Kristian (eds): *Organizing Bronze Age Societies. The Mediterranean, Central Europe, and Scandinavia Compared* (Cambridge: Cambridge University Press, 2010); Earle, T. – Kreiter, A. – Klehm, C. – Ferguson, J. – Vicze, M.: Bronze Age Ceramic Economy: The Benta Valley, Hungary. *European Journal of Archaeology* 14 (2011), 419–440; Reményi, László: The Defensive Settlements of the Vátya Culture and the Central European Bronze Age Exchange System. In: *Enclosed Space–Open society. Contact and Exchange in the Context of Bronze Age Fortified Settlements in Central Europe*, ed. Jaeger, Mateusz – Czebreszuk, Janusz – P. Fischl, Klára *Studien zur Archäologie in Ostmitteleuropa* 9. (Poznań–Bonn: Bogucki Wydawnictwo Naukowe, Poznań, Dr. Rudolf Habelt GmbH, Bonn, 2012), 275–286; Szeverényi, Vajk – Kulcsár, Gabriella: Middle Bronze Age Settlement and Society in Central Hungary. In: *Enclosed Space–Open society. Contact and Exchange in the Context of Bronze Age Fortified Settlements in Central Europe*, ed. Jaeger, Mateusz – Czebreszuk, Janusz – P. Fischl, Klára. *Studien zur Archäologie in Ostmitteleuropa* 9.

One of the methods employed is geoarchaeological (soil) mapping, which has resulted in knowledge about several Bronze Age earthworks in the area and their relationships. These types of investigations have already been performed on sites such as Százhalombatta-Földvár, Mende-Leányvár, Perkáta-Forrás-dűlő and Faluhelyi-dűlő, amongst others.⁸ This group has been extended by our research into the Kakucs region in 2013 (Fig. 1).⁹

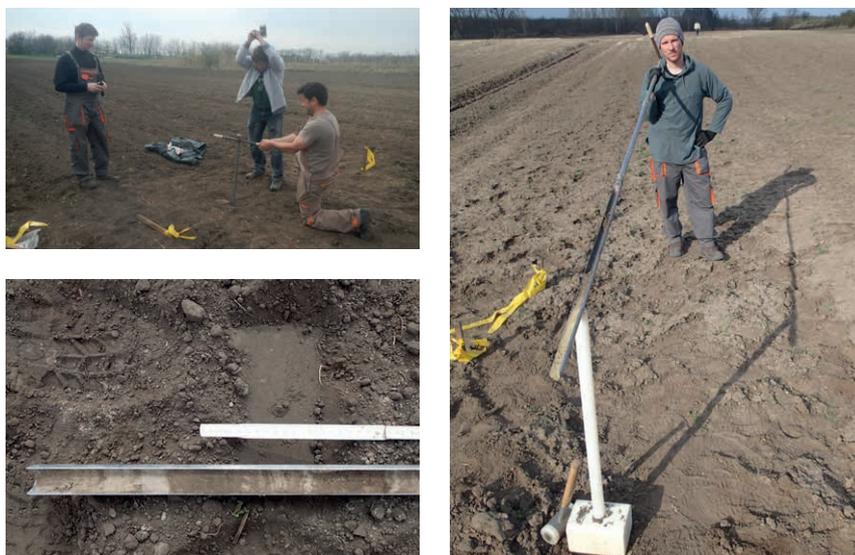


Fig. 1: Geoarchaeological survey of Kakucs-Turján mögött archaeological site

BRONZE AGE SETTLEMENTS IN CENTRAL HUNGARY

Discernible Middle Bronze Age (2000/1900–1500/1450 B.C.) settlements and cemeteries in the central area of the Carpathian Basin are characterized by the Vanya culture (Fig. 2). Numerous sites from this culture are known from eastern Transdanubia, the Danube Valley, the area between the Danube and the

(Poznań–Bonn: Bogucki Wydawnictwo Naukowe, Poznań, Dr. Rudolf Habelt GmbH, Bonn, 2012), 287–351; Kulcsár, Gabriella – Jaeger, Mateusz – Kiss, Viktória – Márkus, Gábor – Müller, Johannes – Pető, Ákos – Serlegi, Gábor – Szeverényi, Vajk – Taylor, Nicole: [Egy új kutatási program kezdetei – Kakucs Archaeological Expedition – KEX 1 / The Beginnings of a New Research Program – Kakucs Archaeological Expedition – KEX 1](#). *Magyar Régészet / Hungarian Archaeology E-Journal* 2014/4.

⁸ Százhalombatta-Földvár: Varga, András: Coring results at Százhalombatta-Földvár. In: *SAX – Százhalombatta Archaeological Expedition Annual Report 1–Field Season 1998.*, ed. Poroszlai, Ildikó – Vicze, Magdolna (Százhalombatta: Matrica Museum, 2000), 75–81. Mende-Leányvár: Sándor, Eszter: *A mendei Leányvár talajvédelmi vizsgálata és annak lehetséges kulturális örökségvédelmi vonatkozásai* (The Soil Conservation Study of Mende-Leányvár and Its Possible Aspect on Heritage Protection). BSc theses. (Gödöllő: Szent István University, 2011); Perkáta-Forrás-dűlő and Faluhelyi-dűlő: Pető, Ákos – Kenéz, Árpád – Reményi, László: Régészeti talajtani kutatások Perkáta, Forrás-dűlő bronzkori földváron (Geoarchaeological study of the Bronze Age fortified settlement of Perkáta, Forrás-dűlő). *Agrokémia és Talajtan* 62/1 (2013), 61–80; Reményi, László – Pető, Ákos – Kenéz, Árpád: Archaeological and pedological investigations at the fortified Bronze Age settlement of Perkáta-Forrás-dűlő. In: *Aerial Archaeology and Remote Sensing from the Baltic to the Adriatic. Selected Papers of the Annual Conference Aerial Archaeology Research Group, 13–15 September 2012*, ed. Czajlik, Zoltán – Bödőcs, András (Budapest: L'Harmattan, 2013), 55–57; Krausz, Edina – Saláta, Dénes – Bidló, András – Pető, Ákos: Perkáta-Forrás-dűlő bronzkori földvár és környezetének tájhasználatintenzitás-vizsgálata (The historical landscape of the Cikoa Watershed system. An analysis landscape changes of Perkáta-Forrás-dűlő archaeological site and its surroundings). *Tájökológiai Lapok* 12/1 (2014), 137–147; Saláta, Dénes – Krausz, Edina – Reményi, László – Kenéz, Árpád – Pető, Ákos: Combining historical land-use and geoarchaeological evidence to support archaeological site detection. *Agrokémia és Talajtan* 63/1 (2014), 99–108.

⁹ Kulcsár, Gabriella – Jaeger, Mateusz – Kiss, Viktória – Márkus, Gábor – Müller, Johannes – Pető, Ákos – Serlegi, Gábor – Szeverényi, Vajk – Taylor, Nicole: [Egy új kutatási program kezdetei – Kakucs Archaeological Expedition – KEX 1 / The Beginnings of a New Research Program – Kakucs Archaeological Expedition – KEX 1](#). *Magyar Régészet / Hungarian Archaeology E-Journal* 2014/4.; Pető, Ákos – Serlegi, Gábor – Krausz, Edina – Jaeger, Mateusz – Kulcsár, Gabriella: Régészeti talajtani megfigyelések “Kakucs-Turján mögött” bronzkori lelőhelyen I (Archaeological Soil Analysis Observations at the “Kakucs-Turján mögött” Bronze Age Site I). *Agrokémia és Talajtan* 64/11 (2015), 219–238.

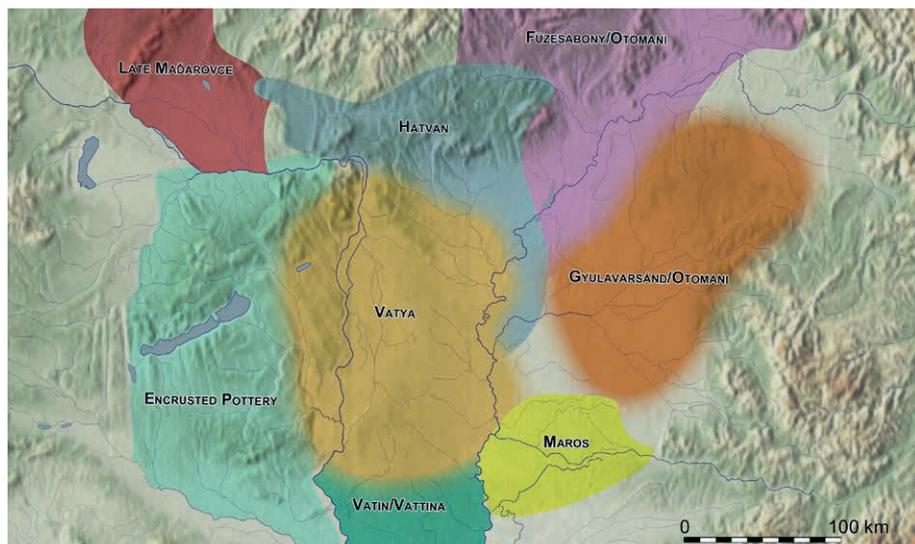
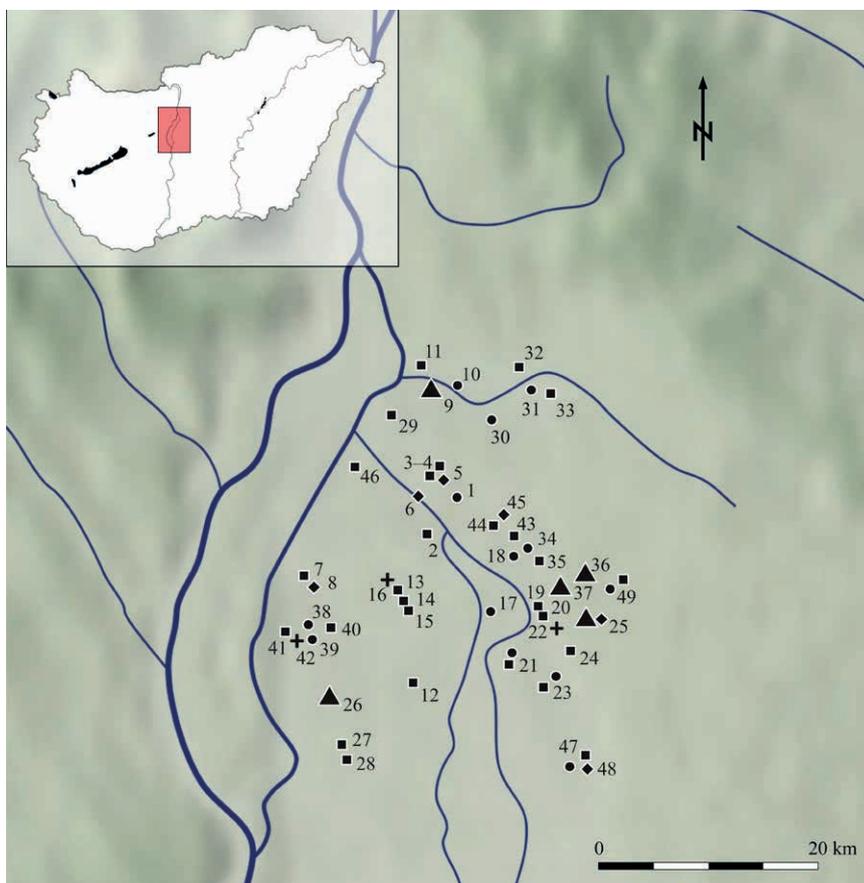


Fig. 2: The Carpathian Basin in the Middle Bronze Age, from P. Fischl, Klára – Kiss, Viktória – Kulcsár, Gabriella – Szeverényi, Vajk: Transformations in the Carpathian Basin around 1600 BC. In: 1600 – Kultureller Umbruch im Schatten des Thera-Ausbruchs? 4. Mitteldeutscher Archäologentag vom 14 bis 16 Oktober 2011 in Halle (Saale). (Tagungen des Landesmuseums für Vorgeschichte Halle 9.), hrsg.: Meller, H. – Bertemes, F. – Bork, H.-R. – Risch, R. 355–371. Halle [Saale]: Landesmuseum für Vorgeschichte, 2013, Fig. 2.

Fig. 3: The Vatyá culture sites in the Kakucs region ▲: tells and fortified settlements ●: open-air settlements ■: graves and cemeteries ◇: bronze treasures +: stray finds, from: Szeverényi, Vajk – Kulcsár, Gabriella: Middle Bronze Age Settlement and Society in Central Hungary. In: *Enclosed Space – Open society. Contact and Exchange in the Context of Bronze Age Fortified Settlements in Central Europe*, ed. Jaeger, Mateusz – Czebreszuk, Janusz – P. Fischl, Klára, *Studien zur Archäologie in Ostmitteleuropa 9*. (Poznań–Bonn: Bogucki Wydawnictwo Naukowe, Poznań, Dr. Rudolf Habelt GmbH, Bonn, 2012), Fig. 1, Fig. 27.



Tisza rivers and the Middle Tisza Region.¹⁰ Attention is being paid to the different strategies for livelihood and the organization of the settlements of this generally unified culture found in areas with differing natural geographic conditions. Multi-layered fortified settlements or tell settlements as well as open-air settlements of various sizes and types can all be found in the settlement network of the period.

¹⁰ Most recently summarized in: Reményi, László: The Defensive Settlements of the Vatyá Culture and the Central European Bronze Age Exchange System. In: *Enclosed Space–Open society. Contact and Exchange in the Context of Bronze Age Fortified Settlements in Central Europe*, ed. Jaeger, Mateusz – Czebreszuk, Janusz – P. Fischl, Klára. *Studien zur Archäologie in Ostmitteleuropa 9*. (Poznań–Bonn: Bogucki Wydawnictwo Naukowe, Poznań, Dr. Rudolf Habelt GmbH, Bonn, 2012), 275–286; Szeverényi, Vajk – Kulcsár, Gabriella: Middle Bronze Age Settlement and Society in Central Hungary. In: *Enclosed Space–Open society. Contact and Exchange in the Context of Bronze Age Fortified Settlements in Central Europe*, ed. Jaeger, Mateusz – Czebreszuk, Janusz – P. Fischl, Klára. *Studien zur Archäologie in Ostmitteleuropa 9*. (Poznań–Bonn: Bogucki Wydawnictwo Naukowe, Poznań, Dr. Rudolf Habelt GmbH, Bonn, 2012), 287–351.

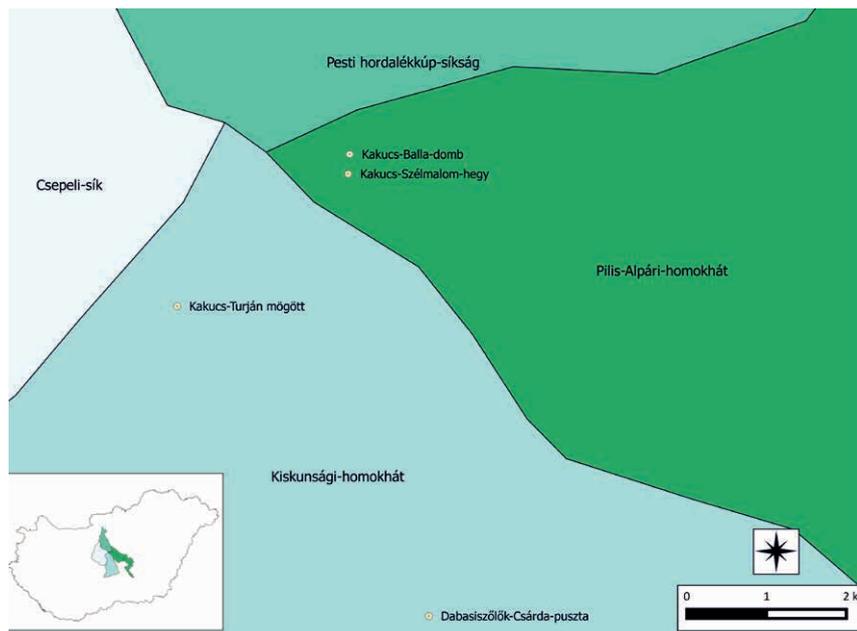


Fig. 4: Junctures of geographical micro-regions in the area of Kakucs on the Danube–Tisza interfluvium and the location of the examined sites

rain may have had a prominent strategic significance as well (e.g. at Perkáta-Forrás-dűlő or Százhalombatta-Földvár). In contrast to this, in the areas of the micro-regions of the Pest Alluvial Fan, the Csepel Plain, the Kiskunság Sand Ridge and the Pilis-Alpár Sand Ridge – all with characteristically sandy soil – it was dry areas gently rising from the flat landscape that provided suitable environmental conditions for the establishment of different kinds of settlements (Fig. 4).

Of the aforementioned settlement types, the fortified earthworks have qualities for soil analysis and environmental history that through interdisciplinary study (can) play a prominent role in understanding the events of environmental history as well as archaeology.¹² From this aspect, the so-called settlement layers (horizons) and the buried soils preserved under the stratigraphic units of the earthworks are the most important, since these can provide important information related to the environment during the period of occupation and the character or land use of the settlement. The anthropogenic deposits and modified soils arising as a result of human activity bear the marks of the history of the settlement and activity of a given human community in a manner that can be recognized through scientific methods.¹³

ARCHAEOLOGICAL SOIL ANALYSIS OF THE KAKUCS-TURJÁN MÖGÖTT SITE

Since 2013 the Hungarian Academy of Sciences, Research Centre for the Humanities, Institute of Archaeology has been performing excavations to the south of Budapest, in the Danube Valley as understood

¹¹ Ibid., 287–351; Kulcsár, Gabriella – Jaeger, Mateusz – Kiss, Viktória – Márkus, Gábor – Müller, Johannes – Pető, Ákos – Serlegi, Gábor – Szeverényi, Vajk – Taylor, Nicole: [Egy új kutatási program kezdetei – Kakucs Archaeological Expedition – KEX 1 / The Beginnings of a New Research Program – Kakucs Archaeological Expedition – KEX 1](#). *Magyar Régészet / Hungarian Archaeology E-Journal* 2014/4.

¹² Pető, Ákos – Kenéz, Árpád – Reményi, László: Régészeti talajtani kutatások Perkáta, Forrás-dűlő bronzkori földváron (Archaeological Soil Analysis Research at the Bronze Age Earthworks of Perkáta, Forrás dűlő). *Agrokémia és Talajtan* 62/1 (2013), 61–80; Pető, Ákos – Serlegi, Gábor – Krausz, Edina – Jaeger, Mateusz – Kulcsár, Gabriella: Régészeti talajtani megfigyelések “Kakucs-Turján mögött” bronzkori lelőhelyen I (Archaeological Soil Analysis Observations at the “Kakucs-Turján mögött” Bronze Age Site I). *Agrokémia és Talajtan* 64/1 (2015), 219–238.

¹³ Vyncke, Kim – Degryse, Patrick – Vassilieva, Elvira – Waelkens, Marc: Identifying domestic functional areas. Chemical analysis of floor sediments at the Classical-Hellenistic settlement at Düzen Tepe (SW Turkey). *Journal of Archaeological Science* 38 (2011), 2274–2292.

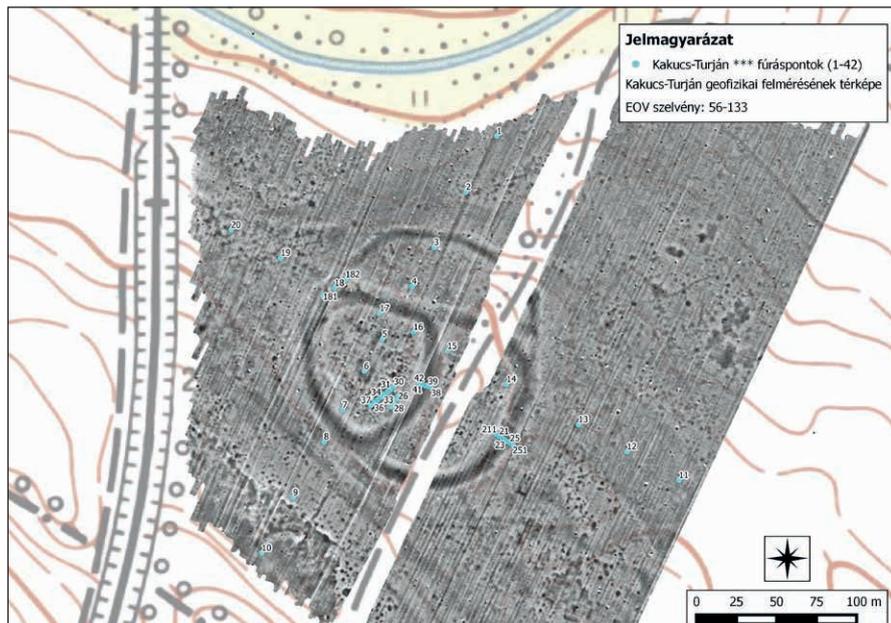


Fig. 5: Locations of the geoarchaeological coring points at the Kakucs-Turján mögött archaeological site on the geophysical survey of the site, from: Pető, Ákos – Serlegi, Gábor – Krausz, Edina – Jaeger, Mateusz – Kulcsár, Gabriella: *Régészeti talajtani megfigyelések “Kakucs-Turján mögött” bronzkori lelőhelyen I* [Archaeological Soil Analysis Observations at the “Kakucs-Turján mögött” Bronze Age Site I]. *Agrokémia és Talajtan* 64/1 (2015), 219–238, figure 1.

in the broader sense, within the framework of a Hungarian-Polish-German research program.¹⁴ The central element of the project is the archaeological investigation of the *Kakucs-Turján mögött* site.

The site is located to the southwest of the town of Kakucs alongside the Danube Valley Main Canal on the border of Kakucs, Dabas and Újhartyán. Attention was focused on this site in 2009 due to aerial photographs by Zoltán Czajlik and Zsuzsa Miklós.¹⁵ Following this, a geophysical survey was performed on the site, covering an area of nearly 5 hectares.¹⁶ As a result of this, the image of a settlement split by a ditch into three sections emerged, which showed the traces of buildings and other features in its central section (Fig. 5).

The geophysical examination of this Bronze Age settlement with a rather complex internal structure divided and surrounded by ditches was supplemented by archaeological soil analyses.¹⁷ The goal of the minimally invasive soil cores was to clear up the stratigraphy of the site and through this understand and reconstruct the circumstances of surface development and soil formation for the area that was home to the settlement.

THE METHODOLOGY OF THE CARTOGRAPHIC SOIL CORING AND SAMPLING

To understand the stratigraphic conditions of the site in detail, a series of targeted cores were taken, devised on the basis of the results of the geophysical survey that covered the entire area of the site (Fig. 5). The cartographic soil coring was aimed at the following:

- exposing the shallow geological cross-section of the site in the north-south and east-west directions,
- understanding the stratigraphic relationships of the round feature located on the northwestern side of the site,
- the inner and outer ditches encircling the settlement, and
- cutting through the built features found in the central section of the settlement.¹⁸

The seven soil analysis/shallow geographical sections (series of cores) were comprised of a total of 46 coring locations. Samples were collected of the characteristic stratigraphic units, and through this it was possible to

¹⁴ For more details on the antecedents, see: Kulcsár, Gabriella – Jaeger, Mateusz – Kiss, Viktória – Márkus, Gábor – Müller, Johannes – Pető, Ákos – Serlegi, Gábor – Szeverényi, Vajk – Taylor, Nicole: [Egy új kutatási program kezdetei – Kakucs Archaeological Expedition – KEX 1 / The Beginnings of a New Research Program – Kakucs Archaeological Expedition – KEX 1](#). *Magyar Régészet / Hungarian Archaeology E-Journal* 2014/4.

¹⁵ For more on the history of the research, see footnote 14.

¹⁶ The geophysical survey of the site was performed by Gábor Márkus (Archeodata 1998 Bt.) with support from the Polish National Science Center; project no.2012/05/B/HS3/03714.

¹⁷ The soil cores and their analysis were performed with the support of the National Cultural Fund (3234/261).

¹⁸ For the research in detail, see: Pető, Ákos – Serlegi, Gábor – Krausz, Edina – Jaeger, Mateusz – Kulcsár, Gabriella: *Régészeti talajtani megfigyelések “Kakucs-Turján mögött” bronzkori lelőhelyen I* (Geoarchaeological Observations at the Bronze Age site of Kakucs-Turján mögött). *Agrokémia és Talajtan* 64/1 (2015), 219–238.

determine the soil levels and anthropogenic deposits identified through high definition cartographic coring, as well as to reach further conclusions in connection with the surface development of the site. Laboratory testing of the fundamental deposit analysis as well as the physical and chemical characteristics of the soil was performed on the samples, and the preliminary results of this are presented below.

GEOARCHAEOLOGICAL SURVEY AND STRATIGRAPHY OF THE SITE

The Stratigraphy of the Site and Its Environs

The sampling locations examining the north-south cross-section of the site extended beyond the encircling ditch outlined by the geophysical survey (*Fig. 5*; KT 01–10). The individual sampling locations were set at equal 40 meter intervals in such a way that we avoided the clear features (e.g. pits), since the goal was not to survey the individual features, but instead to understand of the site's basic stratigraphy. The area to the north and northwest that was formerly prone to flooding was clearly delineated on the basis of the fluvial layers of sediments observed in the cores taken there. Archaeological phenomena were not indicated in these areas. On the basis of our current knowledge it is possible to state that the settlement could not or did not extend to these areas prone to flooding. Remnants of daub and charcoal were found in several coring locations in the cores taken (at depth intervals between 55-100 cm) in the northern half of the more or less round site surrounded by several ditches. These foreign, anthropogenic particles indicate the possible level of human settlement.

The central section of the site is at the highest point of the examined micro-environment. In the central section of the site there are sand and loess/sand deposits upon the lower flood plain filled with fluvial layers of sediment, forming a natural, island-like mound in the landscape. A conspicuous change appears in the central area of the site. There, the particles indicating anthropogenic impact can be observed even on the surface, and their intensity increases from a depth of 50 cm. Below the recent ground cover blanketing the site it was not the parent material that appeared, but a layer of anthropogenic deposits (cultural layer) indicated by the code K1. This deposition¹⁹ clearly contains large amounts of daub debris, ceramic remains, ashy micro-layers and particles of charcoal. Below the K1 cultural layer another formation (K2) could be observed that also developed through human activity, or was altered through its impact. On the basis of the cores, this anthropogenic impact is also detected in the area to the south outside the ditches, and at the same time a deeply eroded ground level appears on the sandy ridge neighboring the site to the south. In the depression between the two sand dunes a transported (*ex situ*) sedimentation most likely washed here from a higher elevation was observed, which contained anthropogenic particles (remains of ceramics, daub, charcoal and ash) in particularly large amounts.

The sampling locations examining the east-west cross section of the site also extended beyond the ditch system encircling the site (*Fig. 5*; KT 11–20). On the basis of the analysis of the cores taken to the east of the outer ditch encircling the site and the laboratory data currently available – in particular the total phosphorus content measured in the samples taken from here – it seems that the former human activity in this area was not as intensive. While the eastern section of the settlement between the two ditches shows some anthropogenic impact, the unified cultural layer indicated by the K1 designation observed in the central section was not detected. This may be related to the fact that this area was (also?) less intensively utilized during occupation in the Bronze Age. Another interesting observation was that the sampling locations near the northern inner ditch in the central section also showed very little anthropogenic impact (see sampling locations 17 and 16 in *Fig. 5*). On the basis of this, the occupation probably had a less intensive impact on this northern half of the central section. However, in the case of the interior of the central section and the sections indicated in the area of the buildings, the cultural layer that can be separated from the natural soil formations appears clearly. Foreign materials (e.g. daub fragments) indicating human settlement and

¹⁹ Deposition: debris transported and accumulated as a result of sedimentation processes. In the present case the cultural layer designated as K1 is comprised of a special sedimentation layer created by the joint effects of human activity and natural processes.

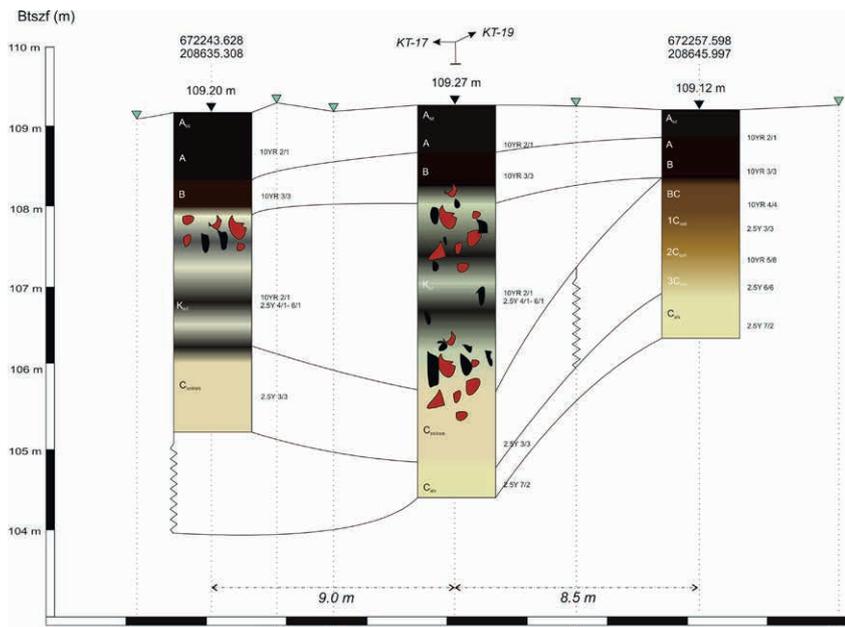


Fig. 6: One of the features with a round ground plan from the Kakucs-Turján mögött site and its geological cross-section (KT-181-18-182)

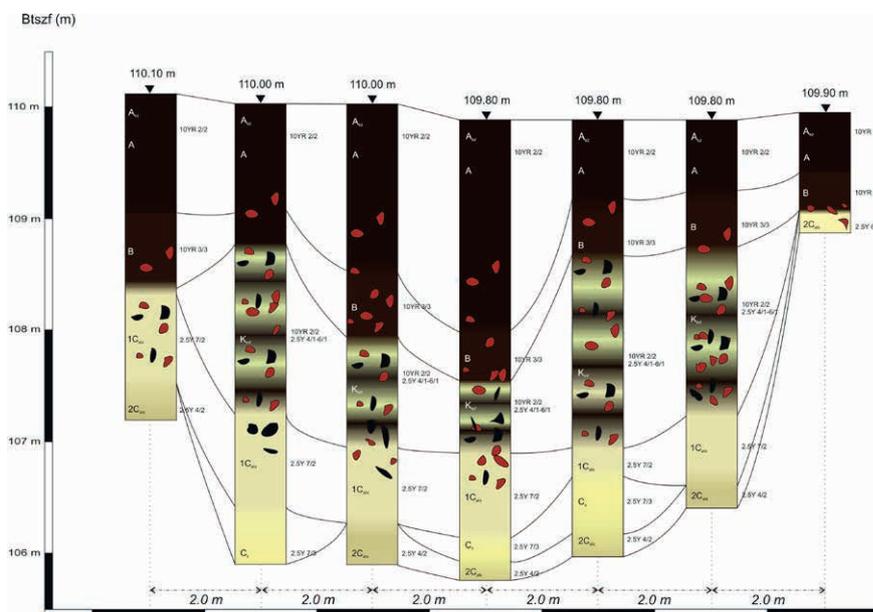


Fig. 7: Geological cross-section of the outer ditch section at the Kakucs-Turján mögött site (KT-21-25)

disruption were also found in the cores from the northern section, but their quantity did not come close to that detected in those performed in the central section. The western sampling locations outside the ditches outlined the lower, formerly flooded areas of the site’s local geographical environment.

Features with a Round Ground Plan – Reservoirs, Cisterns and Wells

One of the most exciting results of the geophysical surveys was the discovery of features with a round ground plan at the northwestern section of the outer ditch bounding the site (Figs. 5–6). The largest of these has a diameter of nearly 10 meters. The geophysical survey of the site clearly shows that this feature has a regular round shape and is located at the conjunction of the outer ditch and the section of the ditch bounding the interior central section. The more precise mapping of this archaeological phenomenon was the purpose of the three cores that were taken from this round feature’s northern and southern sides as well as its geometrical center (Fig. 6). The feature is located in a completely flat area and it is covered by modern soil typical of the entire site. The core taken from the middle of the phenomenon (Fig. 6 KT-18) uncovered

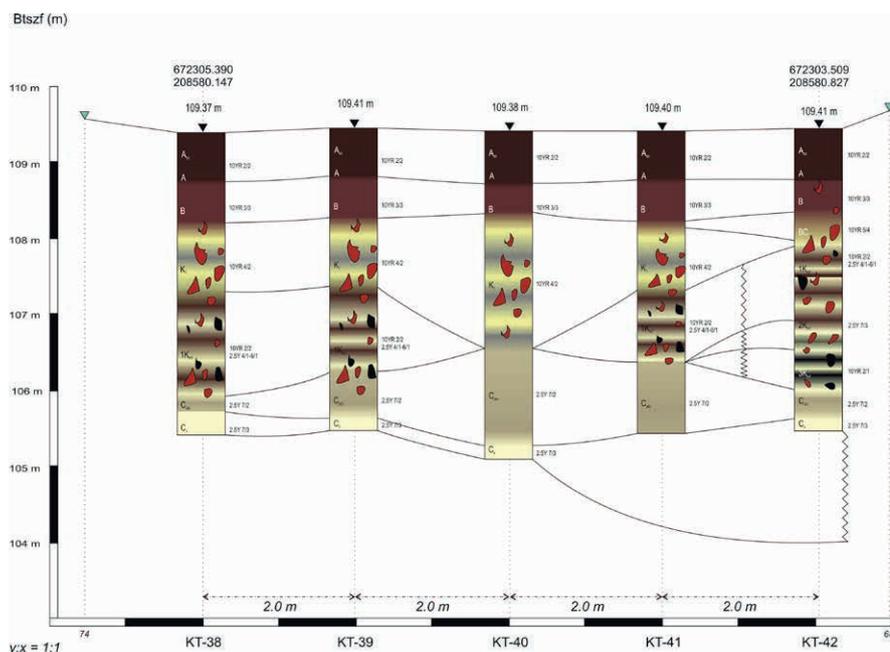


Fig. 8: Geological cross-section of the inner ditch section at the Kakucs-Turján mögött site (KT-38-42)

a 320 cm thick layer showing the traces of human disturbance between the relative depths of 100 and 420 cm. In this deposition that was deemed to be disturbed it was possible to differentiate several (micro) layers. The so called micro-laminations – which form due to the sedimentation of thin sedimentary layers upon one another – observed in the individual layers may suggest that the sedimentation occurred at least recurrently, but in an environment of standing water, or that it took place periodically (in phases of deposition or influx of sedimentation that were clearly separated from one another).

The sedimentation of the feature also allows the conclusion that this open feature collected the surface soil cover of the surrounding area that was richer in humus. The total phosphorus values measured here indicate that waste with a high content of organic matter was not deposited in the feature during its use or around the time when it was abandoned. The rate or intervals of sedimentation cannot be deduced on the basis of the on-site examination of the core sample, so further analysis is required.

The Outer Ditch

Cores were taken in the eastern section of the ditch bounding the site on the exterior with the goal of understanding the cross-section of the phenomenon (Fig. 5, Fig. 7; KT 21-25). The soil and geological characteristics of the outer ditch were examined by a total of seven cores taken two meters apart from one another. The morphological analysis of the sediments taken from the series of cores in the cross-section of the ditch has allowed us to conclude that the former ditch was filled in gradually. The shallow geographical section worked up on the basis of the cores clearly outlines the shape of the ditch. Its depth at the halfway point was as much as 300 cm. On the basis of the present data it is quite difficult to determine whether the ditch was constantly or periodically filled with water. It is certain, though, that the sediment lining the ditch, that is the natural loose sedimentation that settled in the ditch, shows indications suggesting that it was formed in stagnant water.

The Inner Ditch

The soil and geological characteristics of the inner encircling ditch bounding the regular, nearly round nucleus of the site were investigated through five cores (Fig. 5, Fig. 8; KT-38-42). Similar to the outer ditch, the individual sampling locations were performed at two meter intervals from one another. On the basis of the cores it was possible to observe a ditch with a depth of nearly 300-350 cm. The morphological features

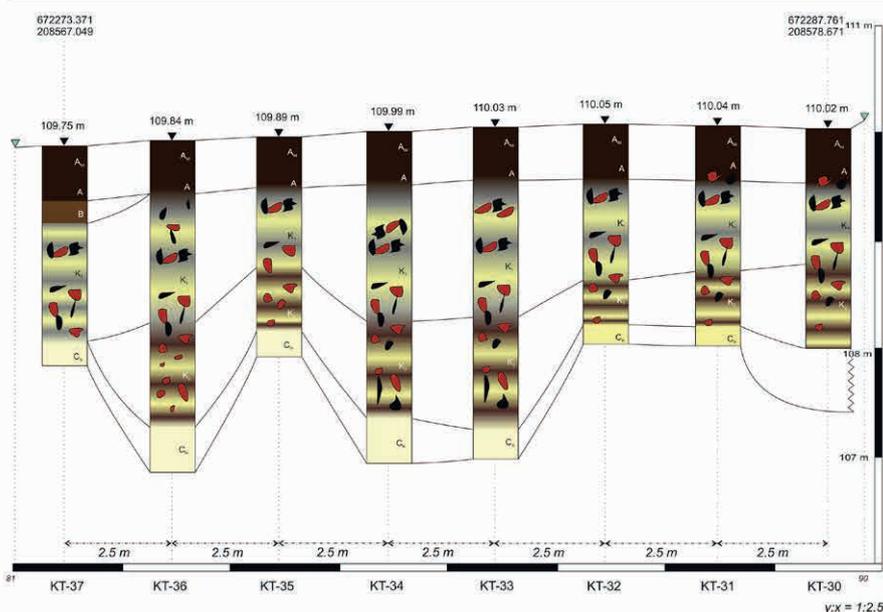
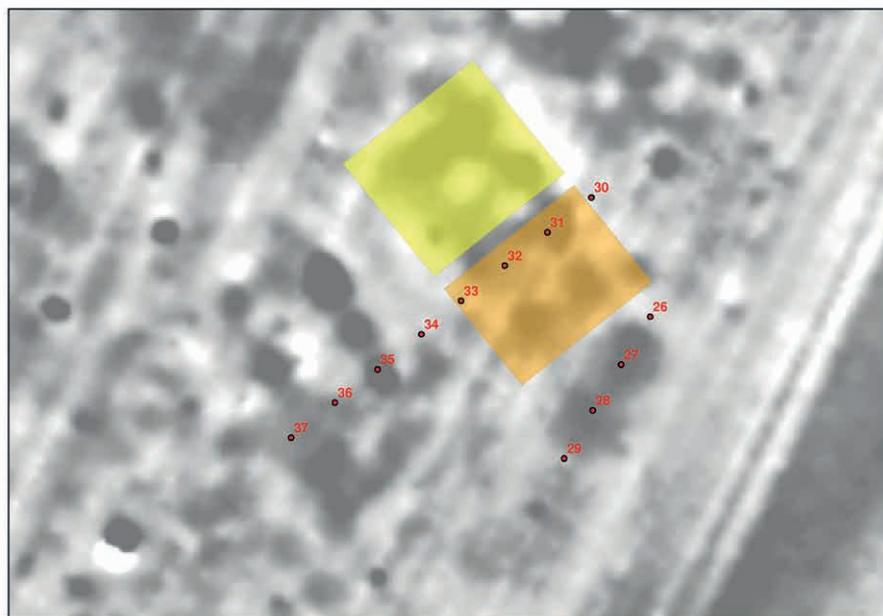


Fig. 9: Geological cross-section of the central buildings at the Kakucs-Turján mögött site (KT-30–37), from: Pető, Ákos – Serlegi, Gábor – Krausz, Edina – Jaeger, Mateusz – Kulcsár, Gabriella: *Régészeti talajtani megfigyelések "Kakucs-Turján mögött" bronzkori lelőhelyen I* [Archaeological Soil Analysis Observations at the "Kakucs-Turján mögött" Bronze Age Site I]. *Agrokémia és Talajtan* 64/1 (2015), 219–238, figure 4.

identified in the undisturbed core samples suggest the presence of stagnant water, and the fine laminated structure detected in several locations indicates gradual sedimentation. An observation in connection with the data on the ditch falling into disuse is that in contrast to the outer ditch, here we could not detect the slope of the ditch, and the cultural layer indicated by the K1 designation that was observed in the central section of the site was also present in the deposits of the ditch. (e.g. Fig. 8, section drawing of the KT-40 core). This may indicate that during the gradual deterioration of the settlement this material eroded into the ditch, or it is also possible that over time the settlement expanded and stretched beyond the inner ditch.

Prehistoric Buildings

In the central section of the site two series of coring were implemented passing through two buildings that were next to one another. (Fig. 5, Fig. 9; KT-30–37). The buildings were located atop predominantly sandy sediments. In the series of cores the individual sampling locations were at 2.5 meter intervals. The buildings are covered by the recent soil type, humus-rich surface soil (A horizon), typical of the site, whose depth and characteristics are uni-

form. Directly below this the unified anthropogenic deposition designated as the cultural layer K1 was formed. Below the K1 cultural layer there is a layer characterized by a typically darker, dark brown sandy clayey texture, the K2.

During the examination of the buildings situated parallel to one another, an essentially identical stratigraphy was found, although differences in thickness could be observed. At certain points the K2 cultural layer below the K1 thickens significantly and shows a specific, visible stratification. In some places the lowest points of the anthropogenic K1 and K2 cultural layers is close to 3 meters below the surface. This is more than 1 meter deeper than the same levels in the neighboring two core samples sunk into what was also presumed to be the interiors of the buildings. The deterioration of the settlement's buildings can be

characterized as a gradual process on the basis of the data from archaeological excavation and soil analysis presently at our disposal. In the excavation that is continuing this year we are seeking the possible answers to two questions: in what way did the settlement come to an end and what correlation does this show with the surface development of the area.

THE FOLLOW-UP OF THE GEOARCHAEOLOGICAL RESEARCH

Similar series of archaeological investigations based on soil analytical methods and geoarchaeological mapping are also planned at the other Bronze Age sites in the region (Dabas-Csárda-puszta, Dömsöd-Leányvár, Kakucs-Balla-domb and Kakucs-Szélmalom-hegy). The results of geoarchaeological mapping based on the same methodological principles will provide a proper basis for comparison in the unified examination of the structure of the sites. Beyond this, the stratigraphic relationships outlined on the basis of the results of the soil analysis examinations will also be able to be easily compared with the data from the ongoing archaeological excavation of the Kakucs-Turján mögött site. All of these – as well as other activities – will serve the fundamental research objective of obtaining comparative data in relation to the characteristics of the stratigraphy of the Bronze Age settlements in the micro-region under study. In addition, it is our hope to be able to compile a methodology for scientific research based upon geoarchaeological mapping that will also develop into a methodology that can be routinely employed in professional archaeological site diagnostics.

RECOMMENDED LITERATURE

KULCSÁR, GABRIELLA – JAEGER, MATEUSZ – KISS, VIKTÓRIA – MÁRKUS, GÁBOR – MÜLLER, JOHANNES – PETŐ, ÁKOS – SERLEGI, GÁBOR – SZEVERÉNYI, VAJK – TAYLOR, NICOLE

[Egy új kutatási program kezdetei – Kakucs Archaeological Expedition – KEX 1 / The Beginnings of a New Research Program – Kakucs Archaeological Expedition – KEX 1.](#) *Magyar Régészet / Hungarian Archaeology E-Journal* 2014/4.

SZEVERÉNYI, VAJK – KULCSÁR, GABRIELLA

Middle Bronze Age Settlement and Society in Central Hungary. In: *Enclosed Space–Open society. Contact and Exchange in the Context of Bronze Age Fortified Settlements in Central Europe*, ed. Jaeger, Mateusz – Czebreszuk, Janusz – P. Fischl, Klára, 287–351. *Studien zur Archäologie in Ostmitteleuropa 9. Poznań–Bonn: Bogucki Wydawnictwo Naukowe, Poznań, Dr. Rudolf Habelt GmbH, Bonn, 2012.*

P. FISCHL, KLÁRA – KISS, VIKTÓRIA – KULCSÁR, GABRIELLA – SZEVERÉNYI, VAJK

Transformations in the Carpathian Basin around 1600 BC. In: *1600 – Kultureller Umbruch im Schatten des Thera-Ausbruchs? 4. Mitteldeutscher Archäologentag vom 14 bis 16 Oktober 2011 in Halle (Saale)*. (Tagungen des Landesmuseums für Vorgeschichte Halle 9.), hrsg.: Meller, H. – Bertemes, F. – Bork, H.-R. – Risch, R. 355–371. Halle (Saale): Landesmuseum für Vorgeschichte, 2013.

PETŐ, ÁKOS – KENÉZ, ÁRPÁD – REMÉNYI, LÁSZLÓ

Régészeti talajtani kutatások Perkáta, Forrás-dűlő bronzkori földváron (Geoarchaeological study of the Bronze Age fortified settlement of Perkáta, Forrás-dűlő). *Agrokémia és Talajtan* 62/1 (2013), 61–80.

PETŐ, ÁKOS – SERLEGI, GÁBOR – KRAUSZ, EDINA – JAEGER, MATEUSZ – KULCSÁR, GABRIELLA

Régészeti talajtani megfigyelések “Kakucs-Turján mögött” bronzkori lelőhelyen I (Geoarchaeological Observations at the Bronze Age site of Kakucs-Turján mögött). *Agrokémia és Talajtan* 64/1 (2015), 219–238.