

## LARGE SCALE GEOMAGNETIC PROSPECTION ON NEOLITHIC SITES IN HUNGARY. PART 2

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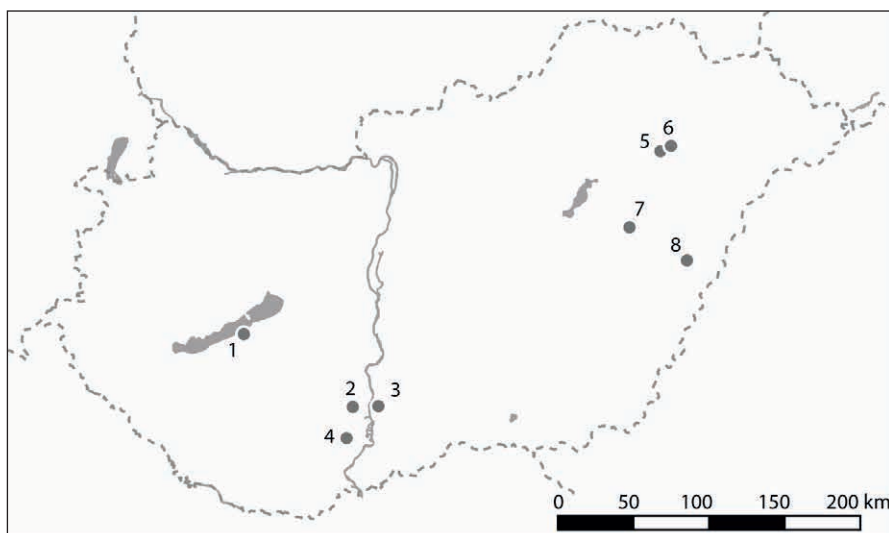
*In 2011, 2013 and 2014 our team engaged in geomagnetic prospections on Hungarian multi-period settlements. Our study began with fieldwork at the Tolna-Mözs and Alsónyék-Bátaszék sites in 2011. In 2013, we continued the survey on both sites, enlarging the program on the tell settlement of Fajsz-Kovácsshalom and on other sites in eastern Hungary (Fig. 1). Our main goal is to discuss the combination of excavation and geomagnetics which provides a great opportunity to estimate the size of the settlements as well as to study their internal structures. The results is published in two parts, this second report focuses on Tolna-Mözs and Fajsz-Kovácsshalom sites.<sup>5</sup> Excellent prerequisites for prospection campaigns include rich comparative excavation data which are useful for understanding and interpreting geomagnetic anomalies from the unexcavated areas.*

### POST-EXCAVATION RESEARCHES: EXTENDED NEOLITHIC SETTLEMENT AT TOLNA-MÖZS

Large-scale rescue excavations were conducted in 2008–2009 by the Institute of Archaeology, RCH, Hungarian Academy of Sciences, in an LBK settlement prior to the construction of the M6. Their excavation trenches followed the nearly north-south running line for approximately 750 meters. The width of the study area measured 60–70 m. Three house clusters were investigated at this time, albeit in a fragmentary position. They were called house groups or settlement parts in the course of the preliminary evaluation of the assemblage. In order to better reconstruct the overall expansion of the settlement to the east and west, the team opted, once again, for large-scale geomagnetic prospections. Given the extensive

*Fig. 1: Overview on the geomagnetic prospections conducted by the RGK in Hungary between 2011–2014.*

1 Balatonszárszó-Kis-erdei-dűlő,  
2 Tolna-Mözs, 3 Fajsz-Kovácsshalom,  
4 Alsónyék-Bátaszék, 5 Hajdúnánás-Büdöshalom, 6 Hajdúnánás-Vereshalom, 7 Nádudvar-Tökhalom,  
8 Berettyóújfalu-Szilhalom



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<sup>5</sup> The first part of this report was published in the [Hungarian Archaeology, e-journal, 2015 Spring](#)



Fig. 2: Tolna-Möz, overview of geomagnetic prospection areas surveyed 2011–2013 close to the M6 motorway. Base map Google Earth



Fig. 3: Tolna-Möz, overview of geomagnetic prospection results from areas surveyed between 2011 and 2013 close to the M6 motorway

size of the potential study area (i.e. over 100 ha), it was necessary to use a vehicle-based system. Prospecting in Tolna-Möz also had the added benefit of the availability of comparative large-scale excavation results (the trenches covered approximately 6 hectares with numerous archaeological findings) to aid in the interpretation of the geomagnetic data.

In 2011 winter and 2013 spring, we prospected 79 ha within this selected study zone (Figs 2–3). As the focal area is currently used for agriculture, we targeted to catch the prospection surface right after harvesting of corn in 2011 and slightly ploughed areas in 2013. In spite of excessive rain and soggy soil conditions, the ground was passable.

The most common finds revealed by the magnetometry results were long pits flanking along houses of the Central European Linearbandkeramik Culture (LBK). These pits appear to have been placed in relation to the house groups that were noted during the excavations. In addition, two further extended house groups can be reconstructed 400 m west of the southernmost excavated cluster and an additional small area with house remains. Another densely built-in area is found east of the motorway (Fig. 4) and some further houses on the western side of the track respectively. Apart of the three house groups brought to light in the course of the excavation, the size of the detected larger house groups varies from 3 to 6.5 ha. Smaller house groups can be reconstructed to have collected between 3–8 houses while the number of detected buildings exceeds 20 in some of the larger ones. In addition to the accompanying long pits, other structures are also visible in the image. Most common of these are anomalies measuring 2–3 m in diameter. These anomalies probably represent settlement pits of various functions and periods. Other circular anomalies with diameters of up to 60 cm measuring in at values of up to 5–10 nT may represent postholes. There was very little evidence of posthole structures within the houses.

A double ditch was detected in the southwest prospection sector which had also been revealed over the course of the preventive excavations. That area was inhabited however in different periods (La Tène, Middle Ages, etc.) and the precise determination of its chronological position needs some further studies.



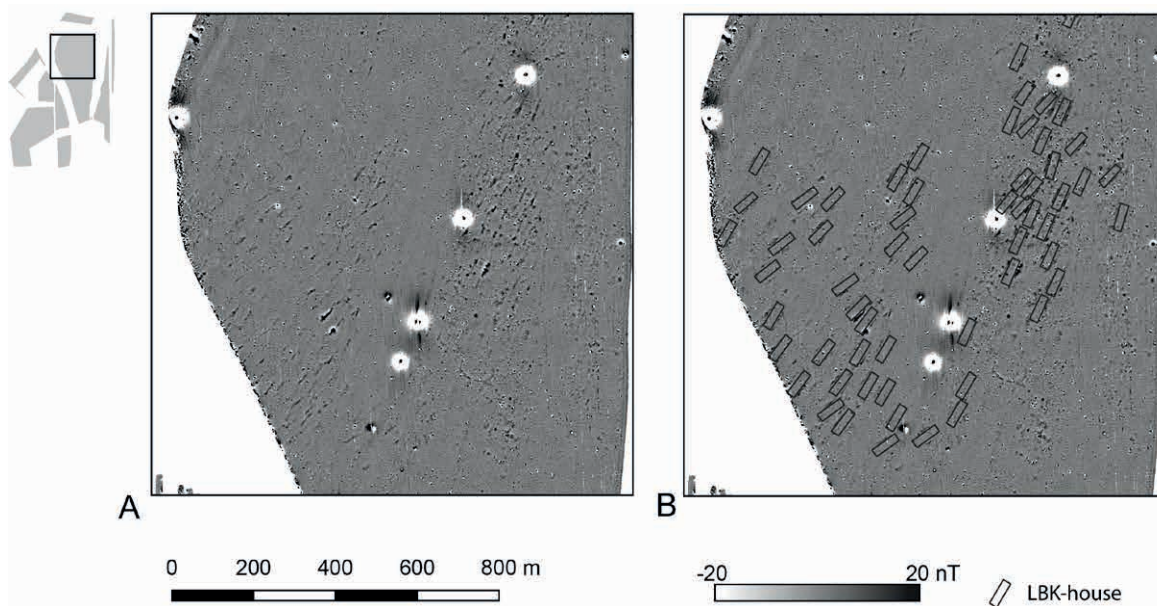


Fig. 4: Tolna-Mözs, geomagnetic prospection in the northern part of the LBK settlement. A) Geomagnetic map and B) Geomagnetic map and the reconstruction of houses based on pit anomalies from eroded LBK houses

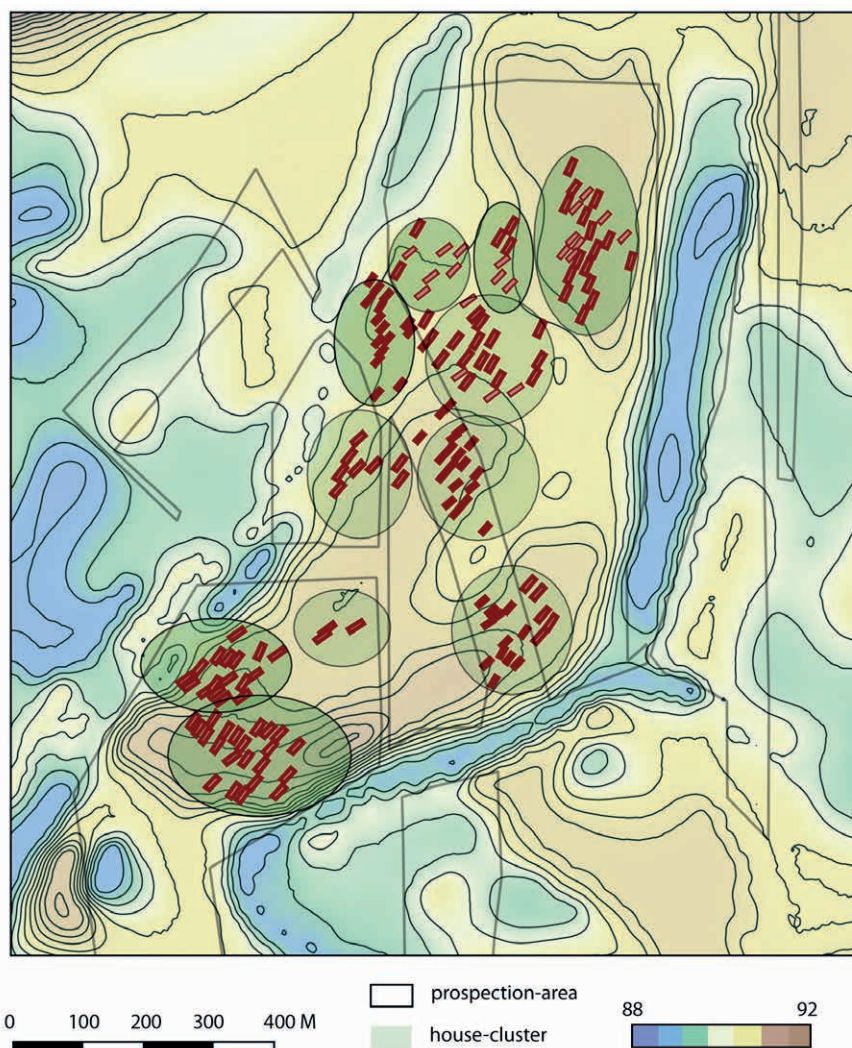


Fig. 5: Tolna-Mözs, areas of geomagnetic prospections around the LBK settlement and a hypothetical model refers to settlement's house groups

The geomagnetic data can be combined with the excavation results to produce an initial model of the settlement size and constituent house clusters (Fig. 5). The archaeological record from the excavation revealed a chronological shift within the houses from south to north.<sup>6</sup> The earliest houses (which demonstrated considerable pottery material resembling to the Starčevo culture and the strongest presence of early Vinča characteristics) were located in the southernmost house group. Finds in the central part could be associated with the Bíňa-Bicske type pottery of the early LBK, while northern houses included Bíňa-Bicske ceramics, artefacts dateable to the Milanovce period in a traditional typo-chronological approach and a smaller number of sherds with *Notenkopf* ornaments represent the beginning of the late LBK period.

With a certain degree of probability we can interpolate these observations onto the house clusters detected via the geomagnetics. The southernmost house group of the uncovered area could be regarded as an independent settlement part both based on its spatial position and material culture, while the other two excavated house groups form the largest, northern settlement part of the LBK site together with further five various sized, recently discovered house groups. The three house groups detected on the southwestern area form most probably the third substantial integral part of the settlement. However, any such conclusions should be regarded as only a first approach to a complex interpretation of the dataset.

The southern Transdanubian distribution area of the Central European LBK is target of various ongoing research programs including the evaluation of assemblages from recent large-scale excavations, field surveys both on site and on microregional scale, targeted small excavations, radiocarbon dating projects and bioarchaeological analyses. The investigated sites are located on the southern shore of Lake Balaton like Balatonszárszó-Kis-erdei-dűlő and in the Tolnai Sárköz microregion such as Tolna-Mözs<sup>7</sup>.

The geomagnetic survey results have helped considerably in improving our general understanding of the spatial organization of this LBK settlement. Certainly, an elaborate cross-comparison with the excavation results will help to draw some more detailed conclusions about the structures that were made visible by the geomagnetics. The evaluation of the excavation finds, compared with radiocarbon dating of the houses will offer an excellent verification of the geophysical prospections, in terms of the temporal structure of these house groups. Even though radiocarbon measurements for the Tolna-Mözs site are only projected, however, ceramic typological comparison with other well dated series from Hungary point to an end of the excavated part of the site around 5200 cal BC at latest. Nevertheless there are considerable uncertainties in the relative and absolute chronology of the LBK in the region, that make the intended radiocarbon dating project combined with the excavation of some houses particularly important.

Beside the information from southern Transdanubian sites, we can integrate the results of the ongoing work in Vráble-Veľke Lehemby, south-western Slovakia,<sup>8</sup> where we prospected an area of 150 ha from 2010 to 2014 and could identify a 50 ha large LBK settlement agglomeration. Radiocarbon dates and pottery typo-chronology (*Notenkopf* and *Želiezovce* pottery styles) point towards an existence of this place from 5100–4850 cal BC. Also here, ongoing excavations allow for a further qualification of the geomagnetic results, and a comparison of the two sites enhances our understanding of the reading of geomagnetic signatures as well as that of social organisational developments in the regional early Neolithic period.

<sup>6</sup> Marton, Tibor – Oross, Krisztián: Siedlungsforschung in linearbandkeramischen Fundorten in Zentral- und Südtransdanubien – Wiege, Peripherie oder beides. In: *Siedlungsstruktur und Kulturwandel in der Bandkeramik. Beiträge der internationalen Tagung „Neue Fragen zur Bandkeramik oder alles beim Alten?!“*, ed. R. Smolnik Arbeits- und Forschungsberichte zur sächsischen Bodendenkmalpflege. Beiheft 25 (Dresden: Druckhaus Dresden GmbH, 2012), 232–233.

<sup>7</sup> Neolithic communities in the contact zone between the Balkans and Central Europe in the second half of the 6<sup>th</sup> millennium BC. OTKA K 112 366, 2015–2018.

<sup>8</sup> Furholt, M. – Bátor, J. – Cheben, I. – Kroll, H. – Rassmann, K. – Tóth, P.: Vráble – Veľké Lehemby: Eine Siedlungsgruppe der Linearkeramik in der Südwestslowakei. Vorbericht über die Untersuchungen der Jahre 2010 und 2012 und Deutungsansätze. *Slovenská Archeológia* 62/2 (2014), 227–266.



## NEOLITHIC TELL SETTLEMENT ON THE DANUBIAN FLOODPLAIN: INVESTIGATION OF FAJSZ-KOVÁCSHALOM

The Neolithic settlements of the Fajsz area, the site at Fajsz-Garadomb and the mound at Fajsz-Kovácsshalom have been under investigation by the Institute of Archaeology of the Hungarian Academy of Sciences and their project partners from the University of Tübingen since 2001. The research activity at Fajsz-Garadomb included three excavation campaigns between 2006 and 2008. Most of the uncovered Neolithic features could be dated to the period of the Sopot culture, but some of them represented the early LBK. The excavations have revealed numerous post-Neolithic burials and settlement pits, sunk into the Neolithic settlement layers. Most of these later structures may have been completely destroyed by agriculture.

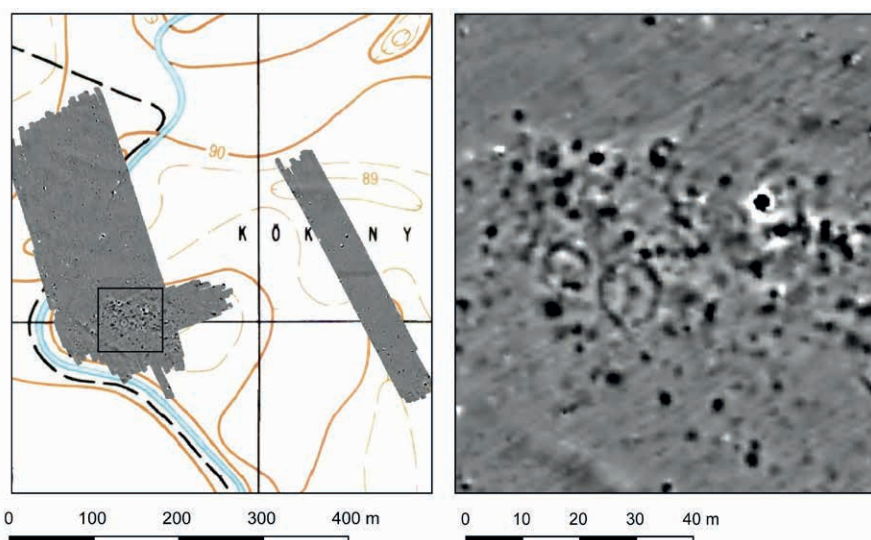
For the time being, our main target has been the assessment of the tell site Fajsz-Kovácsshalom alone, which is located on the Danubian floodplain. Due to modern agriculture, its archaeological structures are endangered, therefore, the site is under protection since 2007. The settlement mound is still visible, albeit probably in a strongly eroded state, so that it stretches no higher than 2.8 m above the plain. The state of the current preservation of the site allows some estimations for the extent of the erosion (and thereby the associated risk to Neolithic material). One can assume that the Neolithic layers would be eroded in the last 100 years at a rate of 2–4 cm a year. As one can imagine, this can be massively destructive to any potential Neolithic discoveries. In this sense, the two-dimensional information provided by geomagnetic exploration carries an even greater value.

On the basis of the field surveys, a more recent geomagnetic prospection was oriented towards searching for supplementary information concerning the site's conservation as a whole, as well as specifically for Neolithic architectural remains (e.g. houses or ditches) and prehistoric burials. As the distance between the two contemporaneous sites is less than 1 km, it was necessary to examine whether any structures could be detected in between the sites that would provide some connections between them.

Geomagnetic prospections were carried out in 2013 February (*Fig. 6*). The study area was ploughed and recent downpours as well caused great difficulty. Deep furrows in the landscape resulted in a rough ride for the measurement trolley, as was reflected in fluctuations of the measurement values. Nevertheless, in spite of these adverse conditions, the team managed to collect usable data for a zone expanding of approximately 6 ha. The settlement mound (diameter of 130 × 80 m) was also fully surveyed. The area which was measured in addition to the settlement mound extends a further 200 meters to the northwest.

The settlement mound is clearly visible in the magnetogram. Interestingly, its extent is visible not through Neolithic structures, but rather human activities probably from the Sarmatian period (1<sup>st</sup>–5<sup>th</sup> century AD). The latter include five circular trenches (diameters between 8–18 m). In addition, approximately 30 pit-like anomalies are also observable. Their diameters vary from 2–3 m. Their low nT-values suggest that they might represent grave pits.

Apart from a few dipoles, only two anomalies reported values between 20-30 nT (which might possible represent layers of burnt daub). The small number of potentially burned houses is surprising, as these trend to common on tells. Neolithic finds were probably not destroyed by human activity from later periods (e.g. the construction



*Fig. 6: Fajsz-Kovácsshalom: Overview of geomagnetic prospection in 2013*

of Sarmatian graves). Burned houses truly seem to have been a rarity at this tell site, at least in the upper settlement layers. No evidence of paths or trackways to the Fajsz-Garadomb settlement were found. Geological signatures as well as the aforementioned archaeological anomalies give evidence to the silted backwaters of the Danubian tributaries. The spatial distribution of early medieval graves over the entire tell can be regarded as an indication that Neolithic settlement layers are generally well preserved.

## CONCLUSION

Large scale excavations and prospections at Alsónyék–Bátaszék and Tolna-Mözs sites provide useful additional information to the excavated parts of the Starčevo, Sopot and Lengyel settlements. The great potential of the data lies in the opportunity to compare archaeological features with geomagnetic anomalies in detail. A better understanding of geomagnetic features is important for reliable extrapolating excavation results in this area. Thanks to the special constellation of excavation and prospection opportunities, we were able to reconstruct the Tolna-Mözs site both in terms of size and internal structure and certain Neolithic settlement parts of Alsónyék–Bátaszék. A decisive prerequisite for realizing this work is the close cooperation between excavation and prospection teams so that both types of data can be discussed in relation to each other and reliable conclusions can be drawn. As a control of our reconstructions and interpretations, we also utilised targeted small-scale excavations and corings. Our prospections at Fajsz-Garadomb revealed the potential of this method, marking an important step in the continuation of a prospection programme intended to gather representative data for this complex series of the investigated sites and their surrounding landscape.

## RECOMMENDED LITERATURE

FURHOLT, M. – BÁTORA, J. – CHEBEN, I. – KROLL, H. – RASSMANN, K. – TÓTH, P.

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[Large Scale Magnetometer Survey of Neolithic Sites in Kalocsa and Tolna Sárköz](#). *Hungarian Archaeology, e-journal*, Spring 2013.