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TANULMÁNYOK – STUDIES

EXCAVATION ALONG THE EASTERNMOST FRONTIER OF THE LBK IN NE-HUNGARY AT APC-BEREKALJA I (2008–2009)

László Domboróczki – Anna Budek – László Daróczi-Szabó – Małgorzata Kaczanowska – Tomasz Kalicki – Edyta Kłusakiewicz – Janusz K. Kozłowski – Angela Kreuz – Péter Pomázi – Michał Wasilewski – Zsuzsanna K. Zoffmann *

The topographical position and size of the site, the number of detected houses, the presence of the early phase make the Apc-Berekalja I settlement one of the most significant sites of the LBK in Hungary. The ongoing processing of the excavation data provided already some very important observations. The geoarchaeological results demonstrated the presence of the in situ soil of the Neolithic period and effects of floods on the settlement. The study of the chipped and ground stone material coming from the Neolithic features revealed no conspicuous changes in the lithic industry of the settlement from the pre-Notenkopf to Želiezovce phases of the LBK. Lithic raw materials came exclusively from territories to the east of the site, which is an evidence of the isolation of the LBK groups that inhabited Apc.

Keywords: *LBK, settlement structure, houses, interdisciplinarity*

Földrajzi helyzete, a lelőhely mérete, a megfigyelt házak száma és a korai fázis megléte alapján Apc-Berekalja I. az egyik legjelentősebb magyarországi VK-település. Az ásatási adatok még folyamatban lévő feldolgozása során közlésre méltó eredmények születtek. A geoarcheológiai vizsgálatok kimutatták egy neolitikus korú talaj in situ meglétét, valamint a települést sújtó áradásokat. A neolitikus korú objektumokból származó pattintott és szerszámkövek a település fennállása alatt a kőipar lényegi változatlanságáról tanúskodnak a VK korai időszakától a zselízi fázisáig. A településen élők a kőnyersanyagokat kizárólag a keletre eső területekről szerezték be, ami az itt lakó csoport izoláltságát igazolja.

Kulcsszavak: *VK, településszerkezet, házak, interdiszciplinaritás*

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* Domboróczki, László. Dobó István Vármúzeum, 3300 Eger, Vár u. 1, Hungary; domboroczki.laszlo@egrivar.hu
Budek, Anna. Institute of Geography and Spatial Organization, Polish Academy of Sciences, Kraków, Poland; annabudek@poczta.fm
Daróczi-Szabó, László. 1144 Budapest, Újváros park 4, Hungary; lacidsz@gmail.com
Kaczanowska, Małgorzata. The Polish Academy of Arts and Sciences, 31016 Kraków, ul. Sławkowska 17; malgorzatakacz@wp.pl
Kalicki, Tomasz. Jan Kochanowski University in Kielce; Institute of Geography, Department of Geomorphology, Geoarchaeology and Environment Management, ul. Świętokrzyska 15, 25-406 Kielce, Poland; tomaszkalicki@ymail.com
Kłusakiewicz, Edyta. Jan Kochanowski University in Kielce, Institute of Geography, Department of Geomorphology, Geoarchaeology and Environment Management, ul. Świętokrzyska 15, 25-406 Kielce, Poland; edytakapusta@interia.eu
Kozłowski, Janusz K. Institute of Archaeology, Jagiellonian University, 31007 Kraków, ul. Gołębia 11; janusz.kozlowski@uj.edu.pl
Kreuz, Angela. State Office for Cultural Heritage Preservation Hesse (LfDH) HessenARCHÄOLOGIE, Schloss Biebrich, 65203 Wiesbaden, Germany; a.kreuz@hessen-archaeologie.de
Pomázi, Péter. State Office for Cultural Heritage Preservation Hesse (LfDH) HessenARCHÄOLOGIE, Schloss Biebrich, 65203 Wiesbaden, Germany; p.pomazi@denkmalpflege-hessen.de
Wasilewski, Michał. Institute of Archaeology, Jagiellonian University, 31007 Kraków, ul. Gołębia 11; mikewas.pl@gmail.com

Location and geographical situation

The archaeological site called Apc-Berekalja I is located in Northern Hungary some 70 kms to the northeast of Budapest. The site lies at 132–135 m above sea level, within a substantially flat, alluvial plain, which, with the narrow north–south valley of the Zagyva River, forms a wedge of the Great Hungarian Plain (Alföld) between the Mátra and Cserhát Mountains (parts of the North Hungarian Range) that lie to the east and to the west respectively *(Fig. 1.A–B)*. A few hundred metres to the west of the site there is an incline rising out of the landscape, which means that the floodplain is on a slight eastward slope to the Zagyva River. Although the area of the floodplain is very flat, there are some shallow depressions with some Holocene backswamps located between remains of the terrace ("finger peninsula"). The narrow basin belongs to the catchment area of the Zagyva River, which cut its bed 1.5 km east of the archaeological site. The present day area is completely deforested and under agricultural cultivation. Many archaeological cultures settled on the fertile alluvial plain of the Zagyva River, surrounded as it is by hills.

Archaeological research at the site

Based on a surface find collection, the site was registered in 2002.[1] Intensive research and partial

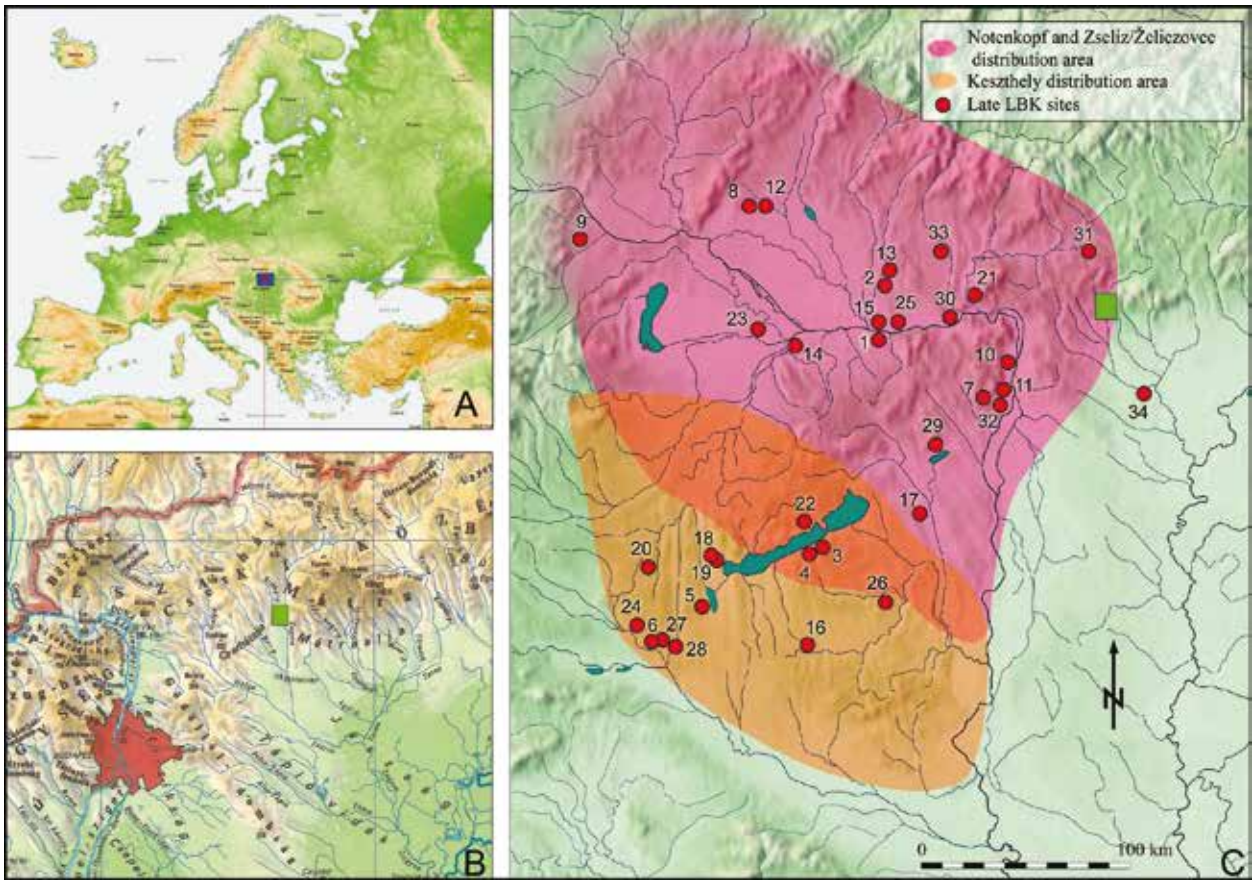

Fig. 1. Location of Apc-Berekalja I. A: within Europe; B: within Northeastern Hungary; C: among the most important late LBK sites in W-Hungary and SW-Slovakia (after Oross–Bánffy 2009). 1: Almásfüzitő-Foktorok; 2: Bajč; 3: Balatonszárszó-Kiserdei-dűlő; 4: Balatonszemes-Szemesi-berek; 5: Balatonmagyaród-Kápolnapuszta; 6: Becsehely II-Homokos; 7: Biatorbágy-Tyúkberek; 8: Blatné; 9: Brunn am Gebirge; 10: Budapest-Békásmegyer; 11: Budapest–Kőérberek-Tóváros lakópark; 12: Čataj; 13: Dvory nad Žitavou; 14: Győr-Pápai vám; 15: Iža-Velky Harčas; 16: Kaposvár-Téglagyár; 17: Káloz-Nagyhörcsök; 18: Keszthely-Dobogó; 19: Keszthely-Zsidi út; 20: Kustánszeg-Lisztessarok; 21: Letkés; 22: Mencshely-Murvagödrök; 23: Mosonszentmiklós-Egyéni-földek; 24: Muraszemenye-Aligvári-mező; 25: Patince; 26: Pári-Altacker; 27: Petrivente-Újkúti-dűlő; 28: Sormás-Török-földek; 29: Sukoró-Tóra-dűlő; 30: Štúrovo; 31: Szécsény-Ültetés; 32: Törökbálint-Dulácska; 33: Želiezovce; 34: Jászberény

1. kép. Apc-Berekalja I. elhelyezkedése. A: Európán belül; B: Északkelet-Magyarországon belül; C: Ny-Magyarország és DNy-Szlovákia legjelentősebb VK-lelőhelyei között (Oross–Bánffy 2009 nyomán)

[1] István Paszternák (CHO), Archaeological Archive of Dobó István Castle Museum n° 896.

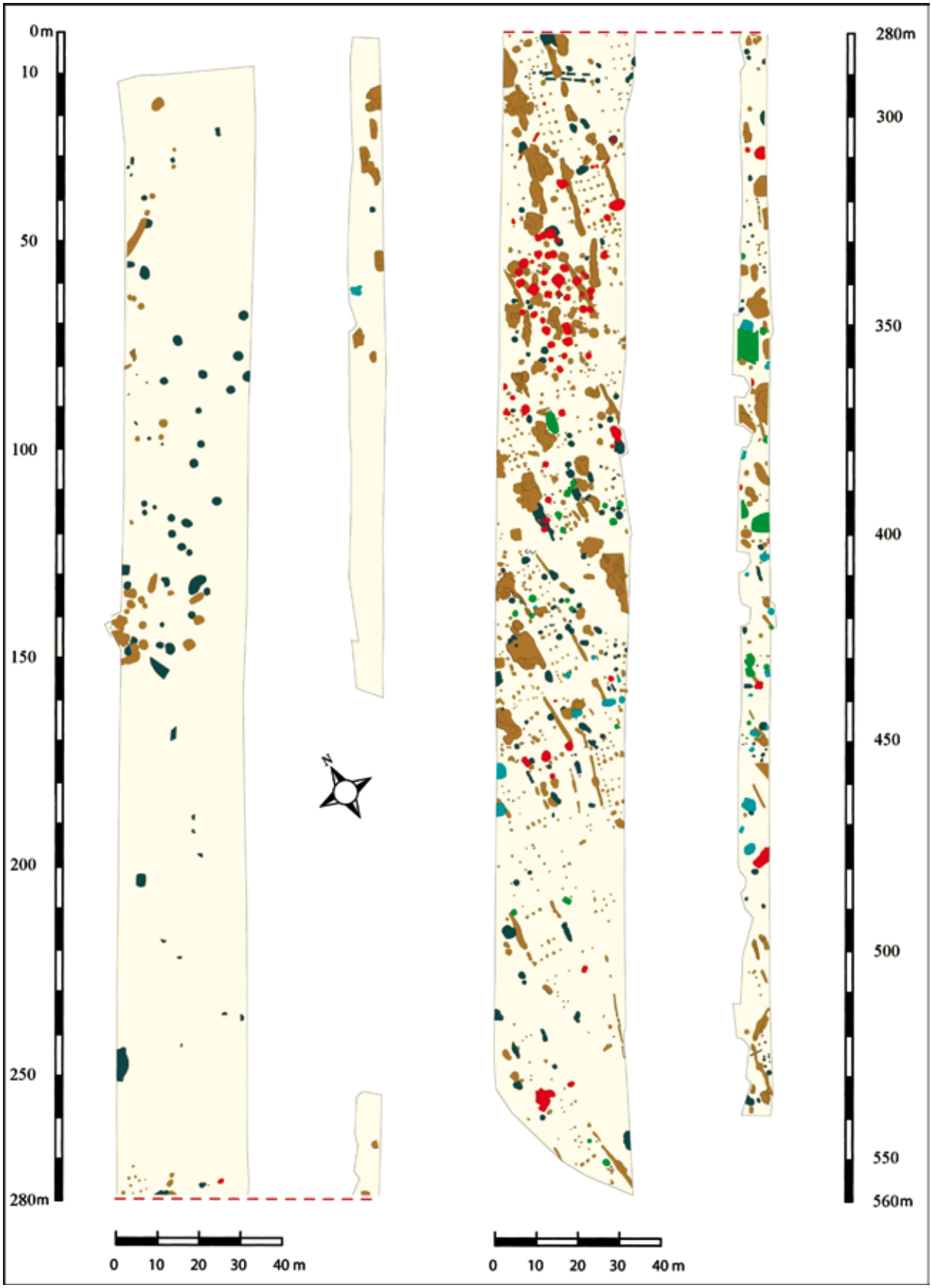

Fig. 2. Apc-Berekalja I. The excavation area. Brown: Neolithic; Green: Late Copper Age; Orange: Early Bronze Age; Red: Late Bronze Age; Blue: Migration Period; Grey: undated features

2. kép. Apc-Berekalja I. Az ásatási felület a neolitikus (barna), késő rézkori (zöld), kora bronzkori (narancssárga), késő bronzkori (piros), népvándorlás kori (kék) és datálatlan (szürke) objektumokkal

exposure of the archaeological site called Apc-Berekalja I began in the autumn of 2008, in connection with the widening of the road No 21. The earthworks affected the archaeological site on both sides of road. On the evidence of the excavations in 2008–2009 and 2014, the researched area covered by archaeological features was 18,911 m² in size. It had a covering of alluvial soil with a humus content reaching a thickness of 90–100 cm, and the clayey subsoil consisting of brownish clay loam. During the excavation 1,460 phenomena have been documented and 14 burials discovered. Some anthropological remains were also collected from the features that could not be linked to the burials.[2]

On the excavation area, the density of archaeological features was not uniform. On the northern part sporadic phenomena of the Neolithic period were observed. To the south of this section, there was a 120 m long almost artefact-free zone. Here the humus layer thickness increased significantly. As it turned out later, this backswamp area might have been the bed of a river, which probably functioned as an active channel during prehistoric times. The south side of this riverbed was very densely populated in the prehistoric times. The excavation brought to light rich material of the Transdanubian Linear Pottery Culture (TLPC or *in German* TLBK, or LBK for short) also revealing numerous traces of post-framed houses, pits and at some places associated layers of finds in the humus level. During the course of the excavation a remarkable LBK site had begun to reveal itself. Such a large LBK site as this had not previously been found in eastern Hungary (*Fig. 1.C*). Beside the dominant Neolithic settlement features, pits of the late Copper Age Baden and the early Bronze Age Makó cultures also appeared in a lesser extent *(Fig. 2)*.[3]

The main periods of the site defined by pottery and radiocarbon dates

The main periods of the site are limited to prehistoric times. In particular, it is the Neolithic settlement that is significant. At the site, in an area that was a white spot in archaeological sense, we managed to unearth partially one of the largest and easternmost settlements of the LBK. The LBK settlement probably covered the entire surface of the estimated 20 to 30 ha site. Although the process of their scientific evaluation is far from over, the remains of approximately 30 post-framed houses can be identified here, most of them linked to the settlement of the LBK. Thus, Apc-Berekalja I can be considered one of the most important LBK sites in Hungary. The excavation of the house areas was carried out with utmost care and entire surfaces were orto-photographed. The features of the excavation, from the observation of the patches through their partial digging up, right up until their final unearthing, were very well documented *(Fig. 3)*. Perhaps uniquely in the case of the LBK period, even surfaces of find densities suggestive of the one-time walking levels were observed and documented. Taking into account the find-material found on them, one can state that the settlement had a considerable amount of pottery scattered on the surfaces, sometimes much more than in the pits' lower layers. Thanks to the micromorphological studies it turned out, however, that these were not real "downtrodden" floor levels, but rather top-load layers created by the action of floods. Even if this seems to be the case, they still give some idea of the filling levels of the existing pits and houses at any given time.

On the evidence of pottery we can say that all phases of the LBK were present at the site. While the early Bicske-Bíňa types of the LBK were observed in closed find associations only sporadically, the later music-note *(Notenkopf)* motif pottery and the latest Želiezovce-type ceramics were found nearly everywhere at the site. The clusters of ^{14}C data confirm the main ceramic phases of the settlement. As can be seen from the nearly 40 radiocarbon dates obtained from various labs (Oxford, Mannheim, Poznań and Debrecen), the LBK settlement existed in the period between 5470–4950 cal BC.[4]

In addition to the significant amount of settlement phenomena, there are even burials that can be linked to the LBK period of the site. So far three burials with strongly contracted skeletons have been proved to be from the LBK period.

Although the settlement features of the late Lengyel Culture have yet to be identified at the site, two burials with slightly contracted skeletons can already be connected to this era. Both of these burials contained grave goods, and beside

[2] Leaders of the excavations: József Danyi (2008–2009), Mónika Gutay (2014). László Domboróczki was involved in the field works from 15th April 2009 onwards, to direct the research of the Neolithic and Copper Age settlement. For the processing and publication of the finds he received exclusive authorization on 2nd November 2009.

[3] For this possibility we owe thanks to Gábor Márkus.

[4] For the samples analysed we would like to thank Alasdair Whittle and Tom Higham (for Oxford), Kurt Alt, Eszter Bánffy, János Jakucs and Bernd Kromer (for Mannheim), Janusz K. Kozłowski (for Poznań), and Mihály Molnár (for Debrecen).

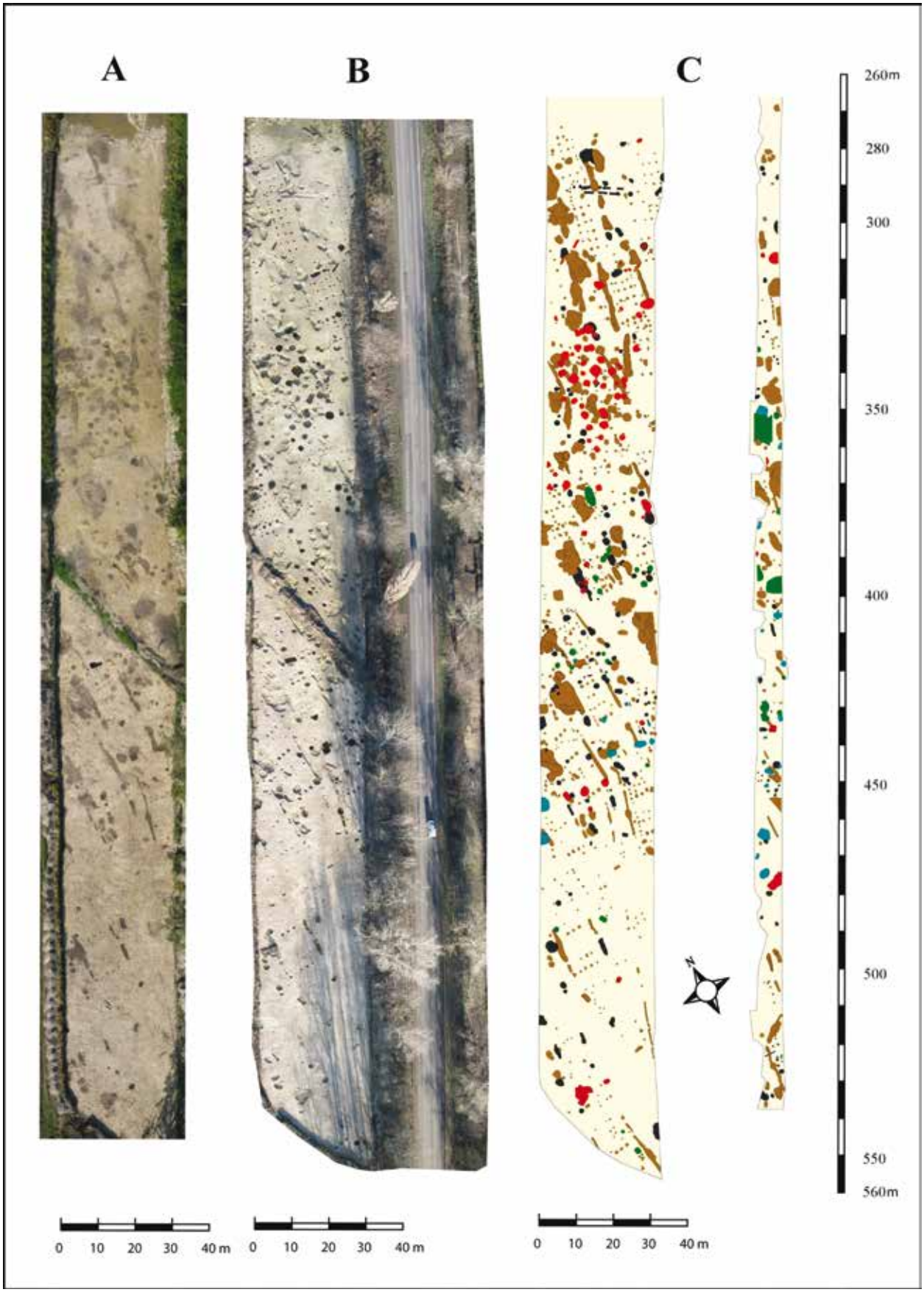

Fig. 3. Apc-Berekalja I. The southern 290 m of the excavation area. A: aerial photograph of the unexcavated features, B: aerial photograph of the excavated features, C: the excavation map with the Neolithic (brown), Late Copper Age (green), Early Bronze Age (orange), Late Bronze Age (red), Migration Period (blue), and undated (grey) features

3. kép. Apc-Berekalja I. A feltárási terület déli 290 m-es szakasza. A: az objektumok légi fotója feltárás előtt, B: a feltárt objektumok légi fotója, C: a feltárás felszínrajza a neolitikus (barna), késő rézkori (zöld), kora bronzkori (narancssárga), késő bronzkori (piros), népvándorlás kori (kék) és datálatlan (szürke) objektumokkal

one of them a very appealing vessel annexe was found.

The next major find-group at the site can be related to the Late Copper Age. The finds of the early proto-Boleráz and the later classical phase of the Baden Culture were found among the excavated features in equal numbers. The settlement features were mostly clustered at the centre of the excavated area, and scattered within a circle c. 150 metres in diameter. Mostly round and large, irregular shaped pits were found during the course of excavation, but on a mere typological basis one or two house plans may also be connected to the Copper Age settlement. Three graves of the Baden period have been identified so far with four lightly contracted skeletons. In one round pit a double burial was found.

During the Early Bronze Age there was also a small settlement at the site. The pits were situated in the middle of the excavation area, within a circle about 80 m in diameter, and in some places appeared in very high densities. Material from the Makó, Nyírség and Hatvan Cultures are also present, and were often found in mixed ensembles here. The only Bronze Age burial, if one is to trust its radiocarbon date, can probably be attributed to the middle Bronze Age Hatvan Culture, although it may also be related to the Füzesabony Culture. A robust male skeleton was found in a contracted position at the bottom of a round pit without any grave goods.

The Late Bronze Age is represented by only a few pits, but these features are fairly scattered throughout the excavated area, albeit concentrated mostly in the southern third of the site.

In addition to the prehistoric phenomena, there are only sporadic Migration Period (Sarmatian) pits and graves to be mentioned. Most of the features were found at the centre of the excavation area, while the burials of four stretched-out skeletons were found on the southern part of the site, separately, at greater distances from one another.

Geoarchaeological investigations

Sedimentology

An attempt at an environmental reconstruction of the site with the help of drillings taken from the floodplain was made at the site in March 2014 by Tomasz Kalicki and his team. Three drillings (Apc 1–3) were done by using hand auger Eijkelkamp. Samples were taken usually on each 20 cm. The grain size analysis was made on laser particle size analyzer Mastersizer 3000. Geological profiles with Falk–Ward distribution param-

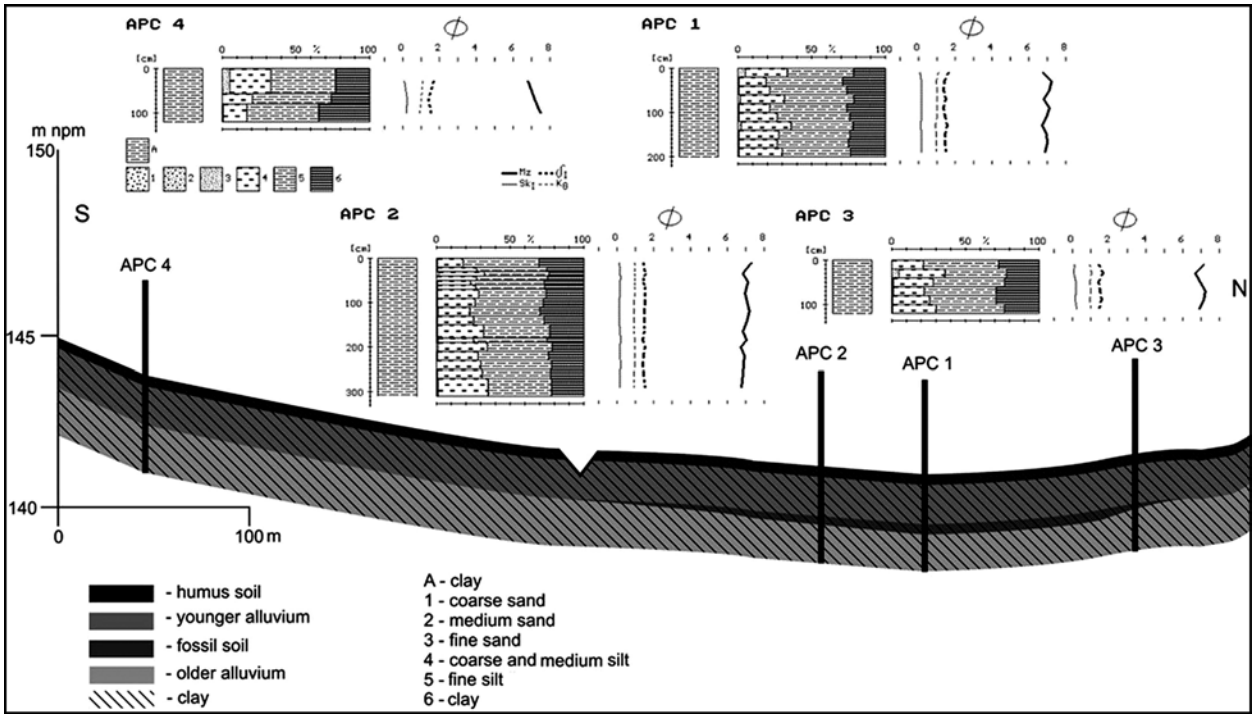

Fig. 4. Apc, archaeological site. Cross sections at terrace remnant (Apc 4) and backswamp on floodplain (Apc 1–3) (Folk–Ward's distribution parameters: Mz: mean diameter, δ_I: standard deviation, Sk_I: skewness, K_G: kurtosis)

4. kép. Apc – régészeti lelőhely. A maradványterasz (Apc 4) és az ártéri mocsár (Apc 1–3) keresztmetszetei az ártéren. (Folk–Ward eloszlási paraméterek: Mz: átlagos szemcseátmérő, δ_I: szórás, Sk_I: ferdeség, K_G: lapultság)

eters have been generated by GRANULOM Programme. The basic analysis were performed by using: potentiometric method for determination of pH value, Scheibler's method for determination of carbonates content and Tiurin's method for determination of organic carbon content. Geochemical analysis, the determination of 20 chemical elements and percentage of Light Elements group (LE) were realized on mobile XRF spectrometer BAS® Delta type.[5]

During drilling in Apc 1 on 120–140 cm of depth (sample nº 7) the level of palaeosoil was discovered which can be distinguished from overlying levels by a little darker colour. The dominant colour of almost all samples was dark grey. Light yellow tinge was characteristic for parent rock layers which emerged out in Apc 2 on 270–310 cm of depth and in Apc 3 even from 80 cm below ground level. Grain size analysis showed an advantage of clay fraction in case of all samples. A quite high share of silt was noted (from above 20% to over 40%). Content of sand is usually very small, no more than 10%. Field works have noted only individual cases of small pebbles on variable depth. The whole profiles are built from weakly sorted clayey deposits with admixture of silt. That material had been accumulated by floods of Zagyva River. Mean diameters of these samples oscillate between 6.58 Φ (0.01 mm) and 7.56 Φ (0.052 mm) *(Fig. 4)*.

The reaction of tested samples are weakly basic or basic. They have high or very high of carbonates content, often more than 15–20%, and even 44.02% in one sample of Apc 3. The content of organic carbon is low, and in some samples the values of that parameter do not reach 0.5%.

The raised concentration of heavy metals in topsoil, that is most visible in Apc 3 in case of Cu, Pb, As, Zn and Ni, can be connected with modern human activity (agriculture). Ancient activities could also exercise some influence on changes of geochemical features. What could strongly mark the high content of Cu, Zn and Fe in level of paleosoil was the occurrence of Neolithic settlement on the terrace of the Zagyva that during periodic floods accumulated the floodplain area. What is interesting, the runs of distributions of copper, zinc and iron content are similar enough, so the occurrences of these heavy metals may be dependent on one another. The development of paleosoil could be connected with the beginning of agriculture, as evidenced by relatively greater accumulation in macroelements, such as K and P.

The conducted geochemical analysis showed that values of Cr and Ni concentration often exceeded the threshold limit established for these metals.[6] According to factor analysis, such content of chromium is caused by the natural features. In the same group of factors are also Zn, Cu, Ni and Fe. Nickel and lead was not marked, because their values in any groups did not exceed >700,000. Factors such as phosphorus concentration, pH and content of carbonates could significantly reduce the activity of trace elements and its bioavailability. The distributions of heavy metals in each profiles are distinguished below, in the order of most to least important:

- The periodic floods – one of the most important factors which caused the mobilization of all heavy metals, practically. It was also strongly connected with other factors.
- The volcanic origin of Mátra and Cserhát Mountains – these kind of stones are always significantly enriched in arsenic and heavy metals. A particulate material from these areas could be transported with water on lower located land. This factor can have the biggest meaning in case of As, Zn, Cu, Pb and Fe.
- A big participation of clayey fraction – it binds strongly almost all heavy metals. This could be the most important reason for significant concentration of Cr and Ni, and partly other elements too in these deposits.
- The concentration of organic carbon – it absorbed the trace elements easily, but because of a little accumulation in deposits it could have a much lesser importance than the participation of clayey fraction. Probably it had a bigger role in topsoil and paleosol.
- The agriculture – an increased concentration of Cu, Pb, As, Zn and Ni is rather significant, but solely limited to topsoil or shallower layers of subsoil. This factor can have a much less importance than natural factors mentioned above.
- Ancient activity – the influence of human activity on Zagyva's floodplain was probably recorded in the deeper layers. A raised concentration of Cu and Zn could be caused by human activity in Neolithic and Bronze Age partially, but this cannot be recognized as a determining factor.
- The communication and industry – these factors are practically irrelevant.

[5] Kalicki et al. 2014; Kłusakiewicz et al. 2015a; 2015b.

[6] Salminen 2005.

Micromorphology

Micromorphological studies at the site of Apc-Berekalja I were performed at the Institute of Geography and Spatial Organization, Polish Academy of Sciences in Kraków by A. Budek. In 2009, for micromorphological analyses seven undisturbed blocks were collected in vertical arrangement *(Table 1)*.

The blocks were acetone-dried and impregnated with epoxy resin and subsequently were cut and made seven 8×10 cm slides. Thin sections were observed under polarising petrographic microscope and a binocular oblique incident light microscope was used for small-scale observation and for features and patterns materials description, respectively.[7] Detailed micromorphological studies have allowed to determine several characteristics, structures and features of silty sediments at the site of Apc-Berekalja I:

- *Microstructure:* The angular, channel and crumb microstructures in all thin sections occur. The angular and subangular aggregates in silty sediments are well formed. In most cases edges of developed units are well arranged, what may indicate drying and wetting. Numerous channels in groundmass provide a high biological activity mainly at the subsurface horizons. In sample S4, in addition to the channels and pores, are chambers with regular round shapes. Such structures are often observed in the sediments strongly saturated with water and formed chambers as tresses of the air bubbles *(Fig. 5)*.[8] The occurrences of flooding marks (air bubble chambers, clay clasts) prove that the area was flooded.[9]
- *Coarse and fine materia, groundmass:* The coarse material consists mainly of quartz grains, with slightly rounded or occasionally sharp (sample S4) edges (c/f limit = 2 microns), and partially

Table 1. Micromorphological samples
1. táblázat. Mikromorfológiai minták

Sample No	Stratigraphic position	Depth
S1	Buried soil (level of artefacts)	100 cm from the surface
S2	Buried soils (level of artefacts)	105 cm from the surface
S3	Bottom of the upper humic layer	60 cm from the surface
S4	Filling of the 3rd ditch	5–25 above the yellow subsoil
S5	Filling of feature 70–74 (III Phase of the LBK) – upper part	57–37 cm from the surface
S6	Filling of feature 70–74 (LBK undetermined phase)	68–48 cm from the surface
S7	Filling of the feature 70–74 (III Phase of the LBK) – lower part	87–67 cm from the surface

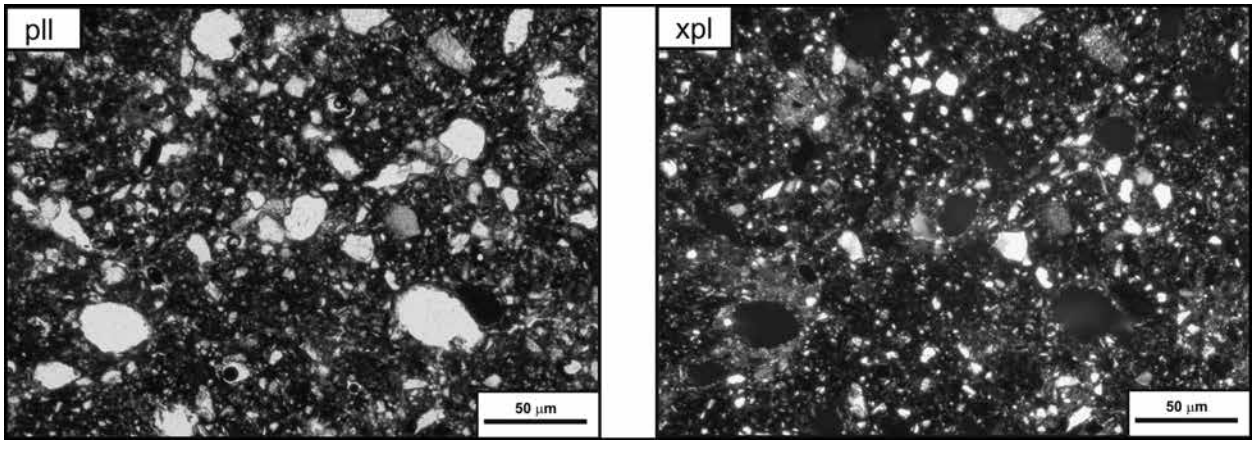

Fig. 5. Photomicrographs of sample S4 showing rounded chambers arise during cracking of air bubbles (pll: plane polarized light, xpl: cross polarized light)

5. kép. Az S4 minta mikroszkópos felvétele a légbuborékok szétpattanásakor keletkezett kerek üregekkel (pll: egy nikollal, xpl: keresztezett nikolokkal)

[7] Thin sections were described using the terminology of Bullock et al. 1985; Stoops 2003.

[8] Gerasimova et al. 1992.

[9] Starkel et al. 2009; Budek 2010.

cracked surfaces. In addition, olivine, biotite and plagioclase occur. In groundmass of sample Apc 2 and Apc 4 in cylindrical shape of conglomerates appear phenocrysts of plagioclase. The groundmass is built from silty-clayey material. In thin section of samples S1–4 it is black-brown and in samples S5–7 it is gray-brown. The colour of the groundmass is caused by the high content of amorphous humus, particularly in the upper horizons and the parent material. Furthermore, high content of calcium carbonate in the parent material determine b-crystalline structure. Sample S5 is dominated in undisturbed b-feature and occasionally porostriates and mosaic (sample S6).

– *Pedofeatures, inorganic species*: On the thin sections various kinds of structures and features can be observed, composed of mineral material. With regard to the environmental conditions and the nature of the deposits in cracks and pores structures have arisen or have been transformed under the influence of various processes, mainly soaking and drying. In the groundmass clay-carbonate or carbonate-ferruginous clasts with rounded shapes occur. Their edges in many cases are sharply defined in relation to the surrounding groundmass. Within these clasts commonly are small grains of quartz. In the transmitted light these forms are gray to pale gray.[10] The nucleic and typic iron nodules are formed by soil or diagenetic processes, and often the nodules have clay hypocoatings.
– *Organic biological residues and inorganic residues of biological origin:* In the groundmass of thin sections of samples S1 and S2 are well developed signs of biological activity. These are mainly earthworms channels (samples S1, S2 and S4), cylindrical excrements as well as fresh root fragments. Moreover, rarely in groundmass are charcoals, well decomposed organic matter (samples S4, S6, S7) shell fragments of ostracode (samples S3, S4, S7) and bones (samples S5–7). In the thin section of sample S3 there are no preserved fragments of organic matter, neither fresh nor decomposed.

Palaeogeographic reconstruction

The geoarchaeological research has revealed clay sediments, more than 4 m thick, accumulated in some phases in the backswamp probably during the whole Late Glacial and Holocene period *(Fig. 4)*. Results of geochemical analyses confirmed the prehistoric age of overbank sediments because concentration of heavy metals connected with modern agriculture occur only in the top of present-day soil. The first phase of overbank accumulation occurred during the Late Glacial and Eoholocene period, followed by a phase of soil development (Mesoholocene). The results of the micromorphological investigations confirmed that soil developed *in situ* on overbank sediments. Neolithic population settled this soil. There were wet environments like damp meadows and wet woods on the flood plain of the Zagyva River with small Szuha Creek cut. On dry soils of terrace remnants, however, typical steppe or dry meadow plants grew.

An increase in the sedimentation rate led to the fossilization of the soil, which could also be the reason why Neolithic settlement decreased. The traces of floods (air bubble chambers, clay clasts) occur also in thin section from a ditch in the depth of buried soil. In profile there is no clear evidence of erosion processes. However, one could explain the reduced depth of postholes of Neolithic long houses, as well as the elongated concentration of artefacts encountered on the site (that was believed to represent walking levels). As these concentrations were observed within the humus layer, one can think on locally cut-out flood channels in the top of the soil that were later filled up with artefacts and organic matter derived from the organic horizon of the washed soil. Around 6500–6000 BP an increase of fluvial activity occurred in the valleys of Central Europe as a whole.[11] Frequent floods during the Neoholocene may have been the reason that a later settlement took place on the remnants of terraces and not in the backswamps on the floodplain.

Plant remains

A total of 69 soil samples from the LBK features (813.5 l volume) have been collected during the course of the excavation and wet sieved at the State Office for Cultural Heritage Preservation Hesse (LfDH) (Wiesbaden, Germany). The archaeobotanical investigations are carried out by Péter Pomázi during the course of his PhD work on 23 Hungarian Neolithic sites. The results of 25 samples from 16 archaeologically well dated Neolithic features are presented in what follows.

[10] Kozłowski et al. 2009; Budek et al. 2013.

[11] Kalicki 2006.

In addition, the results of a further 44 samples are listed in *Table 2*, belonging to 21 pits and ditches, which contained a mixture of LBK sherds and those of more recent (pre)historic periods.

At Apc dry soil conditions were found, just like those prevailing at the other LBK sites in Central Europe.[12] As a consequence, only charred and mineralised plant remains have been found. All in all 17,962 charred and 1,661 mineralised plant remains from 46 plant taxa have been identified and archived in Wiesbaden under the project number HU7 APC.

In the samples from the LBK features (mainly pits and ditches) there has been evidence of four crop plants *(Table 2, Fig. 6)*. The two glume wheats typical for the LBK period[13] were einkorn *(Triticum monococcum)* and emmer *(Triticum dicoccum)*. Of special interest are the singular finds

Table 2. Archaeobotanical results. (Aw: awn fragments; cap: capsule fragments; ch: charred; copr: coprolithe; glu: glume bases; mi: mineralised; rach: rachis; se: seeds; veget: vegetative remains)

2. táblázat. Archeobotanikai eredmények. (Aw: szálkatöredék; cap: tok töredéke; ch: szenült; copr: koprolit; glu: pelyva; mi: ásványosodott; rach: kalászorsó; se: mag; veget: vegetatív maradvány)

Archaeological dating			**LBK**	**Dating?**	
Sample volume (l)			**299**	**514,5**	
Number of features			**16**	**21**	
Number of samples			**25**	**44**	
	Type of plant remains	**State of preservation**	**Number of plant remains**		**English name**
Crops					
Hordeum distichon/vulgare	se	ch		1	Barley
Triticum aestivum s.l./*durum/ turgidum*	se	ch	1	8	Naked wheat
Triticum aestivum s.l./*durum/ turgidum*	rach	ch	1	114	Naked wheat
Triticum dicoccum	se	ch	4	68	Emmer
Triticum dicoccum	glu	ch	123	2,433	Emmer
Triticum dicoccum	rach	ch		1	Emmer
Triticum cf. *dicoccum*	se	ch		6	Emmer
Triticum monococcum	se	ch	4	40	Einkorn
Triticum monococcum	glu	ch	304	6,171	Einkorn
Triticum monococcum	rach	ch		1	Einkorn
Triticum cf. *monococcum*	se	ch		1	Einkorn
Triticum monococcum, 2-körnig	se	ch		3	Einkorn, 2-grained
Triticum aest. s.l./*dur./turg./ dicoccum*	se	ch		5	Naked wheat/emmer
Triticum monococcum/dicoccum	se	ch	1	7	Einkorn/emmer
Triticum monococcum/dicoccum	glu	ch	932	6,782	Einkorn/emmer
Triticum spec.	se	ch	4	6	Wheat
Cerealia indet.	se	ch	83	295	Cereal
Cerealia indet.	rach	ch	4	91	Cereal
Lens culinaris	se	ch	7	19	Lentil
Pisum sativum	se	ch		3	Pea
Weeds and wild plants	aw/se	ch/mi	945	243	
Woodland and shrubs	se	ch	13	35	
Varia	bone/bud/cap/se/veget	ch/mi/ot	831	116	
Zoological remains	fish	ot	125	22	
	copr	ch	18	142	

[12] KREUZ 2012, Chapter 3; WILLERDING 1991.

[13] KREUZ et al. 2005.

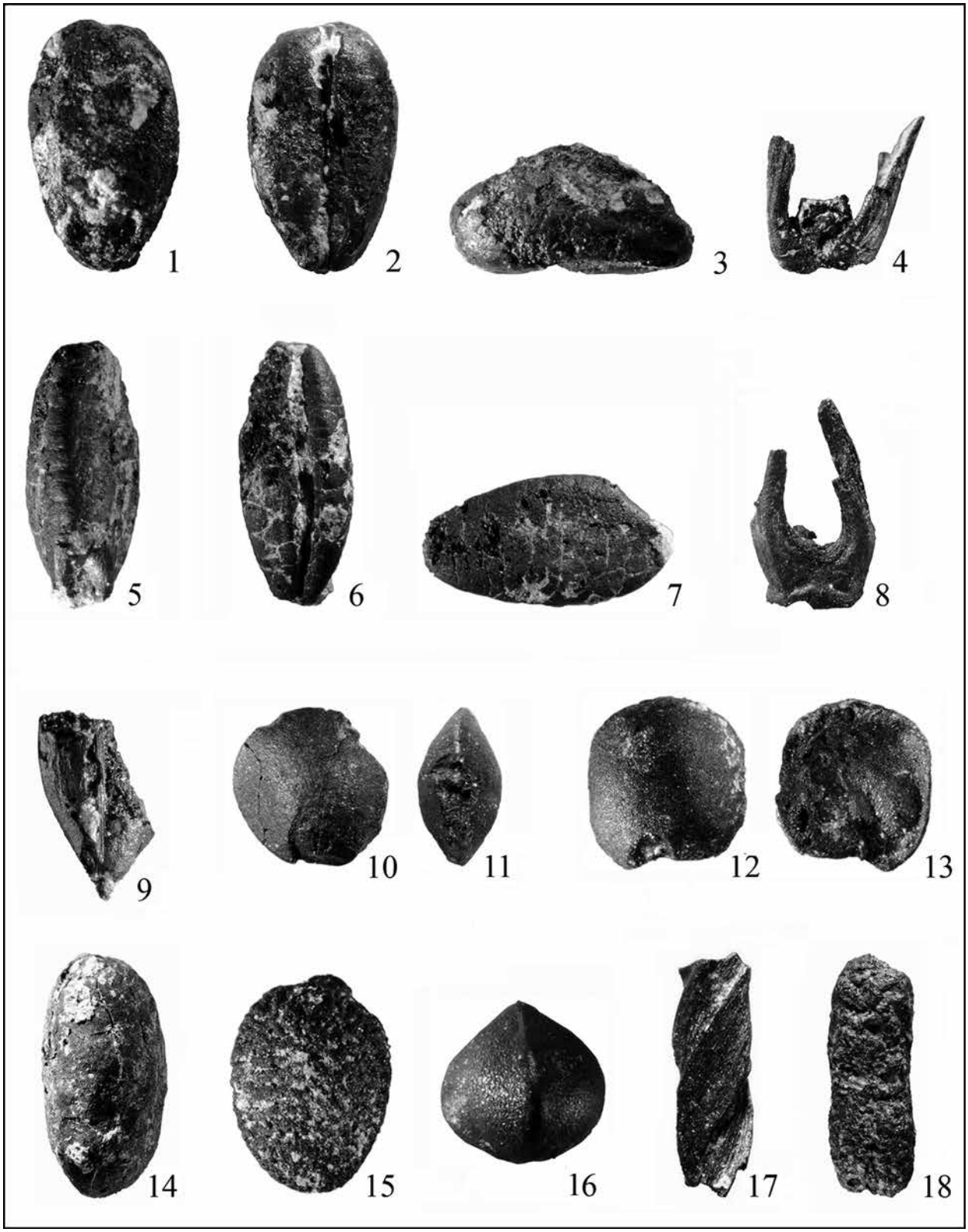

Fig. 6. Apc. Charred plant remains (archaeological dating, see *Table* 2). Emmer *(Triticum dicoccum)*. 1–3: grain, 4: spikelet fork; einkorn *(Triticum monococcum)*. 5–7: grain, 8: spikelet fork; barley *(Hordeum distichon/vulgare)*. 9: grain fragment; lens *(Lens culinaris)* 10–11: seed; pea *(Pisum sativum)*. 12–13: seed; cornelian cherry *(Cornus mas)*. 14: pip; dwarf elder *(Sambucus ebulus)*. 15: seed; black bindweed *(Polygonum convolvulus)*. 16: fruit; feather grass (*Stipa* spec.). 17: awn fragment; 18: (mouse's?) coprolite

6. kép. Apc. Szenült növénymaradványok (a régészeti datálást lásd a 2. *táblázat*ban). Tönke *(Triticum dicoccum)*. 1–3: magok, 4: kalászka villája; alakor *(Triticum monococcum)*. 5–7: magok, 8: kalászka villája; árpa *(Hordeum distichon/vulgare)*. 9: mag töredéke; lencse *(Lens culinaris)*. 10–11: magok; borsó *(Pisum sativum)*. 12–13: magok; húsos som *(Cornus mas)*. 14: gyümölcs magja; gyalogbodza *(Sambucus ebulus)*. 15: mag; fekete szulák *(Polygonum convolvulus)*. 16: termés; árvalányhaj (*Stipa* spec.). 17: szálka töredéke; 18: (egér?)-koprolit

of one rachis fragment (feature 763–764) and one grain (feature 779) of naked wheat (*Triticum aestivum* s.l./*durum*/*turgidum*), as this demanding cereal had not been grown by the Early Neolithic farmers of Western Central Europe before the end of the LBK period.[14] The rachis fragment is of the hexaploid type[15] as is to be expected from other finds from the South-East.[16]

In addition, lentil *(Lens culinaris)* has been identified from one feature, which is one of the two traditional LBK pulses. The proteins of such legumes supplemented a cereal diet that was rich in carbohydrates. Although the pea is lacking in the well-dated features at Apc, it has been found in two of the archaeologically mixed features there *(Table 2)*. The same holds true for the find of one grain of barley *(Hordeum distichon/vulgare)* (see *Fig. 6*), in feature 1359, whose dating is unclear. Barley is to be expected in the LBK distribution area from the Middle Neolithic onwards.[17] This is in contrast to its southeastern distribution, as it had been a crop of the Early Neolithic farmers from the Balkan area, as well as the Starčevo and Körös distribution area in Hungary.[18]

As for the glume wheat emmer and einkorn, it has not only been their grains, but their chaff remains that have been found within the settlement features. After the harvest and the first threshing, the grains of the glume wheat remain enveloped in their chaff, as their ears break into their spikelets only.[19] That is why these grains – being enclosed by their glumes – are more resistant to humidity and fungal diseases.

During the removal of the glumes from the surface, it was possible that the grains got damaged, and could therefore not be kept very long without spoiling. As a consequence the processing of the spikelets had to be done on a day-by-day basis according to the daily needs of the households concerned. This tradition can be reconstructed for the LBK villages too, as indicated by the findings of the threshing remains in 94% of the features from Apc.[20] Another hint as to what daily activities took place is given by 1,615 mineralised plant remains in pit 473, which point to an accumulation of phosphate rich material (dung?) there.

In pit 551 a mass find of cereal grains was found containing for the most part einkorn, together with a considerable amount of emmer and some single grains of naked wheat. As the archaeological dating is unclear, the quantitative analysis of the sample has yet to be carried out. For an age determination to be made radiocarbon dating would be necessary.

An insight into the field management is provided by an analysis of the weed species accompanying the crops.[21] Unfortunately, in the samples from Apc very few weed species were preserved in the LBK features.

Gathered plants certainly were of importance for the human diet during the whole of prehistory. The Apc site showed evidence of fat hen *(Chenopodium album)*, hazelnut *(Corylus avellana)*, elder *(Sambucus nigra)*, cornelian cherry *(Cornus mas)* as well as dogwood *(Cornus sanguinea)*. The occurrence of cornelian cherry in the archaeobotanical samples of Apc is typical for the Balkan Neolithic as well. It is a shrub or small tree within the north Mediterranean dry forests[22] that is not native to Western Central Europe. This is in contrast to a Balkan area like Bulgaria, where it has been identified repeatedly at Neolithic sites by Marinova.[23] Among the further wild plants, feather grass (*Stipa* spec.) is a typical steppe or dry meadow plant growing on dry soils, e.g. steep slopes or sand dunes of the river valleys around the archaeological site. On the other hand, the numerous remains of fish in 37.5% of the LBK features and of ragged-robin *(Lychnis flos-cuculi)* point to wet environments like damp meadows and wet woods in the river valleys of the Zagyva and the Szuha. In the future, further archaeobotanical investigations might be able to differentiate the initial results presented here.

Animal remains

The animal bones were identified and processed by László Daróczi-Szabó. From the total of 4,169 animal remains found at the site, 3,317 were successfully dated, coming from five different ages. The largest part of the animal remains, a total of 2,254 fragments came from the Neolithic period, from which 2,232 could be identified at least on a level of biological order. 95.6% (2,131 fragments)

[14] Kreuz 2012, 141.
[15] For the determining criteria used, see Maier 1996.
[16] Marinova 2006, 75.
[17] Kreuz 2012; Kreuz et al. 2014.
[18] Kreuz 2012, 141; Kreuz et al. 2005; Marinova 2006; P. Pomázi's unpublished results.
[19] As shown by the ethnographic studies from Turkey and Greece by Hillman 1984 and Jones 1984; see also Jacomet 2006; Körber-Grohne 1988, 321.
[20] The processing is described in more detail in Kreuz 2012, 34; for the Neolithic tell sites, see Marinova 2006.
[21] Kreuz–Schäfer 2011.
[22] Oberdorfer 1990; 2001.
[23] Marinova 2006.

of these originate from domestic mammals: cattle (1,578 fragments, 70.6% of the identified remains), sheep and/or goat (385, 17.3%), domestic pig (163, 7.3%), and dog (5, 0.2%).

The proportion of wild animal remains is relatively low: only 95 fragments (4.3%) form this group, and we have to take into consideration that some of these came from animals which might have dug themselves into the archaeological layers and, in this way, it is possible that they make a taphonomical gain, which has nothing to do with the animal usage of the population. To this category belong the following: hamster (2 fragments, 0.1%), lesser mole rat (1, 0.04%), and an unidentified rodent (0.04%). Another group consists of the remains which came from animals about which it is not possible to decide whether they were used (e.g. eaten) by humans, or if they got into the assemblage accidentally. This group is made up of snails (*Cepaea vindobonensis*, 22 fragments, 1% and unidentified snail, 6 fragments, 0.2%). The group of hunted or collected wild animals contains the following: European hare (8 fragments, 0.4%), red deer (5, 0.2%), European bison or aurochs (4, 0.2%), wild horse (3, 0.1%) and roe deer (2, 0.1%). Although their origin and use is questionable, the 37 shells (1.7%) and the four unidentified bird bones (0.2%) may also be considered part of this group. In the assemblage there were a total of six remains (0.3%), where it could not be decided whether they came from wild or domestic animals. This includes the bones of five cattle/bison/aurochs (0.2%) and one domestic or wild pig (0.04%). On the basis of the small number of bones available for such calculations, we were able to calculate the height of the withers of the following animals: domestic pig 85 centimetres (average of three bones) and domestic sheep 53 cm (two bones).[24] Among the animal remains coming from this period, there were only two pathological phenomena identified: traces of a healed fracture on a cattle rib and teeth deficiency on a cattle mandible.

From the Baden period 93 animal remains came to light. 98.9% (92 remains) of these originate from domestic mammals in the following order: cattle (78 remains, 83.8%), sheep and/or goat (11, 11.8%), pig (2, 2.2%) and dog (1, 1.1%). In the case of one bone (1.1%) it cannot be stated whether it came from a domestic or a wild horse, as in this period both lived in the Carpathian Basin. As there was only one bone at our disposal, the question could hardly be answered. There were no pathological phenomena found from this period, and no finds eligible for withers height calculation came to light.

From the Bronze Age a total of 926 animal remains came to the surface, from which 914 could be identified at least on the level of biological class. The distribution of the different animals shows great similarity to that from the Neolithic Age (97.1%, 886 fragments). The identified remains from the domestic animals came in the following order: cattle (653 fragments, 71.4%), sheep and/or goat (163, 17.9%), domestic pig (64, 7.1%) and dog (6, 0.7%). The small group of wild animals (27 remains, 2.8%) consists mainly of those, which can be counted as hunted or collected animals. These are the red deer (6 fragments, 0.7%), European hare (4, 0.4%), roe deer and unidentified birds (both 3 fragments and 0.3%), shell, red fox and wild pig (1–1 fragments, all 0.1%). There is another group of wild animals (snails, 2 items, 0.2%) about which it cannot be decided whether they got into the assemblage accidentally or they were used by humans. The third group of wild animals contains those species which can be counted as taphonomical gains as they possibly dug themselves into the layers at a later stage. These are the hamster (5 fragments, 1.5%) and the lesser mole rat (1 item, 0.1%). In the assemblage there was a single horse bone (0.1%), about which it cannot be decided whether it came from a wild or a domestic horse, as in this period both lived in the region. For withers height estimation six bones were suitable. Three of these came from pigs (averaging a height of 69 cm) and three from cattle (all three were cows, with an average height of 116 cm).[25] There were no pathological symptoms observed on the remains.

A total of 38 animal remains originate from the Sarmatian period and only five bones were found from the Middle Ages. The animal remains from all ages show an overwhelming dominance of domestic animals compared to wild animals. If we leave out those periods with under 100 animal remains where this dominance of domestic animals might be considered a simple coincidence due to the size of the sample, one is left with the remains of Neolithic (2,232 identified remains) and Bronze Age (914) bone fragments. Comparing these two periods, we got a surprisingly similar result. This similarity, if we exclude any kind of cultural tradition that existed between the two ages as well as the possibility of accidental admixture of finds within the pits through erosion, can be explained only by geo-

[24] Teichert 1969; 1975.

[25] Boessneck 1956.

graphical, environmental and climatic conditions, which heavily influenced the animal usage of the existing populations.

Anthropological analyses of skeletons from graves

A total of 14 human skeletons and several dispersed bones were examined and described by Zsuzsanna K. Zoffmann in 2013 using classical methods. The anthropological remains in general were very poorly preserved, fragmentary and incomplete. Much recent damage was to be observed, most of which in all probability occurred during the excavation. Contemporary fractures were much less common, and in any case, they never suggested intentional, even fatal injuries. Due to the poor preservation, the age of death could not be clarified precisely and the systematic observation of the epigenetic traits and lesions were also not possible. The categorization of the metric data followed the Alekseev–Debets method.[26]

From the period of the LBK, three burials have been examined: two adult (a male and a female) skeletons and a child skeleton. The two adults buried in the LBK graves fit well typologically with the population of other sites, especially with the excavated anthropological finds at the Nitra-H.Krškany-Priemyslová ulica[27] and Balatonszárszó-Kiserdei-dűlő[28] sites, where the overall taxonomic picture of the population within the LBK shows a dominance of the leptodolichomorph type. The Lengyel Culture period is represented by two incomplete teenage children's skeletons. From the Baden Culture period, three graves were found at the site. Two burials contained single skeletons of adult women, while the only double burial contained the skeletons of an adult male and a small child. To the period of the late Hatvan–early Füzesabony Culture an adult male skeleton can be dated. Similarly robust individuals, such as the middle-aged man that belonged to the middle Bronze Age Hatvan or Füzesabony Culture of the site, are well known from the Füzesabony Culture.[29] It should be noted, however, that anthropologically we know nothing as yet about the population of Hatvan Culture.[30] Among the sporadic anthropological finds unearthed in the pits are mostly individual bone fragments, by which even the gender-determination is uncertain. Thus, their incomplete nature did not allow for a more detailed analysis.

Three skeletons, including one of the LBK, the late Lengyel and the Baden Cultures were successfully sampled for DNA. Ron Pinhasi and his team in Dublin managed to obtain such good quality DNA samples that in principle can help to identify a number of genetic characteristics of the people which are as yet unknown.

Chipped and ground stone industry

The chipped and polished stone tools were examined and processed by Małgorzata Kaczanowska, Janusz K. Kozłowski and Michał Wasilewski. The Neolithic LBK features at Apc provided 408 chipped stone artefacts. As excavations confirmed the multi-phase evolution of the site from the pre-Notenkopf to the Želiezovce phases in Apc, the local evolution of the LBK chipped stone industry could have been studied.

In comparison with other LBK sites in Northwestern Hungary and Southwestern Slovakia, the series of lithic artefacts from Apc seems large.[31] However, in proportion to the excavated area and the fact that all the phases of the LBK are represented, the number of artefacts per phase and habitation unit is small. The general inventory structure indicates that a specific, small scale, local lithic production was conducted on the site. The role of blades was minor, while flakes were more important. The majority of tools were made of flakes. The proportion of cores, which was fairly large, was probably caused by the poor quality and poor cleavage of the raw materials.

The majority of raw materials used in all occupation phases were siliceous rocks, mainly limnoquartzites (nearly 70%). The most frequent types of limno/hydroquartzites originate from the southern and southwestern part of the Mátra and the Cserhát Mountains, lying approximately 20 kms to the east and west of the site. Some limnoquartzites may originate from the region west from Gyöngyös (less than 15 km to the east of the site) and from the Miskolc-Avas (about 70–80 km to the east). The only extralocal raw material was obsidian, but it amounted to only 1.7% of the finds. In comparison with other LBK lithic finds close to the eastern margin of this culture, we can see the following differences:

– The most important sources of raw material in Apc are local or mesolocal. Mesolocal sources

[26] Alekseev–Debets 1964.
[27] Jelinek 1973.
[28] Zoffmann 2012.
[29] Zoffmann 2007.
[30] Köhler 2004.
[31] Kaczanowska 2003; Kaczanowska–Kozłowski 2003.

are situated mostly to the east of Apc. A different situation can be observed in other easternmost LBK sites in the region of Budapest[32] and in the Ipoly valley,[33] where the Transdanubian raw materials (Szentgál type radiolarite, Tevel flint) are frequently accompanied by "northern" flint (mostly Jurassic chert from the Kraków region). At Szécsény-Ültetés the proportion of obsidian is exceptionally high.

– Extralocal raw materials (obsidian, limnoquartzites from the edge of the Bükk Mountains, and one specimen from Jurassic flint from the Kraków region) are rare and probably imported to the site as ready-made blanks or tools. At many Central European LBK sites from the formative/early phase, it is the extralocal raw materials that are dominant, because the new settlers usually brought raw materials from the cradle area.[34] Therefore it is possible that Apc is not the earliest site in this area, and future excavations may bring older settlements to light.

The use of rather poor quality local raw materials influenced the technique of working raw materials which was, first of all, the flake or flake-blade technique employed over the whole period of the LBK settlement at Apc. At the same time, already in the oldest phase, a limited supply of blade blanks and blade tools, produced elsewhere, can be seen.

Although changes in the ceramic style took place, no conspicuous evolution of the lithic industry has been recorded. On the other hand, it should be stressed that the oldest phase at Apc exhibits a somewhat separate character. The small series of lithics from Apc means that we cannot determine whether the separate nature of the oldest phase at Apc resulted from specific occupations of the inhabitants, or whether it reflected a different techno-morphological tradition. The distinctive feature of the oldest phase at Apc is the absence of blade tools and, in later phases, the almost complete absence of truncations used as sickle inserts. At Apc sickle inserts belonged to the world of unworked bladelets or blade-flakes. The overall picture of blank production techniques and the raw materials composition do not markedly differ from the pre-Notenkopf to Želiezovce phases.

In Apc more than 200 ground stone artefacts and fragments were recovered, including lower and upper grinding stones (also half-finished products), plaquettes with polished surfaces, hammerstones, grinders/pounders. The raw materials used in the ground stone industry are either local (quartz, conglomerate, sandstones) or, partially come from river alluvia, or from the hills at the Hungarian-Slovakian border such as gabbro and basalt (among others from the fringes of the Bükk Mountains) i.e. from the distance of about 50 km. Andesites, probably from the Mátra Mountains, occur in small quantities. Thus, the raw materials worked in the ground stone production are predominantly mesolocal, unlike the chipped stone industry, which is dominated by local raw materials. The apparent incongruity (heavy artefacts brought from larger distances than the lighter and smaller chipped stone artefacts) could be accounted for by the difficulty in replacing mesolocal raw materials used in ground stone tools production by local rocks.

The absence of raw materials from the territories to the west of Apc is clear evidence of the isolation of the LBK groups that inhabited Apc. This isolation is not manifested in ceramic styles whose decorative motifs are found in western Slovakia and in the vicinity of Budapest. Some contacts with the ALPC territory in northeastern Hungary are confirmed not only by imported mesolocal raw materials, but also by Tiszadob and Bükk pottery imports.

Preliminary assessment of the Neolithic settlement

From archaeological point of view, the most important phenomenon of the Apc-Berekalja I site is undoubtedly the settlement of the Transdanubian (or Central European) Linear Pottery Culture (LBK).[35] Although the interpretation of the finds and processing of the excavation data is only just beginning, the topographical position and size of the site, the number of detected houses and the quality of the observations are the kind of factors that immediately make the Apc-Berekalja I settlement one of the most significant sites of the LBK. The presence of the early stage of the LBK/TLPC at the settlement and the settlement's direct proximity to the western border of the neighbouring Alföld Linear Pottery Culture (ALPC, *in Hungarian* AVK, *in German* ALBK) of the Great Hungarian Plain are also significant factors from the point of view of the neolitization of the wider region of northeastern Hungary. Moreover, since after the final phase of the LBK settlement at the site – as we believe it to be now – there is no direct evi-

[32] Budapest-Aranyhegy: KALICZ-SCHREIBER–KALICZ 1992.

[33] Szécsény-Ültetés: BIRÓ 2001.

[34] KACZANOWSKA–LECH 1977; LECH 1989.

[35] In this chapter we often use TLPC with the LBK as we want to emphasize the geographical character in the name that clearly distinguishes that from the ALPC.

dence for the presence of the early Lengyel Culture, the closing events can be paralleled with the end of the ALPC in neighbouring territories and indicate in a similar way some kind of general disaster. The presence of late Lengyel Culture at the site, however, is also noteworthy, since in this region, on the eastern periphery, we did not have such data previously. Overall, it can be said that in almost all the respects mentioned above, the region around Apc was a white patch in the research and the excavation of the site in 2009, and due to its abundance of information it can fundamentally alter the hitherto formulated visions of the Neolithic history of the area.

The topographical situation of the settlement is very interesting, because the site falls in the easternmost border area of the Central European Linear Pottery Culture within Hungary. Of course, LBK sites also existed to the east and north of here, as they are present in the Carpathian and Transcarpathian areas of Slovakia, Poland, Ukraine, Moldova and indeed Romania,[36] but within the Hungarian areas of the Carpathian Basin, Apc-Berekalja represents the easternmost border zone. From field surveys it was known long ago that the LBK spread into the area of the Gödöllő Hills[37] and the area of the Tápió River.[38] On the basis of some sporadic finds, it was even suggested that the LBK settlement line reached as far as the river Zagyva from the west, from the direction of Budapest,[39] but right up to the Apc-Berekalja excavation there were no concrete large-scale excavation results from the region. Up until now we could name only two sites in the eastern periphery where excavations were made, but these were rather limited in scope. One of them was the Szécsény-Ültetés site unearthed along the Csitári and Szentlélek streams, tributaries of the Ipoly River, in 1979–1985, which brought to light relics of the Želiezovce phase of the LBK. The excavations, which consisted of exploratory trenches and inspected an area of c. 1500 m², revealed several pits, the remains of a house marked by daub-debris and some postholes laid out in an irregular arrangement.[40] A ditch system was also identified here with the help of aerial photographs and old maps. The second site was Jászberény-Belső-szőlők on the southern outskirts of Jászberény, where features of both the ALPC and TLPC were detected during an excavation in 2004–2005. Here in a smaller area, 4 pits of the ALPC-Szakálhát phase as well as 13 pits of the LBK-Želiezovce phase were dug out, producing find materials.[41] Though Szécsény-Ültetés and Jászberény-Belső-szőlők are very important sites as they proved the settlement of the people of the LBK in this region, the results of the large-scale excavation at Apc-Berekalja I may give much more conclusive information on the settlement structure than these formerly mentioned ones.

Though any surface collection data confirming the exact W–E dimension of the site have yet to be found, if one calculates using an oval rather than a circular settlement form, the size of the LBK settlement at Apc-Berekalja I, with its 720 m long NE–SW directed cross section, the 550 m long excavation surface from 2009 combined with the further 170 m long exploratory ditch from 2014, could even have reached a size of 20–30 ha. This would mean that we have only excavated 6–10% of the total settlement area. Although large LBK settlements are known in the regions lying slightly to the west, both in neighbouring Slovakia and in northern Transdanubia,[42] really huge 20 to 30 ha large sites are relatively rare. Only Blatné and Mosonszentmiklós are known in the Kisalföld, while around Lake Balaton in Transdanubia only Balatonszárszó is known to us.

At Apc-Berekalja, due to the uncertainties and prolonged completion of the excavation documentation, a thorough analysis of the house floor plans has yet to be done, nevertheless at least 20 to 30 house plans can be identified in the excavated area almost immediately *(Fig. 3)*. These house plans belonged mostly to the long-ditched LBK type and were usually 16–24 m long, but smaller and larger ones also existed. Based on the five transversely situated postholes, the estimated width ranged between 5–7 m, although some houses of 10 m wide cannot be excluded. Similar constructions were observed in the area of Budapest, in Transdanubia and in SW Slovakia.[43] Even the oval postholes at the southern parts of some houses at Apc have their parallels in the mentioned regions.[44] The traces of posts were in some places very well preserved, so it will be well within our power to reconstruct the struc-

[36] Godłowska 1982, 46; Kulczycka-Leciejewiczowa 1982, Abb. 1; Czekaj-Zastawny 2013, 171; Lüning 1991, 32; Kotova 2003, Fig. 1; Dębiec–Saile, 2015, 17, Abb. 15.

[37] Kalicz 1970, 7–8; Kalicz 1995, 29.

[38] Dinnyés 1985, 13, 44; Bondár 2007, 59–61; Virág 2009, 12–13; Virág 2014, 21.

[39] Kalicz–Kalicz-Schreiber 2002, 27–29; Virág 2009, 11.

[40] Fábián 2010, 225–231.

[41] Kertész 2014, 25.

[42] Štúrovo: Pavúk 1982; 1994; Blatné: Pavúk 1980a; 1994, 238; Mosonszentmiklós-Egyéni földek: Egry 2003; Oross 2014, 432–433; Balatonszárszó-Kiserdei-dűlő: Oross 2013; 2014; Oross–Bánffy 2009; area of Budapest: Virág 2014, 25, 62.

[43] Oross 2014, 402–408; Pavúk 1994, 51–70.

[44] Virág 2014, 27–29; Oross 2014, 408–413; Pavúk 1994, 51.

ture of the houses in the future. In the southern part of the excavation site, the post holes were registered as early as the dehumusing process was under way, almost at the time of their occurrence in the grayish soil, with a total station. Later, once the mould was removed, the post marks were recorded again at the level of the yellow sub-soil, and these measurements were of course repeated after their eventual excavation. Using measurements made on the different levels, the vanishing effects of wood decay can be reduced and such recording of the postholes will certainly produce high quality structural reconstructions. The identification of the house structures will also be helped by the orthophotos, which were taken at different stages of the excavation, both when the dark marks of the features appeared on the yellow subsoil level and when they were dug up. Furthermore, the house structures covered an extensive area. The house plans almost uniformly pointed in a north–south direction and were sometimes very densely spread in the excavated area. This arrangement seems to be characteristic to the area of Budapest, where similar observations were made.[45] Some slightly differently positioned structures suggest superpositions, which obviously refer to different settlement phases, but these superpositions are not frequently occurring at our site. These are also reminiscent of the observations made in the area of Budapest from where superimposing structures were also mentioned but not frequently.[46] This shows contrast both to the territories of Lake Balaton where there were no superpositions observed at all and to the territories of Slovakia where a lot of superpositions were documented.[47] At Apc-Berekalja, on the basis of the existing house plans, at least five settlement rows can be postulated. Recently, the possibility of the linear settlement structures also arose within the LBK.[48] As for the length of the settlement rows at Apc, estimations cannot be made for the time being as we do not know exactly where the western and eastern fringes of the settlement were. With our site any detailed settlement structure analyses is yet to come. Nevertheless we plan to do it in a way similar to that it was done with some larger settlements in the more westerly-lying territories.[49]

It is to be mentioned that we managed to observe find dispersion levels within the humus that though we would like to interpret them as walking levels, they may have rather been washed away layers of finds heaped up above the pits. Though these were not trampled-down layers but rather the workings of water during the course of frequent flooding, they still show us the extent of the infilling. Thus, albeit indirectly, they still give us a picture of the features kept open, their relation to the neighbouring houses and the level on which the people of the time might have walked.

The primary description of the finds also produced some interesting results. It turned out that before the Music-note and Želiezovce phases, even the early Bicske-Bíňa phase of the LBK was present at the site *(Fig. 7)*. Several features of the settlement attested the presence of those early LBK find materials that were represented by plastic ornaments, buttons, finger-printed edges, carved and polished decorations and typical vessel forms that are most reminiscent of the Starčevo Culture material, yet find their closest parallels in the published finds at Bicske-Galagonyás, Budapest-Aranyhegyi út, Bíňa and Brunn-Wolfholz.[50]

So far, the only site east of the Danube which produced a similarly early collection of LBK finds was available at Galgahévíz, where the finds were collected from the surface.[51] From Apc-Berekalja, however, this early material came from authentic contexts. Although it seems unlikely that one can identify those Starčevo ceramics in a closed context that are now believed to be representative of the earliest phase of the LBK, the earliest ^{14}C dates from Apc-Berekalja are not much younger (if they are at all) than those of the earliest phase at Szentgyörgyvölgy-Pityerdomb.[52] Of the currently available 30 age data of the LBK settlement, which have an average ± 20 to 40 year

[45] Virág 2014, 29; Oross 2014, 418–428.

[46] Virág 2014, 31.

[47] Oross 2014, 430–435.

[48] Rück 2013, 224; Oross 2014, 430–438; Virág 2014, 32; for the linear settlements of the ALPC see Domboróczki 2009, 79–113; 2013.

[49] Strögen, Neckenmarkt: Lenneis–Lüning 2001; Štúrovo: Pavúk 1994, 197–224; Bylany: Pavlů et al. 1986, 314–363; Aldenhoven: Lüning 1982, 125–156; Stehli 1982; Elsloo: Modderman 1985, 73–90; Balatonszárszó-Kiserdei-dűlő: Oross 2014, 309–345.

[50] Makkay 1978; Kalicz-Schreiber–Kalicz 1992; Pavúk 1980b, 8–10; Stadler–Kotova 2010.

[51] Kalicz–Kalicz-Schreiber 2002, 30–31.

[52] Bánffy 2004, 299–307. Much earlier dates than these are among the Brunn ^{14}C data, but most of them come from charcoal samples, and hence may not produce the most accurate date. Still, it is far from sure that only the TLPC contexts were present at Brunn. We have to agree with P. Stadler and N. Kotova in so far as the earliest ^{14}C data may also suggest that even Starčevo colonists may have settled on the spot (Stadler–Kotova 2013, 60–73). Concerning the process of the neolithization, on the basis of the experience gained from the areas of the ALPC, one can consider the possibility of the colonization of remotely lying areas: Domboróczki 2009, 111–113; 2010, 156–159. This may explain the early data of Brunn too.

Fig. 7. Apc, Neolithic settlement. Pottery from the early phase

7. kép. Apc, neolitikus település. Kerámiák a korai fázisból

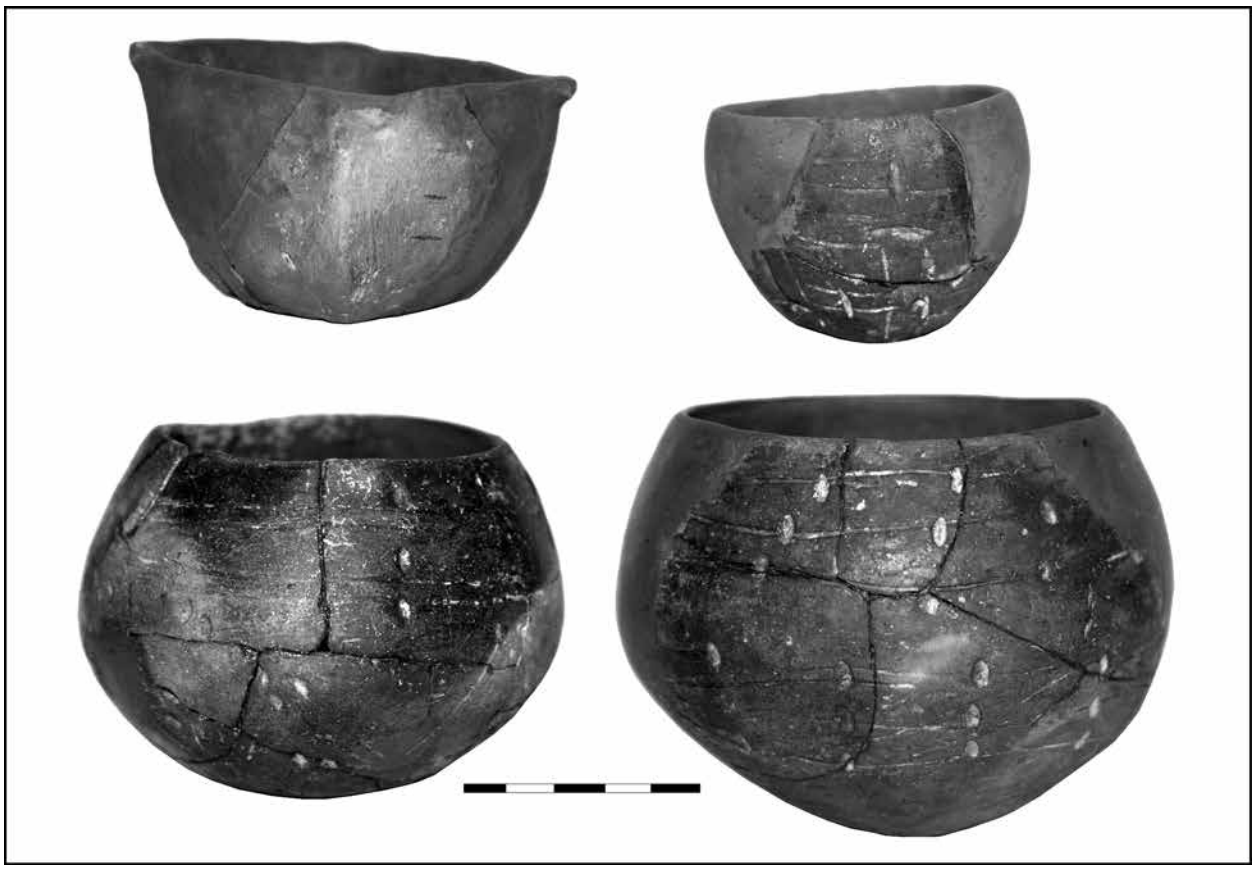

Fig. 8. Apc, Neolithic settlement. Pottery of the middle (Music-note) and late (Želiezovce) phase

8. kép. Apc, neolitikus település. Kerámiák a középső (kottafejes) és késői (zselízi) fázisból

deviance, 6 fall into the interval between 6424–6388 BP. These measurements came from bone samples, with only one 6390 BP date deriving from charcoal. These are very early dates and can indeed be considered as being among the earliest LBK dates in the entire territory it covered. It is worth taking into account here again the importance of the stone analysis, which suggests that in contrast to Apc at many Central European LBK sites from the formative/early phase onwards the extralocal raw materials were dominant because the new settlers usually brought raw materials with them from the cradle areas.[53] Therefore it is possible that Apc is not the earliest site in this area, or even earlier features may be found at this site other than those excavated so far. As regards the ratio of excavated/unexcavated areas, this latter suggestion is a real possibility. The next date cluster after the earliest phase consists of 5 samples, which indicate the period of 6368–6339 BP. This is followed by a significant thickening consisting of 12 dates from the interval between 6320–6258 BP, which clearly refers to the settlement's heyday. Finally the last phase of the settlement can be placed between 6231–6080 BP based on 7 samples. Before any thorough analyses of the finds, we are not intending to deal with the historical reconstruction of the LBK settlement at Apc-Berekalja. For the time being one can be satisfied with the fact, based on raw ceramic typology, that the above date clusters obviously correspond well with the Bicske-Bíňa, Music-note/Notenkopf and Želiezovce periods *(Fig. 8)*. As we stressed above, the earliest date cluster at Apc-Berekalja probably represents the earliest clear LBK dates in Hungary not having the Starčevo component. These early LBK data, however, are at least 100 years later than the earliest dates of the ALPC in the neighbouring areas.[54]

But why did the TLPC develop here later than the ALPC along the Tisza River? A possible explanation could be that the early LBK evolved elsewhere, in southern Transdanubia, for example in the Lake Balaton region, from where it took a while to reach its eastern periphery. On this there is currently consent among Hungarian scholars.[55] Yet the earliest dates of the culture are now also available on the eastern periphery at Apc, just as they are at Brunn in the foothills of the Alps on the western periphery, and beyond to the LBK sites in Germany.[56] What is more, the early LBK sites were clustered most densely along the eastern periphery around the Danube Bend – according to the current distribution maps.[57] Is it not possible that the development of the LBK/TLPC followed similar patterns as that of the ALPC, and the leap-frog migration hypotheses were valid also for the LBK's spread?[58]

Could it be either way, now it seems that up to the time when the TLPC/LBK was formed out of the Starčevo Culture, the ALPC had already developed out of the Körös Culture, and what is more, precisely in this area, about 50 km, that is a day's walk, to the east of Apc, along the Tisza River. But how did this TLPC/LBK settlement at Apc-Berekalja manage to be right next to the border zone of the APLC? The most probable answer could be that the territory of the ALPC at the time of the foundation of the settlement at Apc began to grow so large that its western border was along the Zagyva River. The effects of the early ALPC may have been strongly in evidence on the approaches to the Bükk and Mátra Mountains at this time.[59]

But what kind of incentives would have brought about the establishment of the LBK settlement at Apc-Berekalja? Was it a simple LBK land conquest without any confrontations? Or were there some Starčevo, Körös, Mesolithic or ALPC influences in the background? Unfortunately, these questions cannot be answered by us at the present time with utmost certainty. We cannot call into question the major impact the Starčevo Culture had on the development of the LBK in the south, but the local endowments of the northern Hungarian territories should also properly be taken into consideration. It has now become clear during the processing of the stone materials at Apc-Berekalja that the typical raw materials of the LBK hardly occurred on the site. Transdanubian stones were not present at all, and Tokaj obsidian only in smaller amounts, so the overwhelming majority of raw material came from local sources in the Cserhát, Mátra and Bükk Mountains. While the Cserhát lies to the west of the site, the other two ranges point eastward, towards the area of the ALPC. The TLPC settlement at Apc-Berekalja lies just a few hours' walk away from the settlements of the ALPC. The TLPC settlers of Apc-Berekalja probably met

[53] Kaczanowska–Lech 1977; Lech 1989.

[54] Füzesabony-Gubakút, Füzesabony-Szikszói-berek: Domboróczki 2003; 2009.

[55] Oross–Bánffy 2009, 175–179.

[56] Bánffy–Oross 2010, 259–261.

[57] Oross–Bánffy 2009, 179, Fig. 4.

[58] Domboróczki 2009, 111–113; 2010, 156–172; Stadler–Kotova 2010, 343–346.

[59] Tillier et al. 2009, 210–211.

the people of the ALPC, who had already had a significant history in the region by that time.

Though Nándor Kalicz has long raised the question whether certain cultural influences from the Körös Culture sites in Szolnok could not have travelled along the Zagyva, Tápió and Galga Rivers to create and develop the LBK sites around Budapest,[60] the required archaeological evidences were missing. Though the people of the Körös Culture spread to the west from the Tisza River and reached the Danube in the south,[61] their further northern expansion along the Danube is not attested and neither is known any Körös site along the Zagyva River to the west of Szolnok. It is another problem that the Körös Culture's settlement area at this time, i.e. at the time of the establishment of the TLPC/LBK settlement at Apc-Berekalja, had already ceased to exist around Szolnok, so along the above rivers only the cultural influences of the emergent ALPC could have reached Apc.[62] However early ALPC sites were also not found along the Zagyva route west from Szolnok. Róbert Kertész, while he maintained that to the Mesolithic stone industry of the Jászság the closest Neolithic parallels were among the LBK stone finds at Budapest-Aranyhegyi út, went so far as to claim that the Jászság Mesolithic people should be considered a possible popular ingredient of the LBK.[63] Our view contradicts this too. In principle, it is not inconceivable that while the Jászság Mesolithic population kept its distance from the Körös-based Neolithic population of the Szatmár group that had already produced the earliest ALP, they managed not only to evade it to the north, but to the northwest as well, i.e. along the Zagyva, Galga and Tápió Rivers. However such avoidance could not have happened in mass scale, because no early LBK sites are known from this region that could be interpreted as the settlements of the converts from the Jászság Mesolithic.[64] It is another problem for this theory that the Mesolithic ethnic component of the Linear Pottery Cultures seems to have been minimal according to the new DNA studies. The most recent approaches are counting with genetic discontinuity between the Mesolithic and Early Neolithic people in Central Europe, while stressing the genetic countinuity between the Starčevo/Körös and TLP/ALP cultures.[65]

Despite the lack of Körös, Early ALPC and Early TLPC sites along the Zagyva–Tápió–Galga route, the validity of this corridor cannot be questioned altogether as in later times the TLPC–ALPC contacts are well documented along this route.

Earlier in the 1960s and 1970s, it was believed that the sites of the TLP and ALP cultures were separated by a 20–50 km wide settlement-free zone between the Zagyva and Tarna Rivers at its centre with the Gyöngyös–Jászberény line, which was not crossed by either culture.[66] Later in the early 1980s, due to intensive field surveys, sites of both cultures were discovered along the Tápió River and their territories even overlapped each other.[67] Today we know that over time the border area became almost illusory between the two cultures. On the large scale excavations at Ludas, Visonta and Adács,[68] just 20 kms away from Apc, settlement remains were found from both the classical and late ALPC. The surface finds of the ALPC at Szücsi and Rózsaszentmárton[69] are situated just 6–8 kms from Apc, while on the outskirts of Jászberény, as it was detected by M. Csányi and R. Kertész in 2004–2005,[70] the two cultures met and even replaced each other. Despite this proximity and the proposed genetic similarity, the settlers of the TLPC and ALPC settlements apparently clung to their own traditions and although some import pieces appear here and there, one cannot talk about syncretism.

But why did the ALPC not expand further to the west and why did the TLPC not expand further eastward? The answer seems to be simple: because the different linear pottery makers probably did not want their settlements too close to each other. The slight differences in the material culture may mirror deeper differences in the people's sense of identity. Initially, certainly there were still large distances between the settlements but later, towards the final stages of the LPC, the settled areas and communities came closer to each other. In fact, the imports are actually better documented in the later stages, at the time of the

[60] Kalicz 1970, 7–10; Kalicz 1995, 29; Kalicz–Kalicz-Schreiber 2002, 28.

[61] Bánffy 2013.

[62] It can be taken for granted on the basis of absolute dates that at the time of the formation of the TLPC in the vicinity of Szolnok the former Körös population had already taken over the material culture of the ALPC (Domboróczki 2009, 118–119; 2010, 156–173). Later, the course of the influences could occur in the opposite direction as well, as TLPC imports were also present within ALPC find groups (Kalicz 1970, 9).

[63] Kertész et al. 1994, 33.

[64] Domboróczki 2003, 42; 2005, 185.

[65] Szécsényi-Nagy et al. 2015; Keerl 2014, 111–133.

[66] Kalicz 1970, 55.

[67] Dinnyés 1985, 12–14, 44–45. Virág 2009, 11–12.

[68] Domboróczki 2009, 77–79.

[69] Personal communication on recent field surveys in April 2014 by Mónika Gutay.

[70] Kertész 2014, 25.

Fig. 9. Apc, Neolithic settlement. Imported ALPC (Tiszadob and Bükk) fragments

9. kép. Apc, neolitikus település. Import AVK (Tiszadob és Bükk)-kerámiák töredékei

Želiezovce as well as the Tiszadob, Bükk and Szakálhát ceramic types.[71] Even at our site at Apc we can mention Tiszadob and Bükk-type imports from Želiezovce contexts *(Fig. 9)*. The LBK expansion into the Jászság area is documented for the time being only after the Music-note phase of the LBK.[72] As the boundary problem of the LPC raises very interesting questions, further topographical research is required to investigate the TLPC–ALPC border zone more accurately.

Finally, let us devote some words also to the end of the Neolithic settlement at Apc-Berekalja. In the final period of the TLPC, the people at the site may also have been subjected to the same shock that led to the depopulation of wide territories in the east, amongst the colonies of the late ALP and Bükk Cultures.[73] This process was explained by some kind of climate change for a long time now and it is still the dominant theory today.[74] Due to supposed drought, the population of the LPC settlements may have moved into the larger and better situated settlements of the Lengyel and Tisza Cultures. Probably due to climatic reasons, life at the settlement of the TLPC at Apc-Berekalja also came to a halt too. The late appearance of the Lengyel Culture at Apc can be assigned to some late Lengyel expansion. The late Lengyel presence here betray connections with the more easterly sites at Mónosbél, Gönc and Hernádcéce,[75] but the ties towards the closer centres in the west may have been much more dominant.[76] This is the period, however, of the dawning of the Copper Age, when new cultures also appeared in the area.

[71] Virág 2009, 13–23.
[72] Kertész 2014, 25.
[73] Šiška 1995, 10–14; Pavúk 1985, 214–216; Makkay 1982, 104–164; Domboróczki 2009, 119–122.
[74] Gronenborn 2009, 98–103.
[75] Kalicz 1994.
[76] Pavúk 2004, 146–154.

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ÁSATÁSOK A VK LEGKELETIBB HATÁRÁN, APC-BEREKALJA I. LELŐHELYEN (2008–2009)

DOMBORÓCZKI LÁSZLÓ – ANNA BUDEK – DARÓCZI-SZABÓ LÁSZLÓ – MAŁGORZATA KACZANOWSKA – TOMASZ KALICKI – EDYTA KŁUSAKIEWICZ – JANUSZ K. KOZŁOWSKI – ANGELA KREUZ – POMÁZI PÉTER – MICHAŁ WASILEWSKI – K. ZOFFMANN ZSUZSANNA

Az Apc-Berekalja I. lelőhely Észak-Magyarországon, Budapesttől mintegy 70 km-re található a Zagyva 132–135 m magas teraszán. A Zagyva-völgy alluviális síkja az Alföld nyúlványaként ékelődik be a Cserhát és a Mátra közé. Felszíni leletek alapján a lelőhely 2002 óta ismert. Ásatását a 21-es főút kiszélesítéséhez kapcsolódó megelőző feltárások tették szükségessé. A 2008 októbere és 2009 decembere között kutatott 18 911 m^2 felületen 1460 objektumot és 14 temetkezést tártak fel. A lelőhely teljes kiterjedése 20–30 ha-ra becsülhető.

A régészeti objektumok – köztük mintegy 30 cölöpszerkezetes ház – nagy része a neolitikum idejére keltezhető. A kerámialeletek alapján ezeket a dunántúli (közép-európai) vonaldíszes kerámia (VK) kultúrájához köthetjük. Az apci VK-telep különlegessége, hogy a kultúra korai (Bicske-Biňa típus) fázisa mellett a kottafejes és zselízi fázis is jelen van. A közel 40 radiokarbon-dátum tanúsága szerint a telep fennállása 5470–4950 cal BC közé tehető. Ugyanehhez a kultúrához sorolható három erősen zsugorított vázas temetkezés is. A késő lengyeli kultúrát két enyhén zsugorított vázas temetkezés képviseli, a kapcsolódó telepobjektumok azonosítása még nem történt meg.

A következő jelentősebb periódus a késő rézkor, amelyet a badeni kultúra korai, proto-bolerázi és késői klaszszikus fázisa reprezentál. Objektumai főként nagy, kerek gödrök, amelyek egy 150 méteres körben az ásatási terület közepén koncentrálódnak. Leginkább tipológiai megfontolásokból idetartozhat egy vagy két ház is; három badeni temetkezést is azonosítani lehetett.

A feltárt terület közepén egy 80 méteres körön belül elhelyezkedő gödrök jelölik egy kora bronzkori kis település helyét. Leletanyagukban a Makó-, a Nyírség- és a Hatvan-kultúra gyakran keveredik. Az egyetlen bronzkori temetkezés a radiokarbon dátuma szerint a középső bronzkorba tartozhat. A késő bronzkorba csupán néhány elszórtan elhelyezkedő gödör sorolható.

Az őskori jelenségeken kívül a feltárás népvándorlás kori (szarmata) objektumokat hozott napvilágra.

A lelőhelyen a Zagyva alluviális síkjának őskörnyezeti rekonstrukciója céljából 2014-ben Tomasz Kalicki és csapata fúrásos mintavételezést végzett. A fúrásokból 20 centiméterenként vett minták szedimentológiai és geokémiai elemzése kimutatta, hogy a főként agyagból álló üledékben 120–140 cm-es mélységben egy eltemetett talajhorizont található. Ebben a megemelkedett réz- és cinkkoncentráció az őskori talajművelésre utal. A mikromorfológiai elemzés az üledékben az áradások nyomait (buborékos struktúrák és agyagtörmelékek), az eltemetett talajhorizontban a biológiai aktivitás bizonyítékait tárta fel. Az őskörnyezeti rekonstrukció egy, a késő glaciálisban és a kora holocénban keletkezett ártéri mocsár fölé magasodó terasz meglétét mutatja. Ezen talaj fejlődött a holocén középső szakaszában, amelyen neolitikus közösségek telepedtek meg. A teraszt rendszeresen áradások öntötték el, amelyek hozzájárulhattak a település feladásához. Valószínűleg az áradások számlájára írhatók azok az elnyújtott leletkoncentrációk is, amelyek a feltáráskor járószintnek tűntek.

A VK-objektumokból (gödrök és árkok) vett minták iszapolásával nyert archeobotanikai anyag elemzését Pomázi Péter végezte el doktori disszertációja keretében. A több mint 18 ezer szenült és ásványosodott növényi

maradvány között négyféle gabonafaj jelenlétét mutatta ki (alakor, tönke, két közönséges búza). Emellett lencse- és árpamagok is előkerültek. A vadon gyűjtött növények közül a fehér libatop, a mogyoró, a bodza és a húsos som figyelemre méltó.

Az állatcsontanyagot Daróczi-Szabó László dolgozta fel. A 4169 állati maradványnak több mint a fele a neolitikumhoz tartozik. 96,6% háziállat, dominánsan szarvasmarha, mellette juh-kecske, sertés és kutya. A vadállatok aránya viszonylag alacsony, köztük vannak olyan fajok (pl. hörcsög, pocok), amelyeket nem az emberek vittek a telepre. Zsákmányállatnak az üregi nyúl, az erdei szarvas, a bölény/őstulok, a vadló és az őz tekinthető. Idesorolhatók még a kagylók is, bár a tényleges táplálkozási felhasználásuk egyelőre kérdéses. A badeni korszak állatcsontjai szinte kizárólag háziállatok maradványai, döntően szarvasmarha, azonkívül juh-kecske, sertés és kutya. Egy lócsont esetében nem lehetett eldönteni, vajon vad vagy háziasított fajhoz tartozik. A bronzkorra datálható állatcsontanyag fajösszetétele nagyon hasonlít a neolitikumiakéra. Ennek oka azonban a környezeti, földrajzi és klimatikus viszonyokban is kereshető.

A sírokból előkerült embercsontokat K. Zoffmann Zsuzsanna tanulmányozta. Az elég gyenge megtartású és töredékes csontanyagban a nemek pontos meghatározása általában nem volt lehetséges. A három megvizsgált VK-sír (férfi, nő, gyermek) jól beleillik a más DVK-lelőhelyekről ismert embertani típusba (leptodolichomorf). Három sírból (VK, lengyeli, badeni) sikeres mintavétel történt paleogenetikai vizsgálat céljából, melyet Ron Pinhasi és csapata fog analizálni.

A VK-objektumokból származó pattintott- és csiszoltkő-ipart Małgorzata Kaczanowska, Janusz K. Kozłowski és Michał Wasilewski elemezte. A leletanyag jelentősége, hogy vizsgálható a kőeszközkészítés alakulása a kultúra fázisain keresztül. A felhasznált nyersanyagok a pattintottkő-ipar esetében főleg helyi vagy regionális limnokvarcitok (közel 70%), elsősorban a Mátra és a Cserhát területéről, esetenként a Bükk régiójából. Ez a vonás eltér a Budapest környéki és az Ipoly-völgyi VK-lelőhelyekétől, ahol a dunántúli nyersanyagokhoz (radiolarit és teveli kova) gyakran társultak északi (főként krakkói jura) tűzkövek. A távolsági nyersanyagok Apcon ritkák, s valószínűleg már kész eszközként kerültek a telepre. Mivel Közép-Európában számos, a formatív fázisba tartozó telepen a távolsági nyersanyagok dominálnak (minthogy az első telepesek hozzák a megszokott nyersanyagaikat), lehetséges, hogy a további kutatások az apcinál korábbi VK-telepet is találnak majd a régióban. A VK fázisaiban a technológiában és a tipológiában nem észlelhető lényeges változás. A szerszámkövek nyersanyagai részben a környékbeli folyóvölgyek lerakódásaiból származhatnak (kvarcit, konglomerátum, homokkő), részben a szlovák–magyar határ vidékéről (gabbró és bazalt). Feltűnő a lelőhelytől nyugatra levő nyersanyagforrások használatának hiánya az apci kőiparban, amiből az itteni VK-közösség izoláltságára lehet következtetni. Az AVK-területekkel való kapcsolatra importkerámiák jelenléte is utal.

Az Apc-Berekalja I. lelőhelyen feltárt neolitikus telep jelentősége, hogy egyértelműen a dunántúli (közép-európai) vonaldíszes kerámia kultúrájához tartozik, de az elterjedési terület legkeletibb határán, az AVK-terület közvetlen közelében fekszik, továbbá, hogy a telep élete a VK korai fázisában kezdődött. Ugyanígy fontos adat a régióban korábban nem ismert lengyeli kultúra jelenléte is. A házakra vonatkozó ásatási megfigyelések alapján előzetesen megállapítható, hogy az alaprajzok és a településszerkezet hasonlít a Budapest környékén és a Balaton vidékén feltárt telepekére. Különbség viszont, hogy Apcon ritkán fordulnak elő egymást átfedő házalapok.

Az Apc-Berekalja I. lelőhely legjelentősebb jelenségcsoportját a dunántúli (közép-európai) vonaldíszes kerámia kultúrájának települése képezi. Noha az ásatási adatok értelmezése és a leletanyag feldolgozása szinte csak most indul, a település topográfiai helyzete, az hogy az elterjedési terület legkeletibb határán található, óriási mérete, a feltárt házak nagy száma, a megfigyelések minősége és a begyűjtött leletanyag mennyisége mind olyan tényezők, amelyek együttese az Apc-Berekaljai települést máris a legjelentősebb DVK lelőhelyek közé emelik. A korai DVK fázis jelenléte, valamint a szomszédos AVK kultúra határzónájával való közvetlen közelség a tágabb térség neolitizációjával kapcsolatos kérdések vizsgálata szempontjából jelentős tényezők. A házakra vonatkozó ásatási megfigyelések alapján előzetesen megállapítható, hogy az alaprajzok és a településszerkezet hasonlít a Budapest környékén, a Balaton vidékén és Délnyugat-Szlovákiában feltárt telepekére. Mivel a házalaprajzok feltárását a legnagyobb gonddal végezték, és az ortofotókkal teljes felületeket sikerült lefotózni, ezért a cölöphelyek a foltok előkerülésétől a bontás különböző fázisain át egészen a teljes feltárásig nagyon jól dokumentáltak. Ez a házszerkezetek tanulmányozása szempontjából fontos.

A rendelkezésre álló 30 radiokarbon-dátum szerint a telep legkorábbi fázisa 6424–6388 BP közé esik, ami nem sokkal fiatalabb kor, mint a Dél-Dunától Szentgyörgyvölgy-Pityerdomb legidősebb fázisáé. A következő települési fázist 6368–6339 BP közé datálják a ^{14}C adatok. A mért dátumok határozott sűrűsödést mutatnak 6320–6258 BP között, amely a telep virágkorát jelenthette. Az utolsó települési fázis 6231–6080 BP közé tehető. Ezeket a periódusokat előzetesen a VK Bicske-Biňa-, kottafejes és zselízi fázisainak feleltethetjük meg. A részletes településtörténeti rekonstrukció a kerámialeletek elemzése után készülhet majd el.