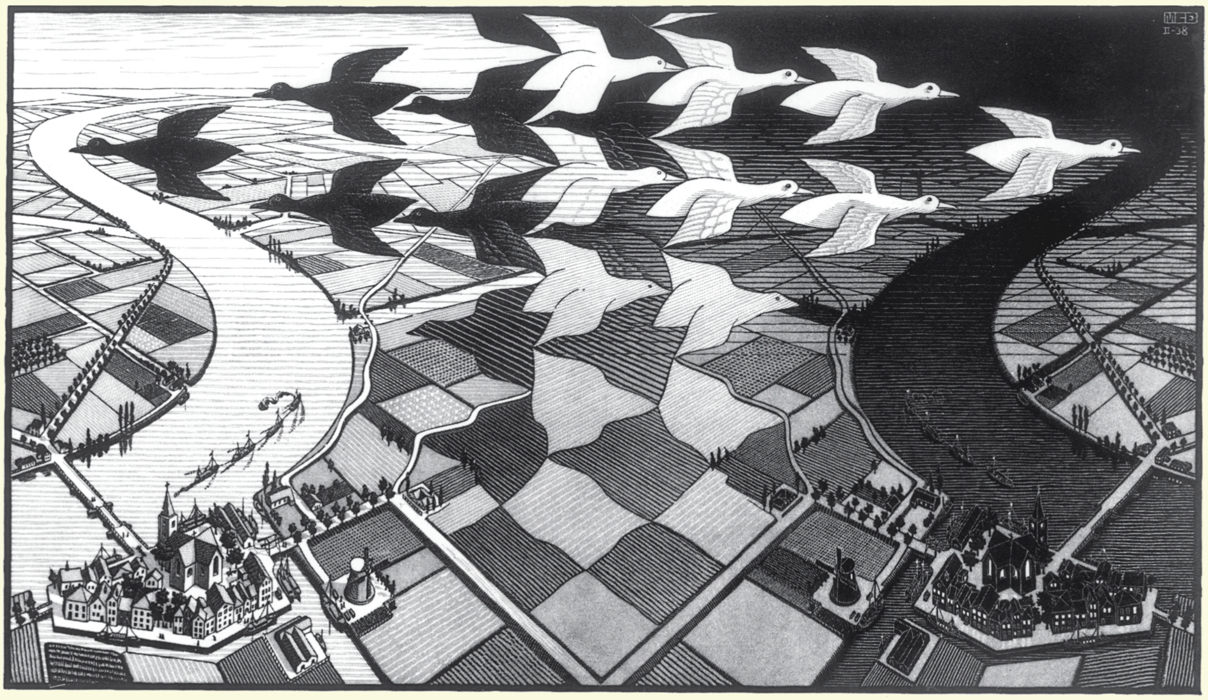
TRANSITIONS TO THE BRONZE AGE

Interregional Interaction and Socio-Cultural Change in the Third Millennium BC Carpathian Basin and Neighbouring Regions



Edited by

VOLKER HEYD, GABRIELLA KULCSÁR and VAJK SZEVERÉNYI

ARCHAEOLINGUA

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Front Cover

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Back Cover

Interior decorated bowl fragments from Somogyvár-Kupavárhegy, Hungary
(photo by Fanni Fazekas)

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Contents

Multidisciplinary Contributions to the Study of Pit Grave Culture Kurgans of the Great Hungarian Plain[1]

TÜNDE HORVÁTH – JÁNOS DANI – ÁKOS PETŐ – ŁUKASZ POSPIESZNY – ÉVA SVINGOR

Abstract

The aim of our paper is to provide analytical data to the multidisciplinary research of Pit Grave culture kurgans of the Carpathian Basin. The data presented in the following have chronological, cultural, environmental and anthropological implications. People of the Pit Grave culture inhabited the Carpathian Basin during the Late Copper and Early Bronze Age. Radiocarbon dates of Pit Grave culture kurgans and other contemporary cultures help to integrate this cultural complex in the prehistory of the Carpathian Basin. Environmental data – from two archaeological sites – provide detailed information on the environmental setting this culture lived in, and information on nutritional habits as well as burial rituals.

Introduction

After having seen the groundbreaking publication of István Ecsedy's book about the theme ("The People of the Pit Grave kurgans in Eastern Hungary") in 1979, new excavations were made and new research methods and results have emerged in the last 30 years. These facts, and a new approach concerning to the formation of the European Early Bronze Age, have led us to a new summary of the topic. The short case studies presented here complement previously published, more extended summaries on the topic (e.g., Dani 2011; Horváth 2011a; Pető – Barczi [eds] 2011; Barczi *et al.* 2012).

The first part of the paper gives an overview on the environmental and burial reconstruction of the Hajdúnánás-Tedej-Lyukashalom kurgan *(Fig. 4)*. Based on these, we formulate a preliminary hypothesis on the possible annual migration patterns of the Pit Grave culture populations of the Carpathian Basin.

The second part of this contribution presents the stable isotope data gained from the primary burial of the Tiszavasvári-Deákhalom kurgan *(Fig. 5)*.

The third part gives an overview on the new magnetometric survey of Hajdúnánás-Tedej-Szálláshalom, which is situated to the south of the Lyukashalom *(Fig. 9)*.

In the fourth part, we aim give an overview on the absolute chronology of the kurgan burials and compare these to the contemporary cultures (Baden, Makó and Nyírség) of the Carpathian Basin. An attempt is made to integrate the radiocarbon dates in the relative chronological system of the prehistoric Carpathian Basin. Suggestions are made on possible changes based on the result of this integration. Besides, we attempt to harmonise the radiocarbon dates of kurgan burials of the Carpathian Basin with the chronology of the North Pontic steppes and the spread of the Pit Grave culture to the Balkans and to Central Europe.

Finally, a cultural and chronological system of the earliest steppe cultures of the Carpathian Basin is developed on the basis of the new radiocarbon dates and archaeological finds, which is synchronized with the existing chronological system.

[1] This paper was an oral presentation at the EAA 2010 in The Hague, in the session "Transition to the Bronze Age: Interregional Interaction and Socio-Cultural Change at the Beginning of the Third Millennium BC in the Carpathian Basin and Surrounding Regions". The presentation is available from the website: http://www.academia.edu/2155452/EAA_2010_Hague_2010._szeptember_2-4_J._Dani_-_T._Horvath_Yamnaya_Intrusion_in_Northeastern_Hungary_and_the_Transition_from_the_Late_Copper_to_the_Early_Bronze_Age.

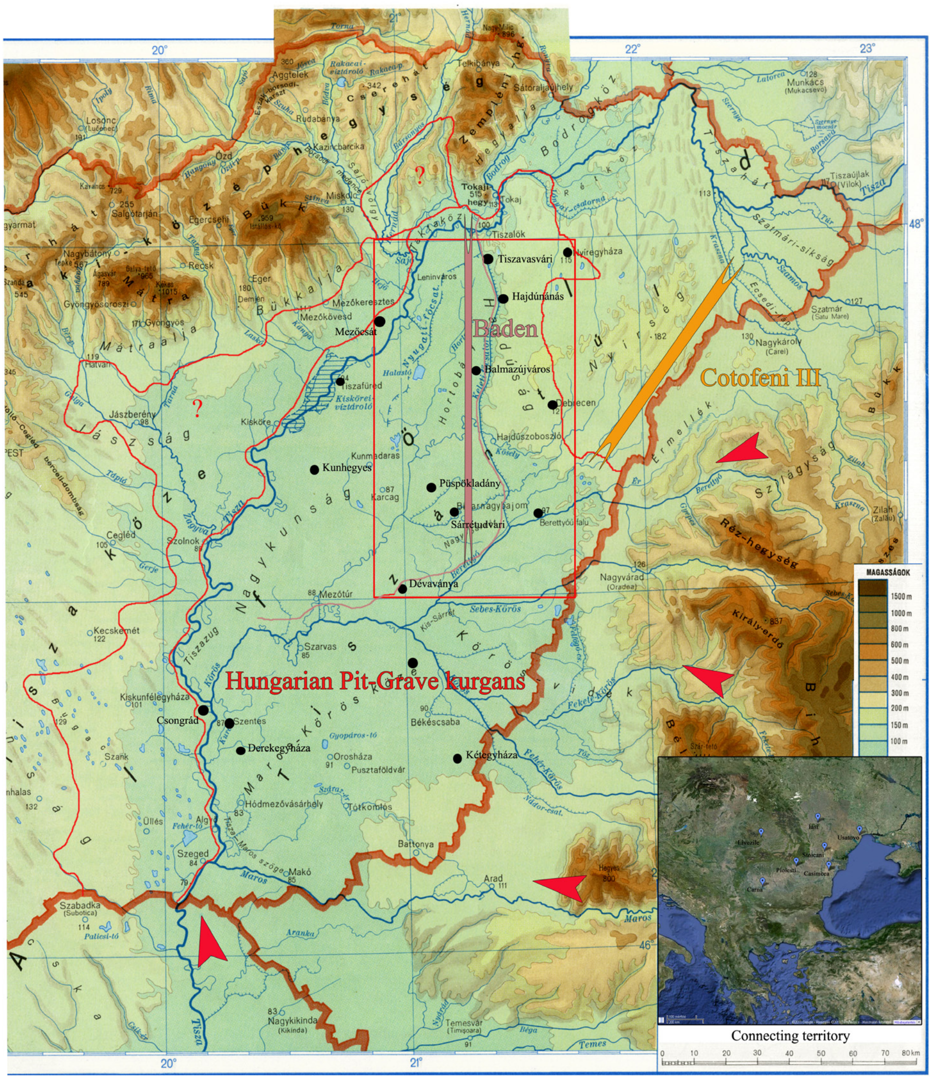


Fig. 1. The territory of the Pit Grave culture in Hungary (by T. Horváth)

A short summary of the environmental and burial reconstruction of Hajdúnánás-Tedej-Lyukashalom

The Hajdúnánás-Tedej-Lyukashalom kurgan was subjected to broad spectra of environmental analyses (for details see Pető – Barczi [eds] 2011), among them palaeobotanical ones. The palaeobotanical analysis, which included phytolith and pollen recovery from the buried soil, the cultural layers of the kurgan, as well as the primary burial aimed at reconstructing the environmental setting of the Pit Grave population and the ritual of the primary burial. The results of the environmental reconstruction have been discussed in detail earlier by Ákos Pető and Linda Scott Cummings (2011), Attila Barczi and Katalin Joó (2011), Attila Csanádi and Tivadar M. Tóth (2011) and recently by A. Barczi and his colleagues (2012). The detailed reconstruction of the primary burial is not entirely finished, thus preliminary data show resemblance with the details of the environmental reconstruction.

The phytolith analysis of the Hajdúnánás-Tedej-Lyukashalom yielded data that reflect a steppe-dominated environment. Data derived from samples taken from the surface of the buried palaeosoil undoubtedly support this theory, as its microfossil composition is dominated by steppeland indicators

Fig. 2. Environment of the Tiszavasvári and Hajdúnánás microregion in the Late Copper Age and Early Bronze Age 1–3 periods (by T. Horváth) — Boleraz/Baden settlement: Wienerberger téglagyár; Baden settlements: Kásaföld, Koldusdomb, Muszkadomb; Baden graves: Keresztfal, Paptelekhát; Baden (?) and Yamnaya graves: Gyepáros; Yamnaya graves: Deákhalom I–II, Kashalom, Lyukashalom; Coţofeni find: Lyukashalom; find with cord decoration: Koldusdomb; Makó settlement: Városföldje-Jegyzőtag; Nyírség settlements: Betepart, Fejérszik, Gyepáros, Keresztfal, Muszkadomb, Nyugati főcsatorna, Paptelekhát, Utasér-part, Városföldje-Jegyzőtag, Sanislău/Szaniszló: Dankó tanya, Végvár

(PETŐ – CUMMINGS 2011, Fig. 3). The amount of arboreal detritus correlated with the total biomorph content, and the occasional appearance (low percentage values) of phytolith morphotypes indicating arboreal vegetation refer to a former grove, grassland vegetation with discrete tree species that may have inhabited this part of the surrounding area, but did not form closed forest habitats (BARCZI – GOLYEVA – PETŐ 2009). Both the existence of closed forest vegetation and an open steppe land lacking any arboreal species can be rejected. Palynological data give more precise insight to possible arboreal appearance in the vicinity of the kurgan and its wider environment.

Arboreal species identified by pollen grains surviving in the buried soil can be grouped in order to interpret their ecological information. *Pinus sylvestris* L., *Picea abies* L. Karsten, and *Fagus sylvatica* L. are

Fig. 3. Location of Pit Grave culture kurgans in the territory of Hungary, Romania, Moldova, Serbia and Bulgaria. Within the territory of Hungary doubtful kurgan sites are marked with grey dots (by T. Horváth)

Fig. 4. Visual reconstruction of the primary burial (Feature 2, Grave 1) of the Hajdúnánás-Tedej-Lyukashalom kurgan (graphics by Viktor Szinyei)

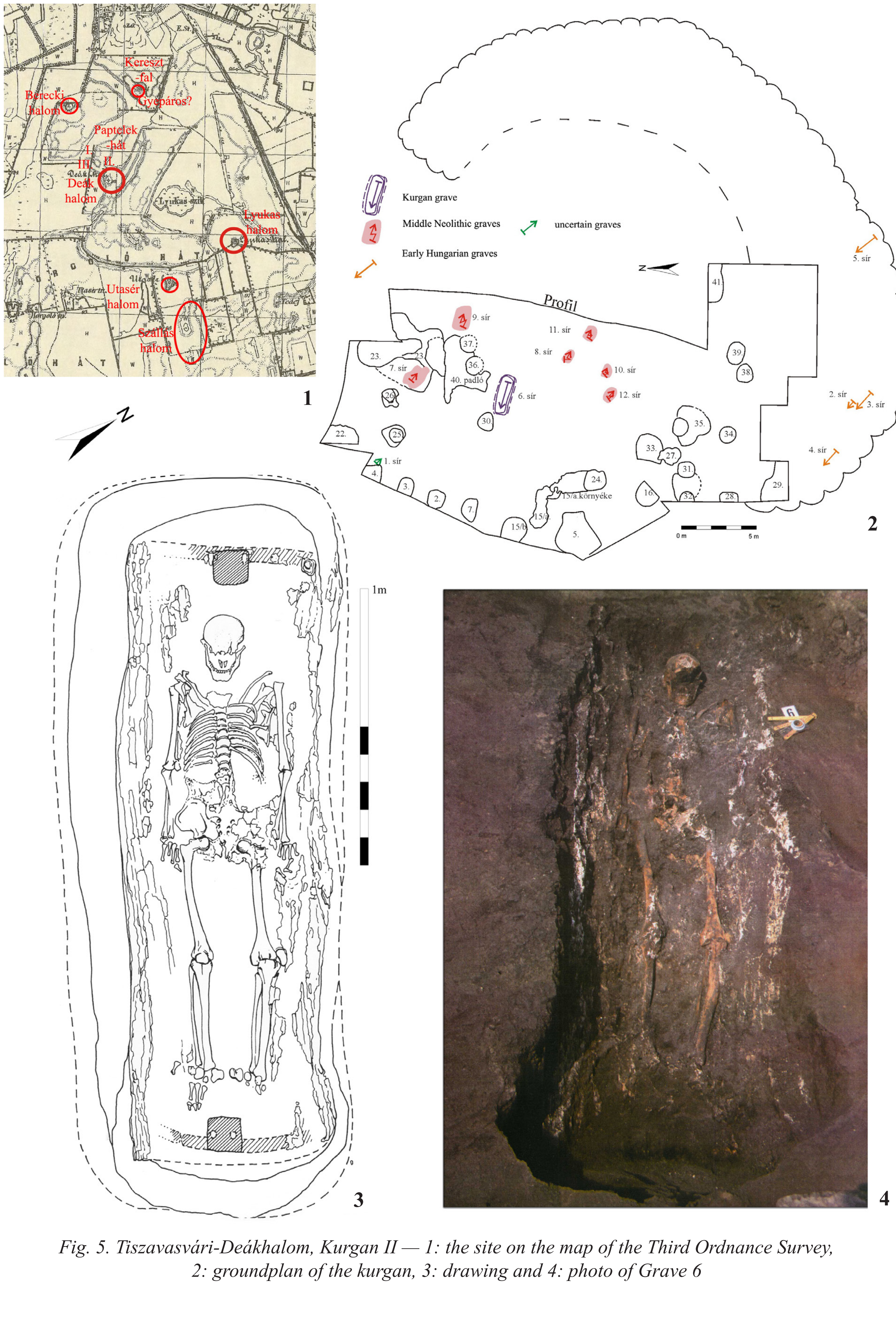


Fig. 5. Tiszavasvári-Deákhalom, Kurgan II — 1: the site on the map of the Third Ordnance Survey, 2: groundplan of the kurgan, 3: drawing and 4: photo of Grave 6

all representatives of mountainous areas. As their pollen is distributed by aeolian process to long distances, the appearance of these pollen grains are considered external, and give neither a local, nor a regional signal. Furthermore, *Pinus* species can only be considered local if their pollen rate in the signal exceeds 25% (Huntley – Birks 1983), which was not met in this case (Pető – Cummings 2011, Fig. 4). A better interpretation of regional flora can be made based on the appearance of *Salix*, *Tilia*, *Ulmus*, *Moraceae* and *Alnus* genera. As the study site is, and has always been, in the closer environment of, although not next to, the Tisza River, these taxa reflect grove forests that inhabited the higher flood plain of lowland river valleys. Plant associations, such as *Fraxino pannonicae–Ulmetum, Senecio fluviatilis–Populetum* or *Leucojo aestivo–Salicetum* can all be characterised to a greater or lesser extent by the identified taxa. The amount of *Quercus* pollen exceeds 2.0% identifying it as a local element of the closer vicinity. In this case, *Quercus* represents a transition between groves and forest steppes as it may be part of both. The so-called shrub-effect in the samples is represented by the appearance of low amounts of *Juniperus* (typical of sandy territories, such as the neighbouring Nyírség region), *Berberidaceae* and *Corylus* pollens.

Although the interpretation of arboreal taxa draws diverse scenery, it must be taken into account that arboreal pollens are underrepresented in all of the samples. The examined samples were dominated by non-arboreal herbaceous plants. Therefore, the local vegetational patterns should be interpreted based on the phytolith and non-arboreal record.

The primary pattern of the territory is influenced by the *Gramineae* and *Asteraceae* plant families (Pető – Cummings 2011, Fig. 5). While arboreal pollen gave a good overview of the tree species possibly inhabiting the kurgan's wider surroundings, herbaceous pollens – combined with the phytolith analytical results – may give an insight of the local flora. Microterritorial vegetation differences can be adjusted based on the rate of the *Liguliflorae* sub-family and *Gramineae* family. Phytolith analysis showed that the central territory of the kurgan was dominated by *Gramineae* species of (semi)arid steppe vegetation, so *Gramineae* pollen can be accepted as an indicator of a former steppe, probably located on a micro loess ridge. *Liguliflorea* sub-family is considered as an indicator of a – probably periodically – water-effected meadow mosaic. Based on the distribution of the above-mentioned indicators we may reconstruct the territory of the kurgan as described below: the central part of the kurgan's base was probably inhabited by steppe vegetation *(Gramineae)*, located on an arid loess ridge, whilst the ring, that is the external skirt of the formation, was inhabited by species more likely to be related to water-effected vegetation *(Liguliflorea)* (see Pető – Cummings 2011, Fig. 6).

Besides the external arboreal pollens, there is one observation, which opens up questions related to the reconstruction of the landscape. The presence of *Nymphaea* pollen (Pető – Cummings 2011, Table 3) suggests the closeness of standing water either in the form of an abandoned meander of the river Tisza or as a flatland lake.

Possible evidence of plant cultivation in the closer environment of the kurgan is shown by cereal and plough weed pollens found in most of the samples. The typical species of cereal cultivation of the Late Copper and Early Bronze Age are *Triticum*, *Hordeum* and *Pannicum* (Gyulai 2001).

Samples from the primary burial were subjected to pollen and phytolith analysis, whilst FT-IR was applied in order to gain data on the circumstances and the possible date of the burial ritual.[2]

Samples taken from the ground surface of the primary burial are dominated by steppeland species. We aimed at placing the time of burial in a calendar year by compiling a pollen calendar of the predominant species recovered from the samples of the primary burial, based upon the theory that species that spread their pollen grains later during the vegetational period will mark the possible date of the ritual. Since the samples are dominated by *Gramineae* and *Asteraceae* pollen grains, the relative time of the burial

[2] The Fourier Transform Infrared Spectroscopy (FT-IR) and the pollen analysis were conducted by Melissa Logan and Linda Scott Cummings at the PaleoResearch Institute, Golden, Colorado, USA.

	February	March	April	May	June	July	August	September	October
Alnus sp.									
Picea sp.									
Pinus sp.									
Quercus sp.									
Salix sp.									
Artemisia sp.									
Corylus avellana L.									
Gramineae									

Table 1. Pollen calendar compiled based upon the pollen record of samples collected from the base burial at Hajdúnánás-Tedej-Lyukashalom kurgan – dark gray fields indicate the main flowering, whilst the light gray fields the pre- and post-flowering periods of the taxa listed in the pollen calendar

can be placed between May and July (see red frame on *Table 1*). The only taxon that broadens this time interval is the *Artemisia* genus, which starts to distribute its pollens at the turn of June/July. These results however are only accepted as preliminary data, since we are aware that the method of identifying annual burial time based on pollen distribution of the ground surface of the burial might have different interpretations as well. At this point of the research, it is not possible to undoubtedly rely on the time interval given by the pollen spectra, but we accept this outcome as guideline for a possible burial date.

FT-IR analyses were performed on soil samples collected from different locations from the base of the grave (burial) and on a sample taken from the mat with red and black stripes (see also Horváth 2011a, 108, Fig. 6). Samples collected from the side of the grave gave signals of galactoglucomannan and rhamnogalacturonan. Galactoglucomannan is a primary component of the woody tissue of coniferous plants (Gymnosperms) (Bochicchio – Reicher 2003). Rhamnogalacturonans are specific pectic polysaccharides that reside in the cell walls of all land plants, and result from the degradation of pectin (Willats *et al.* 2001). These peaks indicate the possible presence of wood in this area, however it is difficult to assess, whether these signals are the result of secondary contamination, or they truly represent wood material used for constructing the burial/grave.

Organic residues extracted from the mat decorated with red paint were tested for protein and organic residues. Protein residue analysis yielded a weak positive to human on the leather fragment recovered (Cummings – Logan 2009). This is possibly the result of association with the burial and decay of bodily fluids and tissues, rather than suggesting the origin of the leather. No other positive reactions were noted, so it was not possible to identify the origin of the leather conclusively. The position of this leather or skin within the burial might be crucial to answering this question. The organic residue signature for the leather fragment included peaks representing the presence of absorbed water, fats/oils/lipids and/or plant waxes, aromatic esters, aromatic rings, pectin, proteins including nucleic acids, and the amino acid valine (Cummings – Logan 2009). Valine, an essential amino acid, is represented in this sample by a peak at 1451 wave numbers. Common dietary sources of valine include fish, poultry, and some legumes. Matches with this signature were made with bird blood and humates. The presence of bird blood, which is interpreted at a general level indicating animals, rather than at the specific level, indicates the presence of animal proteins in the sample, which would be expected for leather. The FT-IR signatures for animal bloods, including humans, are nearly identical, which makes it impossible to identify the specific species or type of animal leather. Finding a match with animal blood does seem to support the possibility that the sample represents a piece of leather; however, identification of raw protein using protein residue analysis, which is based on immunological techniques, is the only method to identify specific animal proteins, and confirm that the sample is a piece of leather. The match with humates probably indicates the presence of the local environmental signature representing the deterioration of plant materials in the sediments in which the leather fragment was buried.

Based on the archaeological finds recovered at the Hajdúnánás-Tedej-Lyukashalom kurgan, the site can be linked to the Pit Grave culture. Since the skeleton in the primary burial was disturbed, it is difficult to identify more precisely the cultural affiliation of the kurgan. Based on the way the skeleton was lying, Pre-Pit Grave communities cannot be excluded, the radiocarbon dates, however, seem to exclude this (younger than 3000 BC).

The kurgan was constructed in multiple steps (see also Barczi – Joó 2011; Csanádi – M. Tóth 2011 for details). The feature – probably a grave – associated with the third cultural layer of the construction was almost entirely robbed, we can only rely on radiocarbon dates gained from the layers and the construction of the grave itself. Since the construction differs from the primary burial, we might conclude that these belonged to different Pit Grave populations, however the radiocarbon dates suggest that these populations appeared very close in time to each other at the location. The primary burial and the one in the third cultural layer can be identified as either Pre-Pit Grave and Early Pit Grave or Early Pit Grave and Late Pit Grave. The later concept is underlined by the absolute chronological dates. Ceramic sherd fragments of Coţofeni III and Early Bronze Age cultures were recovered from the third cultural layer. Moreover, the phenomenon of the burial process, namely that the person was rolled in a mat composed of plant material and laid on the kurgan without any pit dug into the already existing kurgan body, is a typical characteristic of Early Bronze Age cultures influenced by Pit Grave effects (Ciugudean 2011, 24).

Based on what we already know about the time of burial and the environment of the kurgan, it might be concluded that the Hajdúság and the archaeological site could have been part of the summer occupation and settling area of one of the westernmost Pit Grave populations of the Eurasian steppe belt.

Tiszavasvári-Deákhalom, Kurgan II

The Tiszavasvári-Deákhalom (II) kurgan is situated approximately 150 meters north-west of Hajdúnánás-Tedej-Lyukashalom *(Fig. 2)*. Several mounds and burials have been excavated here *(Fig. 5)* by the archaeologists of the Jósa András Museum (Nyíregyháza, Hungary) (Dani 2011, 27–28).

Altogether six graves were found in kurgan II at Tiszavasvári-Deákhalom. The two most interesting ones were selected for radiocarbon dating and stable isotope measurements. Grave 3 was a secondary grave intersecting the original mound, and was dated generally to the Late Copper/Early Bronze Age. It contained remains of an adult male, placed in a straight position on his back. The skeleton was equipped with a hair-ring made of bronze wire. Grave 6 was dug in the palaeosoil buried under the formation. However, it is not certain whether it was the primary burial of the mound or not, since it was located 14 meters from the geometric centre of the kurgan. An adult male was buried in straight position on his back in a log "coffin", and probably covered with animal skin or fur. No other grave goods were preserved.

Collagen samples were taken from single bones of both individuals, and have been subjected to AMS ^{14}C dating at the Poznań Radiocarbon Laboratory. The sample taken from a bone from Grave 6 was dated twice and sent to the Polish Geological Institute (National Research Institute in Warsaw) for stable isotope analysis (δ^{15}N and δ^{13}C).

C:N values of both samples indicate a rather low degree of preservation of collagen. In case of collagen from Grave 6 it significantly exceeds the recommended interval (van Klinken 1999; Bronk Ramsey 2004). The result of the dating from Grave 3 undermines its initial dating to the Early Bronze Age, placing it between 11th and 12th century AD *(Table 2, Fig. 6)*. For the human collagen sample from Grave 6 two radiocarbon determinations were obtained. As they relate to the same event they were combined together for calibration. At 95.4% probability from the Bayesian model the burial dates to 3091–2926 cal BC, with the mean age of 3011 cal BC *(Table 2, Fig. 7)*.

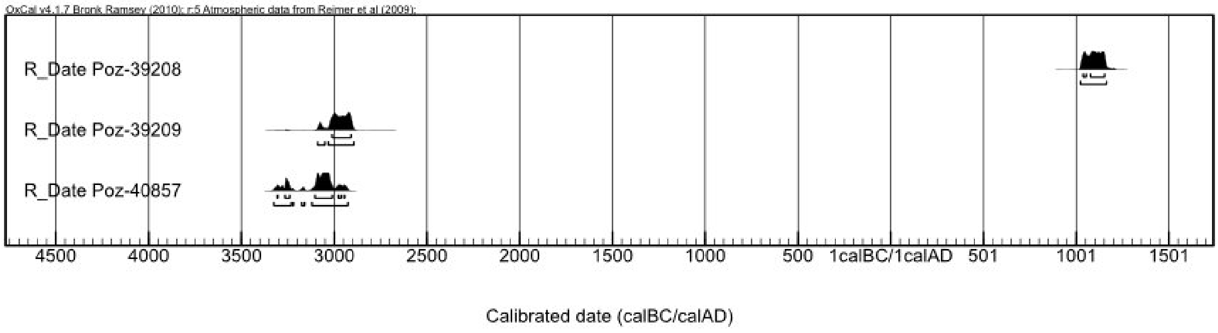


Fig. 6. Calibrated age probability distributions for the individuals from Tiszavasvári-Deákhalom II kurgan

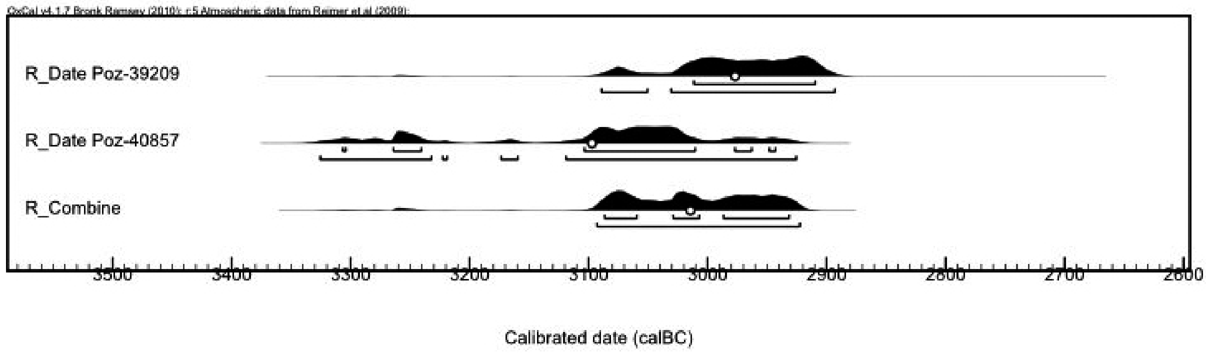
Grave No.	Lab. ID	BP	SD	Sample	68.2% (1σ)	95.4% (2σ)	μ	C %	N %	C:N	$\delta^{13}C$ ‰	$\delta^{15}N$ ‰
3	Poz-39208	935	30	metacarpal bone	1038–1153	1025–1164	1098	9.6	2.5	3.84	–	–
6	Poz-39209	4350	40	frontal bone	3012–2910	3090–2894	2977	4.2	0.9	4.67	–20.4	12.7
	Poz-40857	4430	30		3307–2944	3326–2926	3098					

Table 2. Radiocarbon and stable isotopes results for the individuals from Tiszavasvári-Deákhalom II kurgan

Stable isotopes ratios in humans' bone collagen are related to the protein part of their diet (Ambrose 1993). The $\delta^{13}C$ value in a consumer's bone collagen is approximately 5‰ more positive than the dietary source. The $\delta^{15}N$ value expresses the trophic level of the consumer and is enriched by approximately 3‰. For a better understanding of the results received for Grave 6 of Tiszavasvári-Deákhalom II, they were compared with the published data set obtained for human and animal bones from the Early and Middle Chalcolithic of the Great Hungarian Plain. These reference samples were obtained from the cemetery of Tiszapolgár-Basatanya, from Phase I of the Tiszapolgár culture and from Phase II, which is related to the Bodrogkeresztúr culture, and from the Bodrogkeresztúr culture cemetery at Magyarhomorog (Giblin 2011, Appendix A).

Julia Giblin concluded earlier in her study that the investigated Chalcolithic populations consumed terrestrial plants and animals. Fish and millet (or other type of C4 plants) did not constitute a substantial part of their diet (Giblin 2011, 272). Relatively high $\delta^{15}N$ values indicate that a significant portion of the protein in their diet came from animals (meat and dairy products). The $\delta^{15}N$ value of the sample of Tiszavasvári-Deákhalom was higher in relation to the comparative series. It is plausible, therefore that, the diet of the investigated individual relied largely on animal derived protein (Hedges – Reynard 2007, 1248) excluding fish (see Bonsall *et al.* 1997, 77, Fig. 8). Hence, the assumed offset of the radiocarbon age due to freshwater reservoir effect (Lanting – van der Plicht 1998) is insignificant. The isotopic signal possibly reflects a subsistence strategy similar to pastoralism *(Fig. 8)*.

The evaluation of the analytical dates connects Grave 6 of Tiszavasvári-Deákhalom II with its particular burial rite and relatively early radiocarbon dates to the Pre-Pit Grave Kvityana culture.



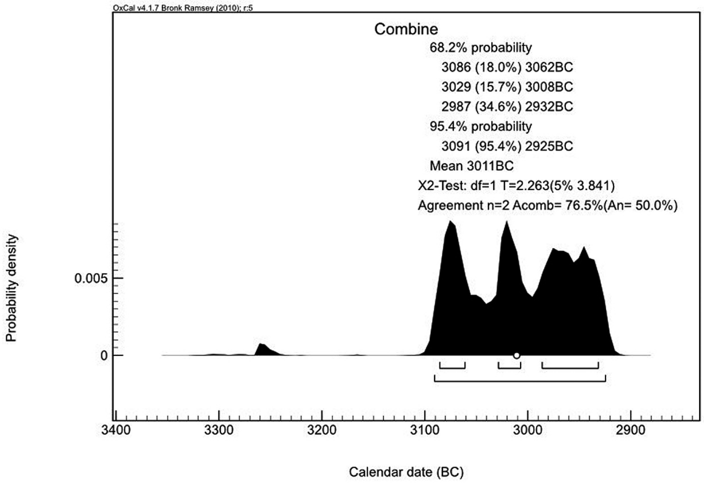


Fig. 7. Calibrated probability distributions of the combined radiocarbon dates of Grave 6 from Tiszavasvári-Deákhalom II kurgan

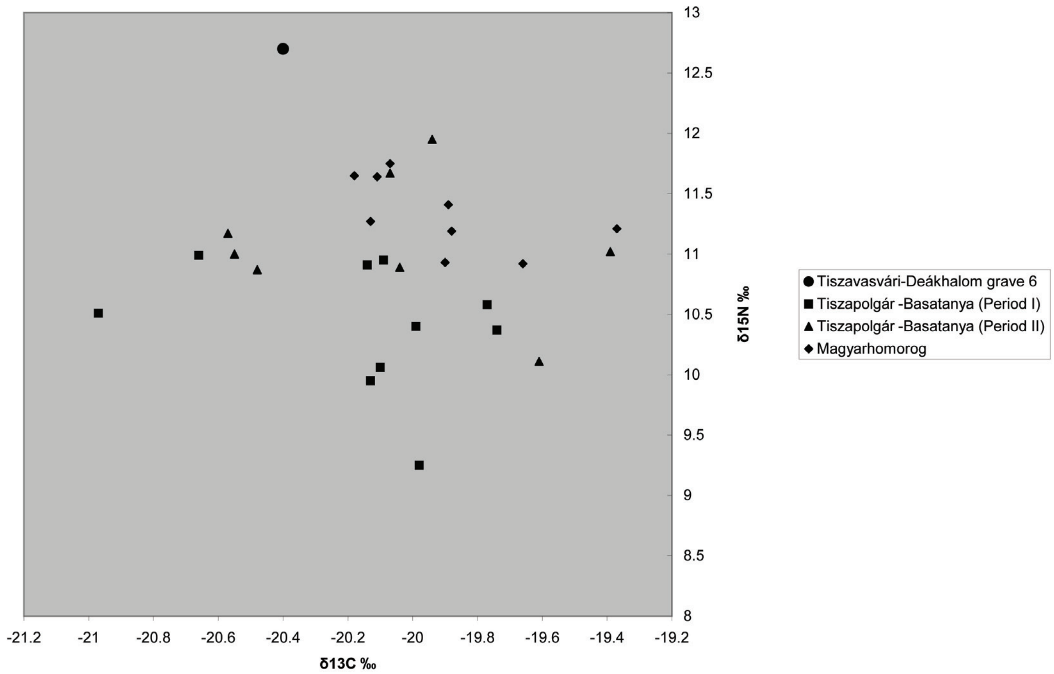


Fig. 8. Isotopic ratios in human bone collagen of the individuals from the Early and Middle Chalcolithic cemeteries on the Great Hungarian Plain (after GIBLIN *2011) and Grave 6 from Tiszavasvári-Deákhalom II kurgan*

Hajdúnánás-Tedej-Szálláshalmi dűlő

1500 meter south-west from Hajdúnánás-Tedej-Lyukashalom, in the Hajdúnánás-Tedej-Szálláshalmi dűlő, a field survey was conducted in 2010. Two natural and/or artificial mounds were identified in the close vicinity of each other. At the so-called Kis-Szálláshalom a geophysical survey was conducted in order to identify if it is a destroyed kurgan or not *(Fig. 9)*.

The Hajdúnánás–Tiszavasvári microregion was densely inhabited in the Late Copper Age (3600–2800 BC) and during the transitional period between Late Copper Age and Early Bronze Age (2800–2600 BC). In the Early Bronze Age 1–3 periods (2600–2000/1900 BC), a dense network of sites existed here *(Fig. 2)*. Baden-Viss type sites (settlement traces and extramural or intramural graves) were noticed in seven cases; Coţofeni sherds as stray finds in one; Pre-Pit Grave/Pit-Grave kurgan sites in approximately 50 (many were destroyed by modern agricultural practice); a cord decorated sherd as stray find in one; a Makó site in one; Nyírség sites (burials and settlement traces) in nine and Sanislău settlements in two cases.

The potential kurgan at Kis-Szálláshalom is marked on the topographical map and has been confirmed by a field survey in the spring of 2010. Precise elevation measurements and geophysical survey were applied on a selected part of the site to identify burial pits, as well as the size and the state of preservation of the mound.

Magnetometry was chosen for the geophysical survey (Aspinall – Gaffney – Schmidt 2008). This method is designed to measure the anomalies in the Earth's magnetic field, caused by near-surface layers and archaeological features of enhanced magnetic susceptibility. The anomalies are initiated by remnant and induced magnetisation. These processes relate to objects made of metal, bricks, decaying or burnt organic materials (humus, wood, plants, bodies of animals and humans), ferromagnetic rocks, etc. The measurements were made with a Bartington Fluxgate Grad 601-1 magnetometer, in a parallel mode. Twenty-five data grids (20.0×20.0 m each), covering an area of 10,000 m^2, were surveyed. The data was processed in the Geoplot 3.0 application.

No clear magnetic anomalies related to the kurgan burial mound were registered. However, a complex structure of settlement or causewayed enclosure features (ditch, palisade?) were discovered (on the basis of the material found on the surface it is identified as a multi-component Middle and Late Neolithic, and Early Copper Age tell(?)/enclosed-settlement with LBK, Esztár and Tiszapolgár potsherds).

In the Upper Tisza region, there are some sites, where antecedent Neolithic and Early Copper Age cultures are connected to the Pit Grave kurgan sites in the same time interval. This phenomenon can probably be seen at the Kis-Szálláshalom site as well: all detected prehistoric cultures need high places close to water for settling. Neolithic traces were excavated under the kurgan sites of Hajdúnánás-Tedej-Lyukashalom (Mesolithic animal bones and uncharacteristic Neolithic potsherds, Tiszavasvári-Deákhalom II (Tiszadob culture, Middle Neolithic), in the palaeosoil of Tiszavasvári-Gyepáros, and at the field survey at Hajdúnánás-Zöldhalom and Nagy-Vidi halom. Such phenomena also occurred at some of the kurgan sites in the Hortobágy region as well (Hortobágy-Halászlaponyag, -Papegyháza: old excavations).

Absolute and relative chronology

According to the Hungarian chronology, nomads of the Eurasian steppes reached the eastern part of the Carpathian Basin between the Middle/Late Copper Age and the Early Bronze Age. The following tables give a summary of the radiocarbon dates that were obtained from finds of steppe and contemporary cultures inhabiting the Carpathian Basin. Based on the radiocarbon dates, the steppe cultures could be divided on a chronological and cultural basis. This division was harmonised with the Hungarian prehistoric terminology *(Tables 3–4, 6)*.

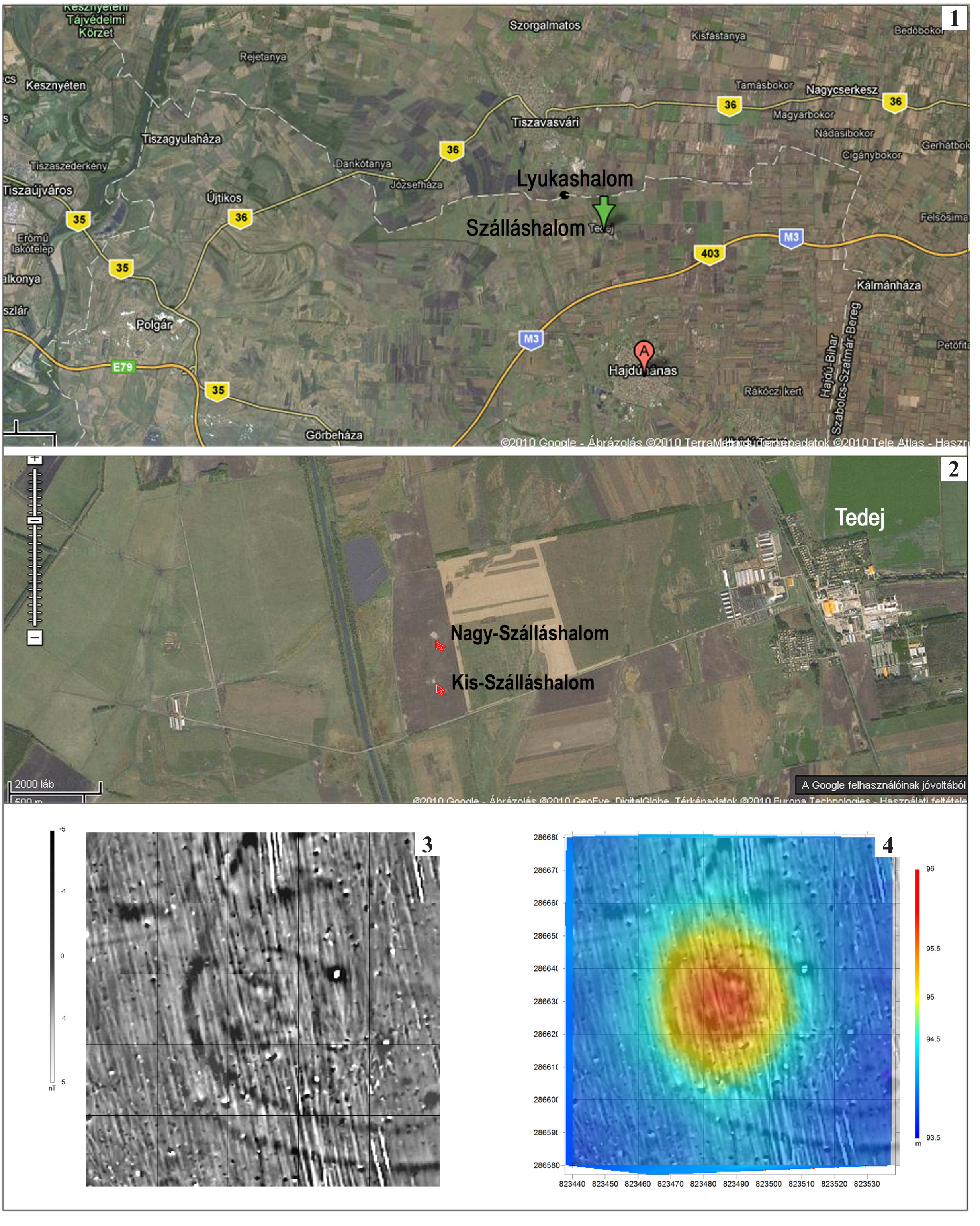


Fig. 9. Hajdúnánás-Tedej-Kis-Szálláshalom and Nagy-Szálláshalom — 1–2: location of the sites, 3: plot of results of magnetometric prospection, 4: plot of results of magnetometric survey overimposed on digital elevation model

Labor ID	Name of the archaeological site	Cultural affiliation	Type of the sample	BP	calibrated BC (1 σ, 68.2%)
OCHRE GRAVE CULTURE					
Poz-41865	Csongrád-Kettőshalom	Steppe Ochre Graves Period I	human bone Grave 1	5470 ± 40	4370–4239
PIT GRAVE CULTURE KURGANS					
Poz-39466	Tiszavasvári-Gyepáros	Early Pit Grave Period III	human bone Grave 6	4355 ± 35	3020–2910
Poz-39209 Poz-40857	Tiszavasvári-Deákhalom	Pre-Pit Grave/Kvityana Period II	human bone Grave 6	4350 ± 40 4430 ± 30	3020–2910 3307–2944
Poz-31637	*Hajdúnánás-Tedej-Lyukashalom*	*Pre/Early Pit Grave Period II/III?*	*charred plant material Feature 1*	*4270 ± 40*	*2920–2870*
Poz-31405	Hajdúnánás-Tedej-Lyukashalom	Early/Late Pit Grave Period III/IV	human bone Grave 1, Feature 2	4210 ± 35	2900–2700
Poz-39464	Hajdúszoboszló-Árkushalom	Early Pit Grave Period III	animal bone sacrificial feasting, O. 331	4385 ± 35	3080–2920
Poz-39461	Balmazújváros-Hortobágy-Árkus-Kettőshalom	Early Pit Grave Period III	human bone kurgan grave	4320 ± 35	3010–2890
Poz-39561	Hortobágy-Ohat-Dunahalom	Early Pit Grave Period III	human bone kurgan grave	4030 ± 35	2580–2480
Poz-42726	*Püspökladány-Kincsesdomb*	*Pre-Pit Grave/Lower Mikhailovka Period II*	*soil material from double burial of Grave 3*	*7340 ± 40*	*6250–6100*
Poz-42724	Püspökladány-Kincsesdomb	Early Pit Grave Period III	human bone Grave 1	4215 ± 35	2900–2710
Poz-42725	*Püspökladány-Kincsesdomb*	*Late Pit Grave Period IV/V?*	*human bone Grave 2, Carbonate contant measurement!*	*3730 ± 35*	*2200–2040*
Poz-39454	Kunhegyes-Nagyálláshalom	Early Pit Grave Period III	human bone Grave 14	4075 ± 35	2840–2490
Poz-39456	Kunhegyes-Nagyálláshalom	Early Pit Grave Period III	human bone Grave 18	4195 ± 35	2890–2700
Bln-609	Kétegyháza-Törökhalom Kurgan 3	Early Pit Grave Period III	human bone Grave 4	4265 ± 80	3020–2690
deb-6869	Sárrétudvari-Őrhalom	Pre/Early Pit Grave Period II/III?	human bone Grave 12	4520 ± 40	3350–3110
Poz-39563	*Sárrétudvari-Őrhalom*	*Early Pit Grave Period III*	*charred plant material Grave 8*	*4530 ± 60*	*3360–3100*
deb-6639	Sárrétudvari-Őrhalom	Early Pit Grave Period III	human bone Grave 10	4350 ± 40	3020–2910
deb-7182	Sárrétudvari-Őrhalom	Late Pit Grave Period IV	human bone Grave 4	4135 ± 60	2870–2520
deb-6871	Sárrétudvari-Őrhalom	Late Pit Grave Period IV	human bone Grave 9	4060 ± 50	2840–2490
BADEN CULTURE					
Poz-39467	Tiszavasvári-Wienerberger Téglagyár	Baden-Viss surviving in the EBA	animal bone from pit Feature 459	3860 ± 50	2457–2235
Poz-39470	Tiszavasvári-Wienerberger Téglagyár	Baden-Viss	animal bone from pit Feature 501	4450 ± 35	3322–3025
Poz-39562	Tiszavasvári-Wienerberger Téglagyár	Baden-Viss	animal bone from pit Feature 502	4405 ± 35	3091–2933
Poz-31799	Berettyóújfalu-Nagy-Bócs dűlő	Baden	animal bone from pit Feature 2006/Str.4251	4480 ± 40	3332–3096
Poz-31805	Berettyóújfalu-Nagy-Bócs dűlő	Baden	animal bone from pit Feature 1989/4234	4505 ± 35	3338–3106
MAKÓ CULTURE					
Poz-31798	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 82/353	3990 ± 30	2566–2473
Poz-31800	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 152/603	3955 ± 35	2566–2351
Poz-31803	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 824/1889	3970 ± 40	2570–2461
Poz-31804	Berettyóújfalu-Nagy-Bócs dűlő	Makó	animal bone from pit Feature 1922/4212	3940 ± 35	2548–2348
Poz-31801	Debrecen-Szennyvíztelep	Makó	human bone Grave 479/617	3955 ± 35	2566–2351
NYÍRSÉG CULTURE					
Poz-39462	Hajdúnánás-Feketehalom	Nyírség	human bone Grave 32/51	3710 ± 30	2190–2037
Poz-39463	Hajdúnánás-Feketehalom	Nyírség	human bone Grave 36/62	3740 ± 30	2201–2053

*Table 3. Radiocarbon dates of Pit Grave culture (Pit Grave) kurgans from the territory of Hungary and new radiocarbon dates of contemporary cultures – * dates typeset with italic yielded younger or older dates and probably need correction*

Unfortunately, not too much is known about the life and economy of the steppe cultures that inhabited the Carpathian Basin in the examined time interval.

Differences in nutrition and nutrition sources (e.g. the ratio of terrestrial and aquatic species), the use of space along rivers and their tributaries all play an important role in the interpretation and correctness of the radiocarbon dates. These circumstances make it difficult to assess the effects that might have altered the archaeological finds that were subjected to radiocarbon dating (SHISHLINA *et al.* 2007). These environmental effects multiply each other in case of group calibration, and may result in a 300 to 500 years variation. To avoid these alternations, we have been using raw data *(Table 4, Fig. 10)*.

Sample code	cal BC 1σ 68.2%	cal BC 2σ 95.4%	μ
R_Date Poz-39563	3360–3100	3500–3020	3225
R_Date deb-6869	3350–3110	3370–3090	3220
R_Date Poz-39464	3080–2920	3100–2900	3005
R_Date Poz-39466	3020–2910	3090–2890	2975
R_Date Poz-39209	3020–2910	3090–2890	2975
R_Date deb-6639	3020–2910	3090–2890	2975
R_Date Poz-39461	3010–2890	3030–2880	2945
R_Date Poz-31637	2920–2870	3020–2700	2885
R_Date Bln-609	3020–2690	3100–2580	2865
R_Date Poz-42724	2900–2710	2910–2670	2800
R_Date Poz-31405	2900–2700	2910–2670	2795
R_Date Poz-39456	2890–2700	2900–2660	2780
R_Date deb-7182	2870–2620	2890–2500	2720
R_Date Poz-39454	2840–2500	2860–2490	2645
R_Date deb-6871	2840–2490	2870–2470	2630
R_Date Poz-39561	2580–2480	2840–2470	2555

Table 4. Calibrated radiocarbon age of Pit Grave culture kurgans

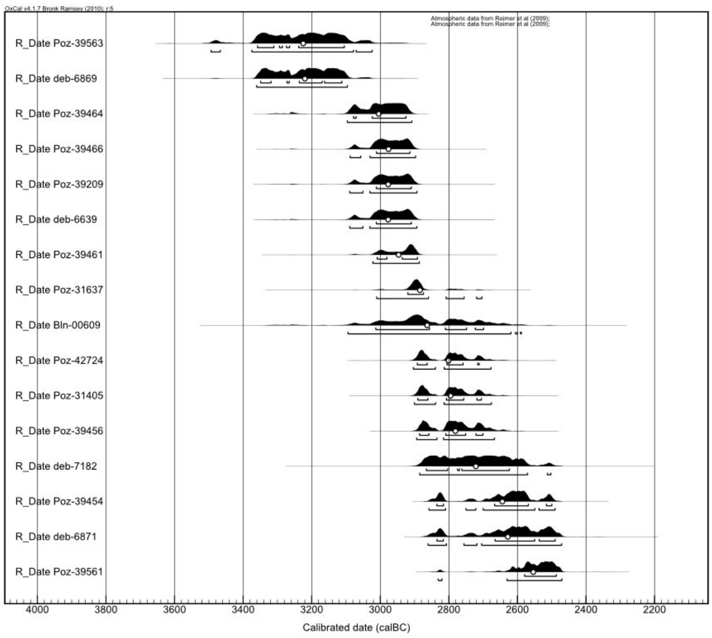
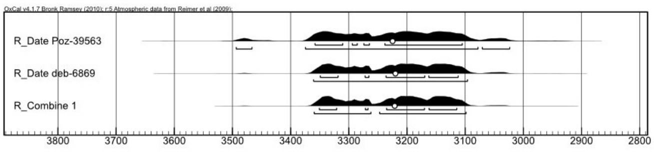


Fig. 10. Calibrated age probability distributions for the individuals from Pit Grave culture kurgans

The widest time interval was detected for the Sárrétudvari-Őrhalom kurgan. The two oldest radiocarbon dates derive from this kurgan as well: sample deb-6869 from Grave 12 and sample Poz-39563 from Grave 8. The age of these are basically the same, so they can be combined *(Fig. 11)*.



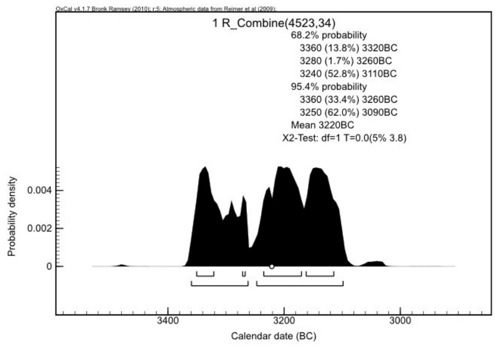


Fig. 11. Calibrated probability distributions of the radiocarbon dates of Grave 8 and 12 from Sárrétudvari-Őrhalom and their combined calibration

The age of two bone samples collected from two different sites in the vicinity of Tiszavasvári (Tiszavasvári-Gyepáros and Tiszavasvári-Deákhalom II, Grave 6), were found to be identical, although they derive from different cultural contexts (Tiszavasvári-Deákhalom II: Pre-Pit Grave/Kvityana, Tiszavasvári-Gyepáros: Pit Grave). The same age interval was measured for a sample collected from Grave 10 at Sárrétudvari-Őrhalom, therefore the combined calibration of the three samples seems logical *(Fig. 12)*.

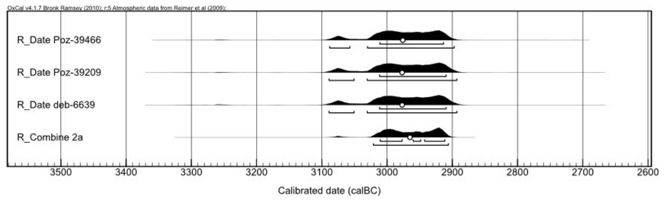
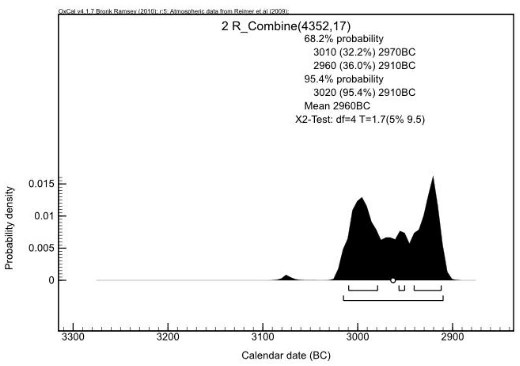


Fig. 12. Calibrated probability distributions of the radiocarbon dates of Grave 6 from Tiszavasvári-Deákhalom and Grave 10 from Sárrétudvari-Őrhalom and their combined calibration

Samples from Hajdúszoboszló-Árkushalom (Poz-39464) and Balmazújváros-Hortobágy-Árkus-Kettőshalom (Poz-39461) gave similar distribution curves *(Fig. 13)*.

The above listed 5 samples can be combined, because statistically their age is the same at a probability of 95% (Student's test), and they can be dated to 3010–2910 cal BC at 1σ probability, to 3020–2910 cal BC at 2σ probability.



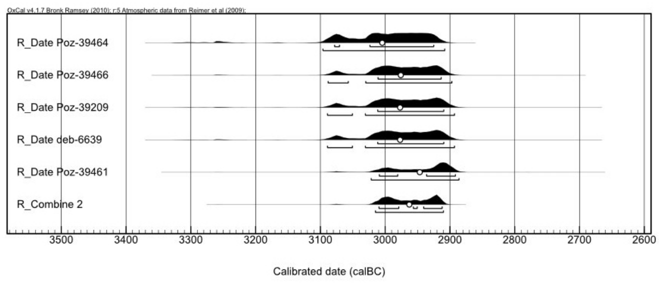


Fig. 13. Calibrated probability distributions of the radiocarbon dates of Grave 6 from Tiszavasvári-Deákhalom, Grave 10 from Sárrétudvari-Őrhalom, Balmazújváros-Hortobágy-Árkus-Kettőshalom and Hajdúszoboszló-Árkushalom kurgans and a possible combined calibration

Similar probability distributions were gained for the following samples: plant material of the secondary burial (Poz-31637) and human bone (Poz-31405) found at Hajdúnánás-Tedej-Lyukashalom; human bones excavated from Grave 4 in Kurgan 3 at Kétegyháza-Törökhalom (Bln-609), Püspökladány-Kincsesdomb (Poz-42724) and Grave 18 at Kunhegyes-Nagyálláshalom (Poz-39456). Therefore, their combination can be done as well *(Fig. 14)*.

These 5 samples can be combined, because statistically their age is the same at a probability of 95% (Student's test), and they can be dated to 2900–2770 cal BC at 1σ probability, to 2900–2710 cal BC at 2σ probability.

The youngest sample (Poz-39561) derives from Hortobágy-Ohat-Dunahalom. The two relatively young samples come from Sárrétudvari-Őrhalom (deb-6871 from Grave 9) and from Kunhegyes-Nagyálláshalom (Poz-39454 from Grave 14). The forth sample from Sárrétudvari-Őrhalom Grave 4 (deb-7182), is a bit older but because of its larger SD, the difference is irrelevant. The four samples can

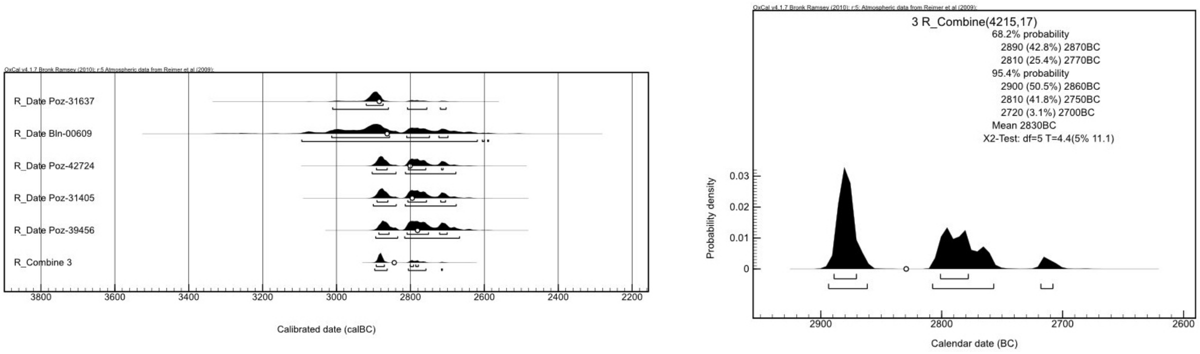
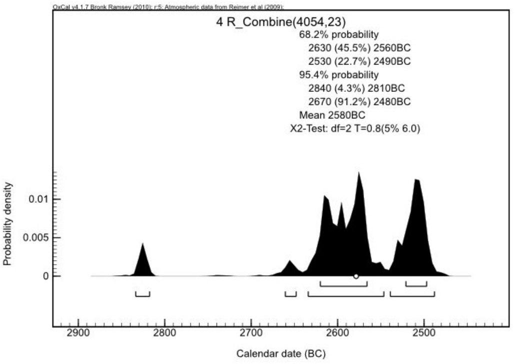


Fig. 14. Calibrated probability distributions of the radiocarbon dates of the samples from Hajdúnánás-Tedej-Lyukashalom, Kétegyháza-Törökhalom, Püspökladány-Kincsesdomb and Kunhegyes-Nagyálláshalom kurgans and a possible combined calibration

be combined, because statistically their age is the same at a probability of 95% (Student's test), and they can be dated to 2630–2490 cal BC at 1σ probability, to 2840–2480 cal BC at 2σ probability *(Fig. 15)*.



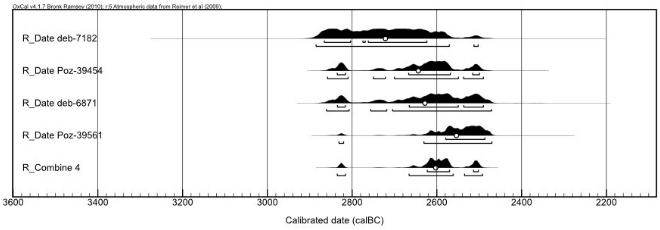


Fig. 15. Calibrated probability distributions of the radiocarbon dates of the samples from Hortobágy-Ohat-Dunahalom, Sárrétudvari-Őrhalom and Grave 14 of Kunhegyes-Nagyálláshalom and a possible combined calibration

The last two sample groups cannot be separated at 2σ level (2900–2710 cal BC and 2840–2480 cal BC respectively). At the same time – based on Student's test – the nine samples are not identical, so they cannot be combined.

We must stress, however, that the above presented clustering was only based on the statistical evaluation of the radiocarbon dates. The grouping does not reflect the cultural context of the samples in every case. These anomalies were dissolved by the overlapping of the periods and the partial co-appearance of different steppe cultures in space and time in the Carpathian Basin. Moreover, we are aware that the consistent and rigorous insistence to the radiocarbon dates themselves would be a similar mistake like a preconception that would neglect scientific measurements. The groups that are shown in *Table 5* and *Fig. 16* therefore only represent a working hypothesis that was formulated on the basis of our current knowledge and data.

Next to the determined T test values the numbers in brackets indicate the maximum T test values for the conformity of data at a probability of 95%. The combinations are *(Fig. 16)*:
R_Combine 1: Poz-39563, deb-6869
R_Combine 2: Poz-39464, Poz-39466, Poz-39461, Poz-39209, deb-6639
R_Combine 3: Poz-31631, Bln-609, Poz-42724, Poz-31405, Poz-39456
R_Combine 4: deb-7182, Poz-39454, deb-6871, Poz-39561

Group	cal BC 1σ, 68.2%	cal BC 2σ, 95.4%	μ	T test
R_Combine 1	3360–3110	3360–3090	3220	0 (3.8)
R_Combine 2	3010–2910	3020–2910	2960	1.7 (9.5)
R_Combine 3	2890–2770	2900–2700	2830	2.5 (9.5)
R_Combine 4	2630–2490	2840–2480	2580	2.5 (7.8)

Table 5. Combined radiocarbon age of Pit Grave kurgans

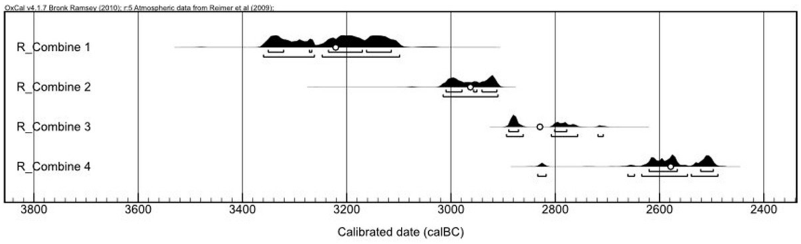


Fig. 16. Combine group-calibration of Pit Grave kurgans

Periods for the steppe cultures

Period I – Steppe Ochre Grave, until 4000 BC

On Great Hungarian Plain the single burial at Csongrád-Kettőshalom – n.b. not a kurgan burial! –should be rather identified as Steppe Ochre Grave culture. Its estimated date is based on the contemporary Marosdécse burials: 4200–4100 cal BC (Govedarica 2004, 71), parallel with the Middle Copper Age Bodrogkeresztúr culture (Ecsedy 1979, 12).

The recently obtained radiocarbon data of the Csongrád-Kettőshalom grave is 4370–4240 cal BC, in good correlation with other Steppe Ochre Grave data (Govedarica 2004), but a little bit earlier then the Middle Copper Age.

In Eastern Europe this is the period of the Early Eneolithic (4550–4100/4000 BC) of the Eurasian steppe region. The period of the Khvalynsk and Skelya cultures is contemporaneous with the Cucuteni A-Tripolye B1 phase (which populations played a significant role in the mediation between the steppe and agricultural communities). Moreover, it is analogous with the Romanian Aldeni-Bolgrad and Bulgarian Varna cultures (Higham *et al.* 2007), whose prosperity is identified with the elite of the Skelya culture.

There is a so-called steppe-hiatus between the early and middle phase of the Eneolithic between 4100/4000–3800/3700 BC (Rassamakin 1999, Table 3. 2).

The Middle Eneolithic Period of the Eurasian steppes (3800/3700–3500/3400 BC) can be characterized by the Cucuteni B-Tripolye B2-C1 Phase (Tomashevo, Zhvanetsk, Kosenovo groups, and the so-called *Scheibenhenkel* horizon, and in the east by the Lower Mikhailovka, Kvityana, Dereivka, Pivikha, Repin and Maikop cultures.

In the Carpathian Basin, the Early Eneolithic, the steppe-hiatus and the Middle Eneolithic Period is identified as the Early and Middle Copper Age, with the Tiszapolgár, Bodrogkeresztúr, Hunyadihalom, Lažňany, Ludanice, Balaton-Lasinja and *Furchenstich* cultures.

Csongrád-Kettőshalom fits rather to the beginning of the Middle Copper Age horizon, and most probably arrived into the Carpathian Basin as an early wave of the eastern Early Eneolithic populations, which can be described as the transition period of the Early and Middle Copper Age (see Bodrogkeresztúr cemetery at Rákóczifalva-Bagi föld: 4334–4075 cal BC; Csányi – Tárnoki – Raczky 2008).

Time period	Name of the Age or Period (Hungarian and *neighbouring territory: Maran 1998; Todorova 2002*)	Cultures in Transdanubia	Cultures east of the Danube
4000–3600 BC	End of the Middle Copper Age *Aenolithikum/Eneolith* *Chalcolithicum* *Jungneolithikum/End-neolithikum* *Postäneolithikum*	Ludanice and Balaton-Lasinja, mixed with *Furchenstich* dates: Balatonőszöd-Temetői dűlő: Horváth 2011b; and 3980–3800 cal BC, Vörs-Máriaasszonysziget, deb-12188: Medzihradszky *et al.* 2009, 24, Table 1	Ludanice, Lažňany, Bodrogkeresztúr, Hunyadihalom, and Balaton-Lasinja, mixed with *Furchenstich* dates: Abony 49: Rajna 2011; Szihalom (Ludanice): Wild *et al.* 2001, Table 1
3600–2800 BC	Late Copper Age *Jungsteinzeit* *Jung- und Spätkupferzeit* *Late Neolithic* *Protobronzezeit* *Bronzezeit (from 3100 BC after Durankulak)* *Early Helladic and ETh (from 3100 BC)*	Boleráz (3600–3400 BC) Boleráz/Baden (3400–3000 BC) Baden (3400–2800 BC) Kostolac (3350–2800 BC) Early Vučedol? (3500?–2900/2800 BC) dates: Balatonőszöd-Temetői dűlő, and Benkő *et al.* 1989; Petrović–Jovanović 2002; Balen 2005, 2011	Boleraz (3600–3400 BC) Boleraz/Baden? (3400–3000 BC) Baden (3400–2800 BC) Coţofeni III (3000–2800 BC) Kostolac? (3350–2700 BC) Pre-Pit Grave/Pit Grave (3350–2800 BC) dates: Balatonőszöd-Temetői dűlő, Benkő *et al.* 1989; Forenbaher 1993; Ciugudean 2000; Stadler *et al.* 2001
2800–2600 BC	Transition between LCA and EBA *Frühbronzezeit* *Early Bronze Age* *Early Helladic I* *Early Helladic II from 2700/2600 BC*	Baden (2800–2600 BC) Vučedol? (2800–2600 BC) Early Makó? Late Kostolac (2880–2670 cal BC, Vörs-Máriaaszonysziget, deb-12763, unpublished, pers. comm. of K. T. Biró) Somogyvár-Vinkovci (2750–2580 cal BC, Vörs-Máriaasszonysziget, deb-12180, Medzihradszky *et al.* 2009, 24, Table 1)	Baden (2800–2600 BC) Pit Grave (2800–2600 BC) Early Makó?
2600–2500 BC	Early Bronze Age 1 *Early Helladic II* *Early Bronze Age*	Baden (2600–2500 BC) Early Makó? Late Vučedol? (2600–2500 BC) Somogyvár-Vinkovci (2750–2580 cal BC, Vörs-Máriaasszonysziget, deb-12180, Medzihradszky *et al.* 2009, 24, Table 1: the date is uncertain, it may belong to the Kostolac period)	Baden (2600–2500 BC) Early Makó (2600–2500 BC) Pit Grave (2600–2500 BC)
2500–2300 BC	Early Bronze Age 2a *Reinecke Bz A0-1* *Early Helladic II*	Baden (2500–2300 BC) Makó (2470–2300 BC; Kővári–Patay 2005) Proto-Nagyrév/Early Nagyrév? (2570–2340 cal BC, e.g. Bln-1649: Bölcske-Vörösgyír) Somogyvár-Vinkovci (Kalafatić 2006; Vinkovci, KIA-29563) Bell Beaker (2500–2300 BC)	Baden (2500–2300 BC) Makó (2500–2300 BC) Pit Grave (2500–2470 BC) Nyírség? Maros? Gyula-Roşia?
2300–2200 BC	Early Bronze Age 2b *Reinecke Bz A0-2 or transition between A0/A1* *Early Helladic II* *EBA/MBA transition*	Late Makó (2300–2200 BC; Kővári–Patay 2005) Bell Beaker (2300–2200 BC) Early Nagyrév? Somogyvár-Vinkovci?	Baden (2300–2200 BC) Maros (from 2270 BC, P. Fischl–Kulcsár 2011, Table 3) Early Nagyrév (2290–2050 cal BC, e.g., Bln-1987: Tószeg-Laposhalom) Late Makó? Nyírség? Gyula-Roşia?
2200–2000 BC	Early Bronze Age 3 *Reinecke Bz A1* *Early Helladic III* *Middle Bronze Age*	Makó (2200–2130 BC; Kővári–Patay 2005) Bell Beaker (2200–2000 BC) Classic Nagyrév? Somogyvár-Vinkovci – Proto-Kisapostag (2100–2000 BC; Medzihradszky *et al.* 2009, Table 1: deb-11965, 12542, 12388, 12390, 12547)	Nyírség (2200–2030 BC) Classic Nagyrév (Raczky–Hertelendi–Veres 1994) Early Hatvan (Raczky–Hertelendi–Veres 1994) Early Maros (P. Fischl–Kulcsár 2011, Table 3) Early Ottomány (2025–1910 cal BC e.g., Bln-1642: Gáborján-Csapszékpart)
2000–1900 BC	Transition between EBA and MBA *Reinecke Bz A2* *Middle Bronze Age* *Middle Helladic*	Bell Beaker (2000–1900 BC) Proto-Nagyrév (2010–1910 cal BC; deb-10117, Endrődi–Pásztor 2006) Somogyvár-Vinkovci (2000–1900 BC; Dirjec 1991, Z-1934: Blatna Brezovica) Kisapostag? Nagyrév/Vatya? (2035–1925 cal BC; e.g., Bln-1646: Bölcske-Vörögyír)	Late Nagyrév? Hatvan (1925–1770 cal BC, e.g., Bln-1844: Jászdózsa-Kápolnahalom) Maros? Ottomány? Proto-Füzesabony?

Table 6. Relative and absolute chronology of the Late Copper Age and Early Bronze Age of the Carpathian Basin ("?" means sites, cultures and periods/ages are in uncertain chronological position, with uncertain absolute dates, or without correct, modern ^{14}C dates. Hungarian Bronze Age dates are from Raczky – Hertelendi – Veres 1994: conventional radiocarbon dates)

Period II – Pre-Pit Grave, 3400/3350–3300/3000–2750 cal BC

The cultures of the Late Eneolithic Period in the Eurasian steppe belt (3500/3400–3000/2900 cal BC) are late Repin, late Konstantinovka, Novosvobodnaja, late Kvityana, late Dereivka and late Lower Mikhailovka cultures, Tripolye C2 (with the Sofievka, Kasperovo/Gordinesti, Gorodsk, Usatovo groups), and with the "Badenization process", together with the local groups at the Dnieper-South-Bug region, Kemi-Oba communities. The emergence of the Pit Grave culture can be dated in this period, which is partly contemporaneous with the Boleráz, respectively the Cernavodă III, and the classical Baden, dating to a bit thereafter. More or less it is the Late Copper Age in the Hungarian prehistory.

The earliest kurgan graves of the Great Hungarian Plain can be classified as Pre-Pit Grave (*syn.* Pre-Yamnaya) horizons (Sárrétudvari-Őrhalom, Grave 12; Dani – M. Nepper 2006; K. Zoffmann 2006; Tiszavasvári-Deákhalom, Grave 6/Kvityana; Püspökladány-Kincsesdomb, Grave 3/Lower Mikhailovka, and perhaps Hajdúnánás-Tedej-Lyukashalom, Grave 1).

An overlap with this period appears with the earliest Pit Grave: the earliest, primary phase of Pit Grave kurgans with multiple depositions (Kétegyháza-Törökhalom, Kurgan 3, Grave 6, some Pit Grave ochre-graves in the Hortobágy region, e.g. Hortobágy-Árkus, which all lack grave deposits, and also those burials with grave chambers lined with some organic material). Differentiated from Period I, this phase might be identified as a Pre-Pit Grave horizon, and dated on the basis of the burials at Sárrétudvari and Tiszavasvári between: 3400/3350–3300/3000–2750 cal BC.

Period III – Early Pit Grave, 3300/3100–2900/2600 cal BC

In the Eurasian steppe region this is the period of the Early Bronze Age, which corresponds with the Early Pit Grave horizon, with the surviving Pre-Pit Grave groups (Usatovo), and dates from 3300/3100–3000/2600 cal BC.

At the Great Hungarian Plain the youngest period of multi-phase kurgans, moreover, the burials with timber-construction, but no or poor grave deposits can be linked to this period. This horizon can be identified and with the end of the Late Copper Age–Early Bronze Age transitional period, including the Late (and surviving) Baden/Coţofeni IIIa, b culture. This might be called Early Pit Grave Horizon. This period can be dated between 3300/3100 and 2900/2600 cal BC, overlapping with Period II. Our opinion is that Hajdúnánás-Tedej-Lyukashalom, Tiszavasvári-Gyepáros, Sárrétudvari-Őrhalom Graves 8 and 10, Kétegyháza-Törökhalom, Kurgan 3, Grave 4 and some graves from the Hortobágy region (Balmazújváros-Kárhozotthalom) are part of this time span.

Period IV – Late Pit Grave with strong Catacomb influences, 2900/2800–2500/2400 cal BC

The Early Bronze Age in the Eurasian steppes, which is the Late Pit Grave horizon, and simultaneous with the Catacomb entity, can be dated between 2800/2700–2100/2000 cal BC.

On the Great Hungarian Plain the latest, third construction phase of the kurgans, and, this is the time frame when rich metal depositions and Early Bronze Age ceramic sets appear in kurgan burials. It is contemporary with the Period I of the Early Bronze Age, and includes the surviving Baden, Vučedol, Makó-Kosihy-Čaka, early Somogyvár-Vinkovci, Glina-Schneckenbeg A, Coţofeni IIIc-Livezile cultures, and can be dated to 2900/2800–2500/2400 cal BC, according to the radiocarbon dates of Nezsider/Neusiedl am See, Velika Gruda, and the second building phase of the Sárrétudvari kurgan.

In contrast to former theories, we assume that the Catacomb culture – one of the later waves from the Eurasian steppes – did not exist as a discrete tribe on the territory of the Carpathian Basin. Although the late Pit Grave horizon shows similarities with the graves of the Polish Corded Ware culture that are found under mounds as well, it cannot be classified as Catacomb culture.[3]

The affluent arsenic bronze and gold grave goods, the secondary burials in the kurgans, and the arrangement along the outer circle can be a Catacomb influence; however, all these features are represented in the late Pit Grave culture as well. Besides, the contemporaneity as well as the combination of the two cultures has earlier been proved in the northwest Pontic area. Because of this phenomenon we might denominate this fourth phase as Late Pit Grave horizon with strong Catacomb influence.

On the basis of the AMS dates, the graves of Ohat-Dunahalom and Kunhegyes-Nagyálláshalom can be dated to this period, despite the conservative outlook of the burial rite.

Period V – Late Pit Grave effect, 2500/2400–2200/2000 cal BC

It can be presumed that this period enters into the second phase of the Early Bronze Age: Nyírség skeleton graves beside Hajdúnánás-Feketehalom, Somogyvár-Vinkovci type barrow burials, Eastern Slovakian mounds with Nyírség type pottery, all dated to the same period as the emergence of the Bell Beaker culture and the Proto-Nagyrév culture (see Bóna 1994), without the real ethnic presence of the Pit Grave peoples.[4] The study period is an excellent example to illustrate how contemporary cultures unite: in the Budapest region it is nearly impossible to differentiate the Bell Beaker-Early Nagyrév-Makó cultures: both settlements and burials are documented as a special mixture (Kalicz-Schreiber – Kalicz 1998–2000).[5]

The settling steppe communities in Period II and III can be identified with mixed cultural entities of the Pit Grave culture, and the strongly Tripolye C2-Usatovo stimulated Pre-Pit Grave Kvityana and Lower Mikhailovka groups, arriving from the Pontic area to the territory of the Great Hungarian Plain. The direction of the migration led from Moldova,[6] through the passes of the Carpathian Mountains and along the main waterways such as the valleys of the Berettyó, Maros/Mureş, and stopped at the line of the Tisza River.[7]

In Period IV(/V) intercultural connections with local cultures inside the Carpathian Basin strengthened and extended in a way that the original cultural identity of the Catacomb-influenced Late Pit Grave groups diluted, thus it is even more problematic to reconstruct their route than in the earlier periods. The direct route, which this even more far-away group followed when it arrived to Central Europe, has probably changed as compared to the previous periods: another road along the Danube seems to be a dominating one for the whole Carpathian Basin; with the use of the wheel and the wagon (Plačidol) and a developed metal production based on arsenic-bronze raw materials.

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3 In Little Poland, where the presence of niche graves was previously seen as a result of influences from the steppes, there is currently no clear evidence for direct connections with the Catacomb culture (Włodarczak 2006, 135).

4 The beginning of the Reinecke A Bronze Age is identical with the Phase 3 of the Hungarian Early Bronze Age. Thus, when discussing the Phase I or Phase II of the Hungarian Bronze Age this corresponds with the Final Eneolithic, Late Neolithic periods and cultures in Europe, see Horváth 2004, 43; 2012.

5 It was not only proved in the central part of the country, see for instance the paper given by János Dani and Katalin Tóth at the ΜΩΜΟΣ VI conference on the burial at Panyola.

6 The strongest anthropological similarity to Carpathian Basin kurgans can be detected with the ones in Moldova, see Marcsik 1979; K. Zoffmann 2011.

7 Populations of the autochthonous cultures of the Great Hungarian Plain (e.g. Boleráz, Baden, Makó) and the people of the kurgans were presumably mixing between 3350–2400 BC.

Most probably the main reason for this large-scale migration was the drastic change in the ecological circumstances caused by a drier climate and the over-grazing of the meadows (GOLYEVA 2000; SHISHLINA [ed.] 2000).[8]

David W. Anthony (2007, 362–364) recommended that the steppe populations arriving to the Great Hungarian Plain got there east from the Usatovo settlement area, from the South-Bug-Ingul-Dnieper region: the earliest Pit Grave kurgans are situated there (for example Bal'ki, with a deposited wagon, and one wooden plough-tooth: RASSAMAKIN 1999, Fig 3. 58). The steppe along the Lower Dniester were occupied by the Usatovo culture between 3400/3300–2800 BC, but the majority of the Pit Grave kurgans there (from 2800–2400 BC) are dated later than the migration to the Great Hungarian Plain. Thus, D. W. Anthony supposed that the Dniester variant is a sign of a return migration from the Danube valley and the Great Hungarian Plain to that region. Although this is a very pleasant theory, it cannot be verified in the study area: without much more excavation results and radiocarbon dates, and moreover, the overall revision of the Usatovo culture, this debate cannot be resolved (for this see also RASSAMAKIN – NIKOLOVA 2008, 13).

The migrating route sketched by Richard Harrison and Volker Heyd (2007, 194, Fig. 43) cannot be accepted for the whole period. This would lead from the mouth of the Dnieper River, around the Carpathian Mountains and reach the Great Hungarian Plain not just from the southern direction (through the Lower Danube), but through the passes of the northeastern and eastern Carpathians. The radiocarbon dates of some kurgans in Serbia, and Bulgaria are later or can be correlated with Period IV/V (e.g. in case of the kurgan at Jabuka in Serbia, an individual layer of soil formation was documented after a Kostolac stratum, upon which the kurgan was built; in Bulgaria in Kurgan 1 at Trnava, Coţofeni and Pit Grave ceramics with corded decoration were excavated: ANTHONY 2007, 363, Fig. 14. 6).

The hypothesis regarding the so called "Pit Grave package" is similarly not entirely applicable to this problem (HARRISON – HEYD 2007, 196–197). In accordance with the literature of Russian scholars (SAPOSNIKOVA *et al.* 1988; LEVINE *et al.* 1999; SHISHLINA [ed.] 2000; TSUTHKIN – SHISHLINA [eds] 2001; MORGUNOVA *et al.* 2003; MORGUNOVA 2004; RASSAMAKIN 2004; MERPERT *et al.* 2006), the third (social status and sex is markedly expressed),[9] and eighth characteristics (the importance of the horse) are not confirmed. At the same time we should be clarifying the fourth component ("The creation of a special status for craftsman..." in HARRISON – HEYD 2007, 196): the metalworkers had formed a specialized group or layer in the Early Bronze Age society; but this doesn't mean necessarily their highest social status. Irrespectively of this, the complex influence of the Eurasian steppe populations in the investigated period in the geographical area under examination cannot be neglected.

At last, it is anticipated that the excavation results and the series of new ^{14}C dates discussed in this study from the westernmost ethnic presence as well as expansion of these cultures further enhance this extremely complex and problematic jigsaw-puzzle with some new mosaic stones.

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8 According to A. Golyeva, in Kalmykia in most of the kurgans the buried soil was degraded and eroded. This phenomenon was further deteriorated in the Pit Grave/Catacomb transformation period by the drier climate and overgrazing. See GOLYEVA 2000.

9 See also IVANOVA 2003. It should be considered that kurgan burial was a kind of privilege for a not in every detail perfectly identified social group, thus kurgan burials cannot be taken as a mirror for the whole contemporary society. The social differences reflected in the Pit Grave graves are rather outlining local differences or territorial accessibility of raw materials and resources (for example the valley of the River Manych in Kalmykia; see SHISHLINA [ed.] 2000), and not just on the basis of the status or the gender.

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