

# The problem with tells: lessons learned from absolute dating of Bronze Age mortuary ceramics in Hungary

Paul R. Duffy<sup>1,\*</sup>, Györgyi M. Parditka<sup>2</sup>, Julia I. Giblin<sup>3</sup> & László Paja<sup>4</sup>



*Prehistoric population decline is often associated with social collapse, migration and environmental change. Many scholars have assumed that the abandonment of the fortified tell sites of the Great Hungarian Plain c. 1500–1450 BC led to significant regional depopulation. The authors investigate the veracity of this assumption by dating graves from Békés 103—a recently excavated Bronze Age cemetery in eastern Hungary. Using decorative motifs and radiocarbon dates to measure changing ceramic styles over more than 1300 years, they consider the implications for non-tell sites known only through surface survey. The results suggest that, even though people abandoned tell sites, regional populations were maintained.*

**Keywords:** Hungary, Békés 103, Bronze Age, tell settlement, radiocarbon dating

## Introduction

Population decline and regional abandonment are often associated with migrations, warfare and environmental change (Cameron & Tomka 1993; Faust & Ashkenazy 2009; Barberena *et al.* 2017; Middleton 2017). Archaeologists studying regions such as the U.S. Southwest during European colonisation, the Circum-Alpine Late Neolithic and the Greek mainland at the end of the Late Bronze Age have relied heavily on intensive absolute dating to demonstrate extensive population decline across entire regions (Shennan 2000; Middleton 2015; Liebmann *et al.* 2016). A variety of site types, however, need to be radiocarbon-dated to

<sup>1</sup> *The Archaeology Centre, University of Toronto, 19 Russell Street, Toronto, ON M5S 2S2, Canada*

<sup>2</sup> *Museum of Anthropological Archaeology, University of Michigan, 3010 School of Education Building, 610 East University Avenue, Ann Arbor, MI 48109-1259, USA*

<sup>3</sup> *Department of Sociology, Criminal Justice and Anthropology, Quinnipiac University, 275 Mount Carmel Avenue, Hamden, CT 06518-1908, USA*

<sup>4</sup> *Department of Biological Anthropology, University of Szeged, Közép Fásor 52, Szeged H-6723, Hungary*

\* *Author for correspondence (Email: [paul.duffy@utoronto.ca](mailto:paul.duffy@utoronto.ca))*

establish accurately whether, and to what extent, a region underwent population decline. On that basis, this article challenges the evidence for population decline during the Bronze Age of the Great Hungarian Plain.

Towards the end of the Early Bronze Age on the Great Hungarian Plain—*c.* 2000 cal BC in most chronologies, although this varies by region—a portion of the region's population lived in densely packed houses on fortified tells. During this time, regional populations grew, fortified tell settlements expanded horizontally and many other surrounding non-tell settlements were established (Duffy 2014, 2015). The surge in the occupation of this region was accompanied by intensification in metallurgy and craft production (Bóna 1994; Michelaki 2008; Fischl *et al.* 2013; Duffy 2014; Nicodemus 2014). This population expansion did not last, however. In the current chronology for the Great Hungarian Plain, the end of the Middle Bronze Age saw the abandonment of tells (most by 1500/1450 cal BC), followed by a substantial drop in the number of non-tell sites during the first centuries of the Late Bronze Age (Jankovich *et al.* 1998; Earle & Kolb 2010; Fischl *et al.* 2013: 360; Gogáltan 2015). Many other cultures around Europe and the Mediterranean also experienced drastic change at this time.

Some archaeologists have assumed that social collapse prompted high rates of migration across Europe (Risch & Meller 2015). Yet, in the case of the Great Hungarian Plain, the argument for outmigration is based exclusively on radiocarbon dating of the abandonment of tell settlements, assuming that they are representative of all sites, but this ignores the evidence from non-tell sites. In this article, we present the results of radiocarbon dating of mortuary ceramics from a recently excavated Middle Bronze Age cemetery in eastern Hungary, finding little evidence for regional mass depopulation at the beginning of the Late Bronze Age. We then build a chronology for the non-tell site of Békés 103—the first Middle Bronze Age cemetery to be excavated and dated absolutely in the Lower Körös Basin of eastern Hungary and western Romania. The resulting chronology suggests that depopulation at the end of the Middle Bronze Age in this part of the Great Hungarian Plain may be a misconception resulting from previously inadequate dating of non-tell contexts. The result in eastern Hungary, and perhaps for other regions, is that a radical change in settlement pattern took place around 1500/1450 BC, but with no corresponding drop in local population. The implication is that people left the population aggregations at the tells, and dispersed across the surrounding landscape to 'flat' sites.

We used OxCal 4.3.2 (Bronk Ramsey 2009) and the IntCal 13 atmospheric curve (Reimer *et al.* 2013) to plot the stylistic attributes of 95 vessels from 31 graves with radiocarbon dates from the Békés 103 (Jégvermi-kert, Lipcsei-tanya) site in eastern Hungary, near the modern town of Békés (Figure 1). We find that many Middle Bronze Age motifs continued to be used long after people had left the tells. Consequently, we argue that many of the non-tell sites—known only from surface collections—are probably of later date than currently believed. Furthermore, we argue that in the Lower Körös Basin, the Middle Bronze Age saw a shift in settlement away from tells *c.* 1500/1450 cal BC, with no corresponding change in material culture; ceramic stylistic traditions probably continued to *c.* 1300 cal BC. People living at flat settlements therefore probably represent the seed population for the numerous settlements known from the Late Bronze Age. In short, there is no Middle Bronze Age depopulation to be explained.

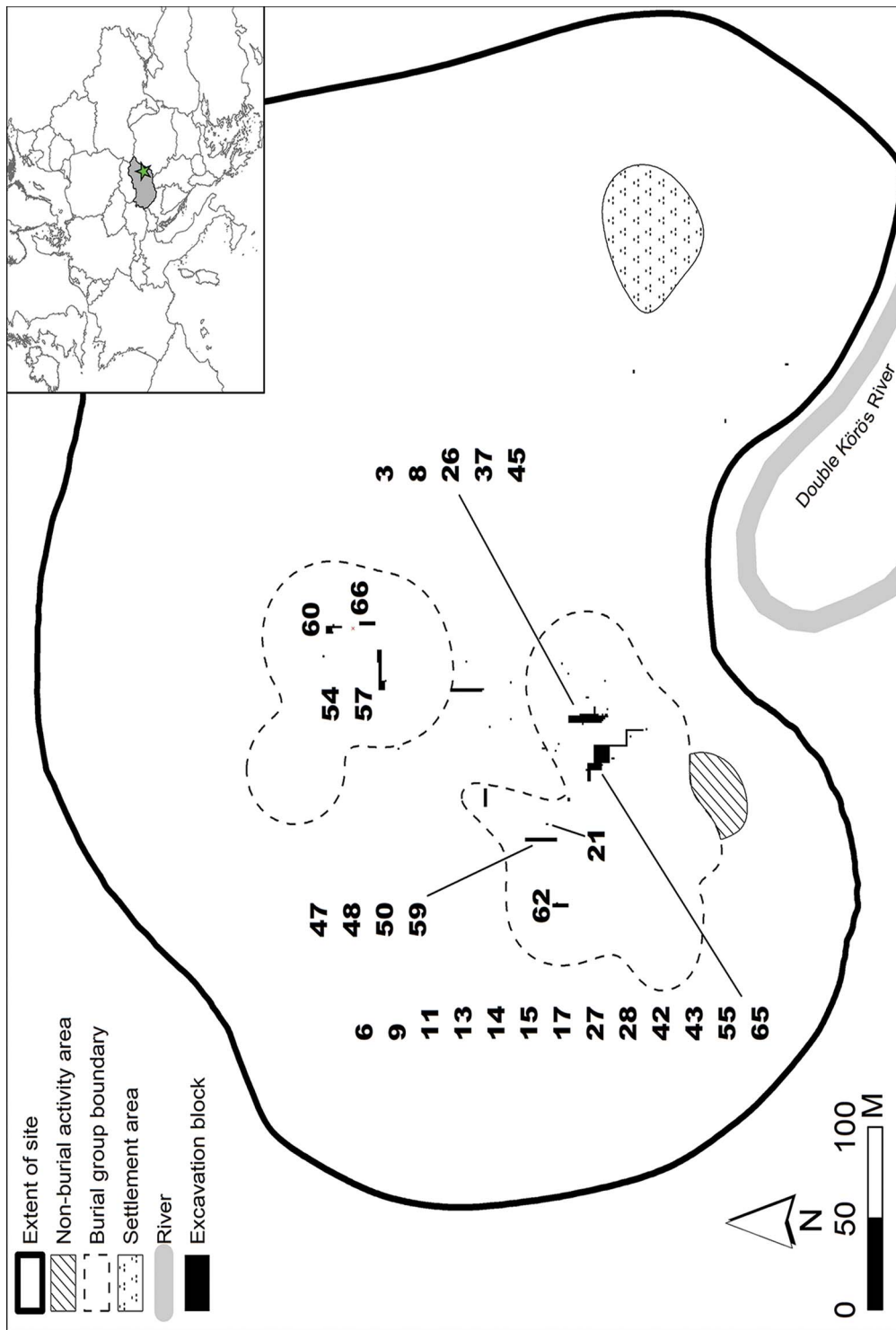


Figure 1. The Békés 103 site displaying the approximate location of human burials (numbers) with analysed radiocarbon samples. The location of Békés 103 is marked on the inset map with a star (figure by P.R. Duffy).

## Style and the end of the Middle Bronze Age

The iconic spirals and lugs of the Middle Bronze Age in the Lower Körös Basin are well-known decorations found in discussions of pan-continental symbolism, contact and trade; archaeologists have long used such stylistic features of Bronze Age ceramics for relative dating (Childe 1929; Bóna 1975; David 1997; Kristiansen & Larsson 2005). Hungarian and Romanian traditions use slightly different chronological terminology for the Bronze Age, but most agree on the basic stylistic changes of ceramics during the second millennium BC (Sz. Máthé 1988; Bader 1998; Gogâltan 1999; Némethi & Molnár 2002; Michelaki 2008; Nicodemus & O'Shea 2015). In the Lower Körös Basin, the Early to Middle Bronze Age transition falls a little later than in most of the Great Hungarian Plain. In the Early Bronze Age Ottomány/Otomani I group (2150–1650 cal BC), decorative elements on fine wares are mostly geometric, including incised lines and chevrons (Duffy 2014: 95–100). In the Middle Bronze Age Gyulavarsánd/Otomani II–III group (1750–1450 cal BC), forms become elaborate; flared rims appear on pitchers, cup handles rise high above the rim and smoothed, uniform surfaces become sculpted bas-relief. Ceramic styles across the Carpathian Basin during the Middle Bronze Age are well known for their enormous variety of forms, techniques and combinations of elements, including a vast array of lugs, spirals, chevrons, channels and other motifs and appliqués (Bóna 1975; Sz. Máthé 1988; Duffy 2014; Sofaer 2015). Most of these diagnostic motifs and forms, however, fell out of use by the Late Bronze Age.

Our current understanding of changes in Bronze Age ceramic styles associated with radiocarbon dates in the Körös region comes almost exclusively through the chronologies built from tell sequences. Focusing on the tells is intuitive, as they appear to be the longest-lived settlements in the landscape, accumulating deposits—and height—generation after generation. Yet tells were not all abandoned at the same time—some were deserted well before 1600 cal BC (Raczky *et al.* 1994) (see Table S1 & Figure S1 in the online supplementary material (OSM)). The latest dates for tell abandonment in the Lower Körös Basin are from Berettyóújfalu-Herpály (1614–1496 cal BC, at 68 per cent confidence) and Eszár-Fenyvesdomb (1496–1323 cal BC, at 68 per cent confidence) (Raczky *et al.* 1994; Duffy 2014). Similar dates for final tell abandonment can be found in the Maros region to the south, at Pecica Șanțul Mare (*c.* 1545 cal BC) and Klárafalva-Hajdova (*c.* 1450 cal BC) (Nicodemus & O'Shea 2015).

The reasons for collapse of the tell system and the transition to the Late Bronze Age on the eastern Great Hungarian Plain are unclear, although this lack of clarity is not due to a dearth of Bronze Age sites available for study. Hungarian archaeologists have systematically surveyed 3800km<sup>2</sup> of Békés County, identifying thousands of archaeological sites from surface scatters (Ecsedy *et al.* 1982; Jankovich *et al.* 1989, 1998; Szatmári n.d.). When we tally the number of sites with diagnostic Bronze Age sherds by culture group and time frame, we can calculate site density across the duration of the Bronze Age (Table 1, with specific numbers by culture group described in Table S2). The visual representation of these densities shows a striking decrease in Late Bronze Age I (1450–1200 cal BC) sites—a pattern similarly suspected for parts of the Great Hungarian Plain that lack systematic survey data (Figure 2). The first substantial Late Bronze Age occupation in the Lower Körös Basin is the Gáva group (in Late

Table 1. Site density in Békés County by major Bronze Age phase. Early Bronze Age I includes sites described as culture group ‘Makó, Nyírség’; Early Bronze Age II includes sites described as ‘Hatvan, Ottomány’; Middle Bronze Age includes sites described as ‘Gyulavarsánd, Koszider, Hajdúsámson’; Late Bronze Age I includes ‘Hajdúbagos, Tumulus’; and Late Bronze Age II includes ‘Pre-Gáva, Gáva’ (Ecsedy *et al.* 1982; Jankovich *et al.* 1989, 1998; Szatmári *n.d.*). Site numbers also include unpublished sites in the Mihály Munkácsy Museum database, identified since publication of the systematic surveys.

	Early Bronze Age I	Early Bronze Age II	Middle Bronze Age	Late Bronze Age I	Late Bronze Age II
Begins cal BC	2700	2150	1750	1450	1200
Ends cal BC	2150	1650	1450	1200	900
Duration (years)	550	500	300	250	300
Site numbers	49	71	131	38	359
Sites/100 years	9	14	52	13	120

Bronze Age II, 1200–900 cal BC)—contemporaneous with the Urnfield culture in Central Europe and Transdanubia—when large numbers of settlements appear once again (V. Szabó 2003).

Unless the density of villages and the sizes of sites varied radically between each period of the Bronze Age, it is straightforward to interpret declining site numbers as evidence for the depopulation of, and possible outward migration from, the Great Hungarian Plain at the end of the Middle Bronze Age. The problem with this conclusion, however, is that radiocarbon dates from the Körös region come exclusively from tells; there are no radiocarbon dates from non-tell sites, and, consequently, the surface ceramics found at the latter are attributed dates by comparison with the material from the tells. In other words, this approach makes it impossible to recognise activity at non-tell sites independently of the tells.

## The Békés 103 site

The Békés 103 cemetery is located at the confluence of the Black (Fekete-) and White (Fehér-) Körös Rivers in an area of dense Middle Bronze Age settlement (Duffy *et al.* 2014). These rivers drain the Apuseni Mountains in Transylvania to the east, the home of the contemporaneous Wietenberg group (Ciugudean & Quinn 2015). The Apuseni Mountains were probably a source of gold, copper and salt for Körös Bronze Age people (Ardeleanu *et al.* 1983; Földessy & Szebényi 2002; Harding & Kavruk 2013).

The site of Békés 103 was initially discovered through systematic fieldwalking by Hungarian archaeologists (Jankovich *et al.* 1998), although the Bronze Age cemetery was not discovered at this time (Duffy *et al.* 2014). In 2011, we identified burnt human bone on the ground surface; since then, we have systematically collected cremated bone from across 3.2ha of the site (Figure 1). In the west of the site, there are two large areas of burnt human bone on the surface, and one small area of ceramics and animal bone, with no associated cremated human remains. There is no human bone on the surface in the eastern half of the site, although there is a small area of Bronze Age settlement debris, including burnt daub.

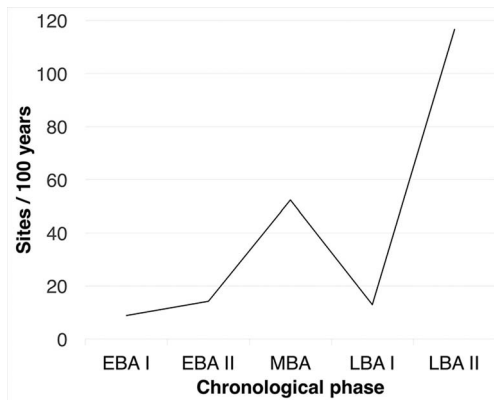


Figure 2. A chronology of Bronze Age occupation in Békés County according to the current typo-chronology (see Table S2 for period definitions) (figure by P.R. Duffy).

Most areas of the site where bone was found on the surface were sampled via excavation. Overall, the density of the burials discovered by excavation was very low, with an average 1 × 20m excavation block containing only 1–2 graves. Given the distribution of surface bone, however, we estimate that the cemetery was large and used by several communities within at least 8km of the site (Duffy *et al.* in press). Between 2011 and 2015, excavations at the Békés 103 cemetery recovered 68 human burials. Of these, five were inhumations and 58 were cremations in urns; two graves were represented

by scattered remains next to whole pots and/or liquid containers. In three very disturbed graves, the burial type was not obvious, although two involved cremations (Paja *et al.* 2016).

## Analysis of the dates for Békés 103

A radiocarbon analysis of mortuary contexts is an ideal method of tracking stylistic changes that occurred over the course of the Bronze Age. Graves are closed contexts and allow confident study of the relationship between restorable ceramics and datable bone. Nonetheless, most of the dated bone from Békés 103 was calcined during cremation, and therefore requires careful screening due to the calcification of other environmental carbon during combustion and the precipitation of carbon-based salts from the burial environment (for further details, see the OSM). Although alternative sources of carbon dating are rare at Békés 103, we attempted to assess the potential impact of these diagenetic processes by double dating one burial (human burial 14)—comparing results between charcoal and burnt bone—and acquiring dates from three inhumation (i.e. non-cremated) burials. Ceramics from Békés 103 exhibit several of the most common stylistic elements of the Middle Bronze Age. In selecting graves for radiocarbon dating, we made sure to include samples associated with these common elements, as well as the rare forms and decorations that may date to the earliest and latest phases of cemetery use. We also attempted to mitigate against spatial bias by dating several parts of the site, as different areas of long-lived cemeteries may have diverse use-histories. Ceramics from the 68 burials excavated include approximately 124 restorable vessels, comprising mostly urns, jugs, cups and bowls. We described these vessels according to form, colour, surface treatment and decorative elements. Examples and descriptions of the latter are given in Figure 3 and Table 2, and the dated graves, vessel and ceramic attributes are listed in Table S3. The decorations included in this study are common to the Gyulavarsánd/Otomani II–III group, although many are also found in other parts of the Great Hungarian Plain. We did not attempt Bayesian modelling of the dates, as none of the graves intercut. Instead, we used the upper and lower extents of one standard deviation to bracket

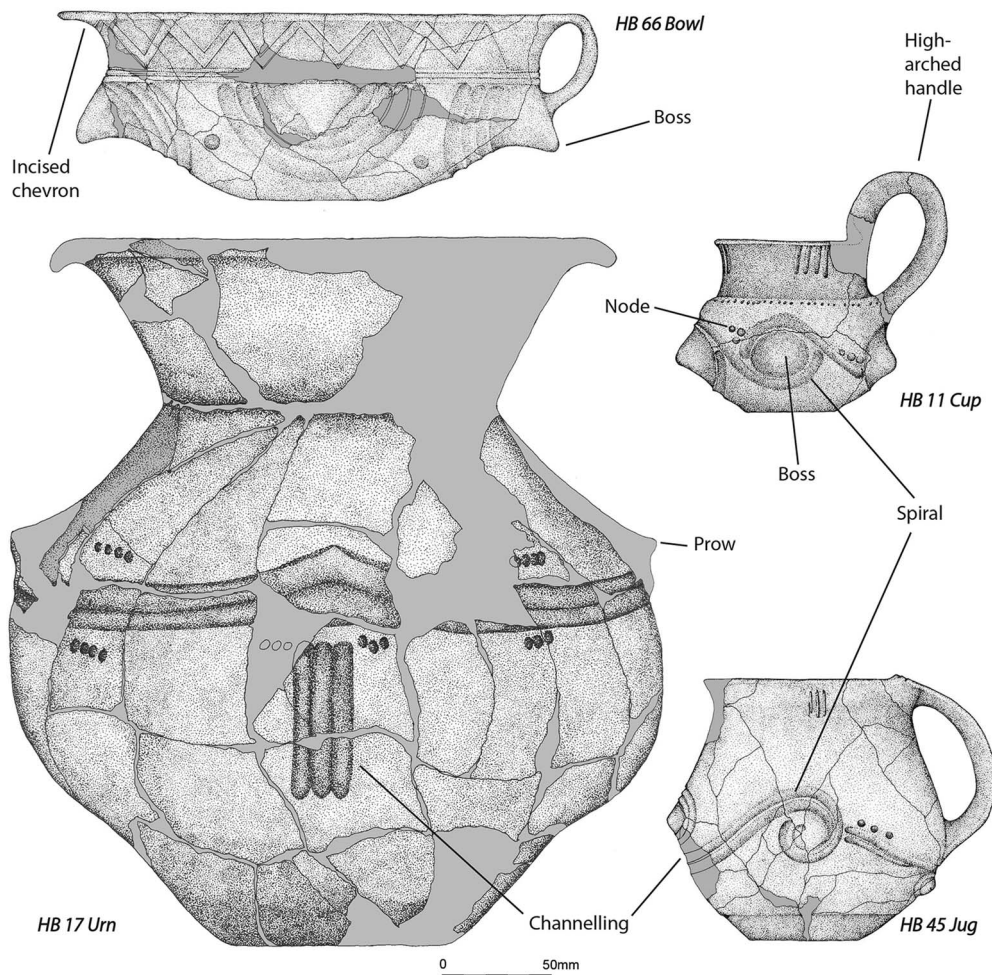


Figure 3. Visual depiction of decorative elements from grave ceramics (drawings by D. Kékegyi & K. Gillikin, arrangement by P.R. Duffy).

the use-life for different stylistic elements. Although further excavation and dating of the site will probably alter the phasing provided below, we argue that our attempts to overcome potential biases, combined with the sizeable sample of dated graves, means that the overall pattern should nonetheless hold.

### Chronology for Békés 103

We present the uncalibrated radiocarbon age BP and  $\pm$  values for the 31 human burials (HB) in Table 3, and we list the calibrated dates in Table S4. Although cemetery use does not seem to have been continuous, it lasted about 1350 years from beginning to end. According to the earliest calibrated date, the cemetery was first used as a burial ground between 2460

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Table 2. Description of decorative elements used in the study.

Element	Description
Channelling	Linear depression with a rounded cross-section
Incising	Thin, linear, usually more squared or v-shaped cross-section
Tick	Small linear depression, made with a thin, sharp tool
Node	Larger rounded depression, made with a wide, rounded-tip tool
Boss	Rounded projection, usually circular or ovoid, either appliqué or pushed outwards from vessel interior
Chevron	Linear, v-shaped pattern
Spiral	A linear pattern winding in continuous curve around a central point
Prow	'Beak'-shaped relief
High-arched handle	More than one third of the loop handle arches above rim level

and 2300 cal BC (68 per cent confidence), with final use between 1110 and 1010 cal BC (68 per cent confidence).

Both charcoal and cremated bone from HB 14 were dated, and the results suggest that cremated bone at Békés 103 is not differentially affected by diagenesis. While we would like to support this with additional paired datings, charcoal associated with calcined bone is exceedingly rare in the graves. Nonetheless, the correspondence in date between unburnt and cremated bone (Figure 4) suggests that there is no systematic distortion of dates from cremations.

Table 4 presents the ceramic decoration dates, allowing immediate comparison with ceramics from other sites—especially sherds from surface collection and settlement excavations, from which information on full ceramic form is not usually available. The absence of certain motifs in different time frames is not chronologically meaningful. The absence of the chevron before 1500 cal BC, for example, or the gap in incised decoration between 2300 and 1900 cal BC, is not particularly important in a regional sense, as these motifs have been radiocarbon dated in other contexts (Raczky *et al.* 1994; Duffy 2014). But some of the ceramic decorations common to the Middle Bronze Age, such as the tick, begin surprisingly early and persist for a long time (about 1000 years). More surprising, however, is the lateness of some of the decorative elements, such as the boss and the spiral, which may have lasted into the thirteenth or twelfth century cal BC.

Table 5 and Figures 4–6 provide phasing for the Békés 103 cemetery. Phase 1 (2460–2200 cal BC) is the initial period of Early Bronze Age use, during which the Makó ceramic style was common across large stretches of Hungary and Romania (Kulcsár & Szeverényi 2013). The earliest graves—HB 55 and HB 62—contain vessel forms unlike any other in the cemetery (Figure 6). The vessel from HB 55 is typologically comparable to Early Bronze Age forms dated to the mid third millennium from Berettyóújfalu-Nagy-Bocs (Dani & Kisjuhász 2013: pl. 6, 1), and radiocarbon dated to *c.* 2500 cal BC. The urn from HB 62 is similar to grave 4 from Sárrétudvari-Órhalom, which is radiocarbon dated to *c.* 2700 cal BC (Dani & Nepper 2006: fig. 4). Both phase 1 Early Bronze Age graves at Békés 103 belong to the Makó group, which precedes the Ottomány culture. Phase 1 cemetery use may



**Table 3. Uncalibrated radiocarbon samples from Békés 103. (UG CAIS is the University of Georgia Center for Applied Isotope Studies; UA AMSL is the University of Arizona Accelerator Mass Spectrometry Laboratory.)**

Human burial (HB)	Special sample no.	Lab.	Lab. no.	Material	Radiocarbon age BP	±
3	625	UG CAIS	16984	Bone	3190	30
4	626	UG CAIS	16985	Calcined bone	3170	30
6	969	UA AMSL	x30876	Calcined bone	3111	24
8	970	UA AMSL	x30877	Calcined bone	3183	23
9	971	UA AMSL	x30878	Calcined bone	3200	24
11	627	UG CAIS	16986	Calcined bone	3300	30
13	972	UA AMSL	x30879	Calcined bone	3144	24
14	535	UA AMSL	x32248	Charcoal	3369	23
14	981	UA AMSL	x32250	Calcined bone	3370	23
15	774	UG CAIS	18385	Calcined bone	3140	25
17	973	UA AMSL	x30880	Calcined bone	3116	23
21	628	UG CAIS	16987	Calcined bone	3340	30
26	629	UG CAIS	16988	Calcined bone	3110	30
27	974	UA AMSL	x30881	Calcined bone	3107	24
28	968	UA AMSL	x29904	Calcined bone	3201	29
37	975	UA AMSL	x30882	Calcined bone	3053	23
42	630	UG CAIS	16989	Calcined bone	3270	30
43	631	UG CAIS	16990	Bone	3130	30
45	976	UA AMSL	x30883	Calcined bone	3095	23
47	977	UA AMSL	x30884	Calcined bone	3272	35
48	775	UG CAIS	18386	Calcined bone	3210	30
50	967	UA AMSL	x29905	Calcined bone	3166	21
52	978	UA AMSL	x30885	Bone	3473	30
52	980	UA AMSL	x32249	Bone	3453	30
54	776	UG CAIS	18387	Calcined bone	3010	25
55	777	UG CAIS	18388	Calcined bone	3880	30
57	778	UG CAIS	18389	Calcined bone	2880	25
59	779	UG CAIS	18390	Bone	2980	40
60	820	UG CAIS	18391	Calcined bone	3260	25
62	964	UA AMSL	x29901	Calcined bone	3837	21

have lasted only about 50 years and probably reflects a low regional population that left very few traces on the landscape—a pattern also seen in other parts of the Great Hungarian Plain. This is followed by phase 2 (2200–1880 cal BC), an approximately 320-year period during which there is no evidence of cemetery use. Given our attempt at spatial sampling, it seems very unlikely that if burials dating to this period were eventually to be found that they would represent a large proportion of the total number.

The cemetery was re-used in phase 3 (1880–1600 cal BC) during the Ottomány and Ottomány–Gyulavarsánd transition, when both styles are present in the Lower Körös Basin (Duffy 2014: 98). This phase has only three burials, one of which (HB 21) has a

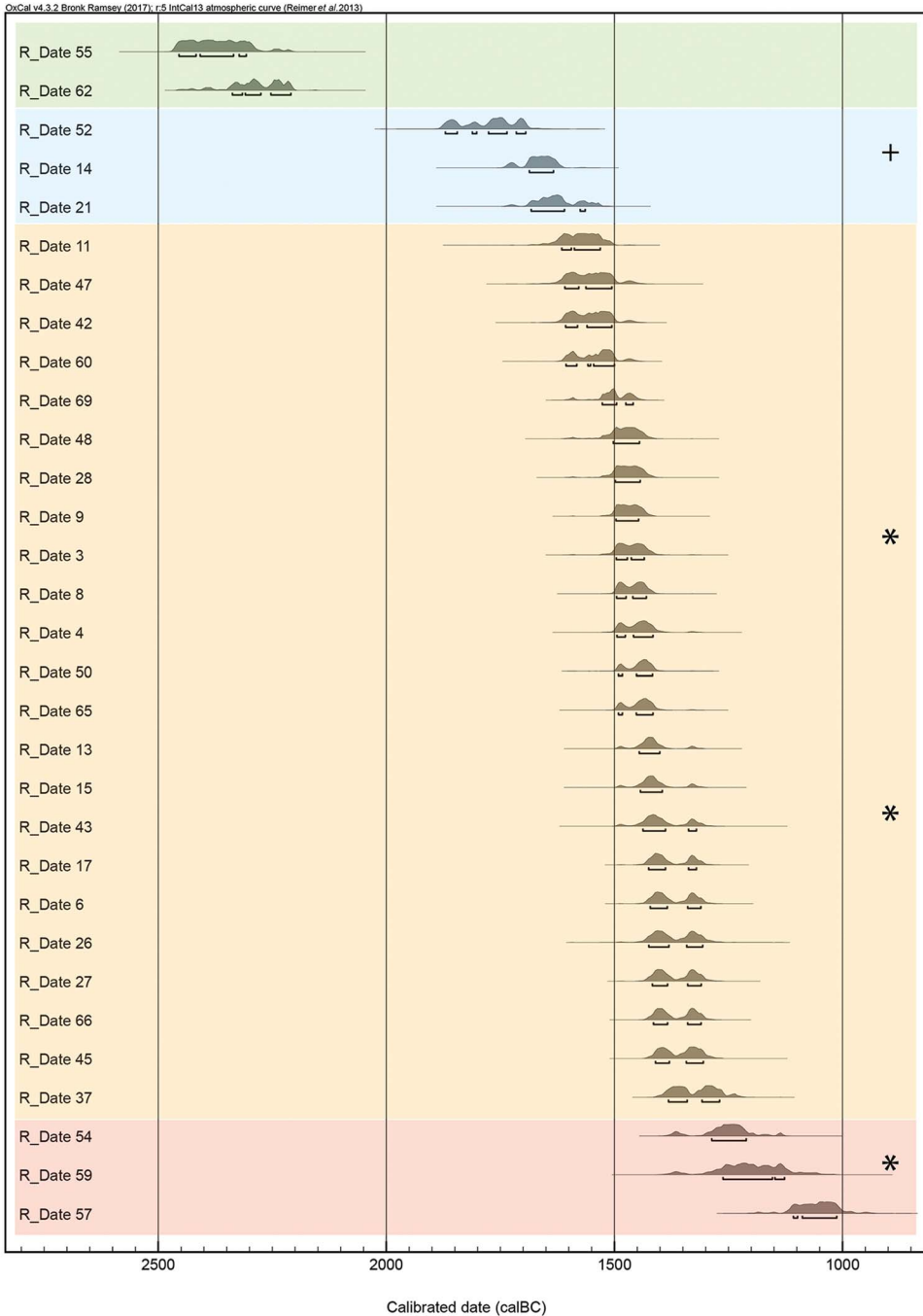


Figure 4. Calibrated data showing phases 1, 3, 4 and 5 (duplicate data for HB 14 and 52 not shown); phase 2 is a period of no mortuary features; \* represents radiocarbon dates from unburnt bone in inhumation graves; and + represents a grave with both dated charcoal and calcined bone providing identical dates (output by OxCal 4.3, coloured by P.R. Duffy).

**Table 4. Calibrated data for Békés 103 individual decorations, and the number of graves containing the decorative element.**

Element	Start cal BC (68% confidence)	End cal BC (68% confidence)	Approximate duration (years)	No. of graves
Incised	2460	1300	1160	8
Tick	2340	1300	1040	3
Channelling	1880	1010	870	23
Boss	1880	1120	760	20
Node	1690	1300	390	11
Spiral	1690	1270	420	7
Prow	1690	1270	420	16
High-arched handle	1620	1010	610	5
Chevron	1510	1310	200	3

**Table 5. Phases assigned to Békés 103.**

Ceramic style	Human burial (HB)	Phase no.	Start (68%)	End (68%)	No. of graves
Early Bronze Age	55, 62	1	2460	2200	2
–	–	2	2200	1880	–
Early/Middle Bronze Age	52, 14, 21	3	1880	1600	3
Middle Bronze Age	Remaining	4	1600	1280	24
Late Bronze Age	54, 59, 57	5	1280	1010	3

recognisably early ceramic style; the urn from this grave is unique in the excavated assemblage, displaying an early spiral decoration on a double-handled biconical form—similar to vessels in the Otomani III group in north-western Romania (Németi & Molnár 2012: pls 7, 90–93). The other two graves, inhumation HB 52 and cremation HB 14, contain ceramics that would generally be considered to be of Middle Bronze Age date. Phase 4 (1600–1280 cal BC) represents the most intensive use of the cemetery—a period of around 320 years—and the ceramics seem characteristically Middle Bronze Age. The majority of the unexcavated burials at Békés 103 probably fall within this period, straddling the Middle–Late Bronze Age transition.

Phase 5 (1280–1010 cal BC) is the final phase, and contains ceramic forms plausibly attributed to either the Middle Bronze Age or Late Bronze Age (Kemenczei 1979: pl. XVIII:9; Furmánek *et al.* 1999: pl. 41.1). The cup in HB 57 has a high-handle and vertical channelling found in the Middle Bronze Age of the Lower Körös Basin, while the cup shape in HB 59 resembles known Late Bronze Age forms. The radiocarbon date for HB 54 clearly falls in this phase too, although its urn form and style are less diagnostic.

## Implications of the chronology for settlement history

The first aim of this paper was to build a plausible chronological model for Békés 103, a large, newly discovered Bronze Age cemetery in an area where no other such examples were known.



Figure 5. Mortuary ceramics falling within phases at Békés 103 (restoration and photographs by L. Gucsi, arrangement by P.R. Duffy).

Based on the radiocarbon data and the stylistic range of ceramic material, we distinguished five phases. Our second goal was to attempt to address the putative drop in population size at the end of the Middle Bronze Age in Békés County. Our data suggest that Middle

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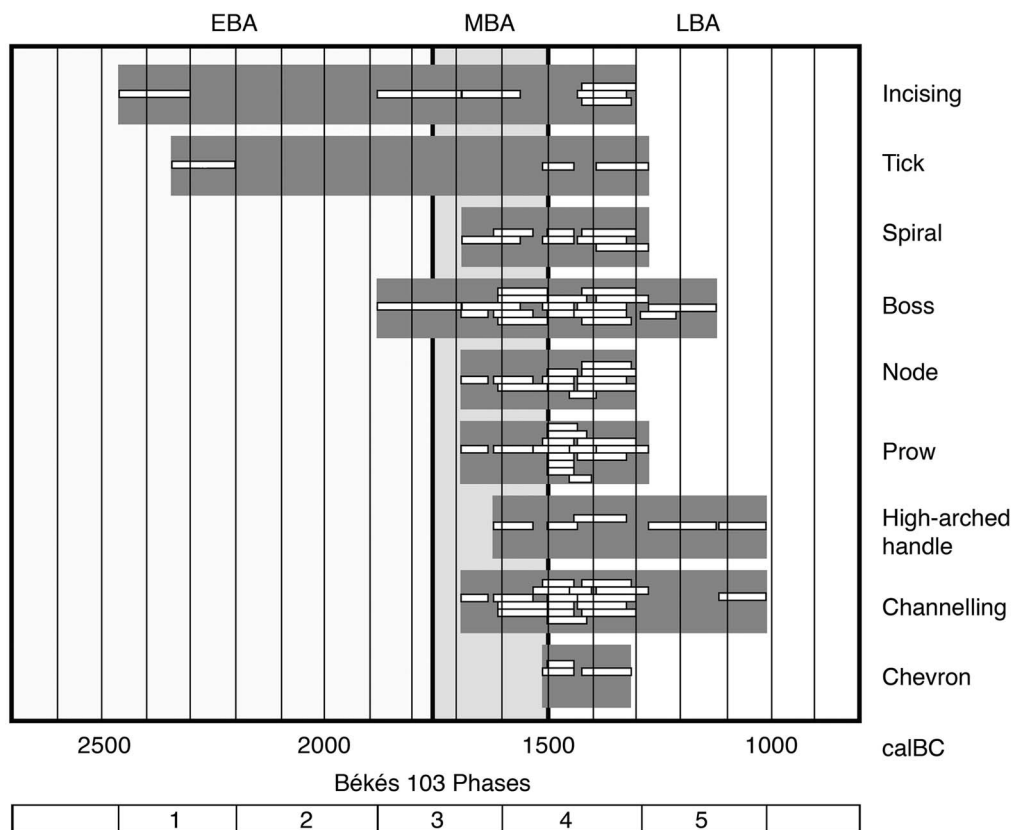


Figure 6. Simplified illustration of phases at Békés 103 (bottom), with individual attributes displayed using 68 per cent confidence for the calibrated burial dates (top). Attributes are overlaid with existing Early, Middle and Late Bronze Age sub-phase boundaries for the Körös region (figure by P.R. Duffy).

Bronze Age ceramic attributes, such as spirals and bossing, persisted for much longer than previously thought. In the current typo-chronology, for example, most of the identified Békés 103 ceramics belonging to phase 4 would be dated routinely to 1750–1500 cal BC—during the height of the tell site occupation; our data place them between 1600 and 1280 cal BC. Given our new dates for these ceramics, we can redraw the changes in site density (Figure 3) using 1300 cal BC as the boundary between the Middle and Late Bronze Ages. This reduces the sites per 100 years in the Middle Bronze Age from 52 to 29, and raises the sites per 100 years in the Late Bronze Age I from 13 to 38 (Figure 7).

Our findings suggest that many of the hundreds of ‘Middle Bronze Age’ sites known from surface collection in Békés County are probably younger than expected. Hence, the population increase between the Early and Middle Bronze Age would be less dramatic than previously proposed (Duffy 2014: 226–27). Consequently, the substantial depopulation of the area—thought to have taken place at the end of the Middle Bronze Age—may be an

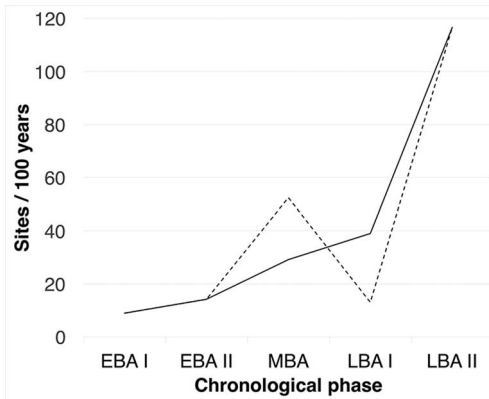


Figure 7. Bronze Age site density in Békés County (black line) according to revised chronology. Current typo-chronology shown via the dashed line (figure by P.R. Duffy).

erroneous conclusion based on survey data and an inaccurate relative chronology (see similar warnings by Fischl *et al.* (2013: 358–59, 2015)). We suggest that ideological changes in Europe around 1600 cal BC—at least initially—may have corresponded only with the abandonment of tell settlements, and not non-tell sites. While archaeologists still need to explain the local transformation that took place when the Lower Körös Basin tells were abandoned, we hope that our results encourage others to study the numerous Middle Bronze Age non-tell sites that post-date them, in order to build a complete picture of the region’s social dynamics.

Our results also question the migration narrative for the Great Hungarian Plain at the end of the Middle Bronze Age. Over 50 years ago, Mozsolics (1957) and Bóna (1958) attributed depopulation of the Great Hungarian Plain to invasion by the Tumulus people migrating from Central Europe. This group occupied the entire Carpathian Basin and is named after their distinctive practice of burial under artificial mounds. They are still widely considered to represent a mass west-to-east migration with significant associated cultural impact, including displacement and depopulation (Csányi 2003). Yet more recent studies do not support catastrophic invasion scenarios (e.g. Kreiter 2005); although the movement of the Tumulus group into the Carpathian Basin certainly had consequences, depopulation in eastern Hungary was not one of them.

Finally, our results indicate that reconstructions of demographic change in antiquity—even when founded on radiocarbon dates—are only as strong as the variety of contexts dated. We argue that discontinuities in the archaeological record should be investigated using different kinds of sites (c.f. Barberena *et al.* 2017). Many archaeological regions rely primarily on the radiocarbon dating of the largest stratified sites to establish ceramic chronologies, which are then used to date surrounding sites located through pedestrian survey. We hope that this article demonstrates that even small temporal shifts in the use of material culture styles (e.g. 150 years later than expected) can have significant impacts on our understanding of regional demographic histories.

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## Supplementary material

To view supplementary material for this article, please visit <https://doi.org/10.15184/axy.2018.179>

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