Abhandlung

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Late Neolithic multicomponent sites of the Tisza region and the emergence of centripetal settlement layouts

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Zusammenfassung: In der Theiß-Region an der nördlichen Peripherie der südosteuropäischen Tellkulturen beobachten wir zwischen 5300 und 4450 v. u. Z. das Auftreten großer bevölkerungsreicher Siedlungen, die durch die Kombinationen unterschiedlicher Siedlungskomponenten, von Tells, Flachsiedlungen und Kreisgrabenanlagen gekennzeichnet sind. In diesem Beitrag ist die Entwicklung einer solchen Mehrkomponenten-Siedlung – Borđoš in der serbischen Vojvodina – rekonstruiert, basierend auf geophysikalischen Untersuchungen, Ausgrabungen, systematischen Oberflächenbegehungen und ^{14}C-Datierungen. Zwischen 4850 und 4700 v. u. Z. wurde in Borđoš eine bereits länger existierende Tellsiedlung durch eine große Flachsiedlung ergänzt oder zeitweise ersetzt. Im Kontext ähnlicher Fundstellen aus dem Theiß-Gebiet und darüber hinaus interpretieren wir diese Dynamik als Ausdruck eines zeitweise verstärkten überregionalen Trends zu Bevölkerungsagglomeration zwischen etwa 4900 und 4700 v. u. Z. Hinsichtlich der Entwicklung von Tellsiedlungen und Flachsiedlungen zeichnen sich innerhalb des Theiß-Gebietes erhebliche regionale Unterschiede ab: Im südlichen Teil des Untersuchungsgebietes bilden Tells häufig die Keimzelle später wachsender komplexer Siedlungen. Dagegen stellen im Norden eher große Flachsiedlungen den Ausgangspunkt großer Siedlungen dar. Tells repräsentieren hier entweder räumliche Separierungen mit speziellen Funktionen oder stellen das Ergebnis einer länger andauernden Besiedlung in einem kleinen Teil der ursprünglichen Siedlungsfläche dar. Diese Größenreduzierung von Siedlungen oder teils ihre komplette Auflassung verstehen wir als Teil eines im Karpatenbecken und dem westlichen Balkan weiträumig sichtbaren Trends hin zu erheblich geringeren Bevölkerungsdichten und räumlich stärker verteilten Siedlungen, der nach 4700 v. u. Z. einsetzte.

Aus Tells- und Flachsiedlungskomponenten bestehende Großsiedlungen der Theiß-Region zeichnen sich durch eine große Diversität hinsichtlich ihrer Größe und räumlichen Konfiguration aus. In Borđoš beobachten wir das Auftreten eines in der Region bisher unbekannten zentripetalen Siedlungslayouts, in dem die Häuser auf einen zentralen Platz im Zentrum der Siedlung ausgerichtet sind. Wir interpretieren die neuartige Siedlungskonfiguration als das Ergebnis des Zusammenschlusses einer im Hinblick auf kulturellen Hintergrund, Identitäten und Netzwerkeinbindung sehr heterogenen Bevölkerung. Demnach können wir die Gruppierung der Häuser um einen zentralen Platz als Ausdruck einer sozialen Organisation verstehen, die in stärkerem Maße als bei Siedlungen mit parallelen Hausreihen auf der Aushandlung kommunaler Belange beruhte.

Schlüsselworte: Theiß-Region, Spätneolithikum, Archäo-Magnetik, ^{14}C-Chronologie, Tells, Flachsiedlungen, Kreisgrabenanlagen, Mehrkomponenten-Siedlungen, Bevöl-

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kerungsagglomeration, zentripetales Siedlungslayout, soziale Organisation.

Résumé: Dans la région de la Tisza, au nord des cultures avec des tells typiques du sud-est de l'Europe, de vastes habitats ont été créés, caractérisés par la combinaison de divers composants: des tells, des habitats plats et des espaces clôturés avec tranchées entre 5300 et 4450 ans av. J.-C. Dans cet article, nous avons essayé de reconstruire un site archéologique complexe, Bordjos en Voïvodine (République de Serbie), basé sur des recherches géophysiques, des fouilles, une collection systématique de découvertes en surface et une datation avec la méthode C14. Entre 4850 et 4700 av. J.-C., la localisation d'origine du tell a été étendue ou temporairement remplacé par un habitat plat. Dans le contexte de découvertes similaires dans la région plus large du bassin de la rivière Tisza, on remarque la tendance de l'agglomération croissante de la population entre 4900 et 4700 av. J.-C. Cependant, les deux composants de ce phénomène: un tell et un habitat plat, montrent des modèles de développement différents dans certaines régions. Au sud de la zone explorée, les tells représentent les noyaux initials des grands habitats composants. Au contraire de cela, au nord, les grands habitats plats ont tendance à représenter le point de départ de l'agglomération de la population locale. Les tells représentent des emplacements séparés avec des fonctions spéciales, ou représentent des habitats initials et plus petits qui se sont développés pour devenir des habitats plats. L'abandon complet ou la réduction de la taille de l'habitats après 4700 av. J.-C. est considéré comme partie d'une tendance qui conduit à une densité de population beaucoup plus faible et à des habitats dispersés dans le bassin des Carpates et dans la région des Balkans occidentaux. Les habitats multicomposants de la région de la Tisza se caractérisent par une grande diversité de taille et de configuration spatiale. À Bordjos, on voit l'occurance d'un plan complètement nouveau et centripète de l'habitat, qui contraste avec la disposition précédemment établie des maisons en lignes parallèles. Ce nouveau phénomène est interprété comme le résultat d'un environnement sociopolitique caractérisé par la coexistence de populations hétérogènes en termes de contexte culturel, d'identité et de connexion à des réseaux de communication et d'échange. Ainsi, un nouvel arrangement d'habitat, caractérisé par un arrangement presque circulaire de maisons autour de l'espace central ouvert, devrait être compris comme l'expression d'une organisation sociale concentre sur la résolution des problèmes communs par le biais de conversations des habitants.

Mots clés: région de la Tisza, néolithique tardif, archéomagnétométrie, datation ^{14}C, tells, habitats plats, espaces circulaire, agglomération de population, habitats multicomposants, arrangement centripète d'habitat, organisation sociale.

Abstract: In the Tisza region, at the northern periphery of the tell cultures, large settlements characterised by combinations of tells, flat settlements, and enclosures emerged between 5300–4450 BCE. Here, the development of one such site, Borđoš in the Serbian Vojvodina, is reconstructed based on geophysical surveys, excavations, systematic surface collections, and ^{14}C dating. Between 4850 and 4700 BCE, the original tell site was complemented or temporarily replaced by a large flat settlement. This development is known from a number of similar sites in the region and is discussed as a trans-regional phenomenon of accelerated population agglomeration in the period between roughly 4900 and 4700 BCE. However, the two components of this phenomenon, the tell site and the connected extended flat settlement, show different development trajectories according to sub-region. In the southern part of the study area, tells represent the core of emerging large multicomponent sites. Contrastingly, in the north, large flat settlements tend to be the starting point of local population agglomerations, and tells represent spatially separated locations with special functions or were the result of a particular part of the larger flat settlements experiencing a longer duration of occupation. The complete abandonment and reduction in size of settlements after 4700 BCE is understood in the context of a transregional trend towards settlement dispersal and population decline in the Carpathian Basin and the whole western Balkans.

Multicomponent sites in the Tisza region are characterised by a great diversity in terms of size and spatial configuration. In Borđoš we observe the emergence of a completely new centripetal settlement layout which contrasts with the previously established arrangement of houses in parallel rows. This new phenomenon is interpreted as an outcome of a socio-political environment which was characterised by the cohabitation of a heterogeneous population in terms of cultural background, identity, and connections to networks of communication and exchange. Thus, the new settlement layout, which is characterised by a nearly circular arrangement of houses around a central open space, should be understood as an expression of a social organisation focused on the negotiation of communal concerns.

Keywords: Tisza Region, Late Neolithic, archaeo-magnetometry, ^{14}C chronology, tells, flat settlements, circular enclo-

sure, population agglomeration, multicomponent settlements, centripetal settlement layout, social organisation.

Introduction

The first emergence of large aggregated and concentrated villages with several hundreds of inhabitants represents a significant social transformation of Neolithic communities in Southeast Europe and the Carpathian Basin. While preceded by similar phenomena in the Near East and Anatolia millennia earlier[1], the phenomenon we focus on here is to be understood first and foremost against the regional background of many centuries of small-scale and dispersed settlements during the Early Neolithic[2]. The emergence of tell settlements and large, concentrated settlements had far-reaching consequences for the economic and social configuration of the communities involved. Major preconditions for these agglomeration processes were rapid population growth in the context of the Neolithic Demographic Transition[3] and an increased degree of sedentism most probably connected to the economic background of mixed, labour-intensive subsistence with intensive garden cultivation and livestock breeding[4]. Also ideological reasons are likely to have played a role both for the creation of tell settlements and for the tendency to concentrate populations. While the emergence of tell settlements was caused by a tendency to value and thus establish spatial permanence, the formation of settlement mounds is connected to the combination of clay-intensive forms of architecture and high building densities[5]. The inhabitants of such densely populated settlements had to accept severe social consequences, like a high degree of communal integration and social monitoring, together with other significant drawbacks such as scalar stress[6], intra-site pollution, and more exposure to infectious diseases. On the other hand, they might have been drawn to a higher degree of security and shared risks, more intensive and probably richer social relations, more pronounced group identity, and the already mentioned ideological benefit of holding closer relationships to their ancestors[7].

The Tisza region represents the northern periphery of these Neolithic tell-based communities which were both a latecomer to and never fully integrated in the region. Indeed, in the Tisza region agglomeration processes started around 5300/5200 BCE in the later phase of the Alföld Linear pottery culture. The contemporary emergence of larger settlement concentrations[8] – albeit more short-lived and showing significantly lower building density than in the Central Balkans[9] – in Transdanubia parallels this development and in the Central European LBK is connected to this process.

In the catchments of the Tisza and Körös Rivers the circa twenty currently known sites include a combination of Late Neolithic tells, extended flat settlements, enclosures, and associated cemeteries. As many of these settlement forms occur in the same location and appear to have been occupied contemporaneously, these sites must be understood as complex and multicomponent, and are considered by some scholars as focal points of centralised settlement clusters within some kind of tribal organization (Tab. 1, Fig. 1)[10]. In recent decades, intensive research and large-scale rescue excavations in Hungary, Romania, and Serbia have contributed to significantly improve our knowledge of similar complex settlements in the surrounding regions[11]. However, comprehensive reconstructions of their developmental dynamics are nevertheless available only in a couple of exceptional cases.

In this paper we want to explore and discuss a set of interrelated questions which will help us understand the social, economic, and political preconditions and consequences of the concentrated, multicomponent sites of the late 6th millennium in the wider Tisza region. Firstly, we will pursue the question of whether these multicomponent settlements represent a transregional interconnected trend, or if we are dealing with different, convergent phenomena. To do this, we will explore how local site settlement pattern trajectories are related to the transregional evidence of comparable developments of agglomerated sites, how their economies were organised, and how well they were integrated into communication and exchange networks in the Carpathian Basin. Secondly, we will trace the origin and significance of a newly discovered distinctive settlement layout pattern, which we call the centripetal layout and contrast to the linear layout, as we

1 Kuijt 2000; Hodder 2014.
2 e. g. Sherratt 1982, 1983; Nandris 2007; Parkinson/Gyucha 2012.
3 Bocquet-Appel/Bar-Yosef 2008; Müller 2013; Shennan *et al.* 2013; Porčić *et al.* 2016.
4 Bogaard 2005; Isaakidou 2011.
5 Chapman 2007; Rosenstock 2009; Duffy *et al.* 2013.
6 Dunbar 1992; Johnson 1982; Bandy 2004.
7 Chapman 2008.
8 Soudský 1962; Makkay 1982; Marton/Oross 2012; Furholt *et al.* 2014.
9 e. g. Petrasch 2012.
10 Parkinson 2006; Raczky/Füzesi2016.
11 Raczky *et al.* 2010; Horváth 2005 (2012); Schier 2014; Neumann *et al.* 2014; Raczky *et al.* 2015; Marić *et al.* 2016; Draşovean *et al.* 2017; Parkinson *et al.* 2017; Bánffy *et al.* 2016.

Tab. 1: List of multicomponent sites of the Tisza and Lower Danube region.

site	latitude	longitude	size total (ha)	size tell (ha)	thickness (cm)	14c dates (n)	dating flat settlement	dating tell	Reference
Békés-Povád	46.7500	21.1167				0			Neumann *et al.* 2014
Berettyóújfalu-Berta-domb	47.1963	21.4854				0			Neumann *et al.* 2014
Berettyóújfalu-Herpály	47.2402	21.5770	15	0.3	300	29	Early Tisza/ Late Szakálhát	4725 or 4620–4470 cal BCE	Kalicz/Raczky 1990a; 1990b
Berettyóújfalu-Szilhalom	47.2167	21.5167		0.3	180	16	no information	LBK: c. 5200– 5100 cal BCE Late Neolithic: c. 4700 –4500 cal BCE Early Copper Age: c. 4500 cal BCE	Neumann *et al.* 2014
Borđoš	45.6000	20.1333	50	7	300	38	4830–4700 cal BC	5000–4515 cal BC	Medović *et al.* 2014, this contribution
Crna Bara	45.9574	20.3130	0.7		330	0	no information	Vinča B2/C1 Hiatus Tiszapolgár	Link 2006, 124 f.
Dévaványa-Sártó	47.0333	20.9500			100	0	no information	ALBK Szakálhát Tisza	Link 2006, 111 f.
Hajdúböszörmény-Pródi-halom	47.7427	21.3406	8	2.4		0	Csőszhalom-group		Raczky *et al.* 2010
Hódmezővásárhely-Kökény-domb	46.3500	20.2667	21	1.5	100	10	no information	Late Szakálhát/Early Tisza– Classical Tisza	Link 2006, 116 f.; Rosenstock 2009
Idjoš-Gradište	45.8537	20.3896	1.56	0.33	250	0	Vinča C/{D1?]/ [Classical?] Tisza	Early Vinča A-B Vinča C/D1?/[Classical?] Tisza	Marić *et al.* 2014; Mirković-Marić/Marić 2017
Öcsöd-Kováshalom	46.8781	20.3299	21	3–5	160	16	Classical Tisza?	Late Szakálhát/Early Tisza– Classical Tisza	Raczky, 2009
Pietrele I-Magura Gorgana	44.0678	26.1565	5	0.69	900	45	5150–5050 cal BCE 4600–4250 cal BCE	4650–4250 cal BCE	Hansen *et al.*, 2012; Reingruber 2015; Hansen *et al.* 2014 (2017)
Polgár-Csőszhalom	47.8667	21.1167	24	2.7	400	40	4900–4680 cal BCE	4850–4450 cal. BCE	Raczky *et al.* 2015; Raczky 2018
Polgár-Bosnyákdomb	47.8667	21.1167	6	0.75	150	7	Later [Classical] Tisza/ Csőszhalom-group	ALBK/Bükk + Csőszhalom, Proto-Tiszapólgar, 4600–4450 ca. BCE	Raczky/Anders 2016
Sîntana-Holumb	46.3820	21.4632	3	0.11	300	0	no information	Late Tisza + Proto-Tiszapolgar	Link 2006, 122–123

Tab. 1 (continued)

Szeghalom-Kovácshalom	47.0167	21.1667	70	0.8	380	0	? –4700 BCE		Gyucha *et al.*, 2015
Szegvár-Tűzkö-ves	46.6167	20.2333	11	3.14	200	8	no information	Early Tisza Hiatus Classical Tisza	Link, 2006, 114–116; Horváth 2015
Szentpéter-szeg-Kovadomb	47.2338	21.6231	≥2.7	0.7		0	no information	no information	Raczky/Anders 2014
Tápé-Lebő A (Felsőhalom)	46.2478	20.4112	5		250	16	no information	frühes Szakálhát, Bükk classical Tisza + late Tisza Proto-Tiszapolgár	Link 2006, 121; Rosenstock 2009
Uivar-Gomila	45.6483	20.8625	3		400	14	? –4500 cal BCE	5150–4700 cal BCE	Schier 2014; Draşeovan *et al.* 2017

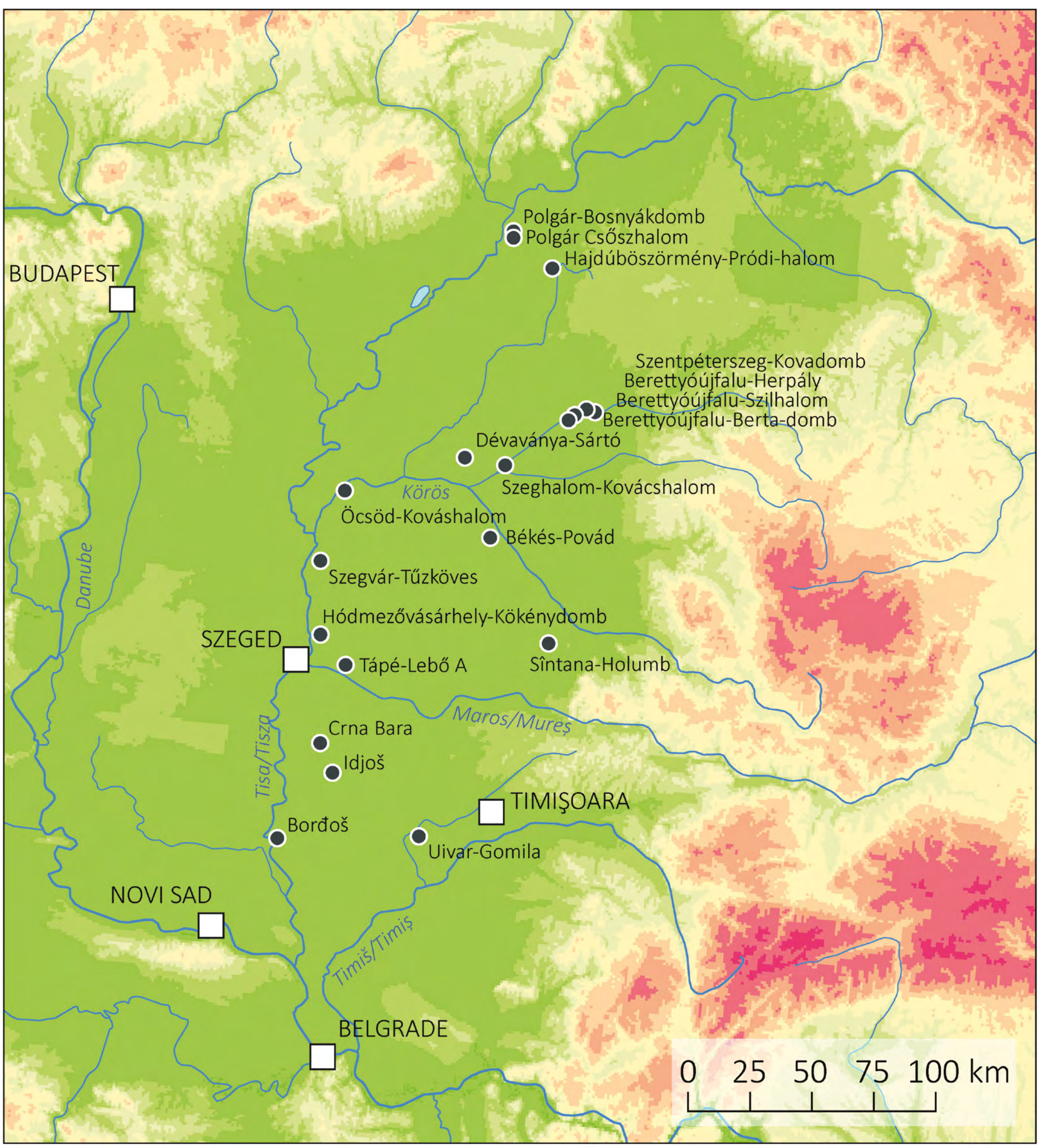

Fig. 1: Spatial distribution of multicomponent sites in the Tisza region (Source: R. Hofmann).

believe that this holds the clue to a better understanding of regional specifics regarding the social organisation of large settlements. Centripetal settlement layouts are characterised by a circular, or almost circular, arrangement of houses creating a central space in the settlement often left open and unbuilt.

The multicomponent site Borđoš

To explore these research questions, we start with new data on the spatial layout, internal development, economy, and integration into regional communication and exchange networks from the site of Borđoš. This new data is the result of field work in a micro-region near the modern town Novi Bečej, situated along the Tisza about 30 km to the north of Novi Sad and the confluence of the Tisza and Danube rivers[12]. There, extensive field work has been carried out on an 11 km² loess terrace and the surrounding floodplains in an ongoing cooperation between the Museum of Vojvodina Novi Sad and the Christian-Albrecht's University in Kiel. A major focus of this project has been the complex Late Neolithic site Borđoš located in the southwestern part of the terrace which was repeatedly settled between 5100 and 4600 BCE by Early Neolithic (Starčevo-Körös-Criş pottery style), Late Neolithic (Tisza, Vinča pottery styles) and additionally by Late Bronze Age (Gava-Belegiš pottery style) communities.

Our study region is located not only where the different ecological zones of the Carpathian Basin and the low middle mountain range of the Central Balkans meet, but also at the interface of different cultural groups with Vinča and Tisza pottery. The overall goal of our research in Borđoš is to achieve a better understanding of the problem of how settlement and population dynamics operate as drivers of social change and how these processes are interlinked with the transformations in subsistence, social organisation, communication, exchange, and mobility which likely underlie the "hybrid" characteristics of these settlements.

This paper, firstly, provides an overview of the fieldwork conducted since 2014 at the site of Borđoš including excavation, a magnetic survey, and a radiocarbon dating program. On a much broader geographical scale, we then take our new data as a starting point for a wider discussion of the social developments of the known multicomponent sites in the Tisza region.

12 Medović *et al.* 2014; Stanković-Pešterac *et al.* 2014.

Geophysical Survey

In order to gain a complete picture of the Neolithic site of Borđoš we performed a geomagnetic survey over an area of 51 ha using a SENSYS MAGNETO® MX V3 Survey System (SENSYS Sensorik & Systemtechnologie GmbH Bad Saarow, Germany). Additionally, in two smaller areas of the site electrical resistivity measurements (ERT) were taken (using an ABEM Terrameter SAS 300B): In the tell area the application of this second survey method was meant to help determine the thickness of the anthropogenic deposits. In the flat settlement, the ERT measurements were meant to clarify whether unburned houses existed which were not visible by means of magnetic survey in addition to the numerous burned buildings which were.

The magnetic survey plan can be interpreted as clearly showing four larger Neolithic settlement components. In addition, parts of a Bronze Age settlement and several smaller, partly still unspecified units could be identified (Fig. 2–3):

In the northern part of the site, a settlement mound with two oval ditches is visible. Although the tell covers over 9 ha, 6.9 ha are enclosed within the double-ditch system[13].

To the southwest of this settlement mound there is a semi-circular rondel-like enclosure composed of two parallel ditches. Today, this structure measures 0.8 ha (enclosed area 0.52 ha), but obviously a large part of the enclosure was lost to lateral erosion of the Tisza towards the formerly existing river bed (today silted up). If it is assumed that the rondel was originally circular, the diameter of the existing structure (135 m, enclosed area 115 m) suggests an original size of ca. 1.4 ha with 1 ha inside of the ditches.

In the southern part of the survey area a large flat settlement of 25 ha is enclosed by several rings of ditches. A small mound partly destroyed by a modern building is located in the centre of this area. Lateral erosion of the terrace has also influenced this settlement zone; its original spatial extent is estimated as 38 ha (enclosed area 37 ha; diameter 700 m). The inner part of the flat settlement enclosed by a set of at least four ditches would have covered around 23 ha (enclosed area 20 ha; diameter 500 m).

To the north of the settlement mound, across a drainage channel likely belonging to the Pleistocene, there is a less densely populated area of 3.5 ha with Early Neolithic finds and scattered Late Neolithic houses. In the south there is additionally a large settlement partly overlap-

13 Compare Medović *et al.* 2014, table I and II.

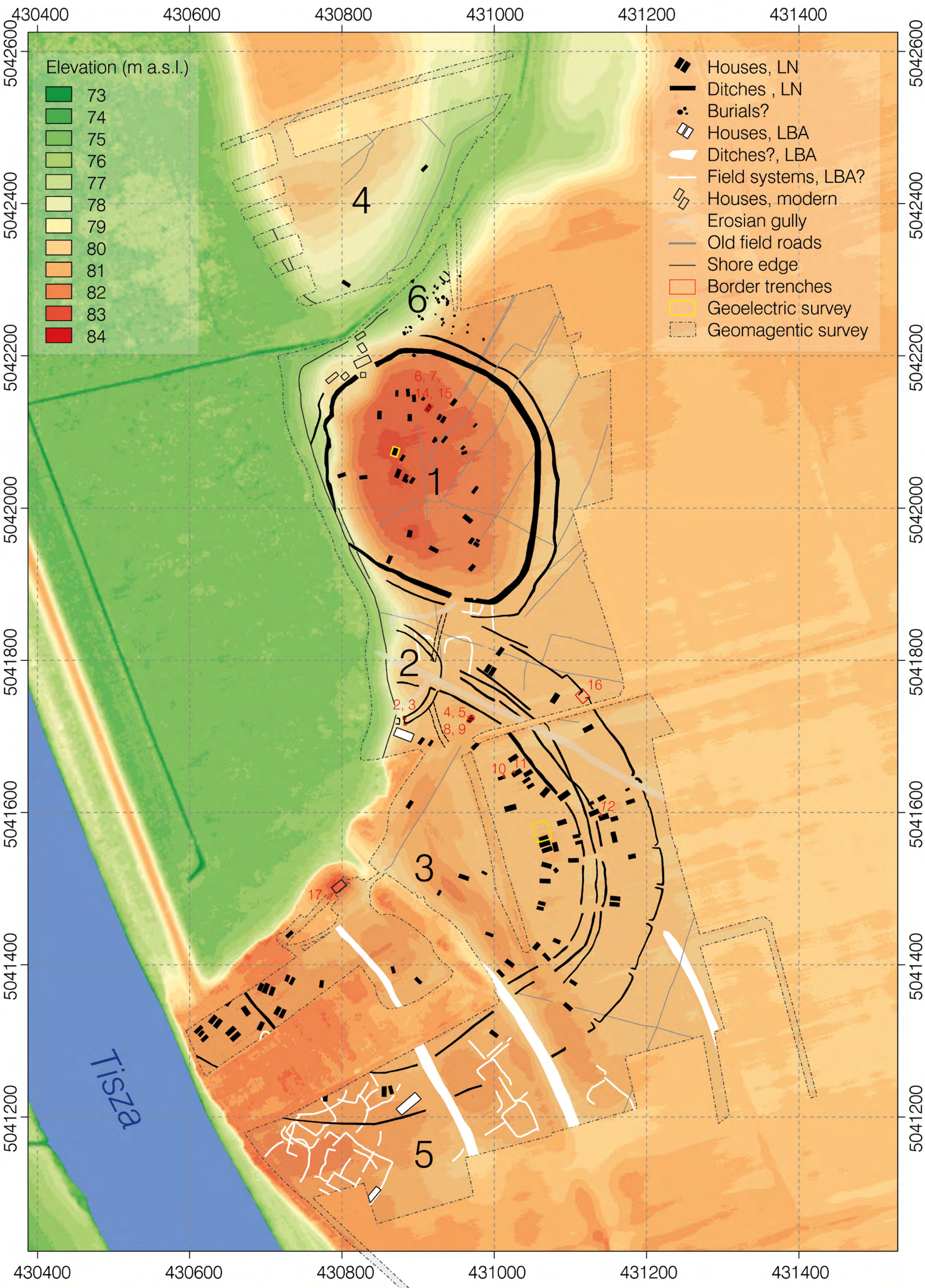

Fig. 2: Borđoš. Interpretative plan of the magnetic survey. The settlement components which are described in the text are marked with black numbers. The red numbers mark the excavation trenches. LN=Late Neolithic, LBA=Late Bronze Age. Base map: SRTM 1 Arc-Second Global. Geodetic system: WGS84 UTM34N (Source: R. Hofmann).

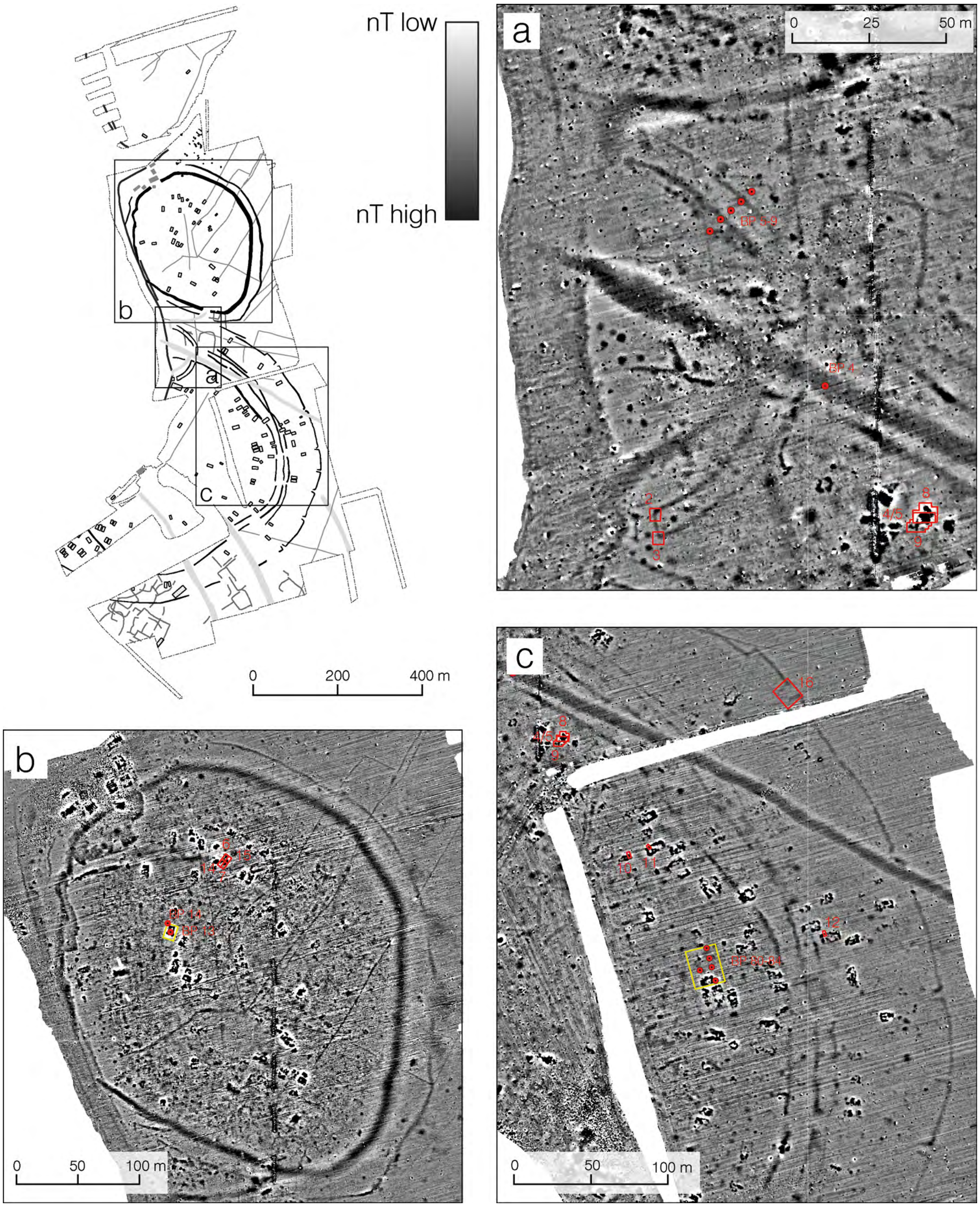

Fig. 3: Borđoš, plan of the magnetic survey with position of trenches, drilling cores, and areas surveyed using electrical resistivity measurements. a) rondel-like circular earthwork; b) enclosure tell settlement and possible cemetery north-east of it; c) north-eastern part of the flat settlement with gates (Source: R. Hofmann).

ping with the Neolithic flat settlement characterized by dispersed large longhouses and field systems with Late Bronze Age Gava ceramics.

To the northeast of the settlement mound, a group of small anomalies is visible which might represent a Neolithic or Late Bronze Age burial place with an area of 0.6 ha.

The main components of the Neolithic settlements are delimited by ditches. The settlement mound is enclosed by an up to 8 m wide inner ditch and a considerably smaller, 4 m wide outer ditch. Both ditches seem to have no entrance and are only interrupted by younger disturbances in the north and the west. In contrast, the parallel and considerably narrower ditches of the rondel-like enclosure are interconnected by traversal ditches where a 5–6 m wide interruption in the main ditches is situated in the south (Fig. 3a). In the flat settlement at least four ditches enclose an inner settlement area originally 20 ha size; a single

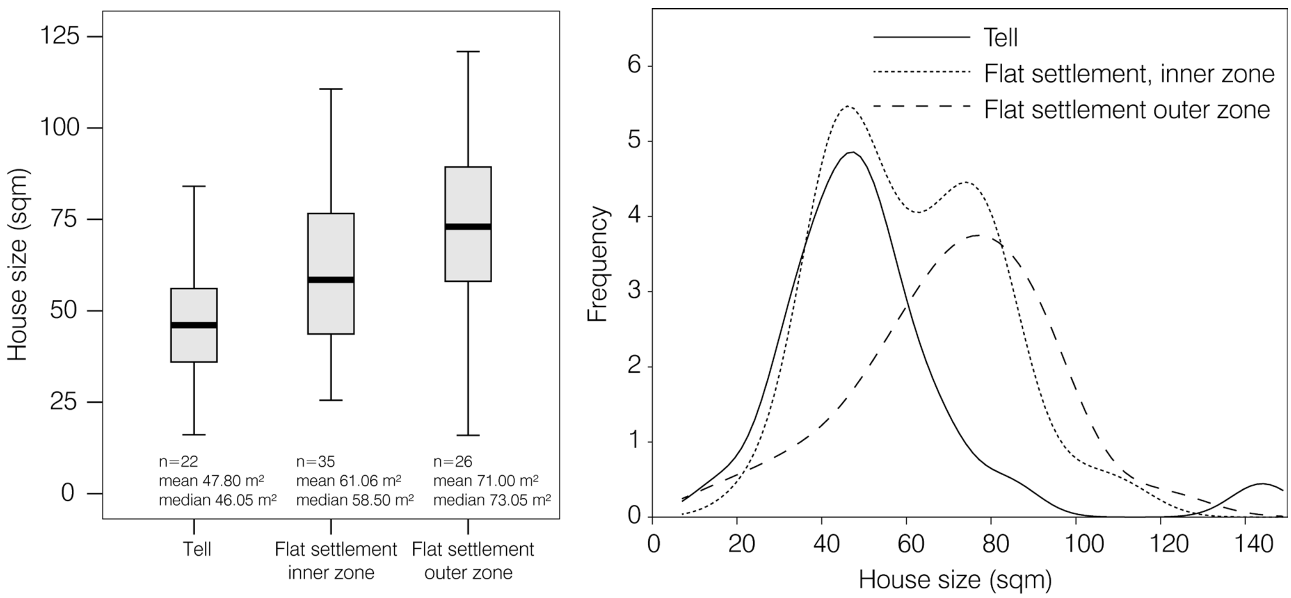

Fig. 4: Borđoš, Comparison of house sizes within the different settlement components: a) Boxplots, b) Kernel density distributions (Source: R. Hofmann).

outer ditch encircled a considerably larger area of 37 ha. Intersections of ditches in the inner bundle suggests that the ditches here were not contemporary, but are the result of repeated re-cuttings.

The ditches of both the inner and the outer enclosure of the flat settlement show interruptions which we interpret as gates (Fig. 3c). This interpretation is particularly well supported in the case of seven discontinuities in the outer ditch whose endings are turned inwardly towards the centre of the settlement. It is remarkable that these gates seem to be restricted to the eastern side of the settlement, while they are lacking in the north and the south. It is quite surprising that no obvious direct connection exists to the adjacent settlement mound. The gates of the outer enclosure ring correspond in at least three cases with interruptions in the inner bundle of ditches. This probably indicates long-lasting continuity of the entrances and the related path system.

Clues regarding the chronological relations of the different settlement parts can be only partly deduced from their spatial relationship in the plan of the magnetic survey. Firstly, the circular enclosure and the flat settlement cannot be completely contemporary since the inner bundle of ditches from the flat settlement run through the area of the enclosure. Secondly, contemporaneity of the settlement mound and the flat settlement cannot be excluded since the outer ditches of the flat settlement and the enclosing ditches of the settlement mound are located very close to each other without touching. The clarification of the temporal relationship of the two settlements was only possible by gaining additional evidence from drillings, targeted excavations, and radiocarbon dating.

The part of the flat settlement which is enclosed by the inner bundle of ditches shows a significantly higher density of disturbances represented by magnetic anomalies than the outer zone of the settlement. Most likely this difference can be best explained by a significantly longer occupation of the inner settlement zone.

In total, in the settlement mound and the flat settlement we can identify about 110 characteristic magnetic anomalies derived from burned houses with floor sizes between 15 and 114 m². Differences regarding size and direction of neighbouring anomalies indicate that not all houses belong to the same construction phase. With regard to the size of house anomalies, there are clear differences between the different zones of the settlement (Fig. 4). The houses in the tell settlement have a median of about 46 m², in the central part of the flat settlement about 60 m², and in the outer part of the of the flat settlement 73 m². A kernel density diagram shows a bimodal distribution for the central part of the flat settlement which might indicate the occurrence of houses from different periods.

The uneven distribution and the clustering of houses in both the flat settlement and the settlement mound suggests that the number of buildings was much higher and that the burning down of houses was due to chance rather than a general rule. Therefore, as evidence from other sites also suggests, we need to take into consideration numerous unburnt buildings which are not visible in the magnetic survey[14]. Perhaps the situation in the southwestern part of the flat settlement gives an impression of the actual building density and building arrangement. There, it is possible to observe groups of two or three houses arranged in parallel rows.

One of the most remarkable observations is the centripetal alignment of the longitudinal axes of the houses towards the settlement centre in both the area of tell settlement and the area of the flat settlement. This is particularly well visible in the area of the flat settlement. Thus, both settlements were organized according to a spatial principle which is so far almost unknown in the Banat and Vojvodina. Hitherto, similarly organized settlements were found exclusively in Transylvania and east of the Carpathian Mountains in Cucuteni-Tripolye settlements of the 4th millennium.

Systematic surface collections, drillings, and excavations

Based on the findings of the magnetic survey, systematic surface collections, drillings, and targeted excavations were performed during seven field campaigns. The sampling strategy aimed at a systematic comparison of the different settlement components and the establishment of an absolute and relative site chronology. In order to gain reliable information regarding the contextualization of ceramic styles and of economic data, two burnt houses were excavated completely in the flat settlement and the mound (area 3: trenches 4, 5, 8 and 9 and area 4: trenches 6–7, 15–16). Moreover, a total of three test trenches were excavated in houses of different size and location within the flat settlement in order to collect datable material from clear contexts (trenches 10–12). Furthermore, we excavated at the entrance of the rondel-like enclosure (trenches 2–3), in the area of a gate on the east side of the flat settlement (trench 14), and in the small mound which is located in the centre of the flat settlement (trench 17).

Analysis of intra-site find distributions recovered during systematic surface collections show considerable variability regarding surface find densities in the different settlement components. The tell area shows clearly higher find densities than the flat settlement which is most likely due to higher occupation intensity and building density, longer settlement duration, and ongoing erosion processes in the area of the settlement mound. The comparison within the area of the settlement mound reveals lower ceramic densities and higher degrees of fragmentation in its central part. We interpret this finding as an indication for the existence of a central unbuilt space since there are also no houses visible in this location in the picture from the magnetic prospection. Analysis of find distributions within the settlement mound furthermore shows concentrations of certain flint raw materials and differentiation between areas with tools and production remains (cores, flakes). Mixed find-assemblages in the southwestern part of the flat settlement reveal a large overlap of the Late Neolithic and Late Bronze Age settlements.

Through drillings and electrical resistivity measurements, in the area of the settlement mound we could identify anthropogenic deposits of up to 3 m thickness[15]. Due to the current high erosion intensity, however, a certain loss of substance from the upper layers cannot be excluded. In contrast, in the area of the flat settlement the conditions of preservation for near-surface features are much better, since here archaeological layers are superimposed by a 35–50 cm thick humus layer. This difference is responsible for the varying degrees of conservation of the two uncovered houses.

Both excavated houses were post-built constructions; the houses measured 5.6 [?] x 4.0 m and 9.0 × 4.5 m in the flat settlement and the settlement mound respectively. In both cases, the buildings had at least partly slightly elevated and heavily burned platforms. In the case of the house in the flat settlement, an intermediate wall encountered in situ enables the reconstruction of a floor plan with two rooms.

On top of the heavily burned platforms, house inventories of the last phases of use were preserved in situ in primary find contexts. In both fully excavated houses, Vinča (C2/D1 and D1 style) and Tisza (classical style) vessels occur together. Vinča pottery is represented by bowls and amphorae, Tisza pottery in particular by different kinds of bowls. However, it should be emphasized that most of the vessels are undecorated and can, before the completion of analysis, only preliminarily and not unambiguously be assigned to certain pottery styles. Differences between tell and flat settlement ceramics concern inter alia the frequency of styles: While inventories of the flat settlement component tend to show a balanced proportion of Tisza and Vinča pots, Vinča pots clearly dominate in the excavation area of the settlement mound. In the tell area it is possible that Proto-Tiszapolgár pottery also occurs.

Besides the different pottery styles and settlement characteristics, different flint raw materials like obsidian, radiolarites (Mecsek, Bakony), and shiny light grey brown

14 Hofmann *et al.* 2006; Tasić *et al.* 2016; Draşovean *et al.* 2017.

15 Medović *et al.* 2014; Stanković Pešterac *et al.* 2014.

(Volhynian?) flint as well as Spondylus prove external relations and exchange contacts in different directions. Accordingly, in the tell settlement, obsidian with 38 % of the 883 chipped stone artefacts (including micro-debris) is one of the most frequent stone raw materials, whereas radiolarite represents only 11 %, and shiny light grey brown flint 7 % of the assemblage. In contrast, only a total of 28 flint artefacts were found in the flat settlement despite a larger excavation area; in this assemblage there is a significantly lower proportion of obsidian (4 %), and similar proportions of radiolarite (11 %) and shiny light grey flint (7 %). However, a quantitative comparison between tell and flat settlement is difficult because of the low find densities in the flat settlement.

Our investigations at the gate of the rondel-like earthwork showed that the two parallel v-shaped ditches were backfilled in the same event. Consequently, the contemporary existence of the two parallel ditches is highly probable. Daub from the remains of buildings inside of the earthwork was included in the fill of the ditches. However, due to the location of the rondel at the modern edge of the terrace, the Neolithic surface is completely eroded and in situ building remains are not preserved.

Absolute chronology

Thirty-nine ^{14}C dates mostly obtained from short-lived sample material from drilling cores and excavation areas provide reliable information on the temporo-spatial development of the settlement complex from Borđoš (Tab. 2). These data were calibrated and modelled using the boundary function of the software OxCal 4.3 and the calibration curve INTCAL13[16]. The results obtained are displayed in Fig. 6 and summarised in Tab. 3.

According to these models the tell and the circular enclosure clearly represent the earliest settlement components: The oldest samples dated so far came from backfill layers of the ditch of the small earthwork, which was most probably completely backfilled and levelled within a short period between 5025 and 4950 BCE[17].

The oldest dates from the tell settlement derived from a drilling core situated in the centre of the mound. The deepest dated samples (Poz-63492 and Poz-63493) were obtained from a layer 2 m below the modern surface and about 0.75 m above the tell base. According to these dates, the habitation started in the area of the tell settlement with the highest probability in the time around 4950 BCE when the adjacent earthwork was already levelled. If we additionally take into consideration the settlement deposits below the deepest dated samples, an earlier onset and the simultaneous existence of tell and circular enclosure seems highly likely.

The uppermost levels (about 1 m thickness) of the tell settlement which correspond to the structures visible in the magnetic survey were excavated in trenches 6, 7, 15 and 16. The modelling of six available datings using the boundary function of the OxCal-software suggests the beginning of the last building horizon around 4730 BCE and an end of the tell sedimentation around 4515 BCE. However, in this model the youngest date Poz-90687 shows a poor agreement with the remaining data and the probability of the model amounts to only 79.3 %. If this date is excluded from the model, a considerably earlier end of the settlement activity before 4600 BCE is suggested. A similar result is obtained when we include the stratigraphic contexts of the sampled material into our model. When this information is included, however, higher levels of model agreement are only reached by exclusion of the dates Poz-90537 and Poz-90687. Preliminarily, from the point of view of the currently available data, the most probable scenario is that the occupation of tell ended in the last decades of the 47th century BCE.

From the flat settlement, 17 ^{14}C dates from four excavation areas are available. In this part of the site, settlement activities start after 4850 BCE and end in the most parts before 4700 BCE. Younger dates from the 47th century originate exclusively from a deposition of 25 vessels which were placed next to the gate in trench 14. Most likely these vessels belong to a group of cremation burials which were interred after the flat settlement was already abandoned and the outer ditch of the settlement was levelled.

So far, dates from the tell settlement that clearly fall into the chronological range of occupation of the flat settlement are absent. Therefore, it is still an open question whether the settlement mound was continuously populated or whether the settlement activities were interrupted during the existence of the flat settlement. Attempts to address this question and to test different sedimentation scenarios by means of age-depth models unfortunately failed due to the small sample size.

16 Bronk Ramsey 2009; 2017; Reimer *et al.* 2013.

17 As they clearly deviate from all other dates in our model, we excluded two very old dates (Poz-63490 and Poz-63491) which were obtained from a drilling core directly above the ditch bottom. Since charcoal of oak was used as sample material, old-wood effects are assumed to be responsible for the early dating in the 7th millennium BC.

Tab. 2: Borđoš, List of ^{14}C dates.

laboratory-id	14c date	sample material	taxon	sample material details	N (%)	C (%)	col (%)	trench-id	find-id	feature-id	level	x	y	context
Poz-63488	6110 ± 90	charcoal	indet.	drilling core BP1008 -158 cm				1	1195					circular earthwork, backfilling ditch
Poz-63490	7690 ± 100	charcoal	indet.	drilling core BP1008 -234 cm				1	1197					circular earthwork, base ditch
Poz-63491	7260 ± 180	charcoal	indet.	drilling core BP1008 -246 cm				1	1198					circular earthwork, base ditch
Poz-63492	6000 ± 35	charcoal	oak cf.	drilling core BP1013 -200 cm				1	1201					settlement mound, settlement layer
Poz-63493	6010 ± 35	charcoal	oak or elm	drilling core BP1013 -200 cm				1	1202					settlement mound settlement layer
Poz-63509	6270 ± 80	charcoal	oak cf.	drilling core BP1008 -200 cm				1	1196					circular earthwork, backfilling ditch
Poz-63510	6060 ± 60	charcoal	oak cf.	drilling core BP1013 -168 cm				1	1200					settlement mound, settlement layer
Poz-90469	6055 ± 35	bone	cattle	part skull	1,8	7,1	3,1	3	3066	3009	2	C	3	circular earthwork, area 2, back-filling ditch, above daub layer
Poz-90470	6110 ± 40	bone	cattle	tibia, distal, left	1,2	6	5	3	3035	3009	3	D	2	circular earthwork, area 2, back-filling ditch, above daub layer
Poz-90471	6115 ± 35	bone	cattle	scapula, right side	0,9	4,7	2,5	2	2091	2023	6	C	3	circular earthwork, area 2, back-filling ditch, layer with daub
Poz-90472	6100 ± 40	seed	triticum sp., triticum cf.					2	2053	2023	5	B	3	circular earthwork, area 2, back-filling ditch, layer with daub
Poz-90473	6020 ± 40	bone	cattle	young, molar m1 or m2	0,8	4,5	2	2	2107	2030	7	C	4	circular earthwork, area 2, back-filling ditch, below daub
Poz-90475	6110 ± 40	seed	prunus	4 mg				2	2104	2030	7	B	3	circular earthwork, area 2, back-filling ditch, below daub
Poz-90476	325 ± 30	bone	medium herbivorous mammal	long bone (humerus or femur)	1,3	5,5	6,6	4	4026	4002	2	C	13	flat settlement, area 3, above burnt wall debris

Poz-90477	6040 ± 40	bone	cattle	phallanx 3	1,8	6,8	4,2	4	4109	4003	4	F	12	flat settlement, area 3, burnt wall debris, last phase of use?
Poz-90479	5850 ± 35	bone	large herbivorous mammal	long bone	1,1	7	0,7	9	9186	9009	4b	E	10	flat settlement, area 3, burnt wall debris, last phase of use?
Poz-90480	5920 ± 40	bone	large herbivorous mammal	metacarpus, eroded	1,9	7,7	2,2	8	8246	8011	6	D	14	flat settlement, area 3, below floor
Poz-90481	5830 ± 40	bone	medium herbivorous mammal	long bone	1,8	7,6	2	8	8250	8011	6	E	15	flat settlement, area 3, below floor
Poz-90534	5795 ± 30	bone	large herbivorous mammal (90 % cattle)	femur	2,1	7,9	2,1	6	6033	6003	3	D	10	settlement mound, area 4, above daub
Poz-90535	5840 ± 40	bone	large herbivorous mammal	long bone	1	5,6	2,4	6	6109	6004	4	C	9	settlement mound, area 4, burnt house debris
Poz-90536	5815 ± 35	bone	cattle	pelvis	0,4	6,4	1,6	6	6180	6010	5	C	9	settlement mound, area 4, on top/between/below floor
Poz-90537	5740 ± 35	bone	cattle	metatarsus	2,9	9,4	0,8	16	16482	16013	5	C	4	settlement mound, area 4, below house
Poz-90538	5875 ± 35	bone	cattle	femur	1,4	7,4	4,8	16	16465	16013	5	B	5	settlement mound, area 4, below house
Poz-90539	5890 ± 40	bone	large herbivorous mammal	long bone	1,6	7	2,4	10	10056	10004	3	A	3	flat settlement, area 5, under burnt wall debris
Poz-90540	5980 ± 40	bone	cattle	astragalus	2,1	8,5	3,2	10	10127	10004	4	A	1	flat settlement, area 5, under burnt wall debris
Poz-90541	5955 ± 35	bone	cattle	metacarpus	1,2	6,6	2,3	10	10131	10007	4	A	3	flat settlement, area 5, layer below floor
Poz-90578	5880 ± 40	seed	cerealia indet./leguminosae sativae indet.	8 mg				8	8224	8005	5	D	15	burnt wall debris, last phase of use?
Poz-90676	5900 ± 40	bone	cattle	pelvic region, part of acetabulum, ishium	1,6	6,6	5,6	11	11030	11004	3	A	2	between construction debris
Poz-90679	5950 ± 40	bone	large herbivorous mammal (70–80 % deer)	calcaneus	0,7	5,5	0,8	11	11040	11005	6	A	2	layer below floor
Poz-90680	5860 ± 120	bone	cattle	femur head	1,4	6,7	3,1	14	14065	14004	3	M	10	flat settlement, gate in the outer ditch, southern end, upper filling

Tab. 2: (continued)

Poz-90681	5910 ± 40	bone	cattle	metacarpus	2,9	10,5	5,1	14	14200	14007	5	M	10	flat settlement, gate in the outer ditch, southern end, lower filling
Poz-90682	5860 ± 40	bone	cattle	proximal shaft fragment (trochan-ter minor)	1,1	5,2	1,6	14	14345	14007	8	L	4	flat settlement, gate in the outer ditch, southern end, lower filling
Poz-90683	5900 ± 35	bone	cattle	horn	1,2	5,1	2,9	14	14392	14007	6	L	6	flat settlement, gate in the outer ditch, southern end, ditch bottom
Poz-90685	5990 ± 40	antler	red deer	antler	0,9	4,4	3,6	14	14394	14007	8	L	9	flat settlement, gate in the outer ditch, southern end, ditch bottom
Poz-90687	5670 ± 40	bone	cattle	phalanx 1	0,4	5,8	1,1	6	6101	6004	4	B	9	settlement mound, area 4, burnt house debris
Poz-90689	5800 ± 40	seed	pea	21 g				14	14154	14004	2c	L	2–3	flat settlement, vessel group, vessel fill (amphora), height of the neck!
Poz-97241	5850 ± 35	seed	pea	7 mg				14	14146	14004	2c	K-L	2	flat settlement, vessel group, vessel group (cremation burial) beside the ditch; vessel content (under part north)
Poz-97242	5840 ± 35	seed	cerealia indet.	5 mg				14	14158	14004	2c	K	3	flat settlement, vessel group, vessel group (cremation burial) beside the ditch, vessel content

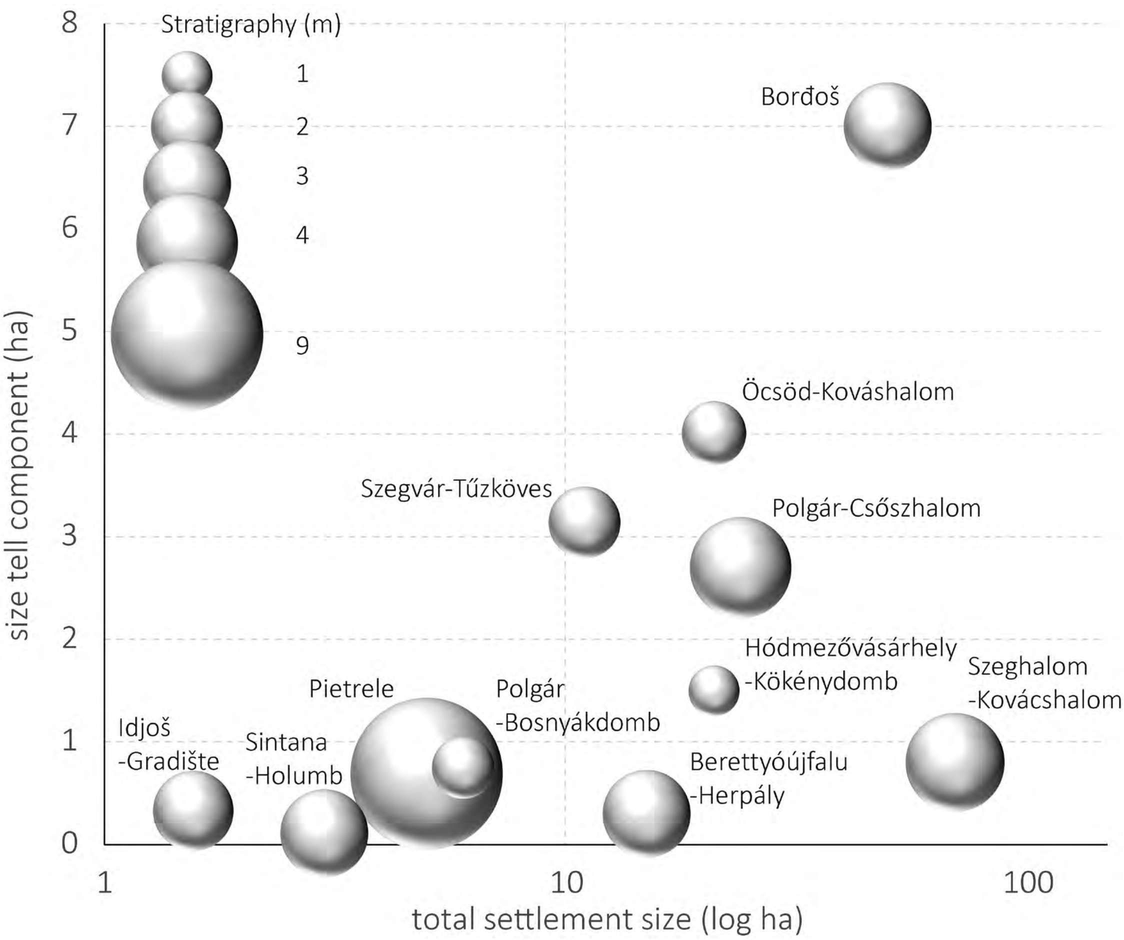

Fig. 5: Selected multicomponent sites of Southeast Europe. Comparative representation of total size, size of the tell component, and the thickness of stratigraphy. The underlying data are listed in table 1 (Source: R. Hofmann).

Borđoš in context: Regional settlement dynamics and local spatial patterns

Late Neolithic population agglomeration processes in the Tisza region were accompanied by a significant decrease in regional settlement density and number[18]. The result of these agglomeration processes was large flat, tell, or multicomponent sites. At the latest, around 4500 BCE reverse processes led to a sharp increase of the number of settlements and decrease of settlement sizes.

Large multicomponent sites in wide parts of the study area are considered as "focal points", central places, or "supersites" within discrete settlement clusters. These Late Neolithic settlement clusters are supposed to represent groups of sites which were spatially separated from each other by unsettled areas, including catchment areas in the size range between 14 and 72 km^2[19]. This grouping or clustering of sites is interpreted as an indication of some kind of regional "tribal organisation". The term describes segmented and decentralised integrative social units above the societal level of extended family units or bands which might be the result of regular interaction[20]. A settlement structure deviating from the described pattern was found for the Herpály group in the catchment of the Körös River; there, the density of settlement mounds is in general much higher and their size very small[21].

Borđoš represents one of the southernmost multicomponent sites in the eastern Tisza region, situated at the northern distribution limit of the Vinča cultural complex. Comparable settlement complexes are concentrated in

18 Sherratt 1982; 1983; Kalicz 2001; Parkinson/Gyucha 2012.

19 Parkinson 2006, 139–144; Raczky/Füzesi2016.

20 Parkinson 2006, 17–18.

21 Kalicz 1995; Link 2006.

Tab. 3: Borđoš, Results of Bayesian modelling of ^{14}C dates (for details, including OxCal-codes, consult supplemental material S1).

Model description	modeled event	modeled age (68.2 %)	modeled age (95.4 %)	median	highest probability	Indices	Remarks
circular earthwork (trenches 2 and 3) 6 dates	start ditch backfilling	5050–4991	5090–4991	5023	5025	A_{model}=77.5 $A_{overall}$=90.6	
	duration backfill 1	0–23	0–78	10	10		
	transition backfill 1–2	5033–4986	5047–4960	5007	5020–5000		
	duration backfill 2	0–19	0–49	9	5		
	transition backfill 2–3	5019–4969	5036–4946	4994	5000		
	duration backfill 3	0–27	0–93	12	3		
	end ditch backfilling	5006–4943	5036–4895	4974	4990		
tell settlement, upper layer (trenches 6, 7, 15, 16) 6 dates	start area 3	4812–4696	4923–4621	4758	4730	A_{model}=80.1 $A_{overall}$=76.7	Poz–90687 excluded (poor agreement 58.8 %)
	duration area 3	71–350	0–524	240	250		
	end area 3	4619–4451	4683–4341	4525	4515		
tell settlement, upper layer (trenches 6, 7, 15, 16) 6 dates	start area 3	4793–4692	4893–4623	4743	4743	A_{model}=92.7 $A_{overall}$=93.9	Poz–90687 excluded (poor agreement)
	duration area 3	0–188	0–399	132	0–100		
	end area 3	4686–4572	4708–4451	4615	4620		
tell settlement, upper layer (trenches 6, 7, 15, 16) 6 dates	start area 3	4808–4711	4991–4685	4770	4740	A_{model}=125.4 $A_{overall}$=122.9	Poz–90687 excluded (poor agreement) Poz–90536 excluded (unclear context)
	levelling layer under house	0–68	0–244	37	20		
	house construction/start house use	4754–4694	4795–4655	4723	4720		
	duration house use	0–55	0–122	33	30		
	end house use	4723–4657	4751–4601	4689	4690		
	duration after house use	0–74	0–249	39	10		
	end after house use	4706–4591	4725–4416	4636	4680		
horizontal settlement (trenches 4, 5, 8, 9) 5 data	start house construction	4803–4731	4897–4710	4776	4770	A_{model}=98.4 $A_{overall}$=102	Poz–90477 excluded (poor agreement)
	duration house construction	0–47	0–157	24	0–50		
	house construction–house use	4768–4719	4790–4699	4744	4770–4720		
	duration house use	0–43	0–140	22	0–40		
	end house use	4755–4686	4784–4607	4715	4730		
horizontal settlement, (trench 10) 3 dates	start house construction	4934–4802	5193–4753	4881	4840	A_{model}=95.9 $A_{overall}$=97.8	
	duration house construction	0–84	0–352	42	20		
	house construction–house use	4861–4786	4906–4751	4825	4820		
	duration house use	0–86	0–261	45	30		
	end house use	4827–4727	4885–4585	4773	4790		

Tab. 3 (continued)

horizontal settlement, (trench 11) 2 dates	start house construction	4951–4782	5306–4726	4896	4840	A_{model}=110.2 $A_{overall}$=109.1
	duration house construction	0–117	0–509	61	40	
	end house construction–start house use	4840–4751	4895–4720	4799	4800	
	duration house use	0–116	0–474	61	50	
	end house use	4821–4676	4886–4332	4729	4730	
horizontal settlement (trench 14) ditch 5 dates	start ditch fill 1	4897–4784	5041–4733	4841	4810–4840	A_{model}=104.4 $A_{overall}$=108.1
	duration ditch fill 1	0–98	0–271	57	25–55	
	transition ditch fill 1–2	4808–4794	4836–4722	4781	4785	
	duration ditch fill 2	0–69	0–186	40	55	
	end ditch fill 2	4781–4701	4822–4601	4732	4730	
horizontal settlement (trench 14) vessel group 3 dates	start vessel group	4807–4692	5051–4619	4750	4715	A_{model}=119.6 $A_{overall}$=116.5
	duration vessel group	0–186	0–660	106	25	
	end vessel group	4715–4588	4765–4300	4645	4690	

the middle and lower course of the Tisza and Körös River, while north of the Körös valley only isolated examples exist (Fig. 1, Tab. 1). These sites show a marked variability regarding size and spatial layout. Only in rare cases do such multicomponent settlements show sizes of more than 20 ha. Regarding both the total size and size of the tell component, Borđoš is at the upper limit of such settlements (Fig. 5).

Modelled ^{14}C dates and relative chronologies from 12 multicomponent sites in the wider study area clearly reveal regionally different trajectories of development (Fig. 6, Tab. 1, S1–2). Paralleling the gradual northward spread of the specific mound-forming settlement behaviour, the start of the formation of the tell components was staggered. While in the southern part of the Tisza region the accumulation of settlement mounds began around 5200 BCE, the onset of mounds in the Körös River Basin occurred slightly later around 5000 BCE[22]. In the distribution area of the Herpály group in the middle course of the Körös River, tell formation started not before 4850 BCE and with highest probability dated in the 46th, 45th and 44th centuries BCE. The same is true for the area north of the catchment of the Körös River, where settlement mounds represent a general exception exclusively related to large central sites of the Csőszhalom Group. After 4700 BCE the ^{14}C datings in the southern part of the study area decrease while they increase in the northern part. In all regions, tells were abandoned at the latest by 4450 BCE.

Although far fewer ^{14}C dates are available from the flat settlement components of these complex sites, the onset of this phenomenon appears to have been much more uniform across the study region. The flat settlements from Borđoš and Polgár-Csőszhalom both date to the time between 4850 and 4700 BCE. Also, according to their relative-chronological synchronisation with “classical Tisza”[23] and Vinča C2/C–D[24], the flat-components in the settlements Idjoš, Szeghalom-Kovácshalom, and Öcsöd-Kováshalom most likely date to the same period. The settlement of Berettyóújfalu-Herpály seems to represent an exception, since here the flat component was occupied earlier and related to Early Tisza/Late Szakálhát.

According to the collected data, the period between 4850 and 4700 BCE marks the climax of the Late Neolithic population agglomeration within large multicomponent settlements of the Tisza region. In the southern parts of the study area, we observe the enlargement of already existing tell settlements by large flat settlements, while at the same time in the upper courses of the Tisza and Körös Rivers the formation of new flat sites took place. In con-

22 Raczky 2015.

23 Chronology after Horváth 2005.

24 Chronology after Tasić *et al.* 2016.

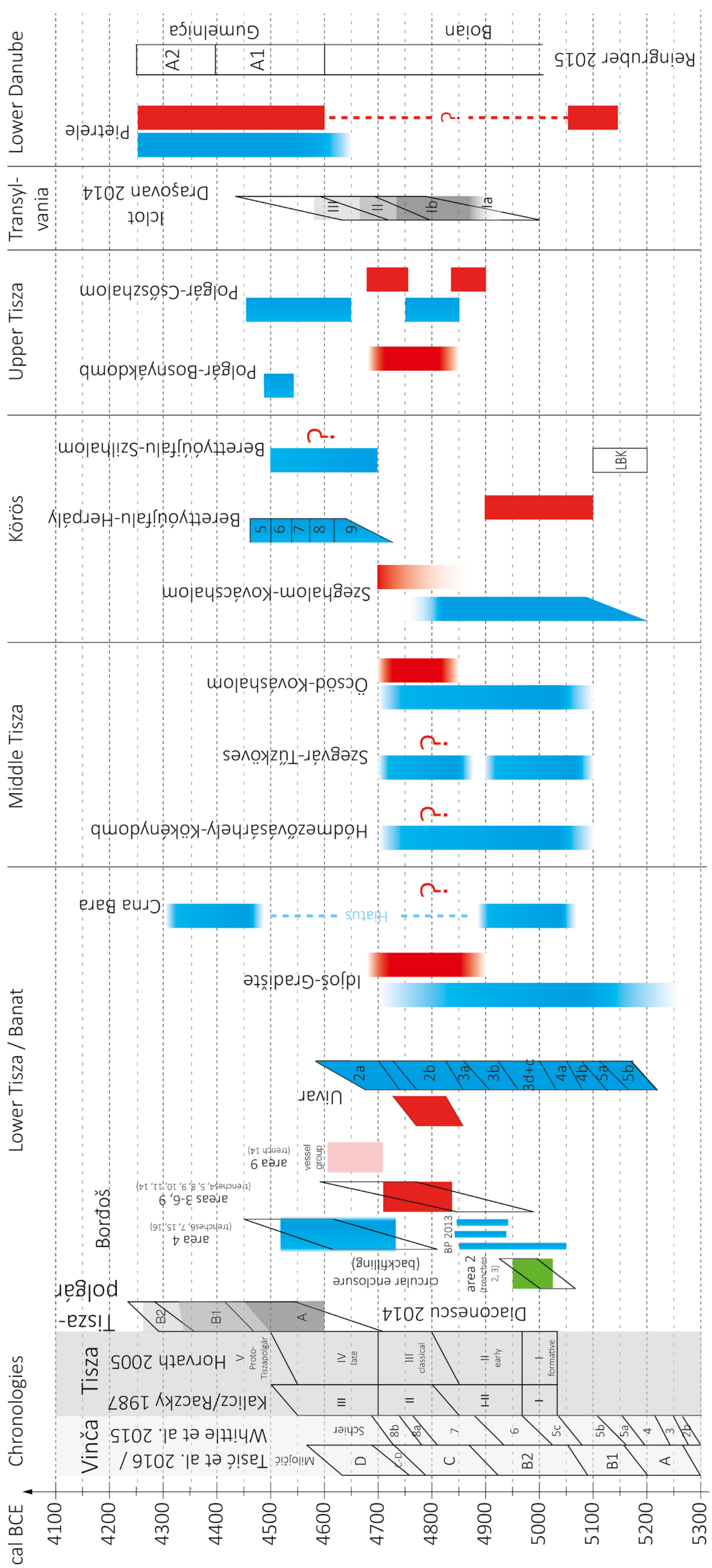

Fig. 6: Modelled ^{14}C dates and absolute dating probabilities derived from relative-chronological classifications of multicomponent sites in the Tisza region and the Lower Danube region. (Graphic: R. Hofmann).

trast to the south, in the north tells should not be understood as the original nuclei of large settlements, but rather as longer occupied possibly separated areas within such flat sites which might have had special functions leading to the different spatial behaviours. Indicators for possible special functions of tell components were found in settlements of the Csőszhalom-group like Polgár-Csőszhalom and Hajdúböszörmény-Pródi-halom. In those sites the tell components developed within rondel-type circular enclosures which emerge slightly later also in Lengyel contexts in the western part of the Carpathian Basin. In contrast to many Transdanubian cases, within the interior space of the earthwork from Polgár-Csőszhalom intensive settlement activity took place, possibly associated with a building with special functions[25].

Concerning the subsistence strategies in these sites, data on animal exploitation and plant cultivation indicate an intensive mixed farming economy, within which horticulture and animal husbandry potentially represent interdependent components due to the demand for animal excrement for manuring[26]. Isotope data show a distinct and surprising lack of mobility of humans and animals which is interpreted as an indicator for an intensive garden economy with a high demand on man power[27]. So far, in contrast to settlements in the central and western Balkan low-middle mountain ranges[28], there are also no clear indicators for seasonal forms of transhumance in the adjacent uplands.

From around 4700 BCE on a surprisingly consistent reversal trend towards de-nucleation and the development of more dispersed settlement patterns began. This is the case not only the Tisza Region[29], but also in the much larger areas of the Western and Central Balkans[30]. Around 4700 BCE not only many flat site components in the Tisza and Körös River Basin were abandoned, but also many tell sites in the distribution areas of societies with Vinča and Butmir pottery styles.

Multicomponent sites show a wide range of settlement layouts which might indicate different degrees of communal integration. In cases like Polgár-Csőszhalom, Szeghalom-Kovácshalom, or Uivar tells are situated in the centres of more or less extensive flat settlements which seems to indicate direct mutual relations and perhaps also special functions of the tell components. In other cases, like Borđoš, the settlement mounds and the flat settlements form discrete units.

Concerning the social relations between the different settlement components, there are different patterns. When the settlement layouts are uniform between different components in sites like Borđoš, this may be interpreted as showing higher degrees of communal integration. In contrast, for sites like Szeghalom-Kovácshalom, where houses in the flat settlement are grouped in potentially more independent small clusters or neighbourhoods, less community-wide integration and higher independence of neighbourhoods seems likely. A more dispersed distribution of settlement activities has also been proven in the settlement Öcsöd-Kováshalom, where around the central tell-like locus 7 several horizontal habitation clusters developed.

A new aspect of settlements which must be considered for the Banat and Vojvodina – and is exhibited, for the first time, at Borđoš – is what can be called the centripetal spatial layout: houses arranged around the centre of the settlement forming a central open space on both settlement mounds and in the flat settlements (Fig. 7). So far, such a centripetal settlement layout in the wider working area is exclusively known from Iclod, Transylvania and from settlements of the Cucuteni-Tripolye complex east of the Carpathians[31]. In the Cucuteni-Tripolye cultural complex, variants of such settlement layouts represent the predominant principle of settlement organisation, starting at the latest in the last centuries of the 5th millennium BCE[32]. In contrast, in the central and western Balkan region, and also in the Tisza region, a settlement organisation with uniformly oriented, free-standing houses is the most common (Fig. 8). However, both organisational principles show major variability regarding the degree of row-formation, building density, arrangement and grouping of houses, and location of central squares. This variability is likely due to differences in household composition (e. g. nuclear family vs. multi-family households)[33].

Discussion

Considering the temporal dynamics of multicomponent sites and their different properties, as laid out above, combinations of tells and flat settlements in the Tisza region are likely in the most cases the result of an overall trend

25 Raczky/Sebők 2014.
26 Hoekman-Sites/Giblin 2012.
27 Giblin *et al.* 2013; Hoekman-Sites/Giblin 2012; Gamarra *et al.* 2018.
28 Müller-Scheeßel *et al.* 2010b; Hoekman-Sites/Giblin 2012.
29 Link 2006; Raczky 2015; Bánffy *et al.* 2016.
30 Borić 2015; Whittle *et al.* 2016; Hofmann 2015.
31 Shishkin 1985; Rassmann *et al.* 2014.
32 Hofmann *et al.* 2016.
33 Tripković 2009.

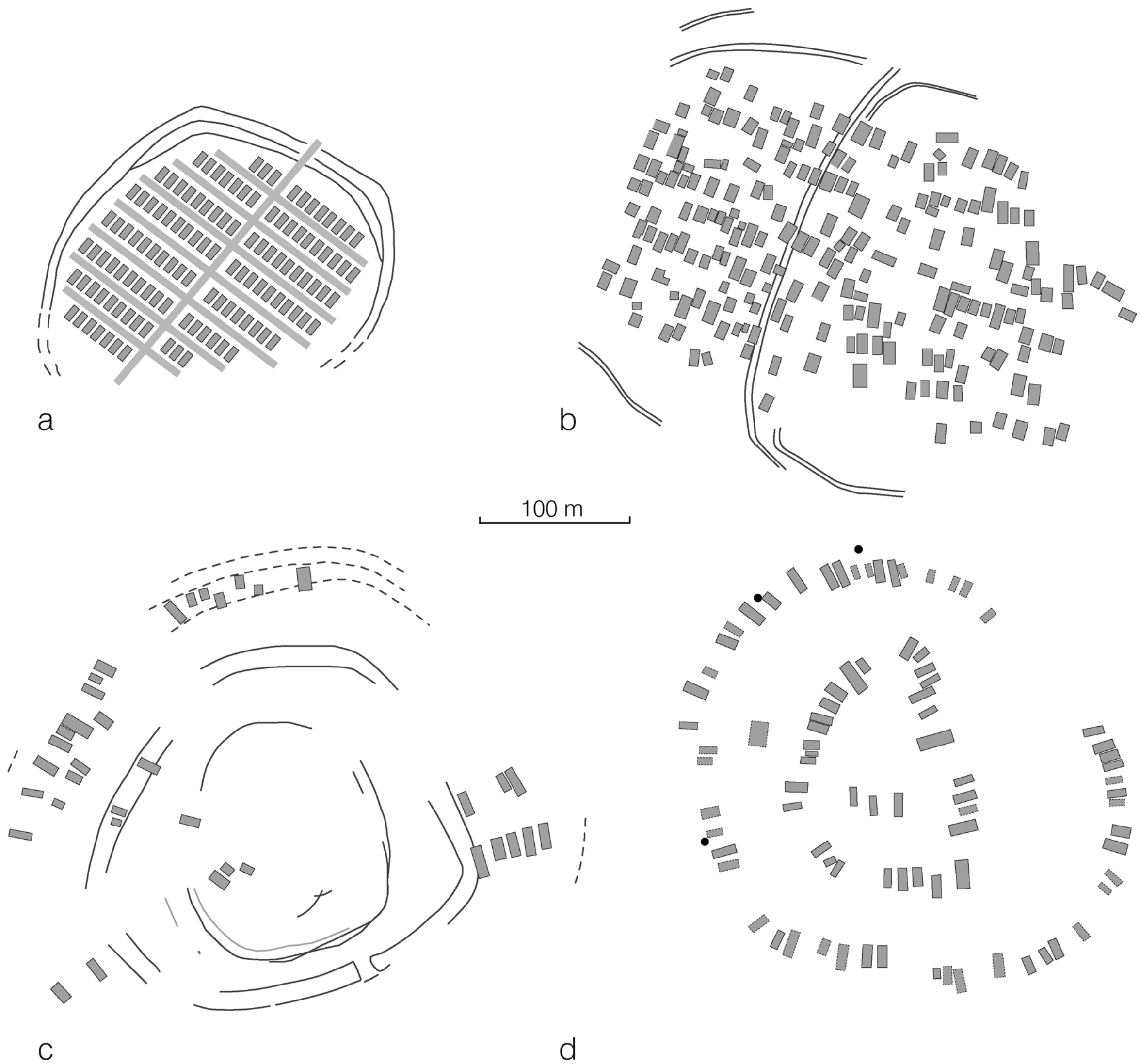

Fig. 7: Examples of different principles of settlement organisation from Southeast and East Europe: a) Okolište (after Müller-Scheeßel *et al.* 2010a) – "true row pattern" with houses arranged in dense rows; b) "false row pattern" with equally directed houses which are, however, not so clearly arranged in rows and might in many cases not be contemporary; c) Iclod (after Mischka 2012) – centripetal pattern with central public square; d) Moshuriv (after Ohlrau 2019) – centripetal pattern with circumferential main road.

of continued agglomeration processes which show different regional trajectories. At the middle and lower course of the Tisza River, like in the case of Borđoš, pre-existing tell settlements constituted the starting point of settlements which later were greatly enlarged. Contrastingly, in the Körös and Upper Tisza region, tells represent distinct areas within the larger flat settlements which developed into spatially more fixed tell structures. Thus, they are the result of the reduction of the settlements in size or – as probably in the case of Polgár Csőszhalom – related to special functions[34].

The development of large multicomponent settlements reflects the general trend in Southeast Europe towards population agglomeration which started between 5300/5200 and 4800 BCE in a regionally differentiated manner and reached its climax between 4850 and 4700 BCE. The trend is likely the result of population growth and inter-site mobility. A reversal of this trend after 4700 BCE is clearly visible and led, until 4450 BCE, to the gradual reorganization of settlement patterns towards much smaller, more dispersedly distributed communities. Frequently, large flat settlements were given up in the course of this process while many tells "survived" the following 200 years, or rather only then emerged in settlements clearly reduced in size.

34 Raczky/Sebők 2014.

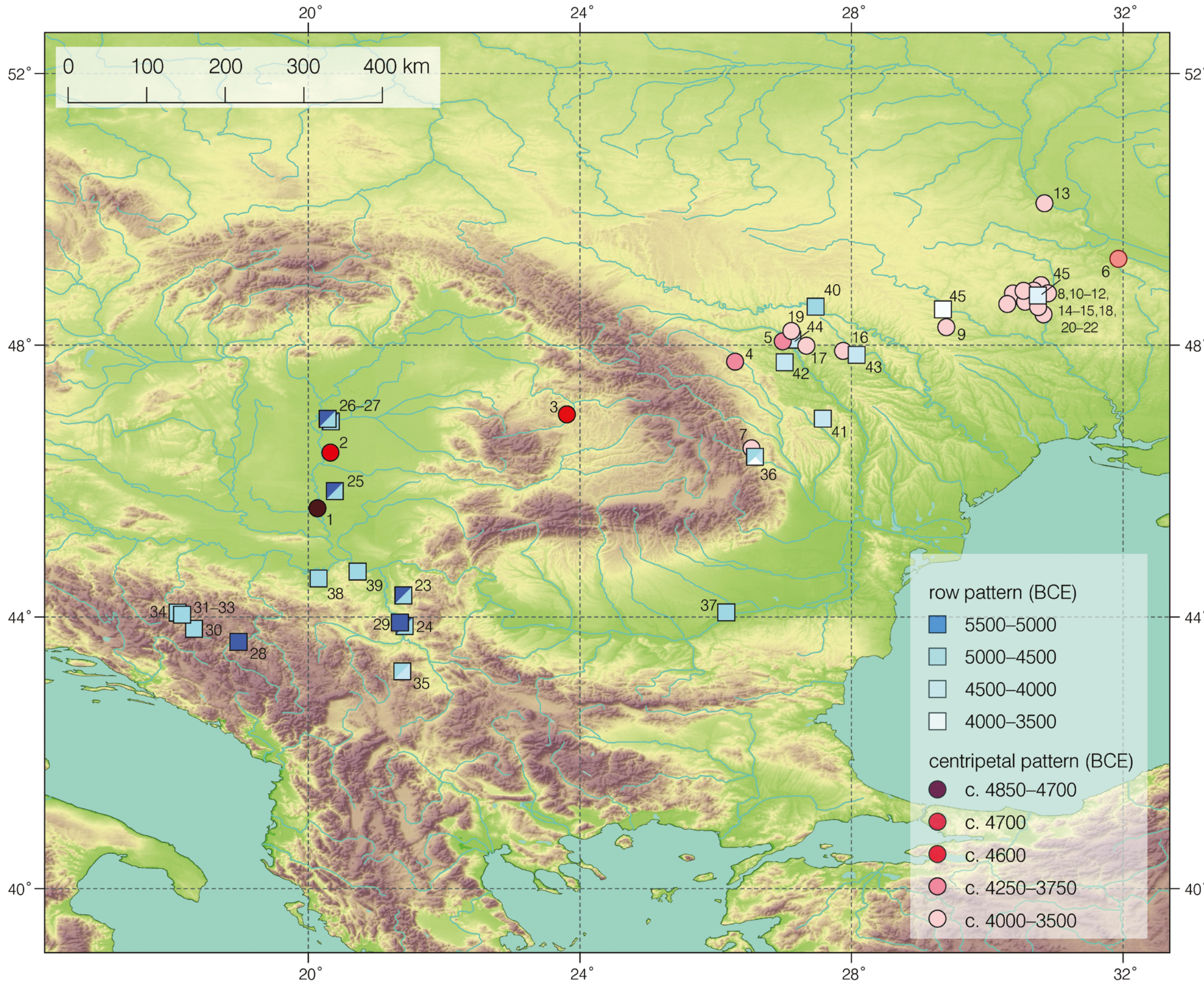

Fig. 8: Map of settlement layouts with row pattern and centripetal pattern in a transect between the western Balkan peninsula and the Dnieper. Base map: SRTM 1 Arc-Second Global. Geodetic system: WGS84 latitude longitude. Centripetal pattern: 1 Borđoš; 2 Hódmezővásárhely-Gorzsa; 3 Iclod B; 4 Adâncata-Dealul Lipovanului zone B; 5 Brinzeni 8; 6 Grebeni; 7 Poduri-Dealul Ghindaru; 8 Apolianka; 9 Bilyi Kamin; 10 Dobrovody; 11 Fedorivka / Mykhailivka; 12 Glybochok, Hlybochok; 13 Kolomijschina 1; 14 Maidanetske; 15 Nebelivka; 16 Petreni; 17 Stolniceni I; 18 Talianki; 19 Trinca-Izvorul lui Luca; 20 Volodymyrovka; 21 Yampil; 22 Yatranivka I. Row pattern: 23 Belovode; 24 Drenovac, Slatina – Turska Česma; 25 Idjoš–Gradište I; 26 Öcsöd-Kováshalom A; 27, Őcsőd-Kováshalom B; 28 Jagnilo; 29 Paraćin-Motel Slatina; 30 Butmir; 31–33 Okolište; 34 Kundruci; 35 Pločnik; 36 Poduri-Dealul Ghindaru; 37 Pietrele I-Magura Gorgana; 38 Stubline-Crkvine; 39 Vinča-Belo Brdo; 40 Bernashevka; 41 Scânteia-Dealul Bodeştilor; 42 Truşesti; 43 Putineşti III; 44 Brinzeni-Ostriv; 45 Trostianchyk; 45 Grebenyukuv Yar (Source R. Hofmann).

Comparing the central and western Balkan uplands[35] and the Tisza region[36], a widely synchronous development of settlement agglomeration took place albeit in different ways (larger tell settlements as opposed to multicomponent sites). An important difference is that the settlement behaviour which led to the emergence of tells was a longer-lived tendency in the Tisza region. In the Tisza region post-agglomeration development took the character of a gradual reorganization, while that in the Central Balkans seems to a much greater extent to be associated with depopulation. In the former region the “cultural concept” of long-lasting settlement permanence and the social configuration behind it eventually loses its importance. Instead, intra-mural and later extra-mural cemeteries evolved into spatial anchors and focal points of societies[37].

In spite of the locally focused requirements of the subsistence economy (see above), in Borđoš and other large

35 Link 2006; Borić 2015; Hofmann 2015.
36 Raczky 2015; Bánffy *et al.* 2016.
37 Link 2006.

settlements clear indications for complex regional interaction and exchange in different directions are abundant. In consideration of its specific characteristics, complex multi-level regional networks and interactions, including inter-group mobility and admixture, are much more likely than the traditional culture-historical premise of culturally homogeneous peoples. In Borđoš, for example, the regular use of both Vinča and Tisza style pottery vessels in the same houses clearly points to the existence of overlapping, or simultaneously active, social relations with different regions, namely the Balkans and the Carpathian Basin. In addition, as referred to above, a differential occurrence of flint raw materials between tell and flat settlement also points to the existence of different regional networks intersecting on the site. This seems to be in accordance with different attitudes of flint use connected with the two spatial spheres of the Polgár settlement complex[38].

Further references to external social relations can be seen in elements of the settlement plan. For example, the occurrence of the circular enclosure with a double ditch spatially separated from the settlement during the earliest phase of the settlement has its best parallels in other regions of the Carpathian Basin[39]. The enclosure represents one of the earliest known cases in which the endings of the double ditch are radially connected with each other. This type of gate occurs in Iclod and also in numerous circular Lengyel enclosures of the 48th and 47th century BCE[40].

Other aspects of the settlement plan from Borđoš cannot be connected to any specific region so far. Widely known, but not concentrated in regions are, for example, v-shaped ditches which are regularly used in both Lengyel enclosures and certain Vinča settlements[41]. The circular layout of Borđoš has earlier analogies in Uivar in the Banat[42], but also in the probably slightly younger Lengyel settlement Sormás Török-földek in Transdanubia[43] or in Iclod in Transylvania[44]. In Sormás Török-földek we also find numerous gates, which, however, do not show inwardly directed ditch endings. Analogies for such gates are actually only found in Lengyel circular enclosures, where they seem to be slightly younger[45]. In contrast to the centripetal arrangement in Borđoš, houses in Lengyel settlements usually show uniform north-south orientation.

In the settlement of Iclod in Transylvania we observe a spatial configuration similar to Borđoš, with houses also directed towards the centre of the settlement[46]. Also in Dimini in Thessaly, Greece, concentric rings of houses are grouped around the settlement centre which is accessible through radial alleys[47]. However, in both cases the exact dating and the internal chronology of these layouts remain unclear: Dimini is dated between 4800 and 4500 BCE[48]. In the case of Iclod only the innermost ditch is dated to early stages of the Iclod group[49], while the centripetal arrangement of houses visible in the magnetic plan most likely represents a later stage of the settlement. According to radiometric data from associated cemeteries, this later phase should be dated rather around or after 4700 BCE than before[50].

Overall, the multiple external relations materialized in both settlement configuration and material culture at Borđoš should be highlighted. Corresponding hybrid fusions of differently regionally located aspects as in Borđoš are also observable in the Upper Tisza region, where in Polgár-Csőszhalom and Polgár-Bosnyákdomb linear arrangements of houses in the flat settlement are combined with circular ditch systems of Lengyel style[51].

Late Neolithic settlement and burial data, so far, do not reveal signs for a pronounced vertical social hierarchy or social inequality in Late Neolithic settlements of the Tisza region[52]. It has been argued[53], and there is no empirical evidence to the contrary, that Neolithic societies were organised in a comparably egalitarian manner with an ideology oriented towards communality, applying strategies to prevent the emergence of social inequality. Yet, the emergence of autonomous households, the necessity to store foodstuffs, and differential economic productivities within the community might have created a constant tension between values of communality and sharing, and an emerging potential for economic inequality[54], intra-group competition, and differential levels of political power. These tensions might have been intensified in the context of growing settlement community sizes and thus might have constituted an important factor in the de-nu-

38 Faragó 2017.
39 Raczky/Anders 2012.
40 Mischka 2012; Literski/Nebelsick 2012.
41 Borić *et al.* 2018.
42 Schier 2014; Draşeovan *et al.* 2017.
43 Barna/Pásztor 2011; Barna 2017.
44 Mischka 2012; Lazarovici 2013.
45 Literski/Nebelsick 2012.
46 Mischka 2012; Lazarovici 2013.
47 Souvatzi 2008, 107–160; Furholt 2017.
48 Souvatzi 2008, 108.
49 Lazarovici 1991.
50 Diaconescu 2015.
51 Raczky/Anders 2010; 2016.
52 Siklósi 2013.
53 Sahlins 1974; Porčić 2012.
54 Halstead 2006, Leppard 2014.

cleation processes which led to more dispersed settlement patterns at the transition to the Early Copper Age[55].

We argue that within the social melting-pot of the multicomponent settlements, different social strategies to mitigate the potential social tensions were pursued. We contend that some of these are visible in the overall settlement layout of house placement. A frequent pattern is that of the "Early Balkan village" with the basic pattern of free-standing houses in more or less regular rows[56]. This pattern emphasises the autonomy and the equality of the individual houses to a stronger degree than in agglutinated clustered neighbourhoods of early Middle Eastern settlements. At the same time, the element of regular house placement reconciles this autonomy with the overall village communality. However, referring to the example of the Late Neolithic site Okolište, it was argued that settlements with such linear arrangements of houses are marked by high degrees of axiality and that they largely lack any convex space which would highlight the importance of the negotiation of communal concerns[57]. This layout allows for a pronounced social monitoring and thus most likely strengthens top-down communal interests at the cost of individuals or households.

In contrast, a centripetal pattern, while still highlighting house equality, most visibly emphasises the central convex space. The main difference to the house-row layout therefore points to a more important role of social negotiations; that is, communality built upon bottom-up agency. Lee (2007) has argued that in the context of non-ranked segmentary societies with growing community size, centripetal plans are considered to facilitate the maintenance of social equality via consensus-based decision making[58].

Thus, the two patterns of settlement organization resolve the tension between house autonomy and settlement wide communality in different ways. While both highlight household autonomy and equality through equal sizes and shapes of houses and their spatial isolation (being free-standing), they still indicate different modes through which village communality is expressed. In a centripetal arrangement, house autonomy and equality is secondary to one further factor, the centre, which represents, in this period, the communal space. In this way, communal gatherings are literally taking place at the heart of village space; they predetermine the position and relation of all other social units of the village community. The axial settlement represents a similar, still significantly different social order, one where autonomy and equality are paired with a social conformity that seems more fixed, lacking the bottom-up aspect of a communal gathering. To conclude, we interpret the axial variant of settlement layout as a more authoritarian way of keeping an egalitarian way of life.

Thus, in our view, under the overall condition of constant conflict between household-based resource extraction, storage, and accumulation that could potentially lead to competitive behaviour, as well as of village-wide communality and solidarity, the axial and the centripetal settlement patterns represent two social strategies of reconciliation expressing both equality and individuality, yet with different focuses on the importance of communality. To use a modern analogy, one could refer to the difference between Communism (axial arrangement) and Anarchism (centripetal arrangement).

The centripetal layout is an expression of a mode of social organisation which values communal decision-making to a higher degree than it is in an axial layout. Overall, we interpret the plan of Borđoš as revealing a high degree of communal integration which might be supported in the flat settlement of Borđoš by the frequent renewal of the enclosure system – on average every 20 years (i. e. every generation). In practice, the central open space was necessary and used to negotiate the communal concerns.

Both principles of settlement organisation represent different attempts of societies to maintain societal balance and social equality. The differences could be, for example, due to the fact that local resources such as arable land tend to be scarce in the low-middle mountain ranges of the Central and Western Balkans[59]. This shortage of resources potentially raised the chances of the emergence of social inequality[60] and, equally, could have allowed the realisation of more authoritarian social rules to prevent the potential of this inequality evolving. In contrast, in the Tisza region, arable land was available in sufficient quantity. Thus, every inhabitant would have had the opportunity to leave and take up farming somewhere else, something discussed in the modern era as "voting with your feet". The formation of the centripetal settlement layout which is focused on communal negotiations could indicate that manpower for intensive gardening and related animal husbandry was more valued as a critical resource. Regardless, the possibly more "democratic" social organisation which is indicated by a new type of settlement organisation in the southern part of the Tisza region might have been a factor which contributed to a more gradual transition to

55 Müller *et al.* 2013a; Gyucha 2015, Arponen *et al.* 2015; Borić 2015.
56 Furholt 2017; derived from Chapman 1989.
57 Müller-Scheeßel *et al.* 2010a; Müller *et al.* 2011; 2013a.
58 Lee 2007.
59 e. g. Müller 2006.
60 cf. Hofmann *et al.* 2010; Müller *et al.* 2011; Arponen *et al.* 2015.

the Early Copper Age than was the case in the Central and Western Balkan region where the end of the age of tells rather had the character of a collapse.

So far, the flat settlement in Borđoš, which was founded around 4850 BCE, represents one of the earliest examples of a centripetal settlement layout with a central square in Neolithic Southeast Europe. Similar principles of settlement organisation were applied from around 4700 BCE or later in Iclod[61] and Gorzsa C[62]. Preliminarily, it remains an open question if this "clustering" of early examples might indicate the origin of this settlement form in the Tisza region.

Conclusion

The centripetal settlement layout which was established in Borđoš at the latest by 4850 BCE was something new in the region, which can be explained partly from contacts to Transylvania (Iclod), Transdanubia (Lengyel), and perhaps also modern day Greece (Dimini). The break with the already long-established linear settlement layout and the emergence of multicomponent settlements most likely represent the outcome of a transregional trend towards accelerated population agglomeration in fewer sites and a negotiation-based socio-political organization. Our absolute-chronological analyses show that this phase of temporarily accelerated population agglomeration was roughly limited to the time between 4900 and 4700 BCE. As part of this agglomeration process, people of different origin and involved in differently directed regional networks joined together in large settlements. The detailed reasons for this development remain unclear. As the overall heterogeneous and sometimes hybrid character of these multicomponent settlements and their material culture impressively show, these population agglomerations represented an innovative environment in which new forms of political organization and social coexistence appear to have emerged.

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61 Mischka 2012.
62 Horváth 1990.

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Supplemental materials

Tab. S1: Borđoš, ^{14}C-modelling, OxCal codes.

Tab. S2: List of used ^{14}C dates of multicomponent sites in the Tisza region.