NEW RADIOCARBON DATES FROM THE LATE NEOLITHIC TELL SETTLEMENT OF HÓDMEZŐVÁSÁRHELY-GORZSA, SE HUNGARY

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ABSTRACT. Understanding the internal chronology of the Late Neolithic Tisza culture and the Neolithic of the Tisza region is the subject of debate in both Hungarian and international prehistoric research. The layer sequence of the Late Neolithic Gorzsa tell from SE Hungary offers ideal match points for determining the successive phases of the Tisza culture. According to the results published so far, in the Gorzsa sequence the Tisza culture was divided into 4 main phases with a fifth phase representing the transitional period to the Early Copper Age. Excavations were carried out in 33 profiles covering about 2% of the original area of the entire settlement. The archaeostratigraphy established was based on the identification of microhorizons corresponding to settlement levels. Radiocarbon dates published thus far were created using a pool of various objects of differing microhorizons deriving from different profiles. However, as archaeological results revealed, the settlement was characterized by frequent, minor spatial shifts during its evolution into a tell complex. Here, we present a succession of 7 ^{14}C dates deriving from a single profile located at the northeastern flank of the excavation area. The 7 dates span the entire profile from the uppermost microhorizons down to the lowermost ones. The new dates were compared with the existing relative chronology mentioned above. According to our findings, material was deposited in this part of the site mainly during the first 2 phases of evolution of the tell complex. The later phases are either less developed or missing due to possibly a spatial shift of the center of the tell complex resulting first in a deceleration and finally a complete cessation of artifact accumulation to the northwest flanks of the former natural levee. Thus, the previous hypothesis of spatial shifts based on relative chronologies within the site has been corroborated. Furthermore, the congruence between our new dates corrected for any reservoir effect and the previous dates of Hertelendi (1998) may refer to a correct determination of freshwater shell carbonate reservoir effect in the fluvial system of the Tisza River, which may be used in further studies in the area.

INTRODUCTION

The Late Neolithic in the Great Hungarian Plains was a period of relative stability for the cultures that settled in the valley of the Tisza River and its tributaries. This was a time when cultural groups engaged in crop cultivation and animal husbandry chose to remain in one place for a longer period of time, instead of onward migration, creating multilevel settlements called tells. The site Hódmezővásárhely-Gorzsa in the SE Great Hungarian Plains represents one of the richest Neolithic tell complexes in Hungary. The site yielded numerous finds attributed to representatives of the Late Neolithic Tisza culture (Horváth 1987, 2005).

Understanding the internal chronology of the Late Neolithic Tisza culture and the Neolithic of the Tisza region is the subject of debate in both Hungarian and international prehistoric research. The layer sequences of the Late Neolithic Gorzsa tell, SE Hungary, offers ideal match points for determining the successive phases of the Tisza culture. According to the results published so far, in the Gorzsa sequence the Tisza culture was divided into 4 main phases, with a fifth phase representing the transitional period to the Early Copper Age, based on relative and absolute chronologies (Horváth 2005). Excavations were carried out in 33 squares in campaigns between 1978 and 1996 covering about 2% of the original area of the entire settlement (Horváth 1987, 2005). The archaeostratigraphy established was based on the identification of microhorizons corresponding to inferred settlement levels. Radiocarbon dates published thus far, on which the previously mentioned internal chronology of the sequence was based, were created using a pool of various objects of differing levels deriving from different excavation squares (Hertelendi and Horváth 1992; Hertelendi et al.

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Proceedings of the 20th International Radiocarbon Conference, edited by A J T Jull
RADIOCARBON, Vol 52, Nr 2–3, 2010, p 1458–1464

https://doi.org/10.1017/S0033822200046543 Published online by Cambridge University Press

1995). However, as archaeological results revealed, the settlement was characterized by frequent, minor spatial shifts during its evolution into a tell complex (Horváth 1987, 2005). Consequently, deposition of material into pits and settlement levels must have shifted as well, possibly yielding shifts in absolute dates deriving from samples taken from different parts or squares of the excavation site. Furthermore, all samples except one subjected to absolute dating in previous studies were charred wood fragments, which may bias the absolute chronology to some extent. The present study was aimed to test the hypothesis of settlement shifts and also to establish an absolute chronology for an archaeomalacological study implemented on samples of a single square, instead using a combination of dates deriving from different squares and settlement levels.

SITE DESCRIPTION AND INTERNAL CHRONOLOGY OF THE SITE

The site Gorzsa in SE Hungary lies near the confluence of the Tisza and Maros rivers, about 25 km NE of the city of Szeged and 15 km SW of the city of Hódmezővásárhely. The site itself is nestled on the floodplain of the Tisza River on the banks of the former Kéró Brook, overlying a former Pleistocene loess-covered natural levee offering protection from seasonal floods of the Tisza (see Figure 1). The site is surrounded by floodplain meadows, back swamps, drainage channels, and natural elevations equally suited to hunting-fishing-gathering and animal husbandry, as well as crop cultivation. The highly varying topography also offered excellent hiding places in times of danger. The site itself covers ~5 ha (Makkay 1991; Horváth 2005). The area of the actual tell complex was estimated around 3–3.5 ha. Occupation deposits of the tell-like part of the settlement accumulated to a height of 2.6–3 m (Figure 1) with levels dating to the Late Neolithic, the Early and Late Copper Age, the

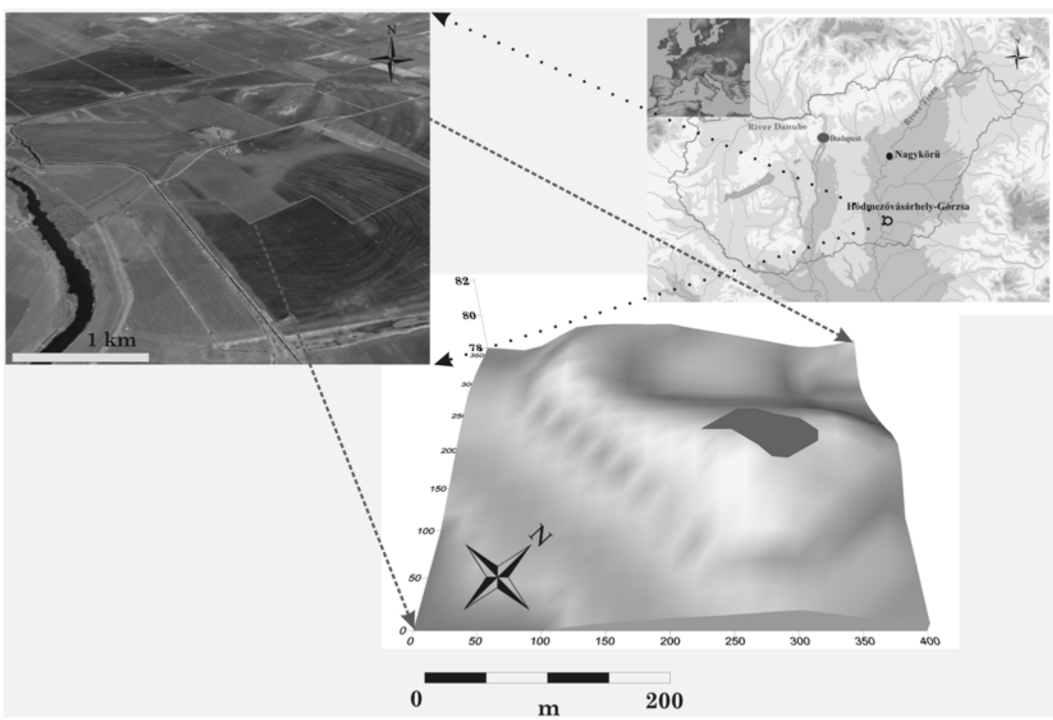

Figure 1 Location of the site Hódmezővásárhely-Gorzsa on a lag surface of a former natural levee in the Lower Tisza Valley (shaded area corresponds to the excavated site during the campaigns of 1978–1996); location of control site of Nagykörü for carbonate reservoir effect.

https://doi.org/10.1017/S0033822200046543 Published online by Cambridge University Press

Early and Middle Bronze Age, the Iron Age, and the Sarmatian period (Horváth 1987). Most significant among these are the 180–200-cm-thick Late Neolithic levels spanning the latter half of the Tisza cultural period. The area excavated thus far comprises ~2% of the entire settlement. The campaigns implemented between 1978 and 1996 were aimed to establish a vertical chronology of the site by Horváth (see Horváth 2005 for latest results). In order to achieve this goal, excavations were methodologically carried out in about 33 squares (Figure 2) via identification of microhorizons interpreted to represent occupation levels. The Tisza culture was divided into 4 main phases, with a fifth phase representing the transitional period to the Early Copper Age, based on a combination relative and absolute chronologies (Horváth 2005). Squares from which these absolute dates were acquired are depicted on Figure 2. The main Tisza phases established by Horváth (2005) based on a combination of available absolute dates (Benkő et al. 1989; Hertelendi and Horváth 1992) are the following:

- Tisza I or proto-Tisza phase, the beginning of which was dated around 5030 cal BC at the nearby settlement of Szegvár-Tűzköves.
- Tisza II or Early Tisza period spanning about 100–150 yr in Gorzsa, starting around 4970 cal BC.
- Tisza III or Classical Tisza period starting around 4850–4800 cal BC.
- Tisza IV or Late Tisza period starting around 4700 cal BC.
- Phase V or Proto-Tiszapolgár period starting around 4450–4500 cal BC (Parkinson et al. 2004).

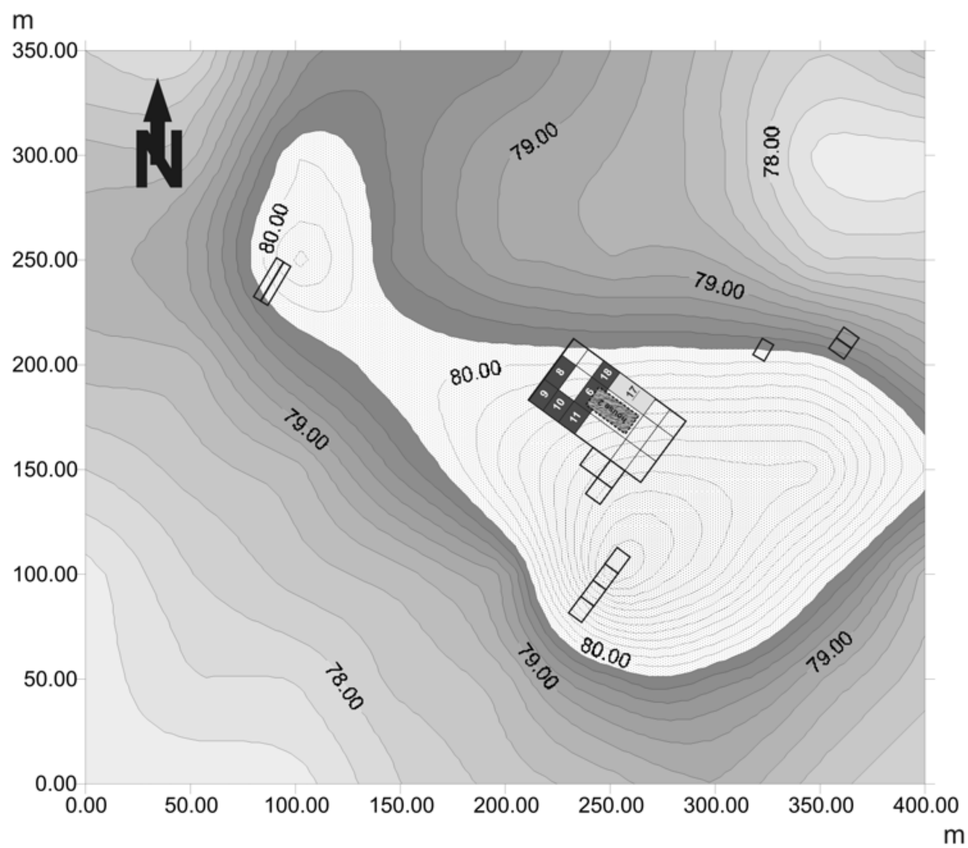

Figure 2 Contour map of the site with excavated squares yielding absolute dates highlighted (dark gray squares: ^{14}C dates from Hertelendi and Horváth 1992; Hertelendi et al. 1995; Hertelendi 1998; light gray square: this study).

https://doi.org/10.1017/S0033822200046543 Published online by Cambridge University Press

MATERIAL AND METHODS

We chose square 17 for our detailed chronological investigations partly because this square represented the thickest occupation deposit with 30 occupation levels identified. A detailed archaeomalacological study was implemented on samples deriving from this square to assess the temporal changes of subsistence practices, for which a reliable vertical absolute chronology was also needed. Square 17 is found in the central northwestern flanks of the excavated area (Figure 2). In contrast to previous studies relying on charcoal samples, here we dated freshwater shellfish material retrieved from the occupation levels. Accelerator mass spectrometry (AMS) ^{14}C dating of 7 *Unio pictorum* shells was implemented in the Poznań Radiocarbon Lab. In order to assess the carbonate reservoir effect, 2 additional samples deriving from the Early Neolithic site of Nagykörü (Figure 1) located on the banks of the same river system was also subjected to ^{14}C analysis. The charred seed and freshwater shell samples come from the same feature and stratigraphic level (Feature 2, Level 16). The raw ^{14}C ages received for the Gorzsa site were corrected for any reservoir effect based on the inferred age difference of the control material from Nagykörü (raw BP years). The raw dates were then calibrated using CALPAL 2007 and the most recent CALPAL-HULU 2007 calibration curve (Weninger et al. 2008). The original dates are indicated as BP, with calibrated dates as cal BP or cal BC. To assess the concordance of the measurement results, the raw dates were checked against their relative archaeostratigraphical position in the sequence. Then, the newly gained calibrated dates were compared with the ones published for the entire settlement recalibrated using the same curve (Hertelendi and Horváth 1992; Hertelendi et al. 1995; Hertelendi 1998), as well as the internal chronology established by Horváth (2005) to see if there is any sign of temporal and/or spatial shift.

RESULTS AND DISCUSSION

^{14}C dates from Gorzsa Square 17 and Nagykörü (Feature 2, Level 16) are given in Table 1. The control dates of Nagykörü yielded a difference of 150–155 yr on average. Thus the dates for the shell were about 150 ± 40 ^{14}C yr older than the dates for the charred seed sample. Taking this value as a sign of a possible reservoir effect in the fluvial system of the Tisza River, the raw ^{14}C ages for Square 17 from the site Hódmezővásárhely-Gorzsa were corrected before calibration.

The absolute dates seem to be consistent with the archaeological stratigraphy of the square down to levels 15–16, yielding successively older ages in the "BP corrected" column of Table 1. From level 15–16 down to level 30–31, there is a slight variance of raw ^{14}C ages, but their general range is nearly the same (between about 6100 and 6000 BP). This may imply the presence of a pit in the area of the square into which material was continuously deposited from the start of occupation initiating at level 15. On the basis of the newly gained calibrated ages, this pit corresponds to the first phase of life of the settlement, known as Tisza I after Horváth (2005), with a minor overlap to Tisza II (Figure 3). The levels upward from level 15 to level 8–9 and even 5–7 must represent the Tisza II phase or Early Tisza period according to Horváth (2005). In level 5–7, there seems to be a partial overlap with the next period of Tisza Phase III or the Classical Tisza period. Conversely, level 1 yielded dates of the initial Tisza Phase IV or the Late Tisza period, while the majority of this latter period seems to be missing from this square, chronologically speaking. This implies the presence of a possible spatial shift in the deposition of material towards the end of the life of the tell settlement complex. If we look at the new chronology of Square 17 in the framework of the previously established inner chronology of the site by Horváth (2005), we can state the following: from the 5 main phases, 3 are fully present in this square while only the initial part of phase 4 is recorded. Phase 5 seems to be completely missing (Figure 3).

Table 1 ^{14}C ages of Square 17 calibrated using CALPAL-2007 and CALPAL-2007 HULU curve (Weninger et al. 2008).

Sample reference	Lab code	Material	^{14}C age BP	BP corrected	1-σ uncer-tainty	cal BP (2 σ)	cal BC (2 σ)	Rate of correction
Nagykörü F2S16	Poz-23317	seed	6890	—	40	7830–7630	5880–5680	reservoir effect:
Nagykörü F2S16	Poz-23460	shell	7040	—	40	7980–7780	6030–5830	150 ± 40
Sq 17 level 1	Poz-7695	shell	5960	5810	40	6730–6490	4780–4540	150
Sq 17 level 5–7	Poz-7967	shell	6110	5960	35	6900–6700	4950–4750	150
Sq 17 level 8–9	Poz-7968	shell	6110	5960	40	6920–6680	4970–4730	150
Sq 17 level 15–16	Poz-7969	shell	6270	6120	40	7220–6860	5270–4910	150
Sq 17 level 22–24	Poz-7971	shell	6230	6080	40	7070–6830	5120–4880	150
Sq 17 level 27–28	Poz-7972	shell	6160	6010	40	6980–6740	5030–4790	150
Sq 17 level 30–31	Poz-7973	shell	6270	6120	40	7220–6860	5270–4910	150
SUM SQ 17 (1 σ)						7090–6760	5140–4810	150
SUM SQ 17 (2 σ)						7160–6560	5210–4610	150
Sq 17 level 1	Poz-7695	shell	5960	5850	40	6770–6570	4820–4620	110
Sq 17 level 5–7	Poz-7967	shell	6110	6000	35	6950–6750	5000–4800	110
Sq 17 level 8–9	Poz-7968	shell	6110	6000	40	6950–6750	5000–4800	110
Sq 17 level 15–16	Poz-7969	shell	6270	6160	40	7210–6930	5260–4980	110
Sq 17 level 22–24	Poz-7971	shell	6230	6120	40	7220–6860	5270–4910	110
Sq 17 level 27–28	Poz-7972	shell	6160	6050	40	7020–6780	5070–4830	110
Sq 17 level 30–31	Poz-7973	shell	6270	6160	40	7210–6930	5260–4980	110
SUM SQ 17 (1 σ)						7100–6790	5150–4840	110
SUM SQ 17 (2 σ)						7160–6640	5210–4680	110
Sq 17 level 1	Poz-7695	shell	5960	5770	40	6700–6460	4750–4510	190
Sq 17 level 5–7	Poz-7967	shell	6110	5920	35	6840–6640	4890–4690	190
Sq 17 level 8–9	Poz-7968	shell	6110	5920	40	6850–6650	4900–4700	190
Sq 17 level 15–16	Poz-7969	shell	6270	6080	40	7070–6830	5120–4880	190
Sq 17 level 22–24	Poz-7971	shell	6230	6040	40	7010–6770	5060–4820	190
Sq 17 level 27–28	Poz-7972	shell	6160	5970	40	6930–6690	4980–4740	190
Sq 17 level 30–31	Poz-7973	shell	6270	6080	40	7070–6830	5120–4880	190
SUM SQ 17 (1 σ)						6950–6640	5000–4690	190
SUM SQ 17 (2 σ)						7070–6510	5120–4560	190
TOTAL SQ 17 (1 σ)						7070–6720	5120–4770	150 ± 40
TOTAL SQ 17 (2 σ)						7150–6540	5210–4590	
Old dates recalibrated (1 σ)						6850–6460	4900–4510	
Old dates recalibrated (2 σ)						7040–6310	5090–4360	

It seems that the majority of the material accumulated during the first 2 phases of the settlement (Tisza I and Tisza II), corresponding to about 20–25 identified occupation levels. The later periods of Tisza III are represented by just 5 identified occupation levels. Furthermore, the incipient Tisza IV is recorded in a single identified occupation level. If we compare our dates with those given for the entire tell settlement complex by Hertelendi (1998), recalibrated, we can make the same inferences (Figure 3). The span of the curves seems to give an almost perfect match with the youngest periods missing in Square 17 and a slight shift towards older dates for the initial part of the tell evolution. The moderately and minimally corrected dates yielded similar ranges after calibration, while those of maximal correction of 190 yr give an almost perfect match with the newly calibrated old dates for the entire settlement. Naturally, shell deposition to Square 17 seems to have ceased earlier as indicated by the smaller span of this latter calibration compared to the lifespan of the entire tell.

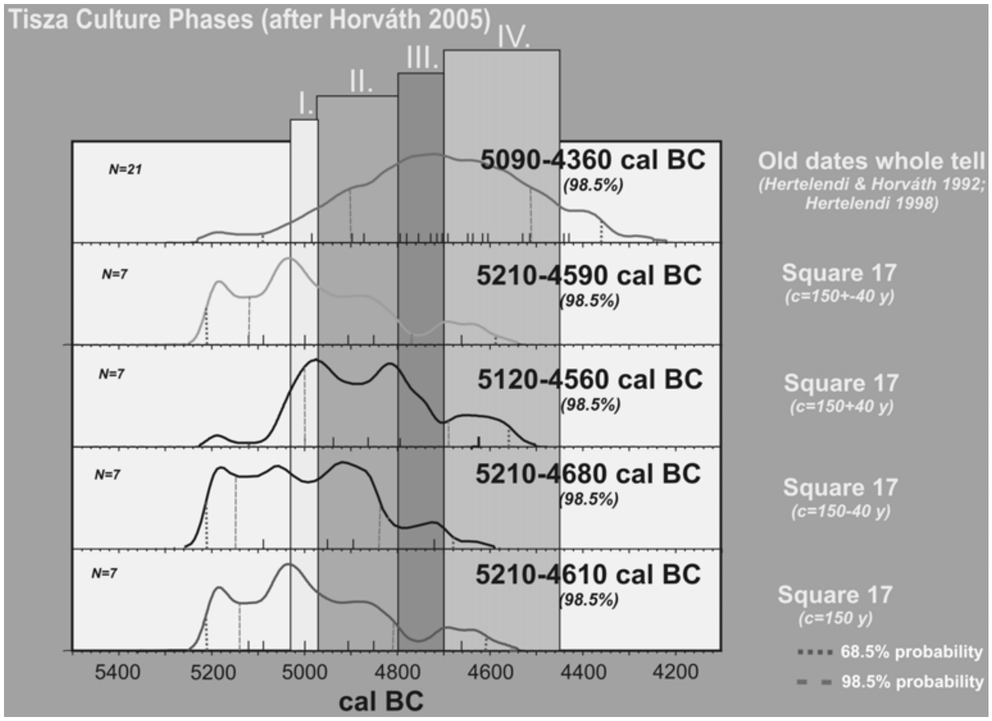

Figure 3 Age of the studied multilevel tell settlement as inferred from old and new ^{14}C dates for the site Hódmezővásárhely-Gorzsa in the light of the chronology proposed by Horváth (2005).

Based on the observations stated above, we can sum up the characteristics of shell accumulation to Square 17 as follows: material was deposited to this part of the site mainly during the first 2 phases of evolution of the tell complex. The later phases are either less developed or missing due to a possible spatial shift of the center of the tell complex, resulting first in a deceleration and finally a complete cessation of artifact accumulation to the northwest flanks of the former natural levee. Thus, the previous hypothesis of spatial shifts based on relative chronologies within the site (Horváth 1987, 2005) can be corroborated. Furthermore, the congruence between our new dates corrected for any reservoir effect and the previous dates of Hertelendi (1998) may refer to a correct determination of freshwater carbonate reservoir effect in the fluvial system of the Tisza River. Moderate and minimal corrections yielded similar results after calibration, while that of the maximal correction yielded a slightly different range. This, however, seemed to show the best agreement with the dates for the first part of the tell's evolution, implying that a likely correct value of reservoir correction is 190 yr. This value, therefore, can be used in similar studies for corrections within the watershed of the Tisza River and possibly its tributaries in the Carpathian Basin.

ACKNOWLEDGMENTS

The authors wish to express their gratitude to the *Radiocarbon* editorial board for making this publication possible. We are greatly indebted to the directory of the Ferenc Móra Museum for granting access to the collections. This work was partially supported by OTKA Grant K 68343.

REFERENCES

Benkő L, Horváth F, Horvatinčić N, Obelić B. 1989. Thermoluminescence dating of prehistoric sites in Hungary and Yugoslavia. *Radiocarbon* 31(3):992–1002.

Hertelendi E. 1998. Radiokarbon kormeghatározás (Radiocarbon dating:material and methodology). *Panniculus* 3:311–34. In Hungarian.

Hertelendi E, Horváth F. 1992. Radiocarbon chronology of Late Neolithic sites in Hungary. *Radiocarbon* 34(3):859–66.

Hertelendi E, Kalicz N, Raczky P, Horváth F, Veres M, Svingor É, Futó I, Bartosiewicz L. 1995. Re-evaluation of the Neolithic in eastern Hungary based on calibrated radiocarbon dates. *Radiocarbon* 37(2):239–45.

Horváth F. 1987. Hódmezővásárhely-Gorzsa, a settlement of the Tisza culture. In: Raczky P, Tálas L, editors. *The Late Neolithic in the Tisza Region*. Budapest: Szolnok. p 31–46.

Horváth F. 2005. Gorzsa, előzetes eredmények az újkőkori tell 1978 és 1996 közötti feltárásából (Gorzsa, preliminary results of excavations of the Neolithic site between 1978 and 1996) In: Bende L, Rinczy G, editors. *Hétköznapok Vénuszai*. Hódmezővásárhely: Móra Ferenc Múzeum. p 51–67. In Hungarian.

Makkay J. 1991. Enstehung, Blüte und Ende der Theiss Kultur. *Saarbrücker Beitrage zur Altertumskunde* 55: 319–28. In German.

Parkinson WA, Yerkes RV, Gyucha A. 2004. The transition from the Neolithic to the Copper Age: excavations at Vésztő-Bikeri, Hungary 2000–2002. *Journal of Field Archeology* 29:101–21.

Weninger B, Jöris O, Danzeglocke U. 2008. CalPal-2007. Cologne radiocarbon calibration & palaeoclimate research package. Radiocarbon Lab Köln. URL: http://www.calpal.de/.