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Topoi Research Project A-4-1-1

ARCHAEOLOGICAL EVIDENCE FOR EARLY WOOL EXPLOITATION IN SOUTH-EAST AND EAST CENTRAL EUROPE: TEXTILE TOOL DATASET

This summarized and catalogued dataset was recorded and analyzed during the Topoi PhD Research Project (A-4-1-1) on Archaeological Evidence for Early Wool Exploitation in South-East and East Central Europe. It contains textile tools sampled within a site cluster that stretches accross the Pannonian Plain. The research study was focused on elucidating spatio-temporal and causal factors of the major changes in Eneolithic textile technologies, which might have been associated with raw fibre material innovation (Becker et al., 2014). The final Catalogue of Finds contains details on, collectively, 1048 archaeological objects classified as textile tools.

Archaeological objects, namely spindle whorls, loom weights and spools, were recorded and analysed according to the methodological standards of the respective field of textile archaeology.

The main objectives of the study are presented in a manuscript published uder the title "Eneolithic Textile Production", which provides insight into the state of the art of textile archaeology, while dealing with actual textile remains and textile tools from the region separately (Grabundžija, 2018a).

Results of the techno-typological analysis performed on the assembled material clarified that animal fibre use, possibly being driven by local environmental conditions, intensified already in the 4th millennium BC (Grabundžija & Russo, 2016). Furthermore, comparison of the investigated spindle whorl assemblages revealed that Eneolithic thread making had a 'culture-specific' technological signature. Both the typological standards and the morphometric specifications of these tools display a statistically significant dependence on what is in the traditional culture-historical discourse, meant by the term 'archaeological culture' (Grabundžija, 2018b). Examination of the social aspects of thread production pointed to intensified fibre processing and plausibly the early specialization of the manufacture during the Eneolithic period (Grabundžija, 2018c).

An experimental method was performed as a remote part of the tool analysis, with the main purpose of investigating alternative tool options and their versatility which could explain the absence of loom weights in some of the inspected contexts (Grabundžija et al., 2016).

GEOGRAPHICAL AND CHRONOLOGICAL FRAME OF THE STUDY

In a broader geographical perspective, the 26 sampled sites (Fig. 1, Tab. 1) are spread across the southern parts of the Pannonian plain, at the edge of the South-East and East Central Europe, covering most of the Western Balkans area (including parts of Slovenia, southern Hungary, northern and eastern Croatia and northern Serbia). The geomorphological term Pannonian Plain is preferred over the 'Carpathian Basin', since the investigated archaeological material was recovered in the lowlands. The dataset does not include higer altitude archaeological sites from the mountain ranges that surround the plain which formed after the Pliocene Pannonian Sea dried out.

In a traditional cultural-historical discourse, textile tool samples that were collected for the study can be attributed to 10 regional and supra-regional Late Neolithic (i.e. Vinča), Eneolithic (i.e. Balaton-Lasinja, Furchenstich, Retz-Gajary, Proto-Boleráz, Boleráz, Baden, Kostolac, Vučedol) and Early Bronze Age (Somogyvár-Vinkovci) cultures.

The chronological timespan covers the Late Neolithic to the Early Bronze Age periods, which spans roughly from the first half of the 5th till the beginning of the 2nd millennium BC (Raczky, 1995).
The upper chronological limit of the research corresponds with the period of the gradual disintegration of the large Neolithic complexes (i.e. Vinča, Sopot, Tisza and Herpály cultures) somewhere around 4600 cal. BC (Borić, 2015; Burić, 2015; Raczky et al., 2014). At the same time some of the Late Neolithic communities, i.e. Lengyel culture in the Hungarian Transdanubia (Bánffy, 1994; Regenye, 2013), and Sopot culture in parts of western Croatia and Slovenia (Balen & Čataj, 2014) continued to live well into what is now considered to be the Early Eneolithic period.

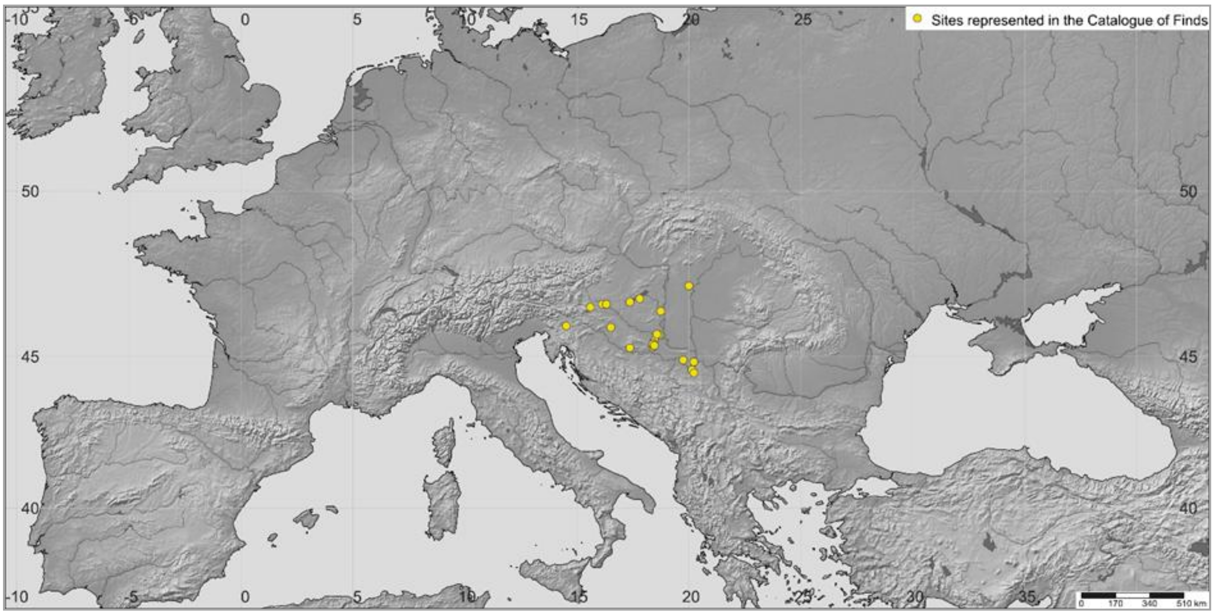

Figure 1. Map of the investigated site cluster represented in the final Catalogue of Finds.

Different "grand narratives" describe the shift between Neolithic and Eneolithic periods in Europe, either as gradual or abrupt transformations of local sociocultural and economical systems. Transformations were not mutual and were not simultaneously occurring throughout the whole of Europe. Settlements in some regions were nucleated in Neolithic and dispersed in Early Eneolithic (Parkinson et al., 2004; Gyucha et al., 2015; Raczky et al., 2014), tell settlements in major parts of the South Pannonia and Central Balkans were abandoned after the Late Neolithic (Link, 2006), burial customs also differed in some areas (Raczky et al., 2014: 328–331), while material culture patterning followed local traditions with significant tendency toward regional formal homogenisation. Characteristic shapes of copper tools and similar pottery forms occur over the vast territory of Europe. The same forms of Early Eneolithic copper axes were produced from the southern Balkans to Central Europe (Diaconescu, 2014), distribution of Early and Middle Eneolithic hollow-foot vessels, incised beakers and lobate vessels of Tiszapolgár and Bodrogkeresztúr cultures point to connections between the far peripheries of the continent (Spasić, 2008; Czekaj-Zastawny at al., 2011). Broad distribution of Late Eneolithic Baden culture cups and so-called Bratislava lids (Maran, 1998; Spasić, 2008; Jovanović & Blagojević, 2014) also speak in favour of intensification of contacts and merchant routes in 4th and 3rd millennium BC Europe. Schier has evaluated the concept of Eneolithic (Copper age) as an historical epoch, as well as all supposed transformations that occurred during the Late Neolithic/Early Eneolithic shift (Schier, 2014). Through his analysis, he implied that the period in question should be investigated on a local and absolute temporal level, and that "the time of grand narratives may be over, but local and regional stories are equally fascinating and more adequate reflections of the dynamic cultural diversity in prehistoric Europe" (Schier, 2014: 432).

A minor part of the recorded textile tool corpus can be dated to the Late Neolithic period which was not in the main chronological focus of the study. Earlier textile practices were analysed in order to establish the degree and the nature of technological change as well as other indications and consequences of it. Therefore, tool assemblages from three Late Neolithic Vinča culture settlements in Serbia were recorded. The biggest sample comes from the tell site of Gomolava (Jovanović, 2011), while significantly smaller samples come from the sites of Masinske Njive (Blagojević 2014) and Crkovne-Stubline (Spasić, 2012; Crnobrnja, 2014). Late Neolithic Vinča culture had a strong textile tradition (Chapman, 1981: 122-124; Tringham & Stefanović, 1990: 325-336). This is reflected in the size of the Vinča culture textile tool sample, in particular, its loom weight segment. Additionally, the amount of textile imprints recovered on numerous Vinča culture ceramic finds (Mazăre, 2012: 23-26; Ninčić, 2011: 181-184; Crnobrnja et al., 2009: 17; Vasić, 1936: 44-45) support this argument.

The Middle Eneolithic sample can be dated to the Balaton-Lasinja culture sites in Croatia and Slovenia (Kalinovnjek pri Turnišću, Turnišče, Pajtenica-Velike Livade, Tomašanci-Palača, Zgornje Radvanje), and to various manifestations of the so called Furchenstich horizon (such as Retz-Gajary) in Sloveina, Croatia and Hungary (Kalinovnjek pri Turnišću, Turnišče, Pod Kotom-jug pri Krogu, Tolna-Mözs Kenderföldek-dűlő, Čeminac-Vakanjac, Ivandvor, Jagodnjak-Napuštene njive, Josipovac Punitovački-Veliko polje). A broad range of different types of Balaton-Lasinja material culture, settlement patterns and burial practices seem to have good analogies and roots in earlier Late Neolithic/Early Eneolithic Sopot and Lengyel traditions but are also very similar to the partly contemporary Bodrogkeresztúr, Salcuţa and Ludanice cultures. In the collected dataset, the Balaton-Lasinja specimen highlights the transition from the Late Neolithic/Early Eneolithic textile production technologies. On the other hand, various manifestations of the so called Furchenstich horizon represent a turning point between Middle and Late Eneolithic (Kalicz & Horváth, 2010), and much of its characteristic textile tool assemblage could be observed in the earliest Late Eneolithic period, i.e. Proto-Boleráz specimen from Abony-Turjányos dűlő site.

The focus of interest for the study of technological change was the Late Eneolithic period, i.e. 3600-2500 BC. The sequence of three consecutive and partly contemporary cultural horizons are typical for the Late Eneolithic of the Southern Pannonian plain, i.e. Boleráz/Baden-Kostolac-Vučedol (Petrović & Jovanović, 2002). The material artefact of all three Late Eneolithic cultures is rather homogenous over the vast territory of Southern Pannonia, especially regarding basic forms of pottery, while settlements, economy and burials differ significantly from region to region and are mainly of local tradition.

The Late Eneolithic period witnessed further social, cultural, economic and technological transformations. Changes in animal husbandry, the use of secondary animal products, changes in textile production, the invention of wheeled vehicles and the plough, the domestication of horses, as well as the appearance of new forms of burial (i.e. tumuli) and material culture were sought in the context of Andrew Sherratt's "Secondary Products Revolution" (SPR), as the joint package of innovations that spread from the proto-urban and urban societies in the Near East (Sherratt, 1981, 1983, 2002). Although significant parts of the mentioned novelties seems to appear much earlier than Sherratt has originally proposed (especially milk products: Evershead et al., 2002; Sherratt, 2002; Craig, 2002: 102-104; Craig et al., 2005; Vigne & Helmer, 2007), his concept remains as one of the most used grand narratives that defines the socio-cultural and technological trajectories of the European Late Eneolithic (Greenfield, 2010).

The vast part of the catalogued corpus dates to the Late Eneolithic period. The Gomolava tell settlement in Serbia stands out as the only site in the cluster with clear vertical stratigraphy comprising of samples dated to four different chronological phases (Petrović & Jovanović, 2002; Jovanović, 2011). This allowed high resolution insight in the development of textile production of both Neolithic (Vinča culture) and Eneolithic period (Baden, Kostolac and Vučedol cultures). Samples from other studied Late Eneolithic sites mainly come from temporal settlements with developed horizontal stratigraphy (i.e. Dobanovci, Masinske Njive, Đakovo-Franjevac, Balatonkeresztúr Réti-dűlő). The majority of Late Eneolithic settlements were investigated during the rescue excavations (i.e. Balatonőszöd–Temetői-dűlő, Tolna-Mözs Kenderföldek-dűlő, Štrosmajerovac-Pustara) which meant that large parts of the settlements were revealed, thus enabling a variety of taphonomical and spatial analyses.

The beginning of the Early Bronze Age, marked by the ending of the Vučedol culture and the onset of the Somogyvár-Vinkovci culture, is the last phase that was included in the chronological timespan of the recorded dataset. Chronology based on 14C absolute dates sets the beginning of the Early Bronze Age around 2500 BC and its end around 1700 BC. (Forenbaher, 1993: 235-236). According to calibrated dates the end of the Vučedol culture is placed around 2500 BC, although somewhat shorter duration is assumed (Forenbaher, 1995: 22).

The Early Bronze Age is the least documented period in the sample, with specimens collected from the Josipovac Punitovački-Veliko polje (Čataj, 2009), Tomašanci-Palača and Viškovci sites in Eastern Croatia. The Ljubljansko Barje specimens come from older excavations which did not allow exact dating of tools, although they can be roughly placed in the 3rd millennium BC, Late Eneolithic/Early Bronze Age period, i.e. Vučedol/ Somogyvár-Vinkovci cultures (Korošec & Korošec, 1969).

A short reconsideration of this study's spatial and temporal frame indicates that the Pannonian plain was neither a uniform homogenous space nor a completely divided heterogeneous area during the Late Neolithic and Eneolithic periods. Rather, it consisted of a myriad of different communities with strong local subsistence and production traditions, intermingled with many common and above-regional characteristics. The textile tool corpus supports such a claim, since the majority of the analized technologies display both common and exceptional features (Grabundžija, 2018c).

ARCHAEOLOGICAL SITE	PUBLICATION
Abony-Turjányos dűlő	Fábián & Serlegi, 2009; Köhler et al., 2017; Fábián et al., 2018
Balatonkeresztúr Réti-dűlő	Fábián, 2007; Fábián, 2014; Fábián et al., 2018
Balatonőszöd–Temetői-dűlő	Horváth, 2010; Horváth, 2012a; Horváth, 2012b; Horváth, 2014
Brezje pri Turnišču	Novšak et al., 2013
Čeminac-Vakanjac	Kalafatić & Hulina, 2016
Čepinski Martinci-Dubrava	Kalafatić, 2009
Crkvine-Stubline	Crnobrnja et al., 2009; Crnobrnja, 2014
Cugovec-Barbarsko	Balen & Drnić, 2014
Dobanovci	Tasić, 1995
Đakovo-Franjevac	Balen, 2011
Gomolava	Petrović & Jovanović, 2002
Ivandvor	SHORT REPORT ONLY: Leleković, 2008
Jagodnjak- Napuštene njive	Dizdar et al., 2016
Josipovac Punitovački-Veliko polje	Čataj, 2009
Kalinovnjek pri Turnišću	Kerman, 2013
Ljubljansko Barje-Ig	Korošec & Korošec, 1969
Masinske Njive	Blagojević, 2014
Pajtenica-Velike Livade	Zorić, 2018
Pod Kotom-jug pri Krogu	Šavel et al., 209
Slavča-Nova Gradiška	Skelac, 1997; Mihaljević, 2006
Štrosmajerovac-Pustara	SHORT REPORT ONLY: Hršak & Bojčić, 2008
Tolna-Mözs Kenderföldek-dűlő	MENTION ONLY: Fábián et al., 2018
Tomašanci-Palača	SHORT REPORT ONLY: Balen, 2008
Turnišče	Tomaž et al., 2012
Viškovci	SHORT REPORT ONLY: Balen, 2013
Zgornje Radvanje	Kramberger, 2014

Table 1. Archaeological sites represented in the final Catalogue of Finds together with relevant bibliographical references.

TEXTILE TOOL DATASET AND THE APPLIED METHODS OF RECORDING

The guidelines for the textile tool recording protocol were adopted from the methodological model established by the Centre for Textile Research (CTR) in Copenhagen. The final Catalogue of Finds contains 901 archaeological objects classified as **spindle whorls** (Catalogue Numbers 1-901), 125 archaeological objects classified as **loom weights** (Catalogue Numbers 902-1026) and 22 archaeological objects classified as **spools** (Catalogue NumberS 1027-1048).

Recorded material originated from 26 **archaeological sites.** Besides being associated with one of the ten different **culture-historical contexts** dated to Neolithic, Eneolithic and Bronze Age periods, each archaeological object was placed in one or more **time slices.** Quarter millennium time slices enabled easier comparison with other datasets within the project (Becker et al., 2014).

Besides their contextual information (such as **archaeological site** where they were found, or **cultural-historical context** to which they belong to) and a reference to where they are stored (such as **inventory number** or **holding institution**), all archaeological objects were classified according to

their **preservation condition** in one of the four different categories: complete, half, partial and small fragments missing (more than 90% of the archaeological object is preserved).
Any presence of **decoration** or decorative design on an archaeological object was noted. For each category of finds (spindle whorl, loom weight, spool) separate set of measurements was taken in millimeters (Fig. 2).

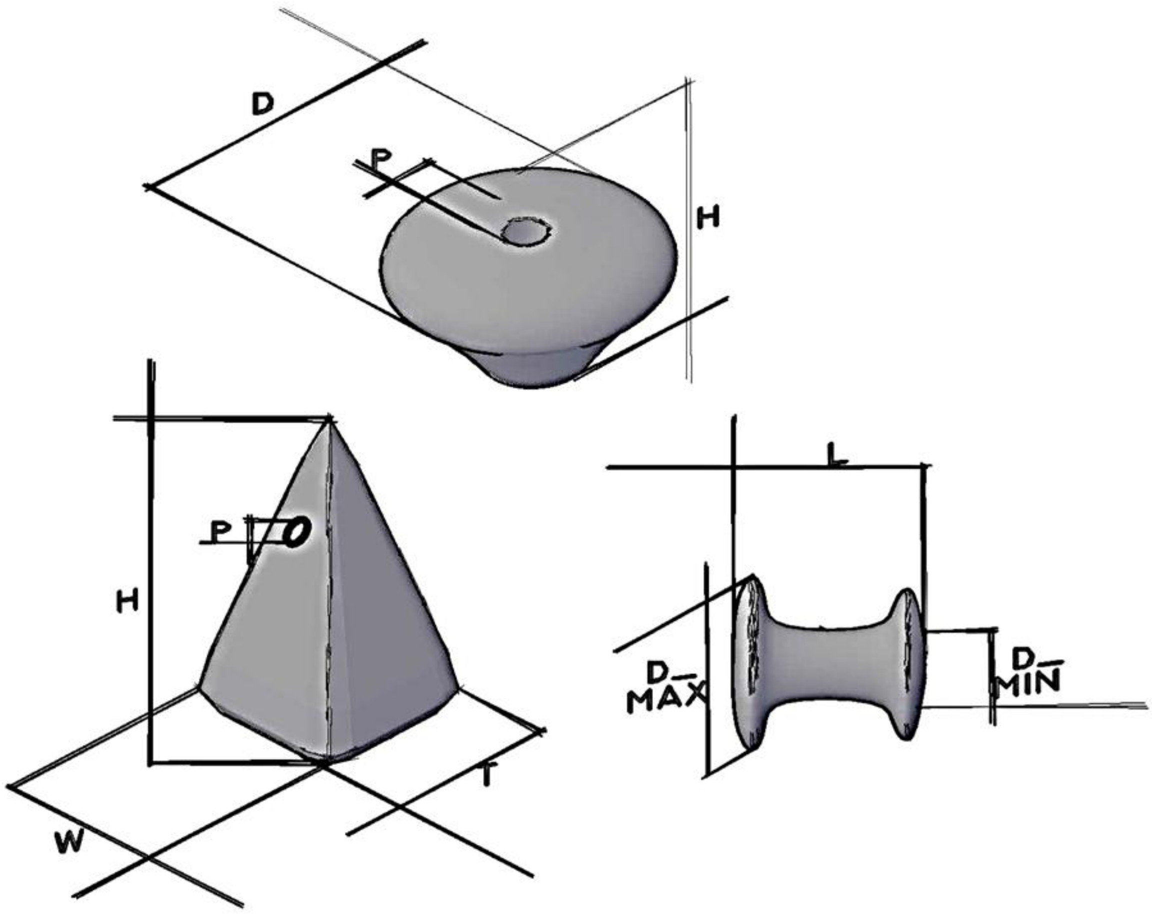

Figure 2. Illustration of the main morphometric parameters measured for each category of finds. Up: three main measurements taken for spindle whorls ("H"- complete height, "D"- complete diameter and "P"- perforation diameter); down left: four main measurements taken for loom weights ("H"- complete height, "P"- perforation diameter, "T"- complete thickness, "W"- complete width); down right: three main measurements taken for spools ("L"- complete length, "D MAX"- maximum diameter and "D MIN"- minimum diameter).

In addition, each archaeological object was weighted with its weight parameter being noted in grams. All archaeological objects in the collected dataset are made of ceramic, fired clay **material**, except one spindle whorl (Catalogue Number: 524), which was made out of bone (Čataj, 2009: 31; Grabundžija & Russo, 2016: 312-313).
A comprehensive spindle whorl analysis, which was enabled by composing this dataset, resonated regional trajectories of thread production at the expense of accounting for site-specific

developments (Grabundžija & Russo, 2016; Djurdjevac Conrad et al., 2018; Grabundžija, 2018a; Grabundžija, 2018b; Grabundžija, 2018c).

Sampled loom weights were recorded mainly with the purpose of addressing typological variability and frequency trends, since the changes in weaving technology were approached and explored primarily as reflective of possible innovations in earlier stages of textile production, namely in fibre processing and thread making segments of the manufacture.

Due to a substantial amount of published experiments involving spindle whorl performances (Grömer, 2005; Kania, 2015; Laurito et al., 2014; Andersson Strand, 2010), no experimental method has been applied for further testing of the spindle whorls' functional parameters.

Spindle whorls

The final Catalogue of Finds contains 901 spindle whorls that were typologically divided into ten **types**: biconical, conical, concave conical, convex, cylindrical, discoid, wheel-like discoid, lenticular, spherical and perforated ceramic fragment (Fig. 3).

The weight values of spindle whorls were documented in two different reliability classes, depending on their preservation condition. Weights of complete samples were documented in the **weight if complete** class and weights of samples that were in any way damaged (whorls preserved in half, whorls with small fragments missing and whorls that were recorded as partial) were recorded in the **weight if not complete** class. Weights of almost complete samples with small fragments missing were additionally documented in the **estimated complete weight** category (estimated complete weight= weight if not complete), weights of samples preserved in half were documented in the **calculated complete weight** category (calculated complete weight = weight if not complete doubled) and finally, weights of partial samples were documented in the **reconstructed complete weight** category (reconstructed complete weight = **density** x **volume**).

Virtual three-dimensional reconstructions of partially preserved spindle whorls were created based on their section drawings by using the Autodesk 3D modeling software. The orto-photo records of the preserved fragments served as a basis for modeling the breakage surface. Knowing the weight of the fragment (weight if not complete) and its volume (**volume of the fragment**), taken from the geometry of the virtual fragment model, the spindle whorl's density parameter was easily calculated (density = weight if not complete / volume of the fragment). Finally, from the calculated density parameter and the **complete volume** parameter (taken from the geometry of the virtual three-dimensional reconstruction), a calculation of the reconstructed complete weight was possible (reconstructed complete weight = density x complete volume). This method has not been applied so far, so its accuracy was tested on a smaller spindle whorl sample. Ten replicated spindle whorls were documented, broken and virtualy reconstructed, in order to test the possibility of miscalculation and to estimate the range of the reconstructed complete weight error. The test sample included ten spindle whorl replicas (Fig. 4, Tab. 2).

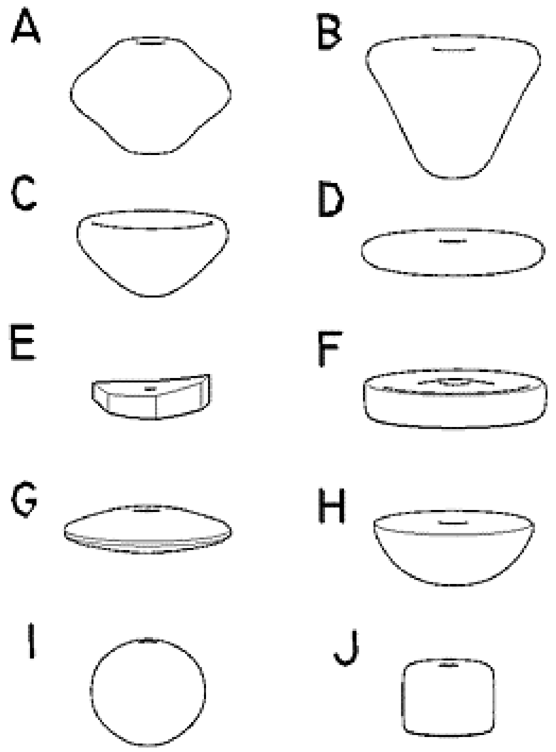

Figure 3. Ten recorded spindle whorl types: biconical (A), conical (B), concave conical (C), discoid (D), perforated ceramic fragment (E), wheel-like discoid (F), lenticular (G), convex (H), spherical (I) and cylindrical (J).

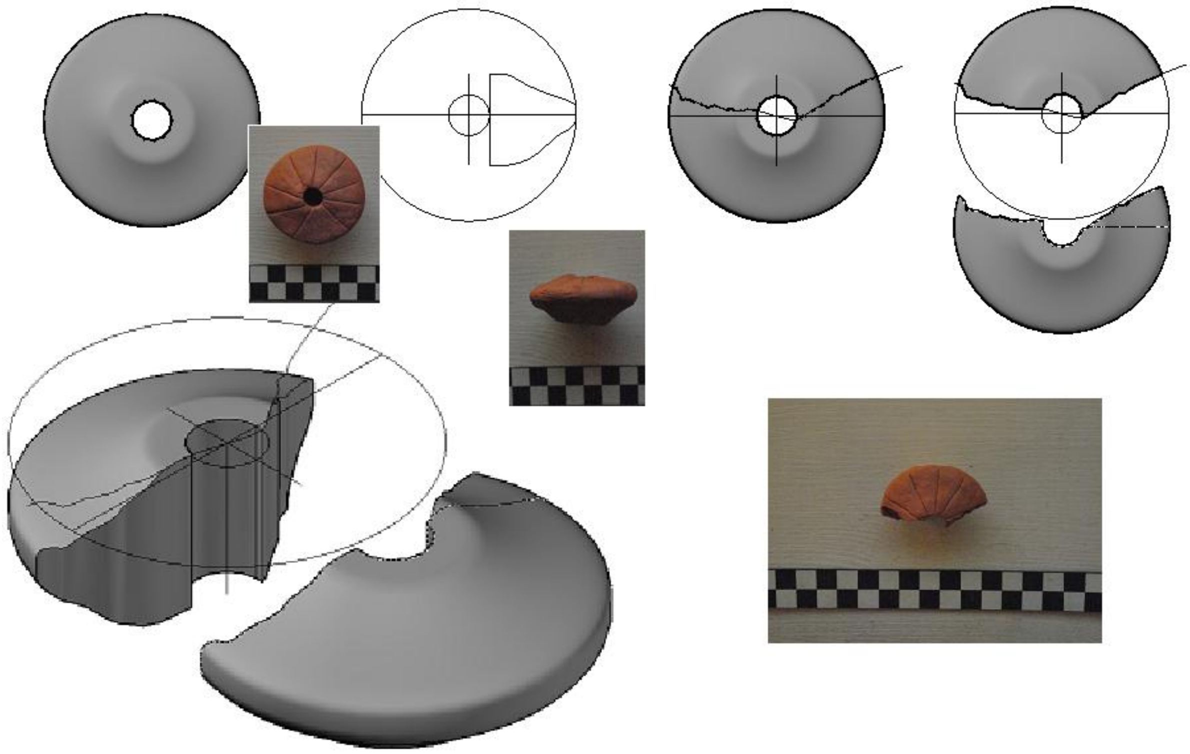

Figure 4. Three-dimensional model of a virtualy reconstructed spindle whorl used for testing the reliability of the applied weight reconstruction method.

TEST_SW_ID	W_C	W_I	V_C	V_F	DEN	W_REC	ERROR (g)	ERROR (%)	MATERIAL
1	96.5	46.3	70098	32757	0.00141344	99.079201	2.57	2.66	UNFIRED CLAY (DRYED)
2	39.4	17.4	29801	12754	0.00136428	40.656845	1.25	3.17	UNFIRED CLAY (DRYED)
3	16.6	10.3	12483	7877	0.0013076	16.322826	0.28	1.68	UNFIRED CLAY (DRYED)
4	13.6	8.6	11809	7891	0.00108985	12.870029	0.73	5.36	UNFIRED CLAY (DRYED)
5	45.3	35.5	36555	30226	0.00117449	42.933319	2.37	5.23	UNFIRED CLAY (DRYED)
6	13.6	3.6	16466	4591	0.00078414	12.911697	0.68	5.06	UNFIRED CLAY (DRYED)
7	13	5.9	10707	5148	0.00114608	12.271037	0.73	5.61	UNFIRED CLAY (DRYED)
8	12.8	6.7	11006	6085	0.00110107	12.118357	0.69	5.39	UNFIRED CLAY (DRYED)
9	91.6	36	51346	21053	0.00170997	87.800124	3.8	4.14	CERAMIC (FIRED CLAY)
10	7.9	4.5	4487	2491	0.0018065	8.1057808	0.2	0.01	CERAMIC (FIRED CLAY)

Table 2. Spindle whorl test sample given with actual (weight if complete – before damage; weight if not complete – weight of a fragment post damage) and reconstructed complete weight values, showing the calculation error range (in grams and percentage).

Loom weights

The final Catalogue of Finds contains 125 loom weights that were typologically divided into five **types**: conical, pyramidal, discoid, elongated ovoid and elongated cylinder (Fig. 5). Only the measured weight (**weight if complete** or **weight if not complete**) was recorded for the loom weight specimen.

The biggest majority (68 specimen, which is more than 54%) of the loom weight sample belongs to the Neolithic (Vinča) contexts. Fewer examples (48 specimen, which is more than 38%) are dated to the Middle Eneolithic, whereas only a small number of occurrences (9 specimen, which is less than 8%) can be associated with the Late Eneolithic and Early Bronze Age contexts (Fig. 6)**.** Rare Late Eneolithic weights largely differ from earlier, more conventional upper-perforated types. They all have an elongated shape (elongated ovoid/elongated cylinder) and are perforated longitudinally.

Between the Neolithic and the Eneolithic samples there are some obvious differences in the distribution of the measured **thickness** parameter. Middle Eneolithic (Balaton-Lasinja and Furchenstich) examples of the conical and pyramidal type are much thicker than the typical Neolithic Vinča culture discoid specimen. The same is the case with the rare later examples dated to the Late Eneolithic/Early Bronze Age, which have an even greater thickness.

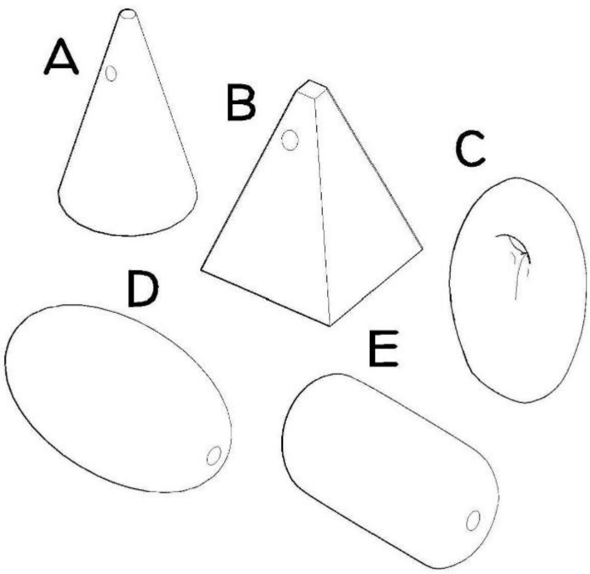

Figure 5. Five recorded loom weight types: conical (A), pyramidal (B), discoid (C), elongated ovoid (D) and elongated cylinder (E).

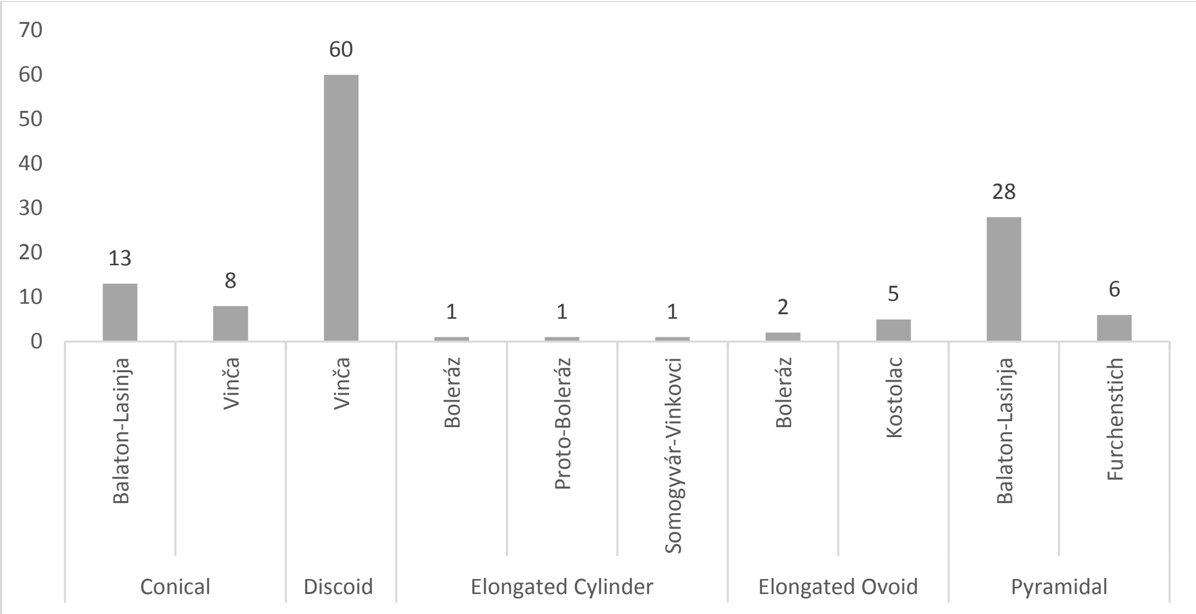

Figure 6. Frequency of loom weight types according to culture-historical contexts.

Spools

All together 22 spools are recorded in the final Catalogue of Finds. Same as for the loom weights, only the measured weight (**weight if complete** or **weight if not complete**) was documented for spools.

All documented specimen come from the Late Eneolithic (Kostolac and Baden) contexts (Fig. 7). Their occurance in the Late Eneolithic material coincides with the observed dissaperance of conventional loom weight types. Spools from the Boleráz/Baden settlement at Balatonőszöd–Temetői-dűlő site in Hungary were not available for recording at the time of the data sampling but are all published in detail by the excavator (Horváth, 2012b).

Figure 7. Kostolac spools from Đakovo-Franjevac (Catalogue Numbers: 1031, 1034 and 1035).

ACKWNOLEDGMENTS
Numerous colleagues and institutions supported my research questions by welcoming me in their working environments and enabling me to examine and record textile tools for this dataset. Dear Jacqueline Balen, Tomo Hršak, Hrvoje Kalafatić, Tino Leleković, Marija Mihaljević, Miloš Spasić, Marija Jovanović, Tijana Stanković-Pešterac, Mirjana Blagojević, Szilvia Fábián, Tünde Horváth, Nandor Norbert Nagy, Alenka Tomaž, Peter Turk, Branko Kerman, Monika Zorko, Bine Kramberger, thank you for your hospitality. Without your generosity and help this research would have not been possible.
The Danish National Research Fondation's Centre for Textile Research (CTR) at the University of Copenhagen offered their methodological suggestions in the early phases of my data recording. Their input and experience were of indispensable value for this project's design and I am tremendously grateful for all their comments, interest and wonderful communication.

BIBLIOGRAPHY

Andersson Strand, E. (2010). Experimental Textile Archaeology. In E. Andersson Strand, M. Gleba, U. Mannering, C. Munkholt & M. Ringgaard (Eds.), *North European Symposium for Archaeological Textiles X,* 1-3. Ancient Textiles Series Vol. 5. Oxford: Oxbow Press.

Balen, J. (2008). Tomašanci-Palača. *Hrvatski arheološki godišnjak* 5, 60-62.

Balen, J. (2011). *Đakovo-Franjevac: Late Eneolithic Site*. Musei Archaeologici Zagrabiensis Catalogi et Monographiae Vol. VII. Zagreb: Arheološki muzej u Zagrebu.

Balen, J. (2013). Viškovci-Gradina. *Hrvatski arheološki godišnjak* 10, 51-53.

Balen J., & Drnić, I. (2014). Archaeological excavations at Barbarsko- a new contribution to understanding of the Middle Copper Age in northern Croatia. *Vjesnik Arheološkog muzeja u Zagrebu* 47(1), 39-76.

Balen, J., & Čataj, L. (2014). Sopot Culture. In J. Balen, T. Hršak & R. Šošić Klindžić (Eds.), *Darovi zemlje*, 59-74. Zagreb: Arheološki muzej u Zagrebu. Muzej Slavonije Osijek. Filozofski fakultet Sveučilišta u Zagrebu.

Bánffy, E. (1994). Transdanubia and Eastern Hungary in the Early Copper Age. *Jósa András Múzeum Évkönyve* 36, 291-296.

Becker, C., Benecke, N., Grabundžija, A., Küchelmann, H. C., Pollock, S., Schier, W., Schoch, C., Schrakamp, I., Schütt, B., & Schumacher, M. (2016). The Textile Revolution. Research into the Origin and Spread of Wool Production between the Near East and Central Europe. In G. Graßhoff & M. Meyer (Eds.), *Space and Knowledge. Topoi Research Group Articles*, 102-151. Journal for Ancient Studies, Special Issue 6. Berlin: eTopoi.

Blagojević, M. (2014). The Transition from Late Neolithic to Eneolithic in Western Serbia in the Light of Recent Research – archaeological rescue excavations in the Kolubara mining basin. In W. Schier & F. Drașovean (Eds.), *The Neolithic and Eneolithic in Southeast Europe: New approaches to dating and cultural dynamics in the 6th to 4th millenium BC*, 173-186. Rahden: Leidorf.

Borić, D. (2015). The End of the Vinča World: Modelling the Neolithic to Copper Age Transition and the Notion of Archaeological Culture. In S. Hansen, P. Raczky, A. Anders & A. Reingruber (Eds.), Neolithic *and Copper Age Between the Carpathians and the Aegean Sea: Chronologies and Technologies from the 6th to 4th Millennia BCE*, 177-237. Archaologie In Eurasien Vol. 31. Bonn: Verlag Dr. Rudolf Habelt.

Burić, M. (2015). Problems of the Late Neolithic Absolute Chronology in Eastern Croatia. In S. Hansen, P. Raczky, A. Anders, & A. Reingruber (Eds.) *Neolithic and Copper Age between the Carpathians and the Aegean Sea. Chronologies and Technologies from the 6th to the 4th Millenium BCE*, 143-156. Archaologie In Eurasien Vol. 31. Bonn: Verlag Dr. Rudolf Habelt.

Chapman, J. (1981). *The Vinča Culture of South-East Europe: studies in the chronology, economy and society.* British Archaeological Reports, International Series 117. Oxford: Archaeopress.

Craig, O. (2002). The development of dairying in Europe: potential evidence from food residues on ceramics. *Documenta Praehistorica* XXIX, 97-107.

Craig, O. E., Chapman, J., Heron, C., Willis, L. H., Bartosiewicz, L., Taylor, G., Whittle, A., & Collins, M. J. (2005). Did the first farmers of Central and Eastern Europe produce dairy foods? *Antiquity* 79, 882-894.

Crnobrnja, A. (2014). The (E)neolithic Settlement Crkvine at Stubline, Serbia. In W. Schier & F. Drașovean (Eds.), *The Neolithic and Eneolithic in Southeast Europe: New approaches to dating and cultural dynamics in the 6th to 4th millenium BC*, 173-186. Rhaden: Leidorf.

Crnobrnja, A., Simić, Z., Janković, M. (2009). Late Vinča culture settlement at Crkvine in Stubline: Household organization and urbanization in the Late Vinča culture period, *Starinar* LIX, 9-25.

Czekaj-Zastawny, A., Kabacinski, J., & Terberger, T. (2011). Long distance exchange in the Central European Neolithic: Hungary to the Baltic. *Antiquity* 85, 43-58.

Djurdjevac Conrad, N., Furstenau, D., Grabundžija, A., Helfmann, L., Park, M., Schier, W., Schützt, B., Schütte, C., Weber, M., Wulkow, N., & Zonker, J. (2018). Mathematical Modeling of the Spreading of Innovations in the Ancient World. *eTopoi Journal for Ancient Studies* 7, 1-32.

Čataj, L. (2009). *Josipovac Punitovački - Veliko Polje I. Eneolitičko, brončanodobno i srednjovjekovno naselje. (Eneolithic, Bronze Age and Medieval Settlement)*. Zagreb: Hrvatski Restauratorsi zavod.

Diaconescu, D. (2014). New remarks about the typology and the chronology of the Pločnik and čoka copper hammer-axes. In W. Schier & F. Drașovean (Eds.), *The Neolithic and Eneolithic in Southeast Europe: New approaches to dating and cultural dynamics in the 6th to 4th millenium BC*, 221-242. Rhaden: Leidorf.

Dizdar, M., Ložnjak Dizdar, D. i Sečkar, M. (2016). Jagodnjak-Napuštene njive (Abandoned fields). Rescue excavations of the Prehistoric and Antique site on the Osijek-Beli Manastir motorway route. *Annales Instituti Archaeologici* XII (1), 24-28.

Evershead, R., Dudd, S. N., Copley, M. S., & Mukherjee, A. (2002). Identification of animal fats via compound specific d13C values of individual fatty acids: assessments of results for reference fats and lipid extracts of archaeological pottery vessels. *Documenta Praehistorica* XXIX, 73-96.

Fábián, Sz. (2007). Balatonkeresztúr-Réti-dűlő (M7/S-35 lelőhely). In S. Honti et al. (Eds.), *Archaeological research on the Somogy county of the M7 highway and Route No. 67. (2004-2005)*, 26-9. Somogyi Múzeumok Közleményei 17/A. Kaposvar: Nemzeti Kulturális Alap.

Fábián, Sz. & Serlegi, G. (2009). Settlement and environment in the Late Copper Age along the southernshore of Lake Balaton in Hungary. In T. Thurston & R. Salisbury (Eds.), *Reimagining Regional Analyses: The Archaeology of Spatial and Social Dynamics*, 199-231. Cambridge: Cambridge Scholars Publishing.

Fábián, Sz. (2014). *The Settlement History of the Baden Culture in the Southern Lake Balaton Region Based on New Research Results*. (Doctoral Dissertation). Budapest: ELTE BTK Történelemtudományi Doktori Iskola, RégészetDoktori Program.

Fábián, Sz., Rajna, A., Csippan, P., György, L., Priskin, A. et al. (2018). Changing horizon of material culture: Spatial Aspects of Symbolic and Everyday Activities in Late Copper Age Settlements, *Hungarian Archaeology E-Journal*. http://files.archaeolingua.hu/2018T/Upload/Fabian_E184.pdf (accessed on August 21st, 2019).

Forenbaher, S. (1993). Radiocarbon dates and absolute chronology of the central European Early Bronze Age. *Antiquity* 67/255, 218-220, 235-256.

Forenbaher, S. (1995). Vučedol: graditeljstvo i veličina vučedolske faze naselja. *Opuscula archaeologica* 19, 17-25.

Grabundžija, A. (2018a). Eneolithic textile production. In J. Balen, I. Miloglav & D. Rajković (Eds.), *Back to the past: Copper Age in northern Croatia*, 257-285. Zagreb: Tiskara Zelina.

Grabundžija, A. (2018b): Two sides of a whorl. Unspinning meanings and functionality of eneolithic textile tools. In M. Siennicka, L. Rahmstorf & A. Ulanowska (Eds.), *First Textiles: The Beginnings of Textile Manufacture in Europe and the Mediterranean*, 129-142. Ancient Textiles Series Vol. 32. Oxford & Philadelphia: Oxbow Press.

Grabundžija, A. (2018c). Threads that bind the establishement. Housing eneolithic textile craft. In J. Balen, I. Miloglav & D. Rajković (Eds.), *Back to the past: Copper Age in northern Croatia*, 287-323. Zagreb: Tiskara Zelina.

Grabundžija, A., & Russo, E. (2016). Tools tell tales – climate trends changing threads in the prehistoric Pannonian Plain. *Documenta Praehistorica* XLIII, 301-326.

Grabundžija, A., Schoch, C., & Ulanowska, A. (2016). Bones for the Loom. Weaving Experiment with Astragali Weights. *Contributions of Institute of Archaeology in Zagreb* 33, 287-306.

Greenfield, H. (2010). The Secondary Products Revolution: the past, the present and the future. *World Archaeology* 42(1), 29-54.

Grömer, K. (2005). Efficiency and technique - experiments with original spindle whorls (Leistung und Technik – Experimente zum Spinnen mit Originalspinwirteln). In P. Bichler, K. Grömer, R. Hofmann-de Keijzer, A. Kern & H. Reschreiter (Eds.), *Hallstatt Textiles. Technical Analysis, Scientific Investigation and Experiment on Iron Age Textiles*, 107-116. BAR International Series 1351. Oxford: Archaeopress.

Gyucha, A., Yerkes, R., Parkinson, W., Sarris, A., Papadopoulos, N., Duffy, P., & Salisbury, B. (2015). Settlement Nucleation in the Neolithic: A Preliminary Reportof the Körös Regional Archaeological Project's Investigationsat Szeghalom-Kovácshalom and Vésztő-Mágor. In S. Hansen, P. Raczky, A. Anders & A. Reingruber (Eds.), *Neolithic and Copper Age Between the Carpathians and the Aegean Sea: Chronologies and Technologies from the 6th to 4th Millennia BCE*, 129-142. Archaologie In Eurasien Vol. 31. Bonn: Verlag Dr. Rudolf Habelt.

Horváth, T. (2010). Manifestation des Transcendenten in der Badener Siedlung von Balatonőszöd-Temetői dűlő-Kultgegenstände. *Praehistorische Zeitschrift* 85, 79-119.

Horváth, T. (2012a). Animal deposits in the Late Copper Age settlement of Balatonőszöd-Temetői dűlő, Hungary. In A. Pluskowski (Ed.), *The Ritual Killing and Burial of Animals,* 115-137. Oxford: European perspectives.

Horváth, T. (2012b). 'Spool-shaped clay artefact': an unknown object-type of the Boleráz-Baden Cultures. *Archeologia Moldovei* 35, 297-310.

Horváth, T. (2014). *The Prehistoric Settlement at Balatonőszöd-Temetői-dűlő, The Middle Copper Age, Late Copper Age and Early Bronze Age Occupation*. Varia archaeologica Hungarica XXIX. Budapest: Archaeolingua.

Hršak, T. & Bojčić, Z. (2008). Štrosmajerovac-Pustara. *Hrvatski arheološki godišnjak* 4, 41-43.

Jovanović, M. (2011). Masters of Clay and Wheat, From the Life of Prehistoric Farmers in the Danube Basin. In M. Jovanović (Ed.), *Masters of Clay and Wheat*, 13-57. Novi Sad: Muzej Vojvodine.

Jovanović, B., & Blagojević, M. (2014). Bratislava type lids as indicators of early copper metallurgy in the early Chalcolithic of central and southeast Europe. In W. Schier & F. Drașovean (Eds.) *The Neolithic and Eneolithic in Southeast Europe: New approaches to dating and cultural dynamics in the 6th to 4th millenium BC*, 409-412. Rahden: Leidorf.

Kalafatić, H. (2009). Rescue Excavations of the Čepinski Martinci-Dubrava site on the Beli Manastir-Osijek-Svilaj Motorway Route in 2007 and 2008, *Annales Instituti Archaeologici* V (1), 20-25.

Kalafatić, H. & Hulina, M. (2016). 'Rescue archaeological excavation at the AN7B Čeminac-Vakanjac site along the A5 Beli Manastir-Osijek motorway in 2014 and 2015, *Annales Instituti Archaeologici* XII(1), 29-35.

Kalicz, N., & Horváth, L. (2010). Die kupferzeitliche Protoboleráz-Phase (Gruppe) im Lichte der neuen Ausgrabungen in Südwest-Transdanubien. In J. Šuteková, P. Pavúk, P. Kalábková & B. Kovár (Eds.), *Panta Rhei: Studies on the Chronology and Cultural Development of South-Eastern and Central Europe in Earlier Prehistory Presented to Juraj Pavúk on the Occasion of his 75th Birthday*, 407-434. Bratislava: Comenius University.

Kania, K. (2015). Soft yarns, hard facts? Evaluating the results of a large scale hand-spinning experiment. *Journal of Archaeological and Anthropological Sciences* 7, 113-130.

Kerman, B. (2013). *Kalinovnjek pri Turnišću*. Ljubljana: Zavod za varstvo kulturne dediščine Slovenije.

Korošec, P., & Korošec, J. (1969). *Najdbe s koliščarskih naselbin pri Igu na Ljubljanskem barju / Fundgut der Pfahlbausiedlungen bei Ig am Laibacher Moor*. Arheološki katalogi Slovenije 3. Ljubljana: Narodni muzej v Ljubljani.

Köhler, K., Marcsik, A., Zádori. P., Biro, G., Szeniczey, T., Fábián, S., et al. (2017). Possible cases of leprosy from the Late Copper Age (3780-3650 cal BC) in Hungary. *PLoS ONE* 12(10): e0185966. https://doi.org/10.1371/journal.pone.

Kramberger, B. (2014). *Naselbinske strukture in keramični zbiri v petem tisočletju pred našim štetjem v severovzhodni Sloveniji.* (Doctoral Dissertation). Ljubljana: Univerza v Ljubljani, Filozofska fakulteta, Oddelek za arheologijo.

Laurito, R., Lemorini, C., & Perilli, A. (2014). Making Textiles at Arslantepe, Turkey, in the 4th and 3rd Millennia BC. Archaeological Data and Experimental Archaeology. In C. Breniquet & C. Michel (Eds.), *Wool Economy in the Ancient Near East and the Aegean*, 151-168. Ancient Textile Series Vol. 17. Oxford: Oxbow Books.

Leleković, T. (2008). Ivandvor. *Hrvatski arheološki godišnjak* 4, 12-15.

Link, T. (2006). *Das Ende der neolithischen Tellsiedlungen. Ein kulturgeschichtliches Phänomen des 5. Jahrtausends v. Chr. im Karpatenbecken.* Bonn: Verlag Dr. Rudolf Habelt.

Maran, J. (1998). Die Badener Kultur und der ägäisch-anatolische Bereich. *Germania* 76(2), 497-525.

Mihaljević, M. (2006). Istraživanje nalazišta Slavča-Nova Gradiška. In A. Tomaž (Ed.) *Od Sopota do Lengyela*, 29-34. Koper: Založba Annales.

Novšak, M., Tomaž, A., Plestenjak, A., Verbič, T., Culiberg, M., Tomazo-Ravnik, T., Djurić, B. et al. (2013). *Brezje pri Turnišču*. Ljubljana: Zavod za varstvo kulturne dediščine Slovenije.

Parkinson, W. A., Yerkes, R. W., & Gyucha, A. (2004). The transition from the Neolithic to the Copper Age: excavations at Veszto-Bikeri 2000–2002, Hungary. *Journal of Field Archaeology* 29, 101-121.

Petrović, J., & Jovanović, B. (2002). *Gomolava: naselja poznog eneolita*. Novi Sad, Beograd: Muzej Vojvodine, Arheološki institut.

Raczky, P. (1995). New data on the absolute chronology of the Copper Age in the Carpathian Basin. In T. Kovács (Ed.), *Neuere Daten zur Siedlungsgeschichte und Chronologie der Kupferzeit des Karpatenbeckens*, 51-60. Budapest: Magyar Nemzeti Múzeum.

Raczky, P., Andres, A., & Siklósi, Z. (2014). Trajectories of Continuity and Change between the Late Neolithic and the Copper Age in Eastern Hungary. In W. Schier & F. Drașovean (Eds.), *The Neolithic and Eneolithic in Southeast Europe: New approaches to dating and cultural dynamics in the 6th to 4th millenium BC*, 319-346. Rahden: Leidorf.

Regenye, J. (2013). Surviving Neolithic — The Early Copper Age in Transdanubia, North of Lake Balaton. In A. Anders & G. Kulcsár (Eds.), *Moments in time: Papers Presented to Pál Raczky on His 60th Birthday*, 557-568. Budapest: Eötvös Loránd University.

Schier, W. (2014). The Copper Age in Southeast Europe – historical epoch or typo-chronological construct? In W. Schier & F. Drașovean (eds.) *The Neolithic and Eneolithic in Southeast Europe: New approaches to dating and cultural dynamics in the 6th to 4th millenium BC*, 419-436. Rahden: Leidorf.

Sherratt, A. (1981). Plough and pastoralism: aspects of the secondary products revolution. In I. Hodder, G. Isaac & N. Hammond (Eds.), *Pattern of the Past: Studies in honour of David Clarke*, 261-305. Cambridge: Cambridge University Press.

Sherratt, A. (2002). Diet and cuisine: farming and its transformations as reflected in pottery. *Documenta Praehistorica* XXIX, 61-71.

Skelac, G. (1997). Prapovijesno nalazište Slavča. *Opvscvla archaeologica* 21 (1), 217-233

Spasić, M., & Crnobrnja, A. (2014). Vinčanske zdele sa protomama. *Starinar* LXIV, 185-203.

Spasić, M. (2008). Horizontal and Vertical Communication Axis in Middle and Late Eneolithic of Southeastern Europe*. Analele Banatului* XVI, 31-44.

Spasić, M. (2012). *Metahousing: Neolithic and modern dwelling in Belgrade*. Belgrade: Belgrade City Museum.

Šavel, I., Sankovič, S., Jereb, M., Kavur, B., Repec, S., Trampuž Orel, N., Urankar, R. et al. (2009). *Pod Kotom - jug pri Krogu*. Ljubljana: Zavod za varstvo kulturne dediščine Slovenije.

Tasić, N. (1995). *Eneolithic Cultures of Central and West Balkans*. Belgrade: Draganić.

Tomaž, A., Djurić, B., Hincak, Z., Ogorelec, A., Tratnik-Šumi, J., Janežič, M., Svenšek, N. et al. (2012). *Turnišče*. Ljubljana: Zavod za varstvo kulturne dediščine Slovenije.

Tringham, R., & Stefanović, M. (1990). The nonceramic uses of clay. In R. Tringham & D. Krstić (Eds.), *Selevac: A Neolithic Village in Yugoslavia*, 323-396. Monumenta Archaeologica No. 15. Los Angeles: Institute of Archaeology, University of California.

Vigne, J. D., & Helmer, D. (2007). Was milk a “secondary product” in the old world Neolithization process? Its role in the domestication of cattle, sheep and goats. *Anthropozoologica* 42(2), 9-40.

Zorić, J. (2018). *Pajtenica-Velike Livade, eneolitičko naselje lasinjske culture*. (Master thesis). Zagreb: Filozofski fakultet, Odsjek za arheologiju.