IV. Commonalities in Craft through Contacts?

Textile Production in the 4th and 3rd Millennia BC in Western Anatolia

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Abstract: The prehistoric textile production in western Anatolia has been an underappreciated field of study. In comparison with other crafts like the production of metal tools, stone tools or pottery, it is mostly an 'uncharted territory'. Recent research, however, indicates that studying technical aspects of the craft at a supraregional scale reveals information about potential connections, contacts and interactions. This demonstrates that studying prehistoric textile production not only provides insights about the technical aspects of the craft, but also the broader social and cultural impacts of the craft. This paper represents the first attempts for a statistical analysis of comparable spindle whorl ensembles from different sites in western Anatolia from the 4th and 3rd millennia BC. The aim is to show whether there are traceable commonalities or differences within the metrical system of the spindle whorls that could indicate areas and routes of interaction.

Keywords: Textile production, western Anatolia, 4th millennium, 3rd millennium, Late Chalcolithic, Early Bronze Age, spindle whorl, contact

Zusammenfassung: Die prähistorische Textilproduktion in Westanatolien war ein lange vernachlässigter Bereich archäologischer Forschungen. Im Vergleich mit anderen Handwerksbereichen, wie der Metallurgie, Lithik oder Keramik, ist es ein weitestgehend ‚unbekanntes Terrain' in Anatolien. Aktuelle Studien zeigen jedoch, dass durch die technische Analyse des Handwerkszweigs im überregionalen Vergleich Erkenntnisse über potentielle Verbindungen, Kontakte und Interaktionen aufgedeckt werden können. Dies zeigt, dass durch die Erforschung der prähistorischen Textilproduktion nicht nur Informationen über die technischen Aspekte des Handwerks, sondern auch Erkenntnisse über kulturelle und soziale Bedeutung und Auswirkung in größerern Umfang gewonnen werden können. Dieser Artikel stellt den ersten Versuch dar, eine statistische Analyse von vergleichbaren Spinnwirtel-Ensembles verschiedener Fundstellen des 3. und 4. Jahrtausends v. Chr. in Westanatolien durchzuführen. Das Ziel der Studie ist es herauszuarbeiten, ob nachweisbare Gemeinsamkeiten oder Unterschiede in den metrischen Systemen der Spinnwirtel vorherrschen, welche auf Gebiete oder Wege von Interaktionen hinweisen können.

Stichworte: Textilproduktion, Westanatolien, 4. Jahrtausend v. Chr., 3. Jahrtausend v. Chr., Spätchalkolithikum, Frühbronzezeit, Spinnwirtel, Kontakt

The production of textiles is an inseparable part of daily life of every society whether referring to clothes or everyday objects made from fibres. This goes back to Palaeolithic times, when simple artefacts made from knotted or wound fibres were used.[275] In the rare cases where environmental conditions allow such artefacts to be found along with objects made from longer lasting material, fibre artefacts outnumber stone tools by a factor of 20 to 1.[276] This is especially noteworthy when considering textile production in the case of early (pre-)state societies. In this paper, the impact of a later – while still very early – state of textile production will be analysed, a state were spinning with the free hand spindle and weaving on the warp-weighted loom had become common.[277] The focus is on the 4th and 3rd millennia in western Anatolia, the Late Chalcolithic and Early Bronze Age. Western Anatolia is an important region for the transport of innovations and technologies

275 Hardy 2007.
276 Adovasio et al. 2007.
277 See for example Crowfoot 1931; Crowfoot 1937; Barber 1993.

from the Near East to Europe as well as a place for crucial developments. Several groundbreaking ideas travelled to Europe via routes of interaction and exchange in western Anatolia, where some elements were adapted and developed.[278] It is therefore highly probable that this is also applicable for techniques, changes and perceptions of style in textile production. Moreover, the time between the Late Chalcolithic and the Early Bronze Age can safely be described as a time of changes in cultural and social contexts, as well as technological context.[279] The temporal focus for this paper should therefore be an ideal foundation for the study of technical changes and their social and cultural impact.

Textile production as a subfield of prehistoric archaeology has been a neglected or at least underappreciated field of study. However, in the last few decades the interest in it is steadily growing, at least in regions with good preservation conditions for textiles.[280] Other regions, like the Aegean or Anatolia, are still uncharted in the matter of prehistoric textile production. Nonetheless, more and more studies are being conducted that clearly show the potential and importance of this craft. Analysing textile production not only gives insight into the complexity of the crafts processes and techniques but also general information about craft specialisation, labour organisation and the division of labour.[281] Ethnological studies in particular have demonstrated that work with fibres – meaning spinning and weaving, as well as string and rope making and other actions – often underlies certain regulations.[282] As an example within the Wola, an indigenous culture living in the central highlands of Papua New Guinea, only women have the privilege to work with fibres to produce string and objects made from it. With this task comes also a certain degree of autonomy and it carries a meaning of strong social importance.[283]

This demonstrates the information and knowledge that can be gained about a society by studying their handling of textile production.

As already implied above, the soils in western Anatolia and the Aegean offer very poor preservation conditions for textiles. Therefore, all information has to be gained from the tools used for textile production, such as spindle whorls, loom weights, needles and awls. Via the metrics, and use-wear analysis in the case of bone tools, the process of textile production can be reconstructed in large part. Experiments show that the weight and size of the spindle whorl defines the thickness of the yarn, as well as the time consumption of the spinning process.[284] With the weight and thickness of the loom weights and the yarn properties, it is possible to calculate the number of warp threads in a loom set-up and thus possible mesh sizes and weaving techniques.[285] With the help of use-wear analysis and other factors, it is even possible to make a statement regarding the used raw material.[286] The aim of this paper is to use metrical data from comparable prehistoric ensembles in order to gain information on the general development of textile production, common techniques and shared knowledge in western Anatolia in the 4th and 3rd millennia BC.[287] The basis for this study are the analyses of Çukuriçi Höyük, a tell settlement at the central Aegean coast in western Anatolia.[288]

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278 See for example Şahoğlu 2005; Çevik 2007; Rahmstorf 2006; Rahmstorf 2011.

279 See Maran 1998; Yakar 2011; as well as Schoop 2005 and Schoop 2011.

280 See for a variety of examples: Carington Smith 1977; Grömer 2010; Gleba – Mannering 2012.

281 See for example Costin 1991.

282 See Malinowsky 1922; Lee 1979; Mackenzie 1991; also Barber 1994.

283 See Sillitoe 1988; Mackenzie 1991.

284 Mårtensson 2007, 101; Andersson et al. 2008, 173; Mårtensson et al. 2009; Andersson et al. 2010, 164–165.

285 See Mårtensson et al. 2009.

286 See Legrand – Sidéra 2007; Christidou 2008; Stone 2009; also Verhecken 2009; Verhecken 2013.

287 This study is restricted to an inter-site comparable analysis. An intra-site perspective, analysing those finds according to their spatial distribution, is presented in another paper (Britsch – Horejs in press) and will therefore not be repeated in the current publication.

288 Horejs 2008b; Horejs 2010; Horejs et al. 2011.

IV.1. Measuring Essentials – The Methods

By analyzing the metrics of textile tools, it is possible to gain a lot of information about the process of textile production. This paper focuses on the impact of the spindle whorls, more precisely the weight of the spindle whorls. Therefore, the following descriptions will be mainly confined to studies and experimental tests about spindle whorls and the spinning process. Several studies and experiments demonstrate that the weight of the spindle whorl has a direct influence on the properties of the spun yarn.[289] According to these, the thread spun with a heavier spindle whorl will be thicker than one spun with a lighter whorl. While this seems to be only one small part of the whole process, it can have a strong influence, if the spinner(s) used a standardised range in weight for the whorls. If for example the spinners of a settlement only used very light spindle whorls and thereby only produced very fine thread, this would strongly determine what kind of textile could be produced. The same applies to the use of only heavier whorls or by using a large scale of different whorl sizes. How the yarn properties influence the produced textile was made clear by several tests and experiments, mainly conducted by the Centre for Textile Research in Copenhagen.[290] In these experiments, different sized spindle whorls (4g, 8g, 18g and 44g) were used by one group of trained craftswomen over a considerable amount of time. The tests clearly showed that each weight of spindle whorl produced a specific yarn thickness: 0.3mm with the 4g whorl, 0.3–0.4mm with the 8g, 0.4–0.6mm with the 18g and 0.8–1.0mm with the 44g whorl. This demonstrated that the weight of the spindle whorl, and not the individual spinner, has the greatest influence on the spun yarn.

Weaving experiments revealed that three different factors strongly influence the weaving process: the weight and the thickness of the loom weights, and the thickness and consequently the stability of the yarn.[291] This again demonstrates the strong influence of the yarn properties and therefore the influence of the spindle whorl weight. Bearing these thoughts in mind, it is possible to hypothesise that via the range in weight as well as the mean weight of spindle whorls of one settlement, one can determine how and what kind of textile was produced. The aim of this paper is to test this hypothesis on the inventory of different sites and to see if there are differences or commonalities between different shapes of spindle whorls or the different sites and whether there are traceable patterns that change or continue during the 4th and 3rd millennia BC. The data analysis was conducted with SPSS. The data was analyzed with a 4 (*period*) × 7 (*shape*) × 17 (*site*) ANOVA as well as Tukey post-hoc tests for significant interactions. Since ANOVA is very robust against non-normal variables,[292] it was also calculated with non-normal variables. The number of analyzed spindle whorls is N = 410. There was no missing data in the reported results. The effect sizes of the main effects of the ANOVA are reported by the partial eta-squared (η^2), with values up to .01 as small, up to .06 as medium and up to .14 as large effect sizes.[293]

IV.2. Results of the Statistical Analyses

The data for the statistical analysis was mainly gained via several publications; the only exception is the ensemble from Çukuriçi Höyük, where the information could be recorded directly on the material. Frequencies for the factors *shape*, *period* and *site* are shown in Table 1.

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289 See Mårtensson 2007; Andersson et al. 2008; Andersson et al. 2010.
290 See Andersson et al. 2008.
291 Mårtensson et al. 2009, 378.
292 Tabachnick – Fidell 2007.
293 Cohen 1988.

Site			Period			Shape		
	Frequency	Percent		Frequency	Percent		Frequency	Percent
Aphrodisias	16	3,9	LC	40	9,8	Roundish	36	8,8
Ayio Gala	3	0,7	EBA 1	174	42,4	Flat Roundish	21	5,1
Beycesultan	54	13,2	EBA 2	164	40,0	Conical	38	9,3
Çine-Tepeçik	3	0,7	EBA 3	32	7,8	Biconical	238	58,0
Çukuriçi Höyük	63	15,4				Flat Biconical	20	4,9
Demircihüyük	71	17,3				Round Biconical	13	3,2
Karataş/Bağbaşı	28	6,8				Diamond-Shaped	44	10,7
Emporio	9	2,2						
Hanaytepe	2	0,5						
Heraion	8	2,0						
Ilıpınar	4	1,0						
Kaklık Mevkii	11	2,7						
Karaoğllan Mev.	2	0,5						
Kumtepe	4	1,0						
Kuruçay Höyük	6	1,5						
Troy	88	21,5						
Kanlıgeçit	38	9,3						
Total	410	100,0	Total	410	100,0	Total	410	100,0

Table 1 Frequencies and percent of the factors *site*, *period* and *shape*

A one-way ANOVA with *shape*, *period* and *site* was conducted on the weight of the spindle whorls. It revealed a main effect of *shape*, F (6,404) = 2.930, p = 0.008, η^2 = 0.051 and *site* F (16,394) = 4.638, p < 0.001, η^2 = 0.184. There was no main effect of the factor *period* F (3,407) = 2.114, *ns,* and no significant interactions of *shape* x *period*, *shape* x *site, period* x *site* or *shape* x *period* x *site* F < 1,262, p > 0.285.

Post-hoc analyses were conducted for a further exploration of the relations between *weight* and *shape* and between *weight* and *site*.

Tukey post-hoc tests for the variable *shape* showed, that only two shapes differed significantly in weight. Roundish spindle whorls were significantly heavier than flat biconical (mean difference, 14.1; 95% confidence interval, 2.03 to 26.188; p = 0.011). All other shapes did not differ significantly in weight (p > 0.1).

The post-hoc analyses for *site* were calculated for the 4th and 3rd millennia sites separately to create a chronologically logical comparison. The results of the post-hoc analyses for the variable *sites* on the other hand showed many comparisons with significant (p < 0.1) or highly significant (p < 0.05) differences.

For the Late Chalcolithic sites, the following significant comparisons could be seen: Aphrodisas spindle whorls were significantly heavier than Beycesultan, and Bağbaşı whorls, and significantly lighter than Ayio Gala and Kumtepe whorls. Ayio Gala spindle whorls were significantly heavier than Beycesultan, Bağbaşı and Kuruçay Höyük whorls. Beycesultan spindle whorls were significantly lighter than Kumtepe whorls. Bağbaşı spindle whorls were significantly lighter than Kumtepe whorls and Kumtepe spindle whorls were significantly heavier than Kuruçay Höyük whorls. For mean difference, standard error and significances of the post-hoc analyses for *site* see Table 2.

For the Early Bronze Age sites following significant comparisons could be seen: Beycesultan spindle whorls were significantly heavier than Demircihüyük whorls and significantly lighter than Çukuriçi Höyük and Emporio whorls. Çukuriçi Höyük spindle whorls were significantly heavier than Demircihüyük and Troy spindle whorls. Demircihüyük spindle whorls were significantly lighter than Emporio and Troy whorls and Emporio spindle whorls were significantly heavier than Troy whorls. For mean difference, standard error and significances of the post-hoc analyses for *site* see Table 3.

Site		Mean Difference	Standard Error	Sig.
Aphrodisias	Ayio Gala	–13,89	5,72	0.192
	Beycesultan	18,76	5,72	0.037
	Bağbaşı	15,04	3,69	0.006
	Kumtepe	–15,64	5,09	0.056
	Kuruçay	7,81	5,72	0.746
Ayio Gala	Aphrodisias	13,89	5,72	0.192
	Beycesultan	32,66	7,39	0.003
	Bağbaşı	28,93	5,96	0.001
	Kumtepe	–1,750	6,91	1.000
	Kuruçay	21,71	7,39	0.074
Beycesultan	Aphrodisias	–18,76	5,72	0.037
	Ayio Gala	–32,66	7,39	0.003
	Bağbaşı	–3,72	5,96	0.988
	Kumtepe	–34,41	6,91	0.001
	Kuruçay	–10,95	7,39	0.679
Bağbaşı	Aphrodisias	–15,04	3,69	0.006
	Ayio Gala	–28,93	5,96	0.001
	Beycesultan	3,72	5,96	0.988
	Kumtepe	–30,68	5,35	0.000
	Kuruçay	–7,23	5,96	0.826
Kumtepe	Aphrodisias	15,64	5,09	0.056
	Ayio Gala	1,75	6,91	1.000
	Beycesultan	34,41	6,91	0.001
	Bağbaşı	30,68	5,35	0.000
	Kuruçay	23,46	6,91	0.029
Kuruçay	Aphrodisias	–7,81	5,72	0.746
	Ayio Gala	–21,71	7,39	0.074
	Beycesultan	10,95	7,39	0.679
	Bağbaşı	7,23	5,96	0.826
	Kumtepe	–23,46	6,91	0.029

Table 2 Results from the post-hoc analyses for the LC sites with the factor *site*

Site		Mean Difference	Standard Error	Sig.
Beycesultan	Çukuriçi Höyük	–9,33	2,80	0.052
	Demircihüyük	14,36	2,73	0.000
	Emporio	–22,88	5,38	0.002
Çukuriçi Höyük	Beycesultan	9,33	2,80	0.052
	Demircihüyük	23,70	2,57	0.000
	Troy	15,67	2,45	0.000
Demircihüyük	Beycesultan	–14,36	2,73	0.000
	Çukuriçi Höyük	–23,70	2,57	0.000
	Emporio	–37,25	5,27	0.000
	Troy	–8,02	2,37	0.044
Emporio	Beycesultan	22,88	5,38	0.002
	Demircihüyük	37,25	5,27	0.000
	Troy	29,22	5,21	0.000
Troy	Çukuriçi Höyük	–15,67	2,45	0.000
	Demircihüyük	8,02	2,37	0.044
	Emporio	–29,22	5,21	0.000

Table 3 Results from the post-hoc analyses for the EBA sites with the factor *site*
(for simplicity reasons only significant values are shown)

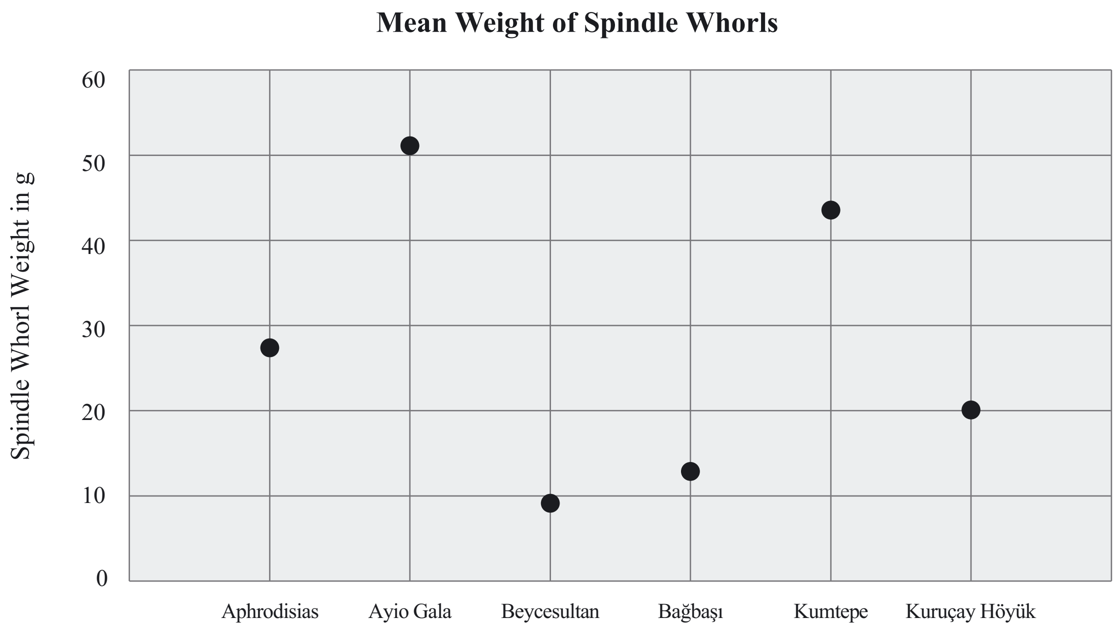

Fig. 4.1 Mean weight of spindle whorls from LC sites; n(total) = 38 [n(Aphrodisias) = 15; n(Ayio Gala) = 3; n(Beycesultan) = 3; n(Bağbaşı) = 10; n(Kumtepe) = 4; n(Kuruçay) = 3] (graphics: Ch. Britsch)

IV.3. Connecting Commonalities and Differences

The main effect of ANOVA for *site* can be seen as relevant due to its large effect size. This shows that the weight and sizes of the spindle whorls strongly depend on the particular settlement in which they were produced. With the results of the post-hoc tests, it was possible to separate the sites into groups connected by the metrics of their spindle whorl ensembles. As a next step, the pairs were separated into two chronological main frames, the 4th and the 3rd millennia BC. In both cases, problems regarding the sample sizes had to be dealt with. For the 4th millennium this mainly related to there being few sites (N = 6) with only small sample sizes (ranging from 3 to 15). For the 3rd millennium, the main problem was the strongly varying sample sizes (ranging from 3 to 88). However, in both cases it was possible to gain clear results for the metrical connection of the sites.

4th Millennium BC

For the 4th millennium BC in western Anatolia, publications featuring useable data are available for only six sites, namely Aphrodisias, Ayio Gala, Beycesultan, Bağbaşı, Kumtepe and Kuruçay Höyük.[294] Aphrodisias contains the largest sample, but has only 15 objects with useful metrical data. By plotting the mean weight of the spindle whorls for the different sites graphically, smaller and larger differences noticeable between certain sites become evident (see Fig. 4.1), although without distinct connections. By performing the post-hoc analyses, not only the mean values, but also the range was compared, thus giving a clearer view of the matter. The results of these analyses showed that significant differences exist between most sites (see Table 2).

These results suggest that there are three metrically related pairs of sites; meaning that within each pair there is no significant difference in weight. On the other hand these pairs show

[294] Lloyd – Mellaart 1962; Sperling 1976; Hood 1981/1982; Sharp Joukowsky 1986; Eslick 1992; Duru 1996.

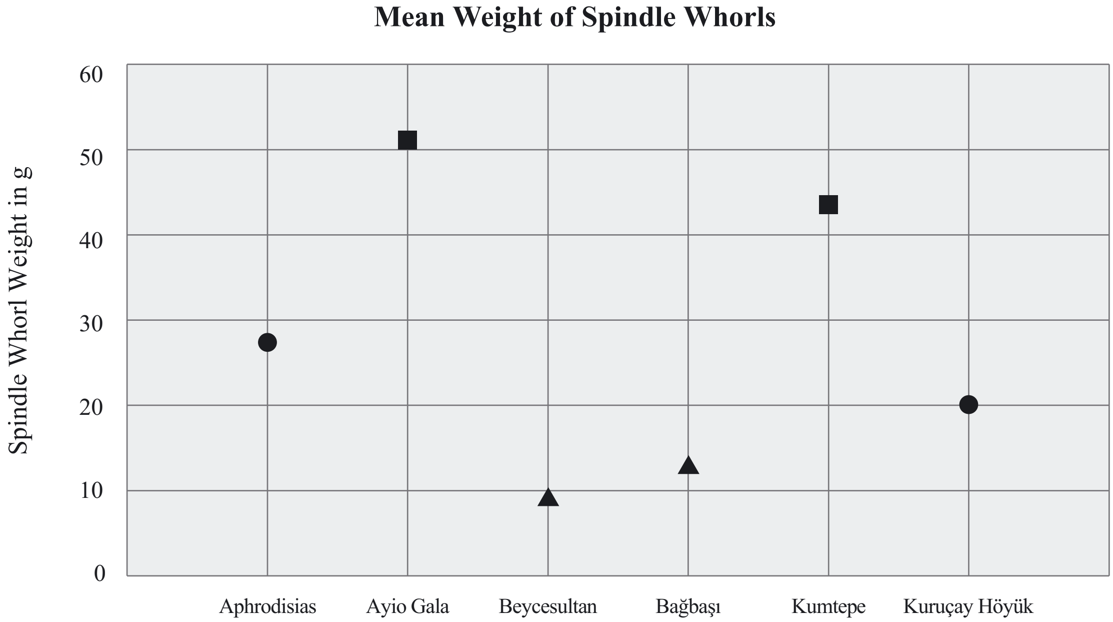

Fig. 4.2 LC sites connectable via post-hoc analysis; n(total) = 38 [n(Aphrodisias) = 15; n(Ayio Gala) = 3; n(Beycesultan) = 3; n(Bağbaşı) = 10; n(Kumtepe) = 4; n(Kuruçay) = 3] (graphics: Ch. Britsch)

significant metrical differences (e.g. higher or lower weight) compared to the other tested sites, thus creating three metrically related groups (see Fig. 4.2).

As a next step, the sites were plotted on a map to examine whether the groups are also spatially related (see Fig. 4.3). As it can be clearly seen on this map, the metrically related groups are also spatially related. Furthermore, the two groups in the south-eastern part are spatially very close to each other. These groups are also very close to each other in the plot of their mean weight of spindle whorls (see Fig. 4.1). This could mean that while still having significant differences, the sites of these groups are closer in their metrical system to each other than to the third group, which is also spatially further away. With only six sites and very small sample sizes, these statements have to be treated with caution. However, these results clearly demonstrate the potential of these analyses and show a traceable tendency for 4th millennium relations between different sites in western Anatolia.

3rd Millennium BC

As already mentioned, the main problem for the analyses of the 3rd millennium sites is the strongly varying sample sizes deriving from the state of publications. While for sites like Çukuriçi Höyük, Beycesultan, Demircihüyük or Troy over 50 spindle whorls could be used, sites like e.g. Ilıpınar, Kuruçay Höyük or Çine-Tepecik featured less than five spindle whorls with useable data.[295] Because of this, the smaller assemblages showed no clear results in the post-hoc analyses. To deal with this problem, the post-hoc analyses were done step by step. First, only the sites with the largest sample sizes (Çukuriçi Höyük, Beycesultan, Demircihüyük and Troy) and Emporio which showed particularly strong significances in all previous tests, were analysed. The post-hoc analyses revealed very strong significances, up to $p < 0.01$ (see Table 3).

[295] Schliemann 1874; Blegen et al. 1950; Miljočić 1961; Lloyd – Mellaart 1962; Hood 1981/1982; Sharp Joukowsky 1986; Efe et al. 1987; Warner 1994; Roodenberg 1995; Duru 1996; Obladen-Kauder 1996; Topbaş et al. 1998; Günel 2008a; Özdoğan – Parzinger 2012.

Fig. 4.3 Map of analysed LC sites with symobls matching to the metrically related groups (map: Ch. Britsch)

These sites formed the basic structure into which the other sites were embedded, and therefore provided the possible metrically related groups. For the next step, all sites with spindle whorl ensembles containing 8 to 38 objects were added. The affiliation of these sites to a particular metrically related group was mainly determined by the results of the post-hoc analyses, but plotting the mean weight of the spindle whorls helped in uncertain cases. This gave a first impression of which sites seemed to have metrically related spindle whorl assemblages (see Fig. 4.4). At this point, metrical relations could be seen between Çukuriçi Höyük and Heraion and between Beycesultan, Karataş, Kaklık Mevkii, Troy I–III and Kanlıgeçit, with Demircihüyük and Emporio as outliers. Since the rest of the sites, with spindle whorl assemblages smaller than five objects, gave no useful information in the post-hoc analyses, their affiliation was mainly determined by the mean weight of spindle whorls. Through these steps, it was possible to determine the relationships between all sites. Thus the metrical relation between the sites could be traced, and metrical groups were formed as follows: Aphrodisias, Çukuriçi Höyük, Heraion, Karaoğlan Mevkii and Kuruçay Höyük; Beycesultan, Karataş, Kaklık Mevkii, Troy I-III and Kanlıgeçit; Çine-Tepecik, Demircihüyük and Ilıpınar and leaving Emporio as an outlier with no distinctly traceable metrical connections to the other sites (see Fig. 4.5).

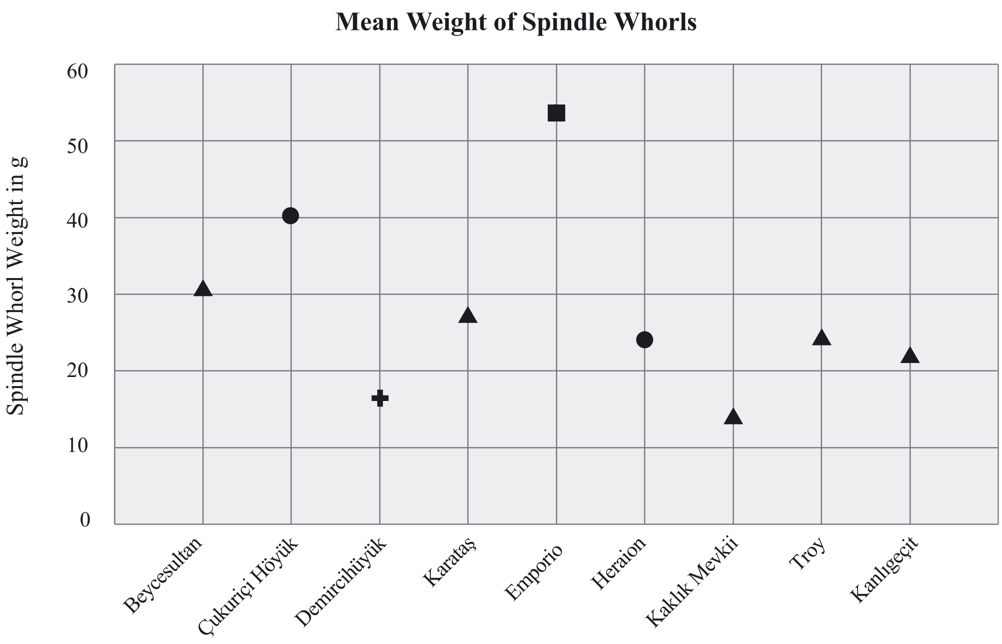

Fig. 4.4 EBA sites connectable via first steps of post-hoc analysis; n(total) = 357 [n(Beycesultan) = 51; n(Çukuriçi Höyük) = 63; n(Demircihüyük) = 71; n(Karataş) = 18; n(Emporio) = 9; n(Heraion) = 8; n(Kaklık Mevkii) = 11; n(Troy) = 88; n(Kanlıgeçit) = 38] (graphics: Ch. Britsch)

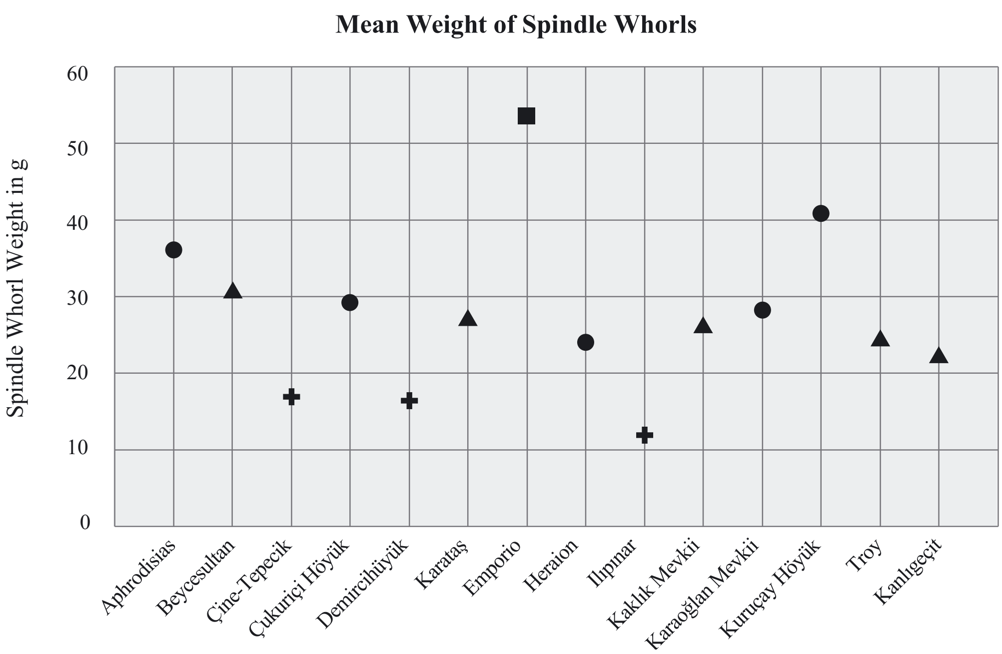

Fig. 4.5 EBA sites connectable via post-hoc analysis and their mean weight of spindle whorls; n(total) = 373 [n(Aphrodisias) = 3; n(Beycesultan) = 51; n(Çine-Tepecik) = 3; n(Çukuriçi Höyük) = 63; n(Demircihüyük) = 71; n(Karataş) = 18; n(Emporio) = 9; n(Heraion) = 8; n(Ilıpınar) = 4; n(Kaklık Mevkii) = 11; n(Karaoğlan Mevkii) = 3; n(Kuruçay Höyük) = 3 ; n(Troy) = 88; n(Kanlıgeçit) = 38] (graphics: Ch. Britsch)

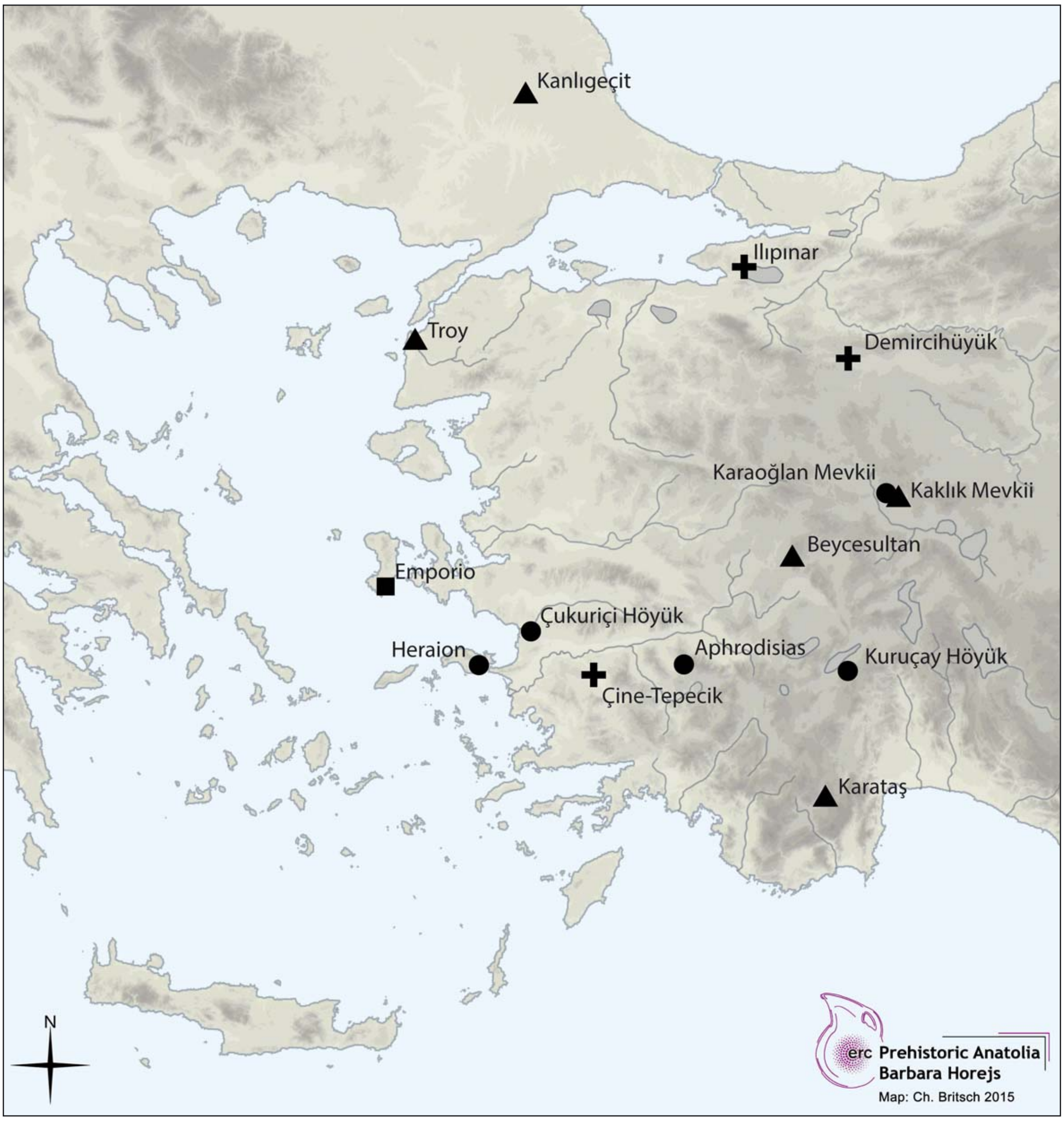

Fig. 4.6 Map of analysed EBA sites with symbols matching to the metrically related groups (map: Ch. Britsch)

As with the 4th millennium sites, the examined 3rd millennium sites were plotted on a map (see Fig. 4.6), and again it can clearly be seen that the metrically related sites were also spatially related. One group of related sites extends from the central Aegean coast along the Büyük Menderes and another around the Marmara Region and Eskişehir Region. The final group seems to be separated between the Troas and Turkish Thrace and the eastern reaches of the Büyük Menderes in the south-eastern part of western Anatolia. The reasons for the separation of this group cannot be explained at the current state of study. It might just be a coincidence, or may be caused by missing information about sites between these regions. Nonetheless, it is possible to trace groups of sites that share metrical relations within their spindle whorl assemblages.

The Meaning of Commonalities

Since the weight of the used spindle whorl has a strong influence on the overall spinning process, the average and range of weight of spindle whorls from any one site gives an impression of the way of textile production in this particular site. Thus, commonalities within this metrical system between different sites could mean mutual textile production techniques. Regarding this, the metrically related groups determined in the statistical analyses could point out sites that shared mutual textile techniques. How far this mutuality might reach, in sense of common used materials, produced types and styles of clothes or even fashion, cannot be said at the current state of studies. However, the results indicate that observable commonalities in the textile production existed between certain sites during the 4th and 3rd millennia BC in western Anatolia. This leads to the hypothesis that such mutuality must result from contact between these sites.

IV.4. Discussion

As a final approach, the results of this paper were compared with more commonly known hypothesises for the distribution of ideas and techniques in the Early Bronze Age in Anatolia. As an experiment, the examined metrical relations for the 3rd millennium were plotted on a map published by Rahmstorf in 2006 (see Fig. 4.7). The spaces and routes of interaction demonstrated on this map are based on several innovations that spread in Anatolia and the Aegean during the second half of the 3rd millennium BC. This includes depas vessels, weights and tin bronze.[296] By plotting the examined sites on this map, it can be seen that the groups along the Büyük Menderes and at its eastern reaches align very well with the routes of distribution postulated by Rahmstorf. In addition, connections between sites at the Büyük Menderes and the Marmara Region and from the south-east to the Troas and Turkish Thrace seem to concur with the suggested routes of interac-

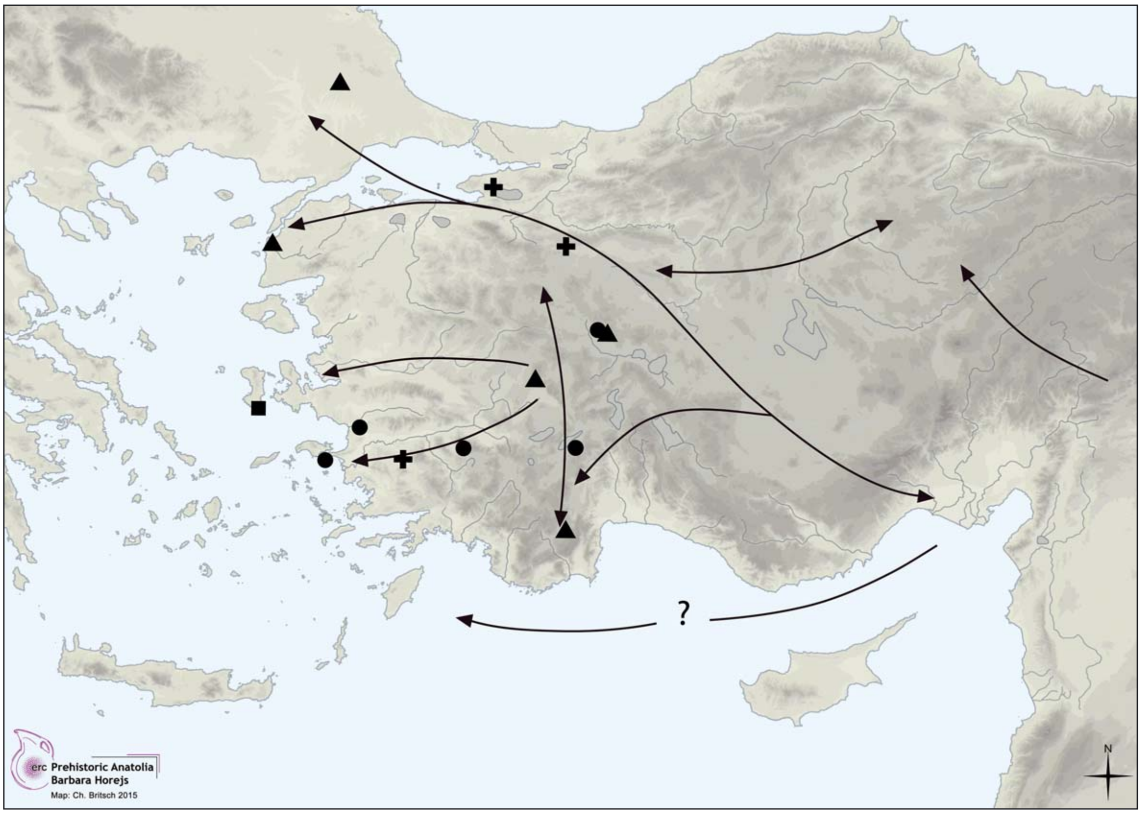

Fig. 4.7 EBA sites with metrically related spindle whorl weights and routes of interaction introduced by L. Rahmstorf (map: Ch. Britsch, after Rahmstorf 2006, fig. 18)

296 Rahmstorf 2006.

tion. If we accept that the metrically connected sites shared mutual textile techniques, this would mean that the contacts resulting in this mutuality spread along the same routes of exchange traceable by other innovations and techniques. This could mean that the spaces and routes of interaction and exchange were already established in the beginning of the 3rd millennium BC and might have had roots in earlier periods, at least in the 4th millennium BC.[297] The metrically related groups that were worked out in this paper would therefore represent bonds of contact and exchange where mutual perception of technique and maybe even style were shared. Future studies will reveal how deep and exclusive these bonds were, and how firmly the mutuality actually was established.

IV.5. Conclusion

The aim of this study was to find traceable commonalities and/or differences within the metrical systems of spindle whorls of different sites. Via a one-way ANOVA and post-hoc analyses it could be shown that both 4th and 3rd millennia BC sites in western Anatolia show significant differences as well as commonalities. This allowed forming metrically related groups of sites for both the 4th and 3rd millennia BC. With the explanation given above, that the spindle whorl weight has a strong influence on the entire textile production process, this suggests that metrical relations indicate mutual textile production techniques. By plotting the sites cartographically, it was possible to demonstrate that the metrically related groups of sites were also spatially related. This gave reason to hypothesise that the metrical relations were not mere coincidence, but resulted from contacts and interactions between these sites and their societies and craftsmen. These results were then compared with other theories of prehistoric routes and spaces of contact and interaction in 3rd millennium western Anatolia.[298] Textile production gives a strong indication that these routes of interaction and communication were established in the early 3rd millennium BC and may be rooted in even earlier periods.

These results clearly demonstrate the potential within the detailed study of textile production. The studies of this paper only referred to spindle whorls and therefore only one stage of textile production. Furthermore, the general problem when studying prehistoric textile tools – insufficient published data – was a strong limiting factor on potential insights. Nonetheless, it could be shown that even with these limitations clear observations of connections could be made. Even though the analysis only relied on the metrics of spindle whorls, it could be shown that certain sites share the metrical range of their tools while being separated from other sites in this matter. It seems very likely that such mutuality arose from contacts and interaction between these sites. This leads to the conclusion that certain aspects of technology were shared within the metrically connected sites. Shared technologies in textile production could point out to commonalities in clothes and styles of everyday objects. If this is the case, this would point out commonalities in a very important social and cultural sphere – the way people want to present themselves in daily life.

So far, of course, this has to remain an assumption, not least because of the limitations mentioned above. However, this paper demonstrates the importance of the study of prehistoric textile production for Anatolia and the Aegean. Textile production is one of the most important crafts with a strong impact on society, which continues today.

To fully understand social and cultural behaviour it is necessary to see it from as many angles as possible. Future studies examining a larger body of material and referring to all parts of textile production will provide a clearer picture of the development and distribution of textile production techniques and therefore give a more distinct statement on its social and cultural impact.

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[297] On this topic see Horejs 2014.

[298] Rahmstorf 2006.

References

Adavasio et al. 2007
J. M. Adavasio – O. Soffer – J. Page, The Invisible Sex (New York 2007).

Andersson et al. 2008
E. Andersson – L. Mårtensson – M.-L. Bech Nosch – L. Rahmstorf, New research on Bronze Age textile production, Bulletin of the Institute of Classical Studies 51, 2008, 171–174.

Andersson et al. 2010
E. Andersson – E. Felluca – M.-L. Nosch – L. Peyronel, New perspectives on Bronze Age textile production in the Eastern Mediterranean. The first results with Ebla as a pilot study, in: P. Matthiae – F. Pinnock – L. Nigro – N. Marchetti (eds.), Proceedings of the 6th International Congress on the Archaeology of the Ancient Near East at the Università di Roma (Italy), May 5th–10th 2008 (Wiesbaden 2010) 159–176.

Barber 1993
E. J. W. Barber, Prehistoric Textiles. The Development of Cloth in the Neolithic and Bronze Ages with Special Reference to the Aegean (Princeton 1993).

Barber 1994
E. J. W. Barber, Women's Work. The First 20,000 Years (New York 1994).

Blegen et al. 1950
C. W. Blegen – J. L. Caskey – M. Rawson – J. Sperling, Troy I. General Introduction. The First and Second Settlements (Princeton 1950).

Britsch – Horejs in press
Ch. Britsch – B. Horejs, Agencies of textile production in western Anatolian and Aegean prehistory, in: L. Quillien – K. Sarri (eds.), Textile Workers. Skills, Labour and Status of Textile Craftspeople Between the Prehistoric Aegean and the Ancient Near East (in press).

Carington Smith 1977
J. Carington Smith, Spinning, Weaving and Textile Manufacture in Prehistoric Greece: From the Beginning of the Neolithic to the End of the Mycenaean Ages (PhD Diss., University of Tasmania, Hobart 1977).

Christidou 2008
R. Christidou, An application of micro-wear analysis to bone experimentally worked using bronze tools, Journal of Archaeological Science 35, 2008, 733–751.

Cohen 1988
J. N. Cohen, Statistical Power Analysis for the Behavioral Sciences, 2nd edition (Hillsdale, NJ 1988).

Costin 1991
C. L. Costin, Craft specialization. Issues in defining, documenting, and explaining the organization of production, in: M. B. Schiffer (ed.), Archaeological Method and Theory 3 (Tucson 1991) 1–56.

Crowfoot 1931
G. M. Crowfoot, Methods of Hand Spinning in Egypt and the Sudan (Halifax 1931).

Crowfoot 1937
G. M. Crowfoot, Of the Warp-Weighted Loom, The Annual of the British School at Athens 37, 1937, 36–47.

Çevik 2007
Ö. Çevik, The emergence of different social systems in Early Bronze Age Anatolia. Urbanisation versus centralisation, Anatolian Studies 57, 2007, 131–140.

Duru 1996
R. Duru, Kuruçay Höyük II. 1978–1988 Kazılarının Sonuçları Geç Kalkolitik ve İlk Tunç Çağı Yerleşmeleri (Ankara 1996).

Efe et al. 1987
T. Efe – A. İlaslı – A. Topbaş, Salvage excavations of the Afyon Archaeological Museum. Part 1: Kaklık Mevkii. Transitional to the Early Bronze Age, Studia Troica 5, 1987, 357–399.

Eslick 1992
C. Eslick, Elmalı-Karataş I. The Neolithic and Chalcolithic Periods: Bağbaşı and other Sites (Bryn Mawr 1992).

Gleba – Mannering 2012
M. Gleba – U. Mannering (eds.), Textiles and Textile Production in Europe. From Prehistory to AD 400 (Oxford 2012).

Grömer 2010
K. Grömer, Prähistorische Textilkunst in Mitteleuropa. Geschichte des Handwerks und der Kleidung vor den Römern (Vienna 2010).

Günel 2008
S. Günel, Çine-Tepecik Höyük 2006 Yılı Kazıları, Kazı Sonuçları Toplantısı 29, 1/2007, 2008, 73–90.

Hardy 2007
K. Hardy, Where would we be without string? Ethnographic and Prehistoric evidence for the use, manufacture and role of string in the Upper Palaeolithic and Mesolithic of northern Europe, in: V. Beugnier – P. Crombé (eds.), Plant Processing from a Prehistoric and Ethnographic Perspective – Préhistoire et ethnographie du travail des plantes. Proceedings of a workshop at Ghent University (Belgium), November 28th, 2006 (Oxford 2007) 9–22.

Hood 1981/1982
S. Hood, Excavations in Chios 1938–1955. Prehistoric Emporio and Ayio Gala I–II, The Annual of the British School at Athens, Supplementary Volumes 15–16 (Athens 1981/1982).

Horejs 2008
B. Horejs mit Beiträgen von F. Galik und U. Thanheiser, Erster Grabungsbericht zu den Kampagnen 2006 und 2007 am Cukurici Höyük bei Ephesos, Jahreshefte des Österreichischen Archäologischen Instituts 77, 2010, 91–106.

Horejs 2010
B. Horejs, Çukuriçi Höyük. Neue Ausgrabungen auf einem Tell bei Ephesos, in: S. Aybek – A. K. Öz (eds.), Metropolis Ionia II. Yolların Kesiştiği Yer. Recep Meriç İçin Yazılar / The Land of the Crossroads. Essays in Honour of Recep Meriç (Istanbul 2010) 167–175.

Horejs 2014
B. Horejs, Proto-Urbanisation without urban centres? A model of transformation for the Izmir region in the 4th millennium BC, in: B. Horejs – M. Mehofer (eds.), Western Anatolia Before Troy. Proto-Urbanisation in 4th Millennium BC. Proceedings of the International Symposium held at the Kunsthistorisches Museum Wien, Vienna, Austria, 21–24 November, 2012, Oriental and European Archaeology 1 (Vienna 2014) 15–41.

Horejs et al. 2011
B. Horejs – A. Galik – U. Thanheiser – S. Wiesinger, Aktivitäten und Subsistenz in den Siedlungen des Çukuriçi Höyük. Der Forschungsstand nach den Ausgrabungen 2006–2009, Prähistorische Zeitschrift 86, 2011, 31–66.

Lee 1979
R. B. Lee, The !Kung-San. Men, Women, and Work in a Foraging Society (Cambridge 1979).

Legrand – Sidéra 2007
A. Legrand – I. Sidéra, Methods, means, and results when studying European bone industry, in: C. Gates St-Pierre – R. Walker (eds.), Bones as Tools: Current Methods and Interpretations in Worked Bone Studies (Oxford 2007) 291–304.

Lloyd – Mellaart 1962
S. Lloyd – J. Mellaart, Beycesultan I. The Chalcolithic and Early Bronze Age Levels, Occasional Publications of the British Institute of Archaeology at Ankara 6 (London 1962).

Mackenzie 1991
M. Mackenzie, Androgynous Objects. String Bags and Gender in Central New Guinea (Chur 1991).

Malinowsky 1922
B. Malinowsky, Argonauts of the Western Pacific (London 1922).

Maran 1998
J. Maran, Kulturwandel auf dem griechischen Festland und den Kykladen im späten 3. Jahrtausend v. Chr. Studien zu den kulturellen Verhältnissen in Südosteuropa und dem zentralen sowie östlichen Mittelmeerraum in der späten Kupfer- und frühen Bronzezeit, Universitätsforschungen zur prähistorischen Archäologie 53 (Bonn 1998).

Mårtensson 2007
L. Mårtensson, Investigating the Function of Mediterranean Bronze Age textile tool using wool and flax fibers, Experimentelle Archäologie in Europa 6, 2007, 97–106.

Mårtensson et al. 2009
L. Mårtensson – M.-L. Nosch – E. Andersson Strand, Shape of things. Understanding a loom weight, Oxford Journal of Archaeology 28, 2009, 373–398.

Milojčić 1961
V. Milojčić, Die prähistorische Siedlung unter dem Heraion. Grabung 1953 und 1955, Samos I (Bonn 1961).

Obladen-Kauder 1996
J. Obladen-Kauder, Die Kleinfunde aus Ton, Knochen und Metall, in: M. Korfmann (ed.), Demircihüyük IV. Die Kleinfunde. Die Ergebnisse der Ausgrabungen 1975–1978 (Mainz am Rhein 1996).

Özdoğan – Parzinger 2012
M. Özdoğan – H. Parzinger, Die frühbronzezeitliche Siedlung von Kanlıgeçit bei Kırklareli. Ostthrakien während des 3. Jahrtausends v. Chr. im Spannungsfeld von anatolischer und balkanischer Kulturentwicklung, Studien im thrakien-MArmara-Raum 3, Archäologie in Eurasien 27 (Darmstadt 2012).

Rahmstorf 2006
L. Rahmstorf, Zur Ausbreitung vorderasiatischer Innovationen in die frühbronzezeitliche Ägäis, Prähistorische Zeitschrift 81, 1, 2006, 49–96.

Rahmstorf 2011
L. Rahmstorf, Re-integrating 'diffusion'. The spread of innovations among the Neolithic and Bronze Age societies of Europe and the Near East, in: T. C. Wilkinson – S. Sherratt – J. Bennet (eds.), Interweaving Worlds. Systematic Interactions in Eurasia, 7th to 1st Millennia BC. Papers from a conference in memory of Professor Andrew Sherratt (Oxford 2011) 100–119.

Roodenberg 1995
J. Roodenberg, The Ilıpınar Excavations I. Five Seasons of Fieldwork in NW Anatolia, 1987–91, Publications de l'Institut Historique et Archéologique Néerlandais de Stamboul 72 (Istanbul 1995).

Schliemann 1874
H. Schliemann, Atlas Trojanischer Alterthümer. Photographische Abbildungen zu dem Berichte über die Ausgrabungen in Troja (Leipzig 1874).

Schoop 2005
U.-D. Schoop, Das anatolische Chalkolithikum. Eine chronologische Untersuchung zur vorbronzezeitlichen Kultursequenz im nördlichen Zentralanatolien und den angrenzenden Gebieten, Urgeschichtliche Studien 1 (Remshalden 2005).

Schoop 2011
U.-D. Schoop, Some thoughts on social and economic development in Western Anatolia in the fourth and third millennia BC, in: N. Bilgen – R. von den Hoff – S. Sandalcı – S. Silek (eds.), Archaeological Research in Western Central Anatolia. Proceedings of the IIIrd International Symposium of Archaeology in Kütahya (Turkey), 8th–9th March 2010 (Kütahya 2011) 29–45.

Sharp Joukowsky 1986
M. Sharp Joukowsky, Prehistoric Aphrodisias. An Account of the Excavations and Artifact Studies. Vol. 1: Excavations and Studies (Providence 1986).

Sillitoe 1988
P. Sillitoe, Made in Niugini (London 1988).

Sperling 1976
J. W. Sperling, Kum Tepe in the Troad trial excavation, 1934, Hesperia 45, 1976, 305–364.

Stone 2009
E. A. Stone, Wear on Magdalenian bone tools. A new methodology for studying evidence of fiber industries, in: E. B. Andersson Strand – M. Gleba – U. Mannering – C. Munkholt – M. Ringgard (eds.), North European Symposium for Archaeological Textiles X, Ancient Textiles Series 5 (Oxford 2009) 225–232.

Şahoğlu 2005
V. Şahoğlu, The Anatolian trade network and the Izmir region during the Early Bronze Age, Oxford Journal of Archaeology 24, 2005, 339–361.

Tabachnick – Fidell 2007
B. G. Tabachnick – L. S. Fidell, Using Multivariate Statistics (Boston 2007).

Topbaş et al. 1998
A. Topbaş – T. Efe – A. İlaslı, Salvage Excavations of the Afyon Archaeological Museum. Part 2: The Settlement of Karaoğlan Mevkii and the Early Bronze Age Cemetery of Kaklık Mevkii, Anatolia Antiqua 6, 1998, 21–94.

Verhecken 2009
A. Verhecken, The Moment of inertia. A parameter for the functional classification of world-wide spindle-whorls from all periods, in: E. B. Andersson Strand – M. Gleba – U. Mannering – C. Munkholt – M. Ringgard (eds.), North European Symposium for Archaeological Textiles X, Ancient Textiles Series 5 (Oxford 2009) 257–270.

Verhecken 2013
A. Verhecken, Spinning with the hand spindle. An analysis of the mechanics and its implications on yarn quality, Achaeological Textiles Review 55, 2013, 97–101.

Warner 1994
J. L. Warner, Elmalı-Karataş II. The Early Bronze Age Village of Karataş (Bryn Mawr 1994).

Yakar 2011
J. Yakar, Reflections of Ancient Anatolian Society in Archaeology. From Neolithic Village Communities to EBA Towns and Polities (Istanbul 2011).