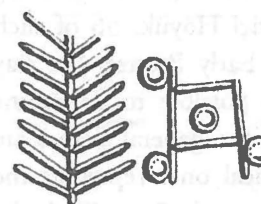


CHAPTER EIGHTEEN

Textile Production and Fishing Technologies at EBA 1 Çukuriçi Höyük



Barbara Horejs,* Christopher Britsch**

INTRODUCTION

Çukuriçi Höyük is situated on the central Aegean coast in Western Anatolia, in the immediate vicinity of the ancient city of Ephesos. Excavations demonstrate that Çukuriçi Höyük is a tell encompassing at least six settlement phases dating to the Pottery Neolithic period (seventh millennium), early Chalcolithic (6200–6000 cal. B.C.), late Chalcolithic (fourth millennium) and Early Bronze Age 1 (2900–2750 B.C.).¹ This paper focuses on the Early Bronze Age 1 phase, consisting of two settlement phases—ÇuHö IV and ÇuHö III. A large number of ovens used for metal production inside the buildings, combined with a high amount of metal artefacts, suggest a strong specialization in metallurgy in the Early Bronze Age occupations. In comparison to other Early Bronze Age sites in Western Anatolia it is possible to assert that Çukuriçi Höyük was a metallurgical center (Horejs 2008; 2009; 2010; Horejs et al. 2011). The small finds inventory indicates that, besides metallurgy, multicrafting households were also contained in the settlement. Two of these—textile production and fishing—are well traceable via clay small finds. Both tasks require distinctive steps and different tools to perform them. This paper explores one of these activities for each of the two crafts—spinning for textile production, and the preparation of bottom gillnets used for fishery. Therefore, the possible function of pierced-clay discs in the Early Bronze Age will be discussed. These discs are sometimes referred to as net weights and in other cases as a spindle whorl type. One aim of this

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paper is to clarify these interpretations by analyzing and comparing the perforated discs and spindle whorls of Çukuriçi Höyük. Additionally, a detailed reconstruction of the spinning process is provided through the analysis of Early Bronze Age spindle whorls from Çukuriçi Höyük. Subsequently, spindle whorl types from other Early Bronze Age sites are also considered and compared to our results.

SPINDLE WHORLS OF EBA I ÇUKURIÇI HÖYÜK

For this analysis, only objects that were conclusively produced and used for spinning with a hand spindle were recorded as spindle whorls. At Çukuriçi Höyük, 56 of such pieces were analyzed, representing the largest group within the Early Bronze Age clay small finds (Figure 18.1). The whorls vary in shape, but it is possible to determine four distinct types, each with different variations (Figure 18.2). The general shapes are round to ovoid, flat, conical, and biconical, whereof the biconical ones represent the largest group (32 pieces). Their weight differs between c. 10 g to nearly 80 g. With the present data there was no correlation detectable between weight and settlement phase or weight and type of spindle whorl (Figure 18.3). However, it was noticeable that type III spindle whorls only occurred in phase ÇuHö IV, the older occupation phase (Figure 18.4). Therefore, conical spindle whorls were only produced and used in the older phase

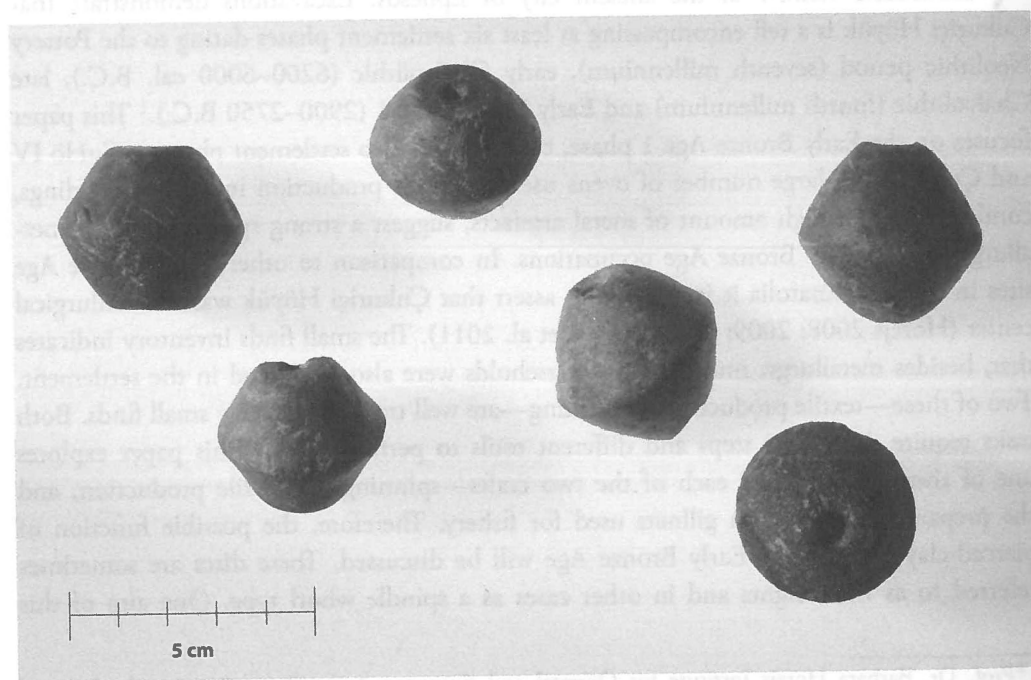


FIGURE 18.1. Selection of spindle whorls of Early Bronze Age Çukuriçi Höyük (Photographer: N. Gail).

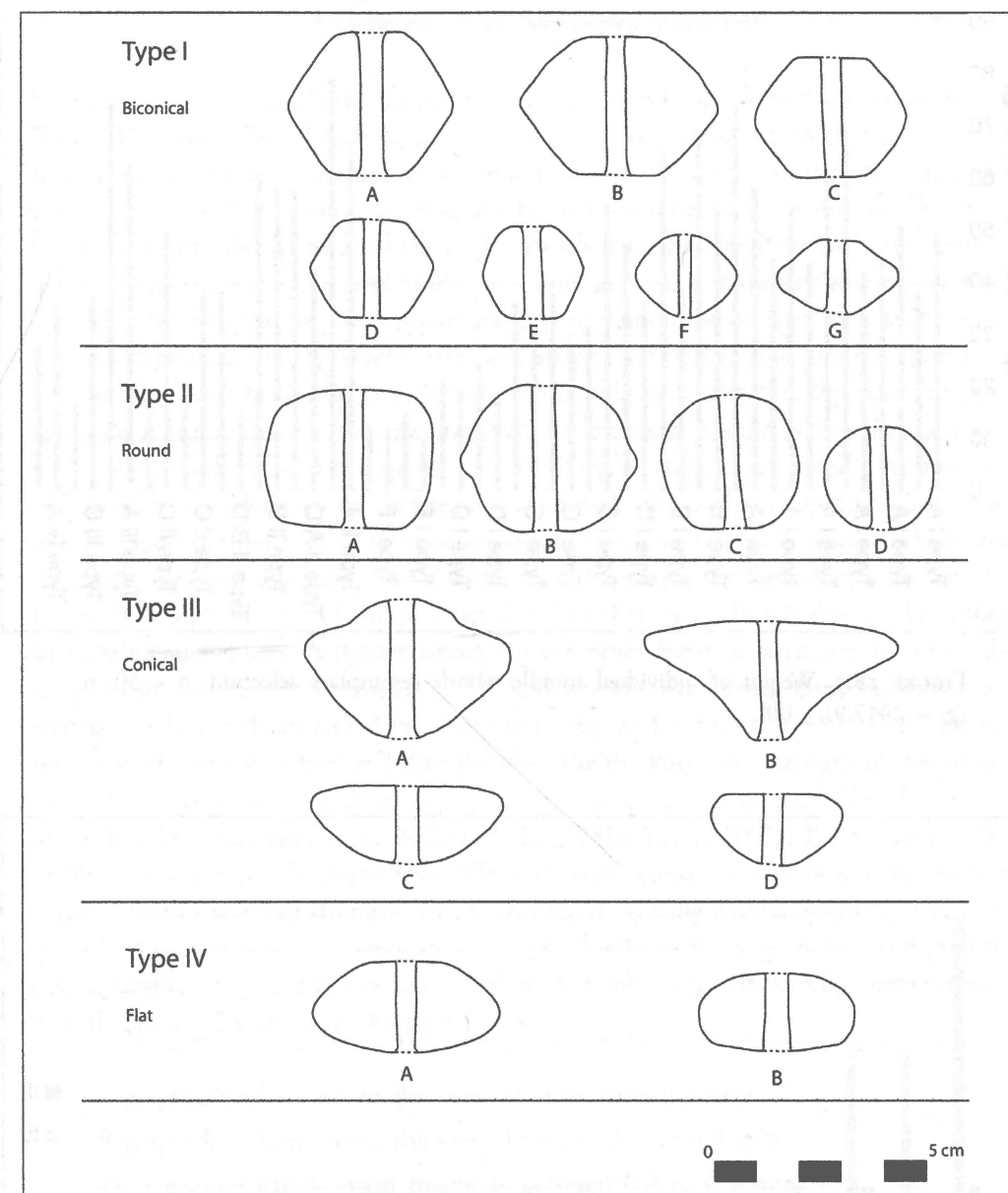


FIGURE 18.2. Typology of spindle whorls of Çukuriçi Höyük phases ÇuHö IV-III (n = 56).

and seem to vanish in the younger settlement. While no preference of a certain clay type was detectable, most spindle whorls were made from finely pored clay, tempered by fine-grained mineral components, with very fine mica inclusions dominating. Nearly all spindle whorls were produced with considerable care. They are often nearly perfectly symmetrical and are in some cases decorated.

ANALYZING THE SPINNING PROCESS

Spinning is the process of manufacturing yarn from previously cleaned and prepared fibers. While there are different techniques to do so, it is commonly assumed that in the Early Bronze Age in Western Anatolia hand spindles were used. Prior to the spinning process, the spinner must form a short starting line by twisting it between the fingers. This starting line is tied onto the spindle, which is also attached to the spindle whorl. The remaining mass of raw fibers can be held under one arm or with a distaff or something similar. The spindle can now be put into rotation. The spindle whorl acts as a swing weight, which—depending on its weight, size, and shape—influences this rotation. During this process, the raw fibers twist into a yarn, which winds on the spindle. Accordingly, the spinning is influenced by the raw material, the size and weight of the spindle and the size, weight, and shape of the spindle whorl. Since, in most cases, spindle whorls are the only artifacts remaining in the archaeological context, approaches in spindle whorl analysis will be demonstrated here. The most important factor is weight. A heavier whorl creates a stronger force on the fibers than a lighter one. Consequently, heavier spindle whorls are better for rough fibers and the production of thicker yarn. This is due to the difficulty in twisting such fibers. A lighter whorl, on the other hand, is necessary for finer fibers, since those are not sturdy enough and would quickly tear during spinning with a whorl that is too heavy (Bohnsack 1981; Schade-Lindig and Schmitt 2003:11–12). Thus, the weight of the spindle whorl will directly affect the thickness and strength of the produced yarn. This was tested in a series of experiments by members of the CTR (Andersson et al. 2008:173; Andersson et al. 2010:164–165; Mårtensson 2007:101; Mårtensson et al. 2009). Their research illustrates that differently sized spindle whorls produced a yarn with a specific thickness and strength. In the test series, spindle whorls weighing 4 g, 8 g, 18 g, and 44 g were tested.² A wool variety, most closely resembling ancient and prehistoric characteristics, was used as the raw material. The following relationships between weight and thickness of yarn were observed:

- 4 g spindle whorl—yarn thickness thinner than 0.3 mm
- 8 g spindle whorl—yarn thickness between 0.3 to 0.4 mm
- 18 g spindle whorl—yarn thickness between 0.4 to 0.6 mm
- 44 g spindle whorl—yarn thickness between 0.8 to 1.0 mm

In another test series, a further effect of the weight of the spindle whorl could be established. It was shown that a spinner with a heavier whorl is able to work faster, although producing a yarn with reduced length, than someone working with a lighter spindle whorl. The following correlations between the weight of the spindle whorl and operating speed (meter yarn/hour) and yarn length (meter yarn/100 g wool) were observed (Andersson et al. 2008:173; Andersson et al. 2010:164–165; Mårtensson 2007:101):

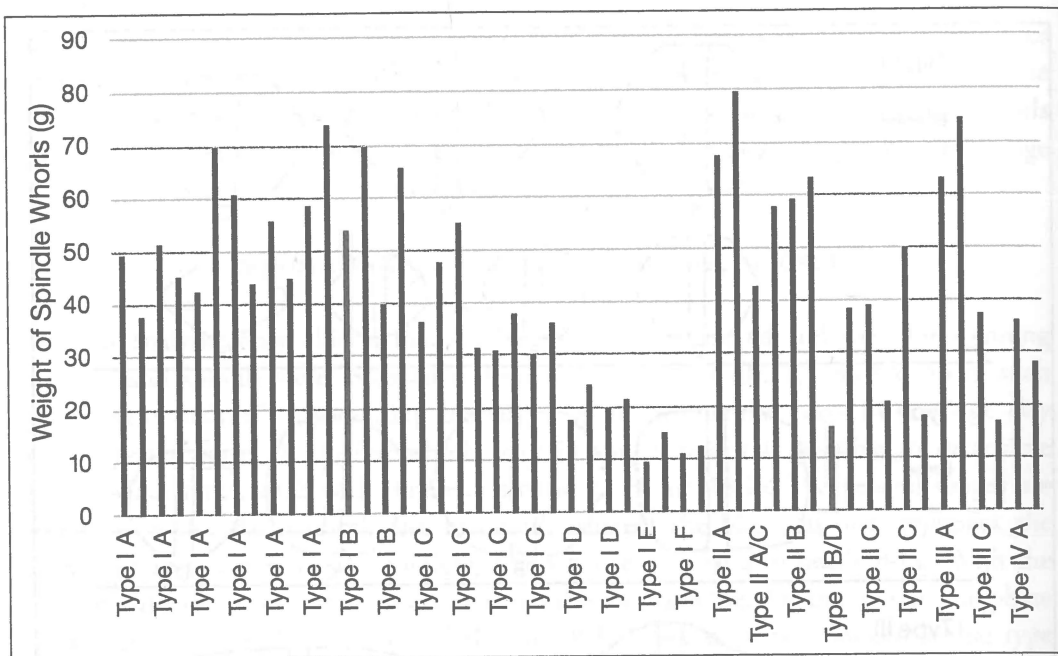


FIGURE 18.3. Weight of individual spindle whorls (exemplary selection, $n = 50$, $n(g) = 2047.9$). 000

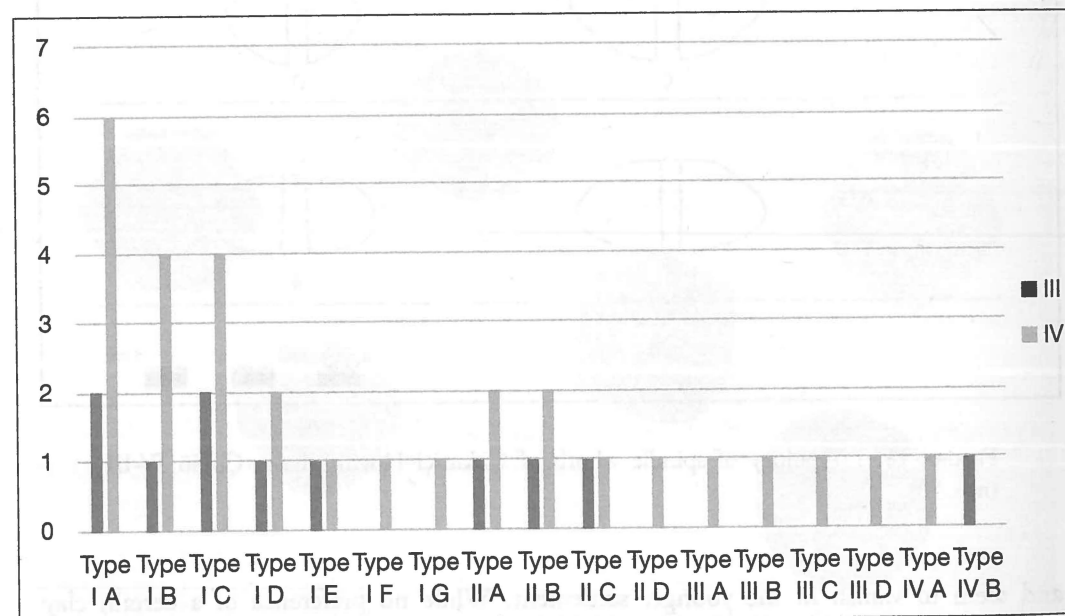


FIGURE 18.4. Distribution of spindle whorl types within phases ÇuHö III and IV ($n = 41$). 000

4 g spindle whorl—35 m/h—1700 m/100 g wool

8 g spindle whorl—40 m/h—1000 m/100 g wool

18 g spindle whorl—50 m/h—625 m/100 g wool

These experiments emphasize the relevance of spindle whorl weight. It has to be mentioned that both experiments were conducted by several individuals under the same conditions and led to the same or similar results. Therefore, it is reasonable to assume that thickness and strength of yarn, as well as the productivity of spinning, primarily depends on the tool, not on the craftswoman or craftsman (Andersson et al. 2010:165).

Such a relationship was not only found for the weight, but also for the shape of the tool. Specific shapes function differently. Biconical-shaped whorls spin faster and in smaller circles, while flat, round, and conical whorls spin more slowly and in larger circles. Faster spinning is an advantage when processing fine, short fibers, while longer, coarser fibers can be processed with both fast and slow spindle whorls. However, for coarse fibers, the latter are sometimes even better (Schade-Lindig and Schmidt 2003). Additionally, a conical whorl will produce a tighter yarn than a biconical one. The spinner must, therefore, consider the kind of spindle whorl and the raw material (s)he chooses, as well as the desired thickness and strength of the yarn. With this information it is possible to give insight into the spinning techniques at Early Bronze Age Çukuriçi Höyük.

As mentioned, the spindle whorls of Çukuriçi Höyük range in weight between c. 10 and 80 g. Referring to the tests of the CTR, yarns with a thickness thinner than 0.4 mm can therefore be ruled out. It is more likely that yarns thicker than 1.0 mm were spun. Since most spindle whorls weigh between c. 20 and 50 g, a general yarn thickness between c. 0.6 and 1.2 mm can be expected.³ This indicates that Çukuriçi Höyük is within a comparable technological framework with other Early Bronze Age sites, such as Troy I (weights of spindle whorls between 3 and 88 g, mostly between 15 and 35 g) (Balfanz 1995:119) and Demircihüyük (weights of spindle whorls between 2.5 and 60 g, mostly between 5 and 25 g) (Obladen-Kauder 1996). Considering the occurrence and preference of certain shapes there also seems to be a typological connection. In Troy I, biconical spindle whorls make up the largest group of spindle whorls and become more and more predominant through Troy II and III (See Völling 2008). The same is true for Demircihüyük and Aphrodisias.⁴

Biconical spindle whorls are advantageous for spinning wool fibers. While this might be only a slight advantage, it must be considered that a person working daily with such a tool would tend to prefer a more efficient whorl, even if the enhancement is only slightly noticeable. Hoffmann notes, "If there is one thing to be learnt from watching people work in old traditional crafts it is this: The tools and the working procedures are never clumsy, never impractical" (Hoffmann 1988). Of course, individual objects cannot be seen as clear indicators. However, a majority of biconical spindle whorls can imply that a preference for wool over plant fibres was prevalent. Therefore, the change in the spectrum of spindle whorls might mark the moment when wool became the more common raw material for textile production. However, it is important to mention that it does not



FIGURE 18.5. Sites mentioned in the text.

indicate the beginning of the use of wool. For Çukuriçi Höyük, this hypothesis would mean that a preference for wool over plant fibers is noticeable and probable.

ANALYZING THE PERFORATED DISCS

Considering the facts and analyses discussed above, it is possible to explore the potential usage of perforated discs at Çukuriçi Höyük. Altogether, 32 objects from the Early Bronze Age small find ensemble can thus far be referred to as pierced or perforated discs. The

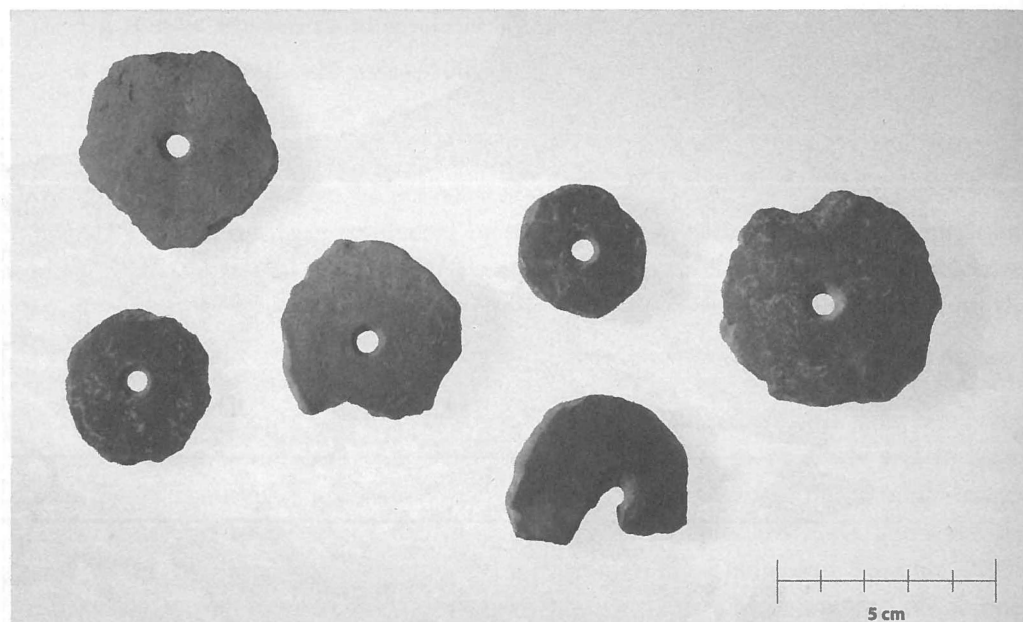


FIGURE 18.6. Selection of pierced discs of Early Bronze Age Çukuriçi Höyük (Photographer: N. Gail).

discs are exclusively made from recycled ceramic body sherds with nearly no or only a very slight curvature. The edges are polished and are relatively round in shape. The discs vary in diameter from 2.5 to 10 cm and weigh from c. 6 to 130 g. It was possible to separate the discs into four groups based on their size and weight (Figure 18.6).

As already mentioned, there are two common interpretations for the function of perforated-clay discs, either as net sinkers or spindle whorls (Blegen 1950; Hochstetter 1987; Obladen-Kauder 1996; Rahmstorf 2008; Sharp and Joukowsky 1986). Comparing the weights of the spindle whorls (Figure 18.3) and pierced discs (Table 18.1), one can see that some discs would be lighter than the smallest spindle whorl. Thus, a thread spun with such a pierced disc would create a thinner and finer yarn than could be produced

TABLE 18.1
WEIGHTS AND DIAMETERS OF THE GROUPS OF
NET SINKERS IN PHASES ÇuHö IV-III

	Weight	Diameter
Group 1	c. 6 to 15 g	c. 3 to 5 cm
Group 2	c. 25 to 50 g	c. 5 to 7 cm
Group 3	c. 70 to 80 g	c. 7 to 8 cm
Group 4	c. 100 to 130 g	c. 8 to 10 cm

with any of the spindle whorls. It seems highly unlikely that one would use a recycled potsherd to make a finer product, rather than using a specially made tool for this task. Since a large quantity of spindle whorls was produced at Çukuriçi Höyük, which would definitely have constituted the better tools, it can be decidedly assumed that only these objects were used to spin yarn and the perforated discs served a different function. The function as net sinkers is especially common for the larger pierced discs but is mostly excluded for the smaller ones, because of their low weight. When reconstructing their use, clear indications of function are rare in prehistoric assemblages, however, they can be detected in later periods. The finds of a shipwreck from the seventh century A.D. on the coast of Dor, Israel, for example, demonstrate that discs of such weight certainly could have been used as net sinkers, contradicting the common opinion. One hundred and fifty-nine objects made of lead were found that could clearly be identified as net sinkers on the shipwreck. Out of these, six pieces weighed c. 30 to 60 g, 78 weighed c. 15 g, 39 c. 9 g, and a total of 36 pieces weighed only 5 to 6 g (Galili and Rosen 2008: 69–70). This means that even the smallest pierced discs of Çukuriçi Höyük could have been used as net sinkers. The impetus for using such small weights when fishing with bottom gillnets lies in their adaption to certain types of sea or lake bottoms. For example, if the sea bottom is muddy or sandy, large and heavy net sinkers will sink into the ground and become buried with sediment. This causes the net to rip apart. In such environmental situations, smaller net sinkers appear not only advantageous but necessary for efficient fishing.

CONCLUSION

This paper demonstrates which considerations and effects are dependent on the spindle whorl used as swing weight when spinning yarn. The main influencing factors are the weight and shape of the spindle whorl. These dictate thickness and strength of the spun yarn. The choice of the spindle whorl thereby fundamentally impinges on the textile end product. With this in mind, a framework can be created that represents the span of probable and possible spindle whorl types. Subsequently, the pierced discs of Early Bronze Age Çukuriçi Höyük were put in contrast to this typology. Referring to these results and the dependency of the produced yarn on the spindle whorl type, it is possible to establish the unlikelihood that the perforated discs were used as swing weights. Although there exist a few discs that could have been used as spindle whorls, it is more probable that all pierced discs possessed the same function since they are all uniformly made. By referring to finds of later periods it was possible to demonstrate that all analyzed pierced discs could have been used as net sinkers. This implies that both the larger pieces, which are often interpreted as net sinkers, and the smallest pieces could have been used as such. Furthermore, it was demonstrated that the small and light pierced discs have advantages when fishing under certain conditions. While this was only attested for the Early Bronze Age finds of Çukuriçi Höyük, it can be assumed that this insight also applies to other Early Bronze Age sites in western Anatolia.

NOTES

1. The research for this paper was funded by the START Project nr. Y 528 G19 and the ERC Starting Grant Project no. 263339.
2. See Mårtensson et al. 2009, as well as *Experimental Reports* at <http://ctr.hum.ku.dk/tools/>.
3. Estimated numbers in comparison to the calculations in Mårtensson et al. 2009: 378.
4. For Troy see Obladen Kauder 1996:231; and Korfmann et al. 1987, XV; for Aphrodisias see Sharp Joukowski 1986:160 and 372.

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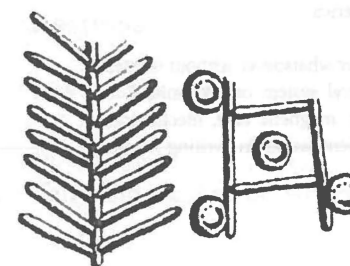
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