Mediterranean Archaeology and Archaeometry
Vol. 20, No 2, (2020), pp. 1-18
Open Access. Online & Print.

www.maajournal.com

DOI: 10.5281/zenodo.3746938

LATE BRONZE AGE SPINDLE WHORLS AND LOOM WEIGHTS FROM BEYCESULTAN IN WESTERN ANATOLIA: NEW FINDINGS, NEW OBSERVATIONS

Gürkan Ergün

Ege University, Faculty of Letters, Protohistory and Near Eastern Archaeology, İzmir, Turkey

Received: 29/02/2020
Accepted: 10/04/2020
**Corresponding author: Gürkan Ergün (gurkanergunege@gmail.com)*

ABSTRACT

This paper examines Late Bronze Age spindle whorls and loom weights found in the ongoing excavations at Beycesultan Höyük restarted in 2007 in context. Some supporting evidence on the functions of weaving tools has been obtained based on the context. The lack of written sources on weaving in Western Anatolia entails directly description of the weaving of this region through archaeological material. Spindle whorls in various forms and sizes indicate that different types of yarns were produced in the settlement while the numerous loom weights in the settlement imply the weavings be woven on the warp-weighted vertical looms of different sizes. The weaving tools found in the houses with several rooms indicate that weaving was practiced as a specialized occupation by some members of the household. It may be assumed that spinning could be done in almost any room, but wider courtyards were generally preferred for weaving with a loom. The storage rooms or living rooms of the houses were areas where the weaving tools were collected/stored after the weaving was stowed/stored. Despite similarities with Central Anatolia and Western Anatolia, local effects on weaving tools are quite dominant. With a large number of decoration elements unique to Beycesultan, some spindle whorls and loom weights found also support this view. The data renders Beycesultan höyük as an important textile production center in Western Anatolia. Hundreds of spindle whorls and loom weights found that will also dim light on the settlement and the region's Late Bronze Age weaving in region.

KEYWORDS: Late Bronze Age, Spindle Whorl, Loom Weight, Weaving Tools, Ancient Weaving

1. INTRODUCTION

Written resources provide limited information on weaving in the 2nd Millennium BC. The tablets dated to the age of Assyrian trade colonies yields information on the fabric trade and the types of fabric traded (Fazlıoğlu 2001: 4). In the Hittite texts, some information was obtained, such as the people were engaged in weaving in their own home, they made their own clothing (Doğan-Alparslan 2004: 54), weavers were engaged in both men and women, and weavers were given some privileges (Yiğit 2002: 83 and Reyhan 2010: 77). In addition, textile tools in both the Aegean and the Eastern Mediterranean prove the presence of intensive textile production during this period (Sauvage 2014: 204-205, Levy et al. 2018: 199, Sideris et al. 2017: 281, Sideris and Liritzis 2018: 219) In Western Anatolia, the lack of written sources entails gathering information about weaving only of the data obtained from weaving tools, thus, Beycesultan bearing a great potential in obtaining this information, provides a significant amount of data accordingly.

Figure 1: Location of Beycesultan Höyük and some settlements obtained weaving tools

The first excavations were carried out in 1954-1959 under the direction of Seton Lloyd and James Mellaart in Beycesultan Höyük (Fig. 1) in Çivril district of Denizli province in Western Anatolia (Lloyd and Mellaart 1962: 7). Later, the second period of excavations in Beycesultan was initiated in 2007 under the direction of Eşref Abay (Abay and Dedeoglu 2012: 303). The most extensively studied period on the western cone of the mound during the excavations of the new period was Late Bronze Age, which was determined on an area of approximately 1200 m². Layers 4 and 6 did not yield enough data in terms of architecture and finds (Dedeoğlu and Abay 2014: 2-4). The layer with the most comprehensive information on the Late Bronze Age with its well preserved architectural structures and in situ finds is the 5th layer consisting of 5b dated 1700-1595 BC and 5a dated 1600-1500 BC (Fig. 2). (This layer corresponds to II in the first excavation stratigraphy and is dated to the 13th and early 12th centuries BC. For the first excavation stratigraphy and dating see Mellaart and Murray 1995: 96. During the second period excavations, a large number of radiocarbon dates obtained from Late Bronze Age layers have greatly changed the dating of the layers. For the second period updated and changed excavation stratigraphy and dating see Dedeoglu and Abay 2014 and more information for second period excavation result see Boz 2016, Dedeoğlu 2016). Although the first excavations did not provide data capable to fully reveal the weaving capacity of

Beycesultan Höyük, the further excavations carried out since 2007 indicate that weaving is an important craft in the settlement. Many in situ finds have yielded data on where weaving was performed and weaving tools were stored after weaving. Hundreds of spindle whorls and weaving weights indicate that weaving had an pivotal role in the settlement also reflecting its importance in the Late Bronze Age.

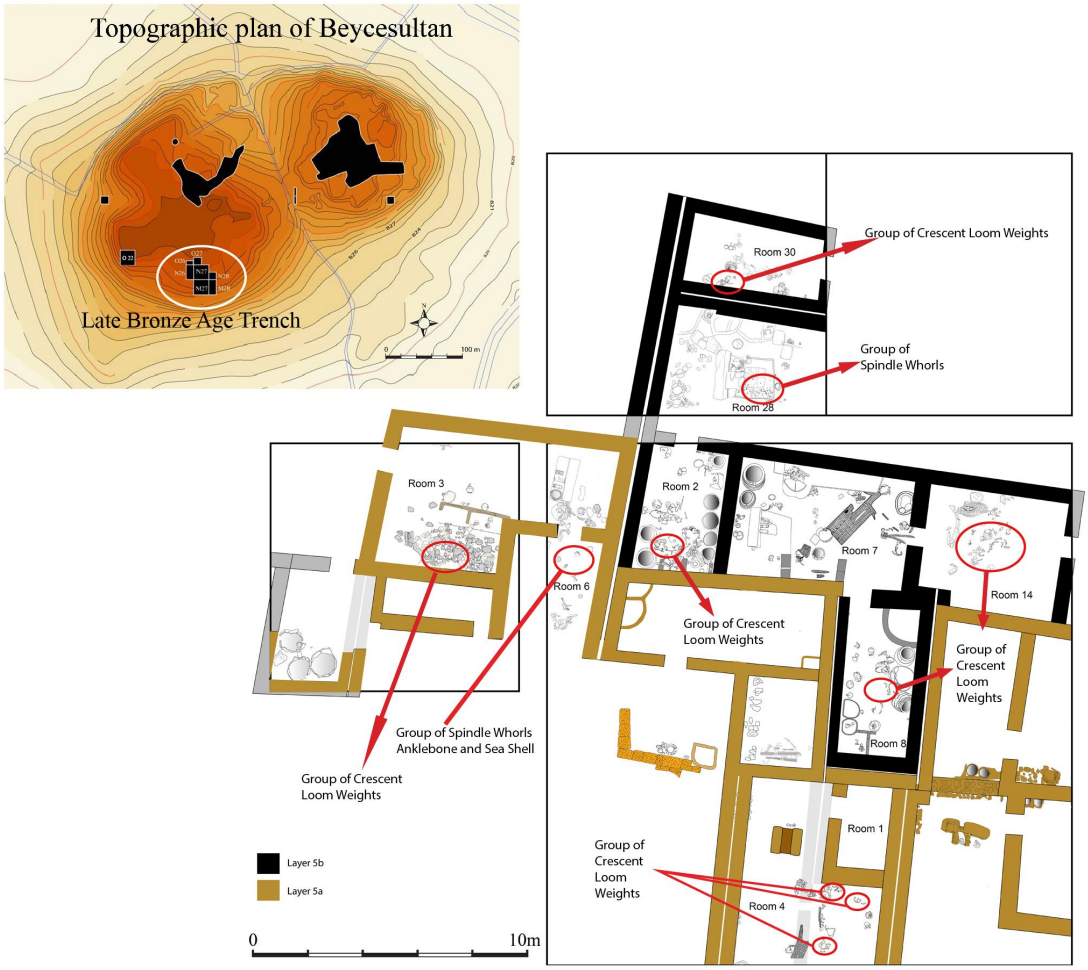

Figure 2: Architectural plan of Layer 5a- 5b. Group of weaving tools in the rooms (Beycesultan excavation archive)

2. ARCHAEOLOGICAL DATA ON WEAVING

2.1. Spindle Whorls

The spindle whorls are passed to the top or bottom of the spindles to ensure that the spun fibers remain taut (Keith 1998: 503). The dimensions of the spindle whorls are very important to determine the quality and quantity of the yarn to be obtained. The softer and shorter fibers were spun and thin yarns were produced in smaller and lighter spindle whorls, while heavier and larger spindle whorls were coarser and longer fibers were spun and coarser yarns were produced (Barber 1991: 52). Further experimental archeology work have shown that smaller and lighter spindle whorls are spun into fibers in a shorter time than large and heavy spindle whorls (Grömer 2005: 111).

Various forms of spindle whorls were identified among the Late Bronze Age spindle whorls of Beycesultan including symmetrical and asymmetrical double conical, conical, spherical and unified forms (Fig. 3: A). Asymmetric double conical forms (Type B-7, B-12- 32) are the most common type (Fig. 4). These spindle whorls with long and flat subforms are 63% in layer 5a and 61% in layer 5b. Their height varies between 3.4 cm and 2 cm and their diameter between 3.4 cm and 2.2. Similar subgroups of this type are found in Troy (Blegen at al 1958: 18) and Alacahöyük (Koşay and Akok 1966 Plate 34). The symmetrical double

conical spindle whorls (Type A-19 -21) are rare in the 6th and 4th layers, 4% in layer 5a and 10% in layer 5b. They are smaller than asymmetric double conical forms with height ranging from 2.5 cm to 1.3 cm and their diameter from 4 cm to 2.6 cm. Conical spindle whorls (Type C-6- 13), which is not found in Layer 6 and 4, is 13% in phase 5a and 20% in phase 5b. Generally, these small spindle whorls have heights between 2.8 cm and 0.9 cm and their diameters vary between 1.9 cm and 4.9 cm. Similar subgroups of this type are found in Troy (Blegen et al. 1953: 24, 31-32). A few specimens of spherical spindle whorls (Type D-2- 9) were found in Layer 6 and 4, while this ratio was 11% in layer 5a and 7% in layer 5b with height varying between 3.1 cm and 1.1 cm, and diameters from 4.3 to 2.4 usually deemed as large. Some similar subgroups of this type are found in Troy (Blegen et al. 1953: 24, 31-32) and Aphrodisias (Joukowsky 1986: Figure 487, 489 and 490). A special form of unified form spindle whorls (Type F-1-3) are formed with two spindle weights on top of each other. In the upper part, there is generally a symmetrical double conical and sometimes asymmetric double conical spindle whorl while at the bottom there is always a long asymmetric double conical spindle whorl. This type of spindle-whorls are found only in layers 5a and 5b in Beycesultan. This type is very rare and it is 7% in layer 5a and only 2% of the found material in layer 5b. Unified form spindle whorls are unique to Beycesultan and have not been found in any other settlements. The heights of these large-sized spindle whorls are between 5 cm and 3.4 cm in diameter and 4 cm to 3.5 cm in diameter.

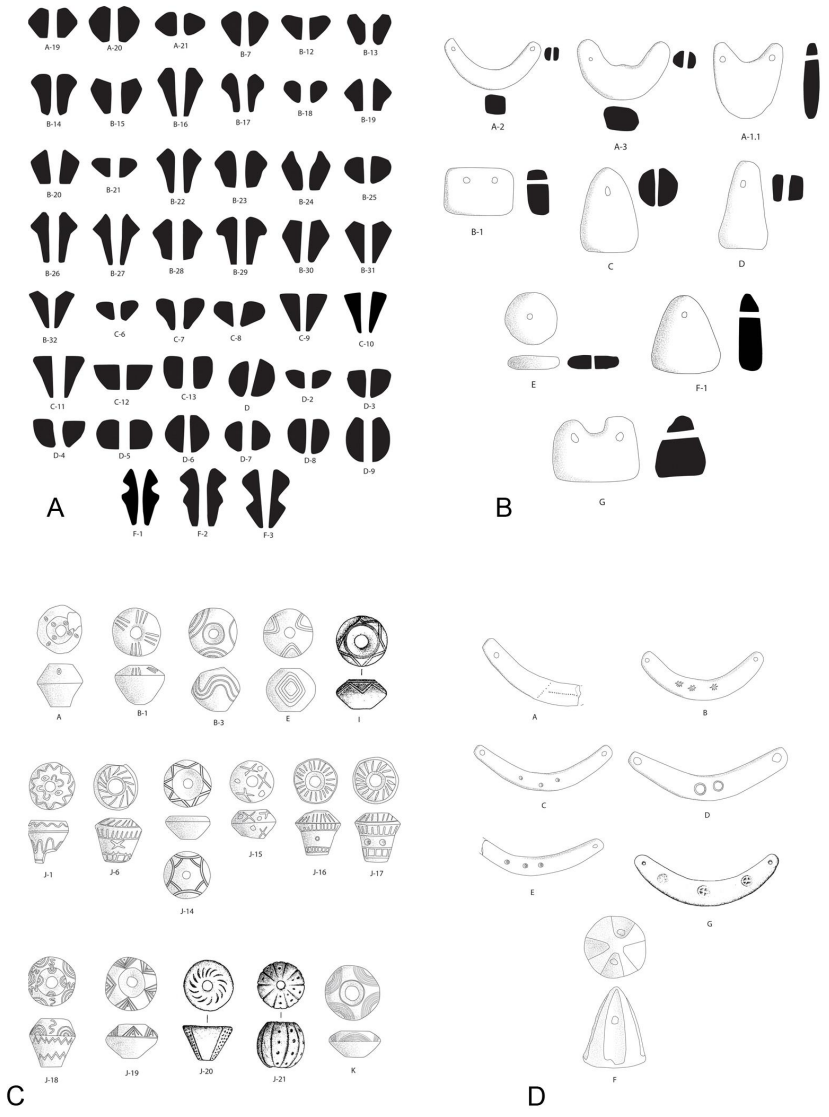

Figure 3: Form type of spindle whorls (A) (Ergün 2013: Fig. 70), loom weights (B) (Ergün 2013: Fig. 72) and decoration type of spindle whorls (C) (Ergün 2013: Fig. 71), loom weights (D) (Ergün 2013: Fig. 73)

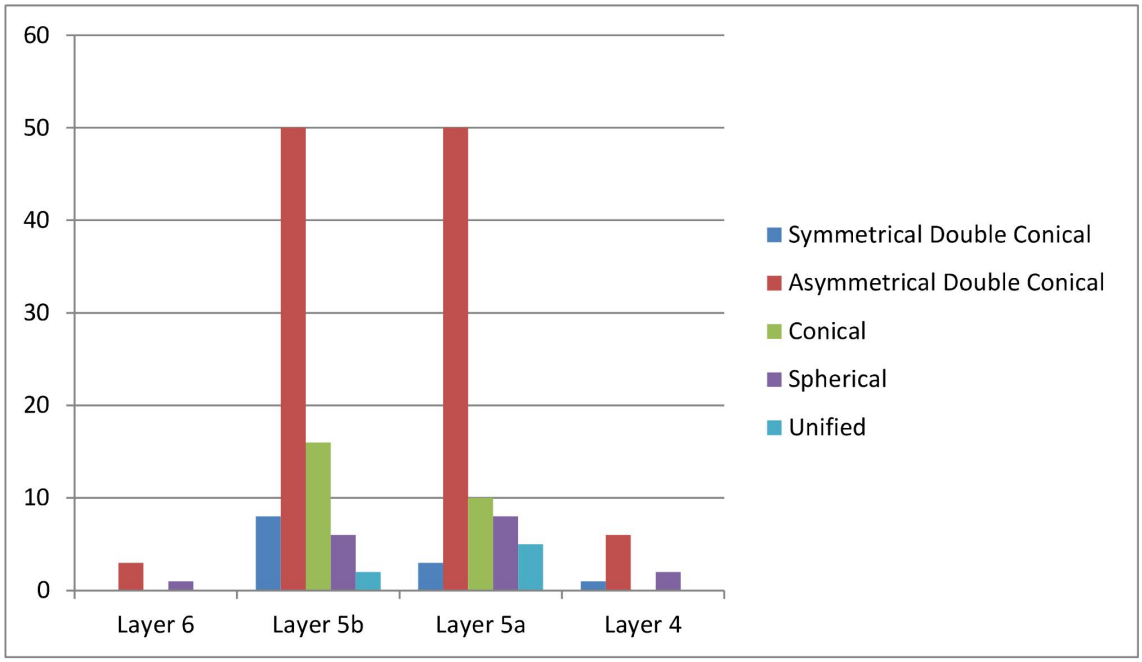

Figure 4: Distribution of Late Bronze Age spindle whorl form types

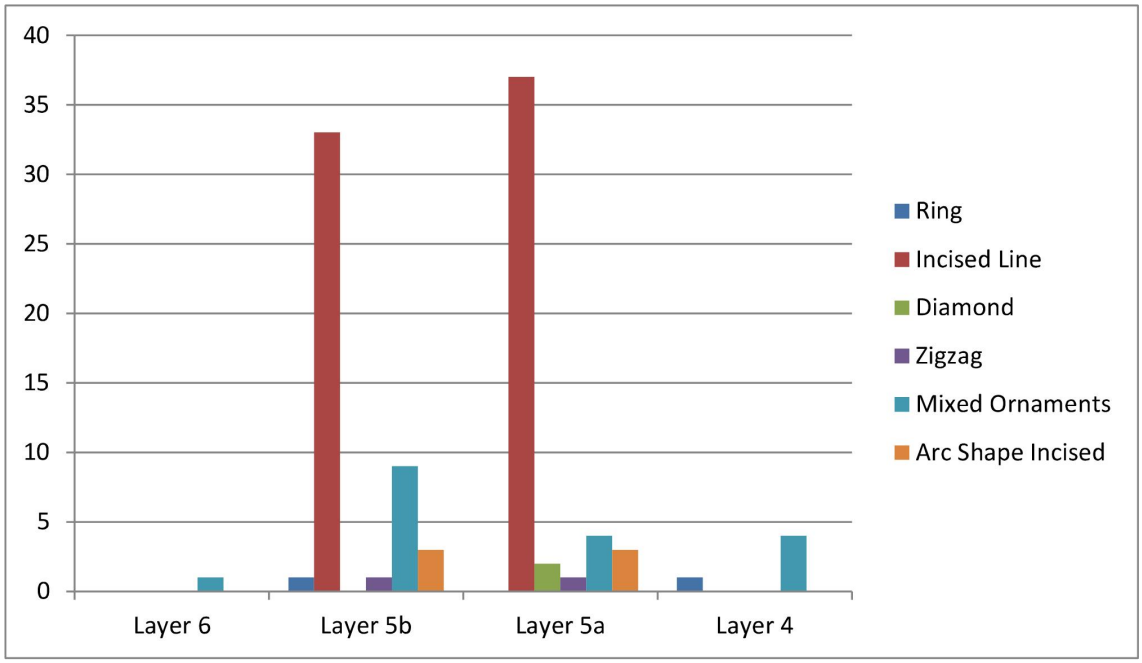

Figure 5: Distribution of Late Bronze Age spindle whorl decoration types

60% of Beycesultan Late Bronze Age spindle whorls are decorated with ring, line, diamond, zigzag, arc shape and mixed ornaments (Fig. 3: C) identified as decoration. The majority of the incise were filled with white clay. Incised line decoration (Type B-1, 3- 4) is the most dominant type and it is 76% in 5a and 70% in 5b (Fig. 5). This type of decoration is found in Troy (Blegen at al 1958: 18) and Alişar (Schmidt 1932: 124-126). Mixed ornaments (Type J-1, J-6. -14-21) represent complex decoration with more than one decoration type. These types of decoration are observed in all Late Bronze Age levels. It is 12% in layer 5a and 19% in layer 5b. These types of decoration consist entirely of original works and are not seen in any other settlement. Arc Shape incised decoration (Type K) is not very common. This type of decoration is seen in 6% only in layer 5a and 5b and is found in many settlements such as Troy (Blegen et al. 1953: 24, 31

and 32), Boğazköy (Bittel 1937 Plate 15 and 18) and Alişar (Schmidt 1932: 124-126).

2.2. *Loom Weights*

Fibers such as flax and wool were spun with spindle whorls and then woven in various types of looms (Fazlıoğlu 2001: 10). Looms, as they were made of wood, have not survived to the present day. However, the looms is known from the loom weights used in looms with various forms (Ellis 1976: 76). In addition, the number of loom weights used in the loom clue in the size of the loom (Fazlıoğlu 2001: 23). These loom weights, usually made of terracotta, were used to keep the warp threads tense during weaving (McLauchlin 1981: 79).

Loom weights of Late Bronze Age were determined to be in various forms including crescent-shaped, rectangular-shaped, conical-shaped, pyramidal-shaped, disc-shaped, triangular-shaped and unified double-pyramidal forms (Fig. 3: B).

Crescent loom weights (Type A-1.1, A-2, A-3) have been used in Anatolia since the Early Bronze Age while the found artifacts detected have been dated to the Middle Bronze Age in Beycesultan, later widely used in the Late Bronze Age. The found samples have rope holes at each end. The most common form of loom weight, crescent-shaped, is 44% in layer 6, 81% in layer 4, 90% in layer 5a and 95% in layer 5b among the Late Bronze Age layers (Fig. 6). These loom weights have lengths ranging from 19 to 13 cm and weights from 408 g to 170 g. The crescent-shaped loom weights were mostly used in Alacahöyük (Koşay and Akok 1973: Plate XLVIII) , Boğazköy (Bittel 1937: Plate 15 and 18) and Alişar (Schmidt 1932: Figure 149) in the Central Anatolia Region, and Aphrodisias (Joukowsky 1986 Figure: 487,489 and 490), Çine Tepecik (Yılmaz 2016: 100-101) and Asopos Hill (Konakçı 2018: 265) in Western Anatolia. It was found in Oluz Höyük (Yurtsever Beyazıt 2014: 88) in the north and Tarsus Gözlü Kule (Goldman 1956: 319) in the South in Turkey. In addition, crescent-shaped loom weights were found in many other places in the Mediterranean region such as Spain, France, Italy and Greece during the Bronze Age. Moreover, these loom weights are also found in Hungary, Austria, Czech Republic, Germany and in the Jevišovice and Funnel Beaker cultures (Grömer 2015).

In the archaeological literature encompasses various ideas on crescent-shaped loom weights, although the general belief presupposes use of them in weaving while they may be used for other purposes. Similarly, various comments have been made about the loom weights of pyramidal, disc and conical forms, but later they were used as weaving weights in antique vase paintings and thus the discussions ended. Unfortunately, no definite evidence has yet been found to cease discussions on crescent-shaped loom weights, and the subject has become open to discussion.

Schmidt used the term "handles" for the crescent-shaped ones found in the 2nd millennium BC in Alişar. He noted that in addition to being handles used to transport goods or packages, some of them may also be associated with trade due to seal impressions (Schmidt 1932:122). A similar view was offered by Alp. A large number of stamped crescent-shaped loom weights were found in Konya Karahöyük some with horizontal or vertical lines or dots. Alp suggested that these tools / signs could be used as debt securities / signs in purchases (Alp 1972: 71-72). The crescent-shaped loom weights in Beycesultan were not found with any items that could be used as handles. In addition, the rope holes are located in the narrowest part of the tools, the end portions, thus these tools of terracotta were easily broken, depending on the weight of the good stransported. Within this context, they were not very useful as handles. Furthermore, the opinion that they are used in trade because of stamp impression does not apply to those in Beycesultan as only 12% of the loom weights with decoration and do not seem to be widely used in trade.

Goldman suggested that crescent-shaped loom weights in groups of 12 and 14 in Late Bronze Age layers in Tarsus Gözlü Kule could be used as fishing net weight (Goldman 1956: 319). Rahmstorf believes that the loom weights found in the ancient shipwrecks were used for the same purpose as the lead fishing net weights. According to Rahmstorf, terracotta objects need to be fired very well in order not to be dispersed in water in such a case (Rahmstorf 2015: 8). If we evaluate the crescent-shaped loom weights of Beycesultan from this perspective, almost all of them are well fired, slipped and burnished. These surface treatments to minimize water and moisture permeability are suitable for tools designed to be used both as fishing net weight and as loom weight. However, if these tools found in Beycesultan were used as fishing net weight, we would have seen traces of intensive consumption related to fishing. However, no findings were found in the excavations except for the mussel shells that were found very little.

Despite all these alternative views, the dominant view is that these tools are used as loom weights on the loom. Reconstruction studies on this subject (Castiglioni 1964; Feldtkeller 2003) and testing of

these studies with experimental archeology method (Baioni 2003; Grömer 2015; Lassen 2015) have shown that these tools can be used on a loom. In fact, it has been observed that there are some advantages such as preventing the tangling of the yarns and allowing the formation of 4 warp yarn series due to having two holes (Lassen 2015: 136).

In order to assert that crescent-shaped loom weights are used as weights in looms, it is necessary to compare their ratio to loom weights in other forms in the layer they are obtained. For example, 114 of the total 120 loom weights of layer 5b are crescent-shaped, while the remaining 6 are conical, pyramidal, triangular and rectangular shaped. In layer 5a, 111 of the total 124 loom weights are crescent-shaped, while the remaining 13 are pyramidal and disc-shaped. With these forms other than crescent-shaped loom weights, it is not possible to weave with such a small number of loom weights on a loom. This supports the view that crescent-shaped loom weights are used as weights on the loom. In addition, crescent-shaped and pyramidal loom weights were found together in Room 3 which implied that pyramidal or other forms are used with crescent-shaped loom weights in looms. Accordingly the crescent-shaped weights and pyramidal weights found in the Early Bronze Age levels of Demircihöyük (Baykal-Seeher and Obladen-Kauder 1996: 239) and the Late Bronze Age levels in Tarsus Gözlükule (Goldman 1956: 319) supports the assumption that they are used as loom weight in the same loom.

Experimental studies indicates that crescent-shaped loom weights are used in warp-weighted looms. However, the pyramidal loom weights attached to the fish net model in the tomb of Meketre (11-12th Dynasty) where pyramidal loom weights, which are known as loom weights today, are deemed to be used as fishing net weight in Egypt (Jarmuzek 2010: 21) which does not contradict with the assumption that pyramidal shaped weights are used as loom weights, it is important to show that the same objects may have been used for different purposes in different regions, thus, it should not be overlooked that crescent-shaped loom weights can be used in different regions, even in different settlements, for primary purposes or for more than one different purpose at the same time.

Finally, crescent-shaped loom weights were used only in the Bronze Age. The experimental archeology studies indicate that these types of weights, which have an advantage in terms of use in looms compared to other loom weights, appeared at the beginning of the Bronze Age and disappeared by the end of the Bronze Age probably due to acts by the sea people who caused great destruction in the Mediterranean region at the end of the Late Bronze Age.

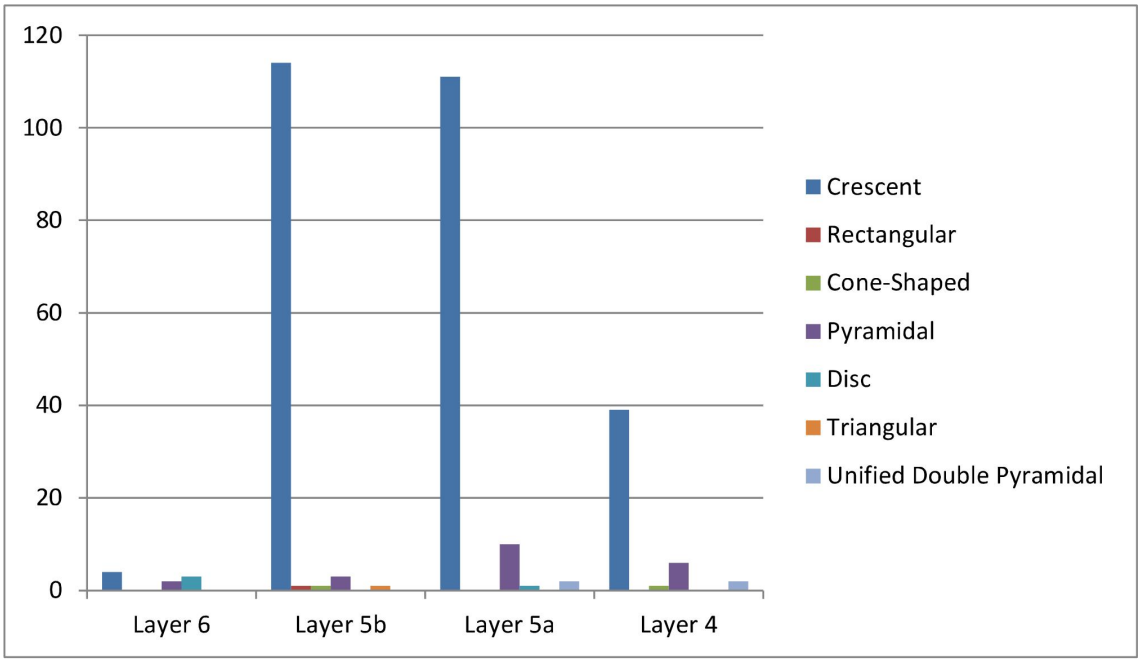

Figure 6: Distribution of Late Bronze Age loom weight form types

Although pyramidal shaped loom weights (Type D) were not widely used in Beycesultan, they are the most common form pursuant to the crescent shaped loom weights. It is 22% in layer 6, 3% in

stage 5b, 8% in stage 5a, and 13% in layer 4. A single string hole is located at the top of the pyramidal woven weights. Their lengths are between 10-8 cm and their weight varies between 310 gr and 173 gr.

The Rectangular loom weight (Type B-1) has a flat rectangular form and has a hole at the top long sides found only at layer 5b with a single sample. A similar form is known from Troy (Blegen et al. 1958: 18).

Cone-Shaped loom weight (Type C) has a single string hole at the top. This type, which is not found in layer 6 and 5a in Beycesultan, is seen only in 1% in layer 4 and 5b.

Disc shaped loom weights (Type E) are also among the rare forms in Beycesultan with only 3 samples in layer 6 and a sample in layer 5a. The string hole of disc-shaped loom weights is located in the center. Disc shaped loom weights are known from Troy (Blegen et al. 1953: 24).

Triangular shaped loom weight (Type F-1) is flat, with a single string hole located at the top. There is only one of this type, which is not very common, at layer 5b. A similar example found in Bolvadin Üçhöyük (Koçak et al. 2019: 106).

Unified Double Pyramidal shaped loom weight (Type G) is made by joining the bottom of two pyramidal weights side by side. Although similar in form with crescent-shaped loom weights as with pyramidal weights, its bottom parts are flattened and have a rectangular form. Two samples were found in layers 4 and 5a of this type and were not found in any settlement other than Beycesultan.

Only 12% of Beycesultan Late Bronze Age loom weights are decorated. There are different types of decoration such as dot, stamped star-shaped, hollow circle-shaped, incised ring, stamped ring, groove decoration, and stamped X-shaped decoration inside the circle (Figure 3: D).

Hollow circle-shaped decoration (Type C) is the most common decoration type with 67% ratio of the total decoration, stamped star-shaped decoration (Type B) in layers 5a and 5b with only one crescent-shaped loom weight (Fig. 7). This decoration was found on the crescent-shaped loom weights in Boğazköy (Bittel 1937: Plate 15 and 18) and Sandıklı-Menteş Üyük settlement (Koçak et al. 2019: 105).

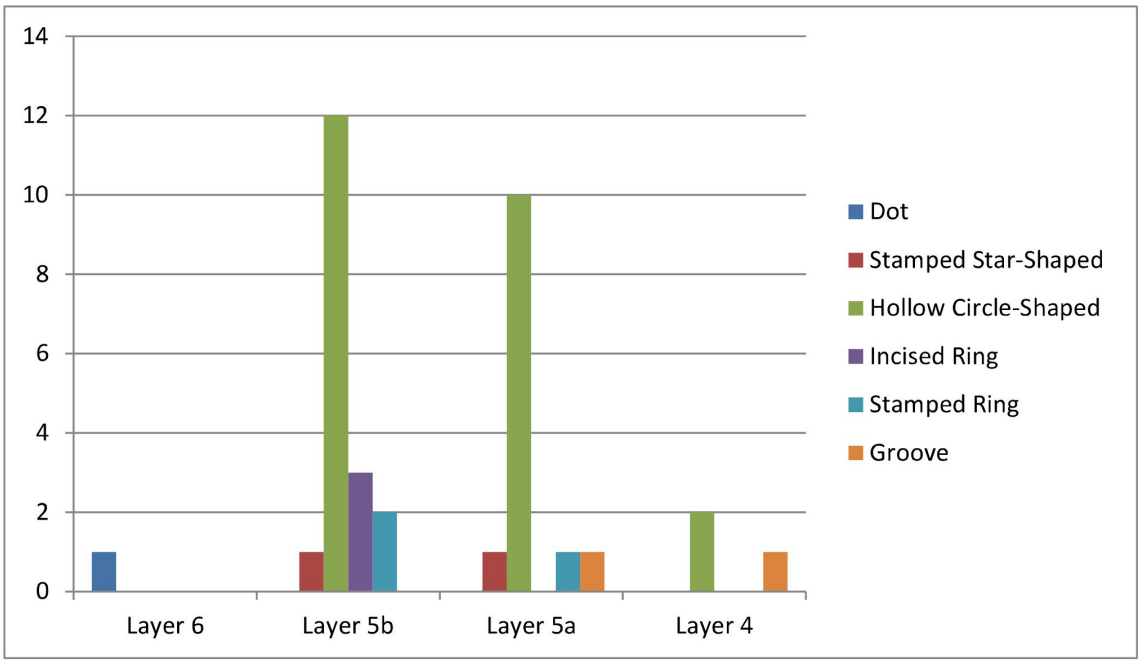

Figure 7: Distribution of Late Bronze Age loom weight decoration types

3. SPINDLE WHORLS AND LOOM WEIGHTS IN CONTEXT

It was reported that there were 32 spindle whorls and 45 loomweights in Late Bronze Age layers during the Beycesultan excavations in the first period (Mellaart & Murray 1995: 118, 120-125). In the second period excavations, much more, 170 spindle whorls and 300 loomweights were found. These findings were found only in an area of 1200m², and attract attention with their dense number of finds in such a narrow space.

According to the new period excavation stratigraphy, 9 spindle whorls (1 bone and 8 clay)

and 48 clay loom weights were found in the 4th layer (Fig. 8: A-B), and 4 clay spindle whorls and 9 clay loom weights in the 6th layer. Due to lack of high number of architectural remains related to these layers exposed to intense destruction of the Byzantine period layers, spindle whorls and loom weights were determined in the layer regardless of type of architecture.

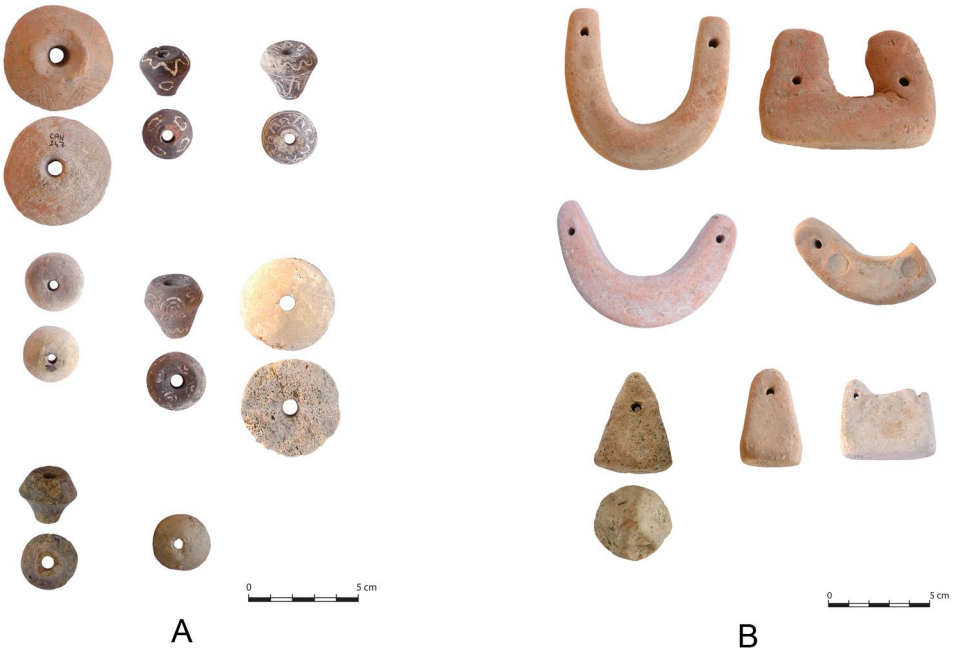

Figure 8: Layer 4 spindle whorls (A), loom weights (B) (Beycesultan excavation archive)

The most detailed information on Late Bronze Age spindle whorls and loom weights is obtained from layer 5. 82 spindle whorls (78 clay and 4 bone) (Fig. 9) and 120 loom weights (119 clay and 1 stone) (Fig. 10) were found in the early phase of this layer 5b. While most of the spindle whorls and loom weights are in the rooms with various functions (Abay 2014: 177-80), some of them are found outside the rooms. Some of these tools were found in storage rooms: with 7 spindle whorls in room 2, and 17 crescent-shaped loom weights in the space between the two pithos in the southwest of the room (Fig. 11: B). In Room 8, 6 spindle whorls and 42 crescent-shaped loom weights are located in the space between two large pithos, which rest on the wall in the east of the room, just as in Room 2 (Fig. 11: A). 14 crescent-shaped loom weights found together in room 30 were found in the corner of the rectangular mudbrick platform located in the southwest corner of the room (Fig. 11: C). Some of these tools were found in the rooms used as living spaces: 1 spindle whorl and 14 crescent-shaped loom weights were found together in the corner of the pithos as in room 2 and 8 in Room 7. 23 spindle whorls and 4 loom weights are detected in some parts of the room Room 28, used as a living area bearing passage to the Room 2. Sometimes these tools were found in the areas used as courtyards as room 14 where 3 spindle whorl and 12 crescent-shaped loom weights are found in groups. In the late phase of this layer, 5a, 75 spindle whorls (68 clay and 7 bone) (Fig. 12) and 124 clay loom weights (Fig. 13) were found. In this phase, some of the spindle whorls and loom weights were found in the areas used as courtyards: In room 4, 2 spindle whorls and 22 crescent-shaped loom weights were found scattered in groups of two or three. Burnt wood remains (loom, roof, cover, furniture) were found in the east of the loom weights and two spindle whorls in the north. 9 spindle whorls and 2 loom weights were found in room 5 with a living and storage function. Finally, in front of the entrance of the room 6 of a large building, which is thought to have both domestic and worship function (Abay and Dedeoğlu 2016: 187-189), 12 spindle whorls with anklebones and many pierced seashells were found together (Fig. 14: B). In Room 3, which is a larger room belonging to this building, 5 spindle whorls were found together with anklebones and many pierced seashells. 24 loom weights, including crescent-shaped and pyramidal shapes, were found collectively in front of the south wall (Fig. 14: A).

Figure 9: Layer 5b spindle whorls (Beycesultan excavation archive)

Figure 10: Layer 5b loom weights (Beycesultan excavation archive)

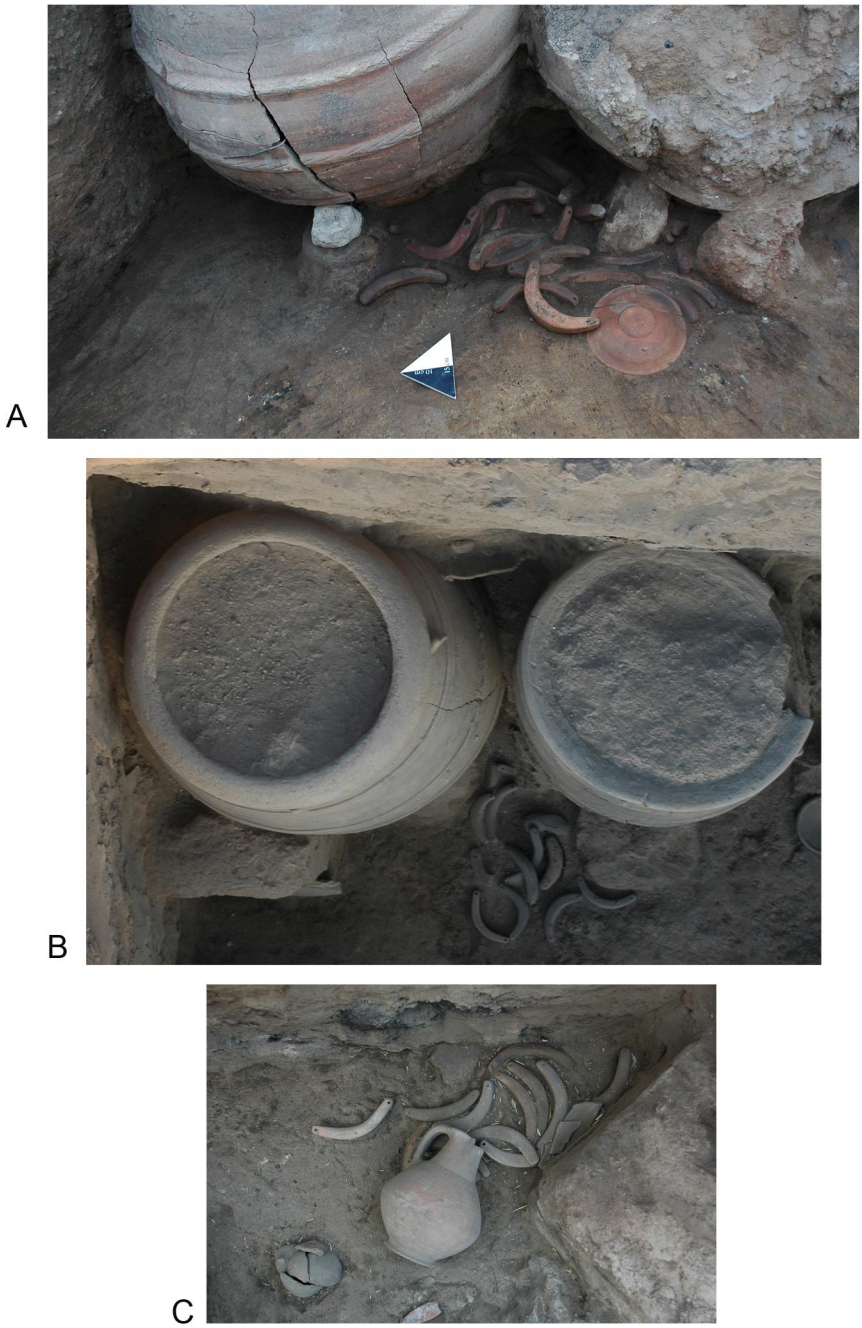

Figure 11: Groups of crescent loom weights in room 8 (A) (Ergün 2013: Fig. 75), in room 2 (B) (Ergün 2013: Fig. 76) and in room 30 (C) (Ergün 2013: Fig. 77) (Beycesultan excavation archive)

Figure 12: Layer 5a spindle whorls (Beycesultan excavation archive)

Figure 13: Layer 5a loom weights (Beycesultan excavation archive)

Figure 14: Groups of crescent and pyramidal loom weights in room 3 (A) (Ergün 2013: Fig. 79) and group of spindle whorls, anklebone and sea shell in room 6 (B) (Ergün 2013: Fig. 78) (Beycesultan excavation archive)

4. CONCLUSION

The variety of spindle whorls, one of the two basic tools used in weaving, reflects the variety of yarns with different qualities and thicknesses and the variety of woven fabrics. We understand that mass production and standardization started in the production of weaving tools and yarn production as the spindle whorls dimensions are not too big and rough, that some spindle whorls such as asymmetric double cones are produced and used more, and that using simple motifs such as short scraping lines that do not take much time as decoration items. The long and elegant appearance of Beycesultan Late Bronze Age spindle whorls, which is the general typological feature, prevented the excessive production of coarse and large spindle whorls used for the production of thicker yarns, but this situation was resolved by the unified spindle whorls consisting of two spindle whorls. Possibly this type of spindle whorls was adapted to

the Beycesultan Late Bronze Age spindle whorls tradition to take over the function of the coarse spindle whorls. While spindle whorl forms do not change much in Late Bronze Age layers, the some changes in decorations may be observed in layers. Incised short line decoration, which is very common in layer 5, disappeared in layer 4. Mixed ornaments, which are not seen in Level 5 appear for the first time in Level 4 suggesting that a different cultural tradition started in this level in the settlement which was reconstructed in Level 4 after the fire in layer 5a. There is also some evidence in Beycesultan that the spindle whorls may have been used for other purposes than spinning which is their basic function. The presence of spindle whorls anklebones and pierced seashells at the entrance of rooms 3 and 6 with domestics and worship function suggests that these objects are part of a possible ritual practice. Although the ritual / religious role of the anklebones in ancient times is known in many societies, group of spindle whorl, seashell and anklebone have not been reported from another settlement. Maybe it reflects the ruins of a local (or just Beycesultan) ritual.Crescent-shaped loom weights, which have been used in Anatolia since the Early Bronze Age and were first seen in Beycesultan since the Middle Bronze Age, are undoubtedly the most preferred loom weight form in the Late Bronze Age in Beycesultan. The fact that these loom weights have more advantages than other loom weights should be the probable reason why crescent-shaped loom weights are preferred over other weight forms in Beycesultan. No significant change is observed between the Late Bronze Age layer and its phases except for a few forms. The fact that the weaving weights are different in size and weight, just like in spindle whorls, indicates that yarns of different qualities are woven on the loom using different weights. From the spindle whorls and loom weights found in almost every room dated to the Late Bronze Age, it is understood that each house produces its own weavings. In this period, there is no weaving workshop in Beycesultan. Weaving tools were found in both the living and storage rooms of the houses. Most of the crescent-shaped loom weights were found in groups at the corner of pithos or benches in storage rooms. Considering that some of the crescent-shaped loom weights are in the storage room, it is difficult to claim that the weaving process is carried out in the storage room. Considering that the rooms used as the storage areas of the houses are smaller than the rooms used as living areas and that most of the storage room are filled with large pithos and granaries, it is almost impossible to weave in these areas with a loom. Weaving was most likely made in large courtyards where rooms were opened, and at the end of weaving, loom weights were collected and placed at the corners of pithos or benches in storage rooms (Ergün 2013: 192). Every room of the house should be used for spinning, which can be made without the need for a large area. In addition, group of loom weights in different numbers in the rooms (such as 42 in room 8, 24 in room 3, 22 in room 4, 17 in room 2, 14 in room 30) indicate that different-sized (large or small) warp-weighted vertical looms are used in the settlement. In the light of acquired data, the loom weight and spindle whorls, which are the most common group of finds after pottery imply that that weaving is one of the most important crafts in the settlement after pottery. Although the size of the production capacity is open to debate, loom weights and spindle whorls found in almost every place reveal that the weaving activity is carried out by some specialist individuals residing at home. When the forms and decorations of spindle whorls and loom weights are examined, local effects are predominantly seen on weaving tools, although there is an interaction between West Anatolia and Central Anatolia.Beycesultan weavers play an important role in Late Bronze Age weaving as they prefer crescent-shaped loom weights that are more advantageous in looms, and they made unified spindle whorls produced to spin thicker fibers in accordance with the tradition of the period and they create many forms and decoration elements that are not found in many settlements.

ACKNOWLEDGEMENTS

This article was produced from the improved version of a part of the unpublished master's thesis titled “Beycesultan Höyük Tunç Çağı Ağırşakları ve Dokuma Ağırlıkları” (Eng. Beycesultan Höyük Bronze Age Spindle Whorls and Loom Weights. Thesis Advisor: Eşref Abay). I would like to thank Eşref Abay, Director of the Beycesultan excavations, for his comment and support. I also would like to thank Fulya Dedeoğlu for her comment.

REFERENCES

Abay, E. and F. Dedeoğlu. (2012) Beycesultan 2007-2010 Yılları Kazı Çalışmaları Raporu *33. Kazı Sonuçları Toplantısı 4.Cilt*, 303-330.

Abay, E. and F. Dedeoğlu. (2016) Beycesultan 2013-2014 Yılı Kazı Çalışmaları *37. Kazı Sonuçları Toplantısı 3.Cilt,* 183-198.

Abay, E. (2014) Kazı Verileri Işığında Arkeolojik Mekan Analizleri Beycesultan Örneği, in Ö. Çevik & B. Erdoğu (ed.) Yerleşim Sistemleri ve Mekan Analizi. TAS 1: 175-189.

Alp, S. (1972) *Konya Civarında Karahöyük Kazılarında Bulunan Silindir ve Damga Mühürleri.* Ankara.

Baioni, M. (2003) Prova sperimentale di produzione di pesi reniformi e loro applicazione a un telaio verticale, in Bazzanella, M., Mayr, A., Moser, L. and Rast-Eicher,A. (ed.), Textiles: intrecci e tessuti dalla preistoria europea, 104–105. Trento. Provincia Autonoma di Trento.

Barber, E. J. W. (1991) *Prehistoric Textiles The Development of Cloth in the Neolithic and Bronze Ages.* Princeton University Press.

Baykal-Seeher, A. and J. Obladen-Kauder. (1996) *Demircihüyük, die Ergebnisse der Ausgrabungen 1975–1978. IV. Die Kleinfunde.*

Bittel, K. (1937) *Boğazköy Die Kleinfunde Der Grabungen 1906-1912 I Funde Hethitischer Zeit.* Leipzig.

Blegen, C. W., C.G. Boulter, J. L. Caskey, M. Rawson. (1958**)** *Troy Settlements VIIa, VIIb and VIII Vol. IV Part I-II.* Princeton University Press

Blegen, C. W., J. L. Caskey, M. Rawson. (1953) *Troy The Sixth Settlement Vol.III Part I-II.* Princeton University Press.

Boz, B. (2016) Considering The Re-Use of Late Bronze Age Buıldings in Light of Contextual Information and Human Remains at Beycesultan. *Mediterranean Archaeology and Archaeometry*, Vol. 16, No. 2. 75-86.

Castiglioni, O. C. (1964) I "reniformi" della Lagozza, in Calderini, A. *et al.*, *Comum – Miscellanea di scritti in onore di Federico Frigerio,* 129–171. Como. Noseda.

Dedeoğlu, F. and E. Abay. (2014) Beycesultan Höyük Excavation Project: New Archaeological Evidence from Late Bronze Age Layers. *Arkeoloji Dergisi XIX*, 1-39.

Dedeoğlu, F. (2016) A Study on Chalices From Beycesultan: Their Function, Socıal Meaning and Cultural Interactions. *Mediterranean Archaeology and Archaeometry,* Vol. 16 No. 2, 13-32.

Doğan- Alparslan M. (2004) Hititlerde Meslekler. *ArkeoAtlas Volume:3*, 54.

Ellis, R. S. (1976) Mesopotamian Crafts in Modern and Ancient Times: Ancient Near Eastern Weaving. *American Journal of Archaeology,* Vol. 80, No.1, 76-77.

Ergün, G. (2013) *Beycesultan Höyük Tunç Çağı Ağırşakları ve Dokuma Ağırlıkları*. Unpublished Master's Thesis, Sosyal Bilimler Enstitüsü, Ege Üniversitesi.

Fazlıoğlu, İ. (2001) *Eski Çağda Dokuma.* İstanbul.

Feldtkeller, A. (2003) Nierenförmige Webgewichte – wie funktionieren sie?, *Archaeological Textiles Newsletter,* 37, 16–19.

Goldman, H. (1956) Excavation at Gözlü Kule, Tarsus From the Neolithic through the Bronze Age. Princeton University Press.

Grömer, K. (2005) Efficiency and technique – Experiments with original spindle whorls. *Hallstatt Textiles Technical Analysis, Scientific Investigation and Experiment on Iron Age Textile* BAR International Series 107-116.

Grömer, K. (2015) Experiments with neolithic weaving-tools (lunular or crescent shaped loom-weights). Paper presented at the First Textiles. The Beginnings of Textile Manufacture
in Europe and the Mediterranean 7th-8th May 2015.

Jarmuzek, L. (2010) Loom-weights or net-weights?. Göttinger Miszellen 226, 17-24.

Joukowsky, M. S. (1986) *Prehistoric Aphrodisias An Account of the Excavations and Artifact Studies,* Vol. I-II.

Keith, K. (1998) Spindle Whorls, Gender, and Ethnicity at Late Chalcolithic Hacınebi Tepe .*Journal of Field Archaeology,* Vol. 25, No.4, 497-517.

Koçak, Ö., Bilgin, M., Küçükbezci, H.G. (2019) *MÖ II. Binyılda Afyonkarahisar ve Çevresi Kültürleri.*

Konakçı, E. (2018) Asopos Tepesi MÖ 2. Binyıl Tezgâh Ağırlıkları ve Ağırşakları. *33. Arkeometri Sonuçları Toplantısı 1. Cilt* 2018, 259-274.

Koşay, H. Z. & M. Akok. (1966) *Alacahöyük Kazısı 1940-1948'deki Çalışmalara ve Keşiflere Ait İlk Rapor.*

Koşay, H. Z. & M. Akok. (1973) *Alacahöyük Kazısı 1963-1967'deki Çalışmalara ve Keşiflere Ait İlk Rapor.*

Lassen, A.W. (2015) Weaving with crescent shaped loom weights. An investigation of a special kind of loom weight. Andersson Strand & M-L Nosch (red), *Tools, Textiles and Contexts. Investigating textile production in the Aegean and Eastern Mediterranean Bronze Age.* Oxbow Books. 127-138.

Levy, E.T, Sideris, T, Howland, M, Liss, B, Tsokas, G, Stambolidis, A, Fikos, E, Vargemezis, G, Tsourlos, P, Georgopoulos, A, Papatheodorou, G, Garaga, M, Christodoulou, D, Norris, R, Rivera-Collazo, I, and Liritzis, I (2018) At-Risk World Heritage, Cyber, and Marine Archaeology: The Kastrouli–Antikyra Bay Land and Sea Project, Phokis, Greece, Springer International Publishing AG In T.E. Levy, I.W.N. Jones (eds.), Cyber-Archaeology and Grand Narratives, One World Archaeology, 143-230.

Lloyd, S. and J. Mellaart. (1962) *Beycesultan Vol. I The Chalcolithic and Early Bronze Ages Levels,* London.

Mclauchlin, B. K. (1981) New Evidence on the Mechanics of Loom Weights. *American Journal of Archaeology,* Vol. 85, No. 1, 79-81.

Mellaart, J.and A. Murray. (1995) *Beycesultan Vol. III Part II Late Bronze Age and Phrygian Pottery and Middle and Late Bronze Age Small Objects.* London.

Rahmstorf, L. (2015) An introduction to the investigation of archaeological textile tools. Andersson Strand & M-L Nosch (red), *Tools, Textiles and Contexts. Investigating textile production in the Aegean and Eastern Mediterranean Bronze Age.* Oxbow Books. 1-23.

Reyhan, E. (2010) Hitilerde Gündelik Hayata Dair İktisadi İlişkiler. *Ankara Üniversitesi Dil ve Tarih Coğrafya Fakültesi Tarih Bölümü Tarih Araştırmaları Dergisi Volume 29, İssue 47,* 65-82.

Sauvage , C. (2014) Spindles and Distaffs: Late Bronze and Early Iron Age eastern Mediterranean use of solid and tapered ivory/bone shafts, in M. Harlow, C. Michel and Marie-Louise Nosch (Ed.) Prehistoric, Ancient Near Eastern & Aegean Textiles and Dress: An Interdisciplinary Anthology. Ancient Textiles Series Vol.18, 184-226.

Schmidt, E.F. (1932) *The Alishar Hüyük Season of 1928 and 1929, Part I,* Researches in Anatolia Vol. IV. University of Chicago Press.

Sideris, A., Liritzis, I., Liss, B., Howland, M.D. & Levy T.E. (2017) At-risk cultural heritage: new excavations and finds from the Mycenaean site of Kastrouli, Phokis, Greece. *Mediterranean Archaeology and Archaeometry*, Vol. 17, No 1, 271-285.

Sideris, A, Liritzis, I (2018) The Mycenaean site of Kastrouli, Phokis, Greece: Second Excavation Season, July 2017. *Mediterranean Archaeology and Archaeometry*, Vol. 18, No 3, 209-224.

Yılmaz, D. (2016) Geç Tunç Çağında Batı Anadolu'da Tekstil Üretimi: Çine Tepecik Höyüğü Tezgah Ağırlıkları. *TÜBA-AR 19*. 99-113.

Yiğit, T. (2002) Hititçe Çivi Yazılı Metinlerde Dokumacılar. *Tarih İncelemeleri Dergisi Cilt XVII Volume: 2,* Ege Üniversitesi Edebiyat Fakültesi Yayınları, 79-84.

Yurtsever Beyazıt, A. (2014) Güncel Arkeolojik Bulgular Işığında MÖ 2. Binyılda Amasya Bölgesi. *TÜBA-AR 17*. 83-110.