EXARC JOURNAL 2023/1
12 Articles | Open Access

Reviewed Article:

Experimental Weaving and Twining with Ceramic Crescents from the Late Neolithic and Chalcolithic in Southwestern Iberia

Persistent Identifier: https://exarc.net/ark:/88735/10676

EXARC Journal Issue 2023/1 | **Publication Date:** 2023-03-03

Author(s): Victoria Priola[1]

[1] Department of Anthropology, University of Iowa, Iowa City, IA 52240, USA.

Ceramic crescents are a common find at Late Neolithic and Chalcolithic sites in southwestern Iberia (late fourth – third millennium BC). These objects, which often weigh less than 100 g and are perforated on each end, are typically referred to as loom weights and thought to be

associated with textile production, although their function remains uncertain. A variety of possible uses have been suggested for similar crescents from other archaeological contexts in Central and Southern Europe and Mesoamerica, including the use of these objects in vertical band weaving, warp twining, and warp-weighted weaving. This experimental project tests the efficacy of these Iberian crescents in each of these methods and compares the results to surviving textile fragments found in southern Iberia contemporary with these tools. My findings suggest that Iberian ceramic crescents could have functioned as warp twining tools or as loom weights with linen threads on a vertical loom.

> “The results of these experiments suggest that Iberian crescents could function effectively in more than one method of textile production. Of the methods tested, the crescents proved to be well- suited for both warp twining and warp-weighted weaving.

Introduction

Textile tools are the primary form of archaeological evidence for textile production in Late Neolithic/Chalcolithic Iberia. Thousands of ceramic loom weights, mostly fragmented, have been found at numerous archaeological sites in the southwestern region of Iberia. During this period (late fourth and third millennium BC), research suggests that agropastoral communities in this area were engaging in labour intensive monument construction, expanding their trade networks, and creating extraordinary craft objects (Lillios, 2019, p.171). Despite the large quantity of loom weights found during this period, very little experimental work has been conducted to explore the functionality of these tools and investigate textile production techniques from this time (Rozzi, 2017, pp.47-52). Instead, research has focused on identifying loom weight typologies, establishing regional patterns, and analysing and comparing specific loom weight assemblages (Costeira, 2010; Pereira, 2010; Costeira 2013; Gomes, 2013; Costeira and Mataloto, 2018; Gomes, 2019). In southwestern Iberia, most loom weights are classified into one of two broad types based on their general shape; they are either plaques or crescents (See Figure 1). While archaeologists often suggest that the plaques were used in tablet weaving (Cardito Rollán, 1996, pp.142–143; Boaventura, 2001, p.52; Gomes, 2013, p.116; Rozzi, 2017, pp.54-55; Costeira and Mataloto, 2018, pp.65-66), the purpose of the crescents is harder to discern without experimental research.

Crescent shaped loom weights are not unique to southwestern Iberia. Similarly shaped ceramic crescent weights have been found elsewhere in Central and Southern Europe during the late fourth and third millennia BC (Lassen, 2015, p.127; Grömer, 2018, p.118; Ulanowska, 2018, p.163), and potentially have been identified in Mesoamerica during the Pre-Classic/Formative period as well (Follensbee, 2020, p.4; Follensbee, 2021, p.3). The shape and size of these crescents can vary widely and they have been associated with a number of different textile production techniques. Testing the function of these artefacts through replication and experimental studies has proved to be a productive means in which their effectiveness in different textile production methods can be better understood (Lassen, 2015, pp.136-137; Grömer, 2018, pp.125-126; Ulanowska, 2018, pp.170-171; Follensbee, 2021, pp.6-7). This project tests the efficacy of Chalcolithic crescent weights from southwestern Iberia in three different textile production methods: 1) vertical band weaving, 2) warp twining, and 3) warp-weighted weaving.

Background Research

There has been relatively little research into prehistoric textile production in the Iberian Peninsula when compared to other regions in Europe, such as central Europe and the Eastern Mediterranean (Marín-Aguilera, 2020, p.142). This is due, in large part, to the perishable nature of textiles and the relatively small quantity and fragmented nature of textile remains found in Iberia. Scholars have also suggested that research on textile tools and textile production practices in Iberia have been neglected or dismissed in the past because of their strong association with female labour and domestic activity (Marín-Aguilera, 2020, p.142; Basso Rial, Jover Maestre and Lopez, 2021, p.2). Over the last two decades, however, textile studies have been increasing in Iberian archaeology, and recent research has revealed some important insights into early textile production practices and provided a more detailed understanding of the variation in textile tools from the Late Neolithic and Chalcolithic.

Ancient textile remains in Iberia are rare, particularly in the southwestern region (Alentejo, Algarve, western Andalucia) where crescent loom weights are found. The exceptional textile remains that do survive, which are always fragmented, provide vital information about how textile tools may have functioned and the types of fabrics they may have been used to create. The majority of ancient textile remains from Iberia have been found in south-eastern Spain, as the dry climate in this region provides better preservation conditions. Some of the oldest woven textile fragments from south-eastern Spain date to the Chalcolithic (third millennium BC), with notable remains found in burial contexts at the site Los Millares in Almeria and at Cueva Sagrada in Murcia. The fabrics found at Los Millares, preserved with cremated human remains, are well-balanced tabby weaves, or plain weaves, made from fine linen or hemp fibres (Alfaro Giner, 2012, pp.338-339). A closer look at one of the hemp fragments with a scanning electron microscope revealed a thread count of 11-12 threads/cm made from s-twisted threads, 0.2-0.4 mm thick. The remarkable textiles found at Cueva Sagrada, dated to 2200 BC, consist of two large rectangular linen tunics with a starting border on one end and a series of long fringes at the other made by knotting the bottom of the warp threads together (Alfaro, 1992, pp.22-24). These tunics are balanced tabbies with a thread count of 21/28 threads/cm made of very fine threads, 0.1-0.2 mm thick (Alfaro Giner, 2012, p.339). The tunics are reinforced in some areas with S2z-piled threads that are 0.4 mm thick. In addition to these Chalcolithic finds, around one-hundred Early Bronze Age textile fragments have also been found in south-eastern Spain, primarily from Argaric burial contexts (Basso Rial, Jover Maestre and Lopez, 2021, p.4). A few of these textiles were identified as wool or esparto grass, but the vast majority are linen tabbies made with Z-twisted threads between 0.2-1 mm thick.

While not as numerous, the few textile remains that have been found in southwestern Iberia are contemporary or even older than those found in the Southeast. The oldest loom-woven textile fragments in the Iberian Peninsula come from Peñacalera Cave (or Cueva de la Peña de La Calera) located in the Sierra Morena near Córdoba, Spain (Gleba et al., 2021, p.5). Five tabby woven textile fragments made of spliced linen threads were found in this cave, all of which date to the Late Neolithic or Chalcolithic. The two oldest textiles, Textiles 1 and 4, are made of coarser S-twisted threads, between 0.6-1 mm thick, and were dated to around 3400 cal BC (Gleba et al., 2021, pp.4-6). Textile 4 is a balanced tabby, and Textile 1 is a warp-faced tabby with double the number of warp threads to weft threads (Gleba et al., 2021, p.3). While the other three textiles have no clearly discernible twist and lack preserved salvages, they are also thought to be warp-faced. These textiles were made of finer threads, with Textiles 2 and 3 made of fine threads 0.2-0.6 mm thick and Textile 5 made of very fine threads 0.1-0.3 mm thick and coloured with cinnabar. Textiles 3 and 5 were dated to around 2500–2300 cal BC (Gleba et al., 2021, p.4). Further west, the oldest textile fragment found in Portugal dates to around this same time. This fragment was found in the megalithic tomb of Belle France in the Algarve region, preserved around a copper axe, and is dated to the middle of the third millennium BC (Soares et al., 2018, p.80). Analysis of this textile identified it as a linen warp-faced tabby made of Z-twisted threads and painted with a reddish-brown stripe from a common madder dye after it was woven (Soares et al., 2018, p.74). A few additional textile fragments, preserved with copper artefacts, have been found at other Chalcolithic and Early Bronze Age sites in Portugal, including Porto Mourão, Monte das Aldeias, Torre Velha 12, and the Sudoeste dos Bugalhos necropolis (Soares et al., 2018, p.80). Most of these textiles are highly fragmentary and all are linen tabby weaves.

Crescent or plaque shaped ceramic artefacts, associated with weaving, first appear during the Late Neolithic and are contemporary with the oldest loom-woven textile fragment found at Peñacalera Cave (Gleba et al., 2021, pp.7-8). These artefacts are common finds at settlement sites in southwestern Iberia during the late fourth and third millennium BC. Crescents are semi-circular in shape, with an oval, circular, or rectangular section, and have a perforation at each end. Plaques, sometimes also called tablets, are often either rectangular, square, or oval in shape, with between two and four perforations located near the corners or on the opposite ends. Plaques with six perforations are occasionally found (Costeira and Mataloto, 2018, p.62), although these are less common. While there is a great deal of diversity in the shape and size of these objects, plaques and crescents found in the Southwest are often lighter and thinner than those found in other areas of Iberia (Costeira and Mataloto, 2018, pp.5-9). More specifically, in the Alentejo region of Portugal, where both types are frequently found at the same sites, many of the plaques and crescents are similar in size, often weigh less than 100 g, and have comparable lengths, widths, thicknesses, and distances between the perforations

(Boaventura, 2001, p.49; Costeira and Mataloto, 2013, pp.64-5; Costeira and Mataloto, 2018, p.62). These similarities are especially true for plaques and crescents with 2 perforations, leading some scholars to suggest that both types may have been used in similar ways (Boaventura 2001, p.52; Gomes, 2013, p.220; Costeira and Mataloto, 2018, p.66).

While these crescents and plaques are both frequently referred to as loom weights, some researchers prefer to label them as loom elements or loom components. They suggest that the term 'loom weight' may not be appropriate to describe the function of these objects, as it implies that they were used to provide tension to warp threads while weaving (Boaventura, 2001, p.48; Pereira, 2012, pp.2-4). Specifically, these scholars have questioned whether the lightweight crescents and plaques frequently found in the Alentejo region of Portugal would have been heavy enough to act as loom weights on a vertical loom. Pereira (2012, p.3) argued that these artefacts should be divided into 3 main groups, with only the less common heavier and larger versions of these artefacts classified as loom weights, before further splitting plaques and crescents into 2 other groups. While these artefacts are not frequently categorized or analysed in these 3 groups, their functions continue to be conceived and interpreted in this way. Researchers suggest that heavier versions of both plaques and crescents could be used as weights on a vertical loom (Boaventura 2001, p.53; Costeira and Mataloto, 2013, pp.645-646; Costeira and Mataloto, 2018, p.66), and most scholars generally agree that the smaller plaques appear well-suited for tablet weaving (Cardito Rollán, 1996, pp.142–143; Boaventura, 2001, p.52; Gomes, 2013, p.116; Costeira and Mataloto, 2018, pp.65-66). Functional interpretations for the lighter crescents are often much less confident and range from suggesting that they could be used in a manner similar to the plaques (Boaventura, 2001, p.52), to proposing they could be used in various twining methods (Costeira and Mataloto, 2013, pp.64-5; Costeira and Mataloto, 2018, p.66).

Weaving experiments with ceramic crescents found outside of Iberia, in Central and Southern Europe, have demonstrated that these artefacts are able to function effectively as loom weights. While these crescents vary in size and shape, they are often much heavier than those found in southwestern Iberia, weighing between 250 g to over 500 g (Lassen, 2015, p.132; Grömer, 2018, p.120; Ulanowska, 2018, p.166). Much smaller lunate objects from Mesoamerica, weighing under 10 g, have also been suggested to be loom weights (Follensbee, 2020, p.4). Recent replication studies have supported this interpretation, illustrating that these small objects can also function effectively as loom weights and warp-twining tools (Follensbee, 2020, p.10; Follensbee, 2021, p.6). The foundational experimental textile research that identified the weight, size, and shape of a loom weight as important functional attributes, also established that variations in these attributes are related to other factors of production, including the type and size of the fibres, the loom set-up or weaving technique, the number of threads attached to each weight, and the desired fabric (Mårtensson, Nosh and Strand, 2009, pp.396-397; Lassen, 2015, p.136; Olofsson, Strand and Nosh, 2015, pp.88 and 98-99;). No matter the shape, Mårtensson, Nosh and Strand (2009, p.397) illustrated that the weight and thickness are the most important dimensions of a loom weight for understanding their function in textile production.

For crescent shaped weights, additional insights related to their function have been identified through experimental work. Based on their shape, crescents have been associated with 3 different methods, vertical band weaving, warp twining, and warp-weighted weaving. Vertical band weaving is often associated with crescents because only 2 weights need to be used to make a tabby fabric band, providing a very easy set up with two separate thread layers, or sheds (Grömer, 2018, p.120). While experimental studies have shown that crescents can provide a practical tool for this method, splitting the shed layers in the middle between the 2 perforations on each crescent has also been noted to create gaps in the centre of the fabric band (Lassen, 2015, p.129; Grömer, 2018, p.120). Using the crescents in warp twining takes advantage of the separation between the perforations to create a natural shed, making it possible to create textiles without using a heddle bar (Grömer, 2018, pp.123-124; Follensbee, 2020, p.5) and allowing for a lot of flexibility in the type of pattern that can be created (Follensbee, 2021, pp.6-7). The crescents can also be used to create a natural shed in warp-weighted weaving, making it possible to use only a single row of weights to create a tabby weave (Grömer, 2018, pp.121-22). Warp-weighted weaving with 2 rows of crescents can also be used to make more intricate twill patterns, separating 4 thread layers, and allowing for the pattern to be changed easily (Lassen, 2015, pp.136-137). Overall, experimental research has demonstrated that crescent weights can provide stable tension to the warp threads, easily separate shed layers, move smoothly while weaving and changing the sheds, and have minimal issues with tangling (Lassen, 2015, p.136; Follensbee, 2020, p.5).

Only one published experimental study has investigated the loom weights from southwestern Iberia. This study primarily focused on tablet weaving with various types of plaques (Rozzi, 2017, pp.47-52), although, the author did briefly consider the function of crescents as well, demonstrating that they could be used in a warp twining method and suggesting that they could act as loom weights (Rozzi, 2017, pp.52-55). The experimental project presented here aims to further clarify the functional capabilities of these Iberian crescents, test their capacity to act as loom weights and explore their ability to create fabrics similar to those found in Iberia at this time.

The Experimental Project

The three methods tested in this project, vertical band weaving, warp twining, and warp-weighted weaving, were chosen based on the background research above. Throughout these experiments, advantages and disadvantages related to the crescents' shape and functional aspects were identified and compared to evaluate the compatibility of these artefacts with each method. I conducted the weaving experiments with a set of replica ceramic crescents and a loom created specifically for this project.

The set of loom weights used in the following experiments were made to replicate the shape and size of ceramic crescents found in southwestern Iberia from the Late Neolithic and Chalcolithic. Specifically, the replica loom weights were based on crescents found at the site São Pedro, located in the Alentejo region of Portugal (See Figure 2). The loom weight assemblage from this site is contemporary with the loom woven textile fragments found in Peñacalera Cave (Gleba et al., 2021, p.8). This assemblage, excavated between 2004 and 2009, was initially researched by Costeira (2010) and later expanded on by Costeira and Mataloto (2013; 2018). This assemblage is highly fragmented and includes both crescents and plaques, with crescents making up 61% of the assemblage (Costeira, 2010, p.38). Measurements from the most complete crescents reveal that these artefacts commonly measure between 8-9.9 cm long, 1-2.9 cm wide, and 0.5-1.4 cm thick (Pereira 2012, p. 11), although the full range of these measurement fall between 6.0-11.9 cm long, 0.7-4.9 cm wide, and 0.5-2.5 cm thick (Costeira and Mataloto, 2013, p.642). The crescents most commonly weigh between 45-59 g, with a full range of 21-80 g, and an average of around 51 g. Costeira and Mataloto (2013, p.642) assert that crescents studied at other contemporary sites, including Perdigões, Pombal, Moinho de Valadares 1, Cerros Verdes 3, Monte do Tosco 1 and Mercador, are similar in size to the crescents from São Pedro. All of the crescents from São Pedro have two perforations, with the diameter range of 0.2-1 cm, most commonly measuring between 0.3-0.5 cm, and a distance between the perforations that ranges between 5.7-9.1 cm.

A set of 60 replica ceramic crescent weights were made at the University of Iowa Department of Anthropology Ceramics Lab in the summer of 2020 to reproduce accurately the size and shape of these weights. The replica weights were modelled by hand into a crescent shape, with two horizontal perforations, one on each end (See Figure 3). They were made from commercial red earthenware clay and fired in a commercial kiln to ensure consistency and accuracy in their construction. While the ceramic composition and firing method used to make these crescents are not authentic replications of ancient practices, their functional dimensions do replicate the archaeological artefacts. After firing, the replica crescents measure approximately 10 cm long, 2 cm wide, between 1-1.5 cm thick, and weigh between 50-52 g. The perforations range from 0.4-0.8 cm in diameter with the distance between the perforations measuring on the higher end at approximately 9 cm. A random selection of loom weights from this set of replica crescents were used in all the weaving and twining experiments discussed below.

A warp-weighted loom was made to conduct all 3 of these experiments (See Figure 4). No looms or depictions of looms survive from the Late Neolithic or Chalcolithic of Iberia. Loom weights are frequently used to imply the existence of a warp-weighted loom and, as such, it is generally considered to be the earliest archaeologically attested loom in Iberia (Gleba et al., 2021, p.6). This type of loom uses vertical warp threads hanging from a single bar, either upright or leaning slightly against a wall. Rather than try to replicate an ancient construction method, the loom used in these experiments was constructed with modern tools, materials, and dimensional lumber purchased from a local hardware store. This loom was constructed with two main vertical sideboards (38 mm x 89 mm x 182.88 cm) which could lean against the wall at approximately a 70° angle. A board (38 mm x 89 mm x 30.48 cm) was attached perpendicularly to the front face of each of these two main sideboards near the top of the loom at approximately a 30° angle. These attachments were added to mimic a naturally forked tree branch that might have been used in the past to create this style of loom and provide a niche for the top bar of the loom to rest. Another board (38 mm x 89 mm x 30.48 cm) was attached perpendicularly to the outside edges of both of the main vertical sideboards about half-way up to accommodate a horizontal heddle bar when necessary. Finally, a horizontal beam (38 mm x 89 mm x 91.44 cm) was attached across the bottom of the two main vertical sideboards, about 61 cm up from the ground, to provide stability to the frame of the loom and act as a shed bar in the warp weighted weaving experiment. Unattached dowel rods were used for both the top bar of the loom and the heddle bar so that they could be moved, rotated, or removed when necessary, depending on the weaving or twining method being used.

The fibres used in all 3 of these experiments consisted of commercially produced 16/2 linen thread, approximately 1 mm thick. This thread was chosen as the size is similar to the size of thread identified in the oldest Iberian textile remains, Textiles 1 and 4 from Peñacalera Cave. These textiles were made of threads between 0.6-1 mm thick (Gleba et al., 2021, p.4). Although many of the other textiles remains are made of finer threads and all prehistoric woven linen textiles from Iberia were made of spliced threads from pre-formed fibre bundles rather than spun and plied fibres (Gleba et al., 2021, p.3), the thread used in these experiments matches the upper size found from oldest remains. As finer threads require less warp tension (Mårtensson, Nosh and Strand, 2009, p.393), using thread of this size effectively tests the ability of these loom weights to provide enough tension for smaller threads as well. In the following experiments, the warp tension was calculated using the equation described by Firth (2015, p.162); in which the warp tension is equal to the weight of the loom weight divided by the number of warp threads per loom weight.

Vertical Band Weaving

The first experiment tested the efficacy of these crescents in vertical band weaving. Twenty linen warp threads were tied to the top bar of the loom and attached to 2 loom weights with 10 threads on each weight (5 threads per perforation). Unlike the other experiments presented here, in this method the crescent weights were hung so that the long side of the weights were facing forward (See Figure 5). The 2 weights rested against each other and the warp threads were alternatively attached to each weight, with the first thread attached to the weight in front, then the next to the weight in the back, and repeating like this across the warp. As a result, the odd threads created the front shed and even threads created the back shed, with the first 10 warp threads attached to the perforations on the left-hand side of the crescents, and the remaining 10 warp threads attached to the perforations on the right-hand side. This set up resulted in about 5-5.2 g of tension per weight. A small floating heddle bar was added above the hanging crescents to create the counter shed while weaving. This method was used to make a band with a warp faced tabby weave.

While it was possible to use these crescents to create a woven band with this method, numerous disadvantages were noted. First, the crescent's light weight limits the number of threads that could be attached to each of the weights. As the 20 warp threads used here already resulted in a less than optimal warp tensions, attaching additional threads would result in an even lower tension and make the weaving process more difficult. The limited number of warp threads also means a limitation in the width of the woven band, allowing very little flexibility in the size of band that could be made with this method. The crescents' lengths and the distance between the perforations also created an issue. As the width of the band started at about 1.5 cm, in comparison to the approximately 9 cm distance between the perforations, the middle of warp was pulled apart by the perforations. While weaving, the centre of the band became increasingly open and uneven as the width of the band expanded to about 2.3 cm at the bottom (See Figure 6). Another issue was caused by the thickness of these crescents. Whereas Grömer (2018, p.120) found that the thicker crescents from Melk-Spielberg, Austria created a clearly separated natural shed that aided in weaving, the thinner Iberian crescents provided very little separation between the sheds (See Figure 7), especially when weaving farther away from the crescents, closer to the top bar of the loom. This almost non-existent natural shed makes the weaving process slower and more time consuming as it is more difficult to differentiate between the sheds and pass the weft threads through. Together the length and thickness caused problems throughout this method, as the thickness slowed down the weaving process on the top half of the band and the length pulled the centre of the band open on the bottom half. While it was possible to create a band with these crescents using this method, the weight, thickness, and length all created obvious disadvantages that made weaving more difficult and resulted in an uneven band with gaps in the centre.

Warp Twining

The next method tested the use of these crescents in warp twining. Once again, 20 linen warp threads were attached to the top bar of the loom. This time 10 loom weights were used, with only one thread attached to each perforation. The loom weights were hung side by side across the loom with the odd warp threads attached to the front perforations and the even threads attached to the perforations in the back (See Figure 8). This set up resulted in a tension of around 25-26 g per weight. This method was used to create both a balanced tabby weave and an open netting effect in the same band (See Figure 9). To create the tabby weave with this warp twining method, the crescents were turned 1800 counter-clockwise, one-by-one across the warp after the weft was initially passed through the natural shed. This motion created the counter shed. After the weft was passed through the counter shed, all of the weights were turned clockwise back to their original positions to reform the natural shed and repeat the process. To create the open netting effect, the crescents were always spun 1800 in the same counter-clockwise direction after the weft was passed through, continuously twisting the warp threads around the weft threads (See Figure 10).

These crescents worked well with this warp twining method and a number of advantages were noted. First, this method was simple and quick to set up. Unlike the other methods tested in this project, warp twining did not require the use of a heddle bar to create the counter shed. This greatly simplified the set-up process, as the only requirement for this method was that the weights hang side by side at the same level so that they stayed ordered and did not tangle. Hanging in this direction, the shape of the crescents and the distance between the perforations created a wide natural shed, making it easy to insert the weft threads. The thickness of the crescents created some separation between the warp threads, resulting in a more open fabric, but this separation did not cause any issues while weaving/twinging with the crescents. Furthermore, unlike vertical band weaving, the weight of these crescents did not limit the number of warp threads that could be used in this method. Instead, the number of warp threads was determined by the number of crescents used, as 2 warp threads are used per weight. This means that the number of warp threads can easily be increased and, therefore, a wider fabric can be made by using more crescent weights in the initial set-up. This also means that the addition of more warp threads has no risk of lowering the warp tension, as the number of threads per weight is always the same. As a result, these crescents consistently provided a high tension for the linen warp threads used in this experiment, keeping the warp threads stable without overstraining them. Additionally, compared to the other methods tested in this project that were only used to create a tabby weave, this warp twining method allowed more flexibility in type of pattern that could easily be made with these crescents. After initially using this method to create a tabby weave, the pattern was changed to an open netting effect (See Figure 11). It was easy to switch between these patterns as nothing about the set up or technique had to change to facilitate this beside the direction the crescents were turned. The most significant constraint noted in this method was not related to the crescents but instead to the experience of the weaver. While this twining technique is relatively simple, it did take some practice to become accustomed to handling the weights and creating a smooth working rhythm. As a result, in practice, adding in more crescents to make a wider fabric may make handling the weights more challenging.

Warp Weighted Weaving

The final experiment tested the use of these crescents in warp weighted weaving with a single row of loom weights. This experiment used 61 linen warp threads and 15 loom weights. Unlike the previous experiments where the warp threads were attached directly to the top bar of the loom, in this method, the warp threads were woven through a horizontal starting border that was attached to the top of the loom. This was done to create a fabric structure similar to the Chalcolithic tunic textiles found at Cueva Sagrada. Although the exact method used to create the starting border for these tunics could not be identified (Alfaro, 1992, p.22), the starting border for this experiment was made from a tablet weaving method, using 4 square tablets with four perforations, one in each corner. As the purpose of this experiment was to test the efficacy of the crescents in warp weighted weaving, the tablets used to make this border were made of cardboard and do not reflect the dimensions of archaeological artefacts from Iberia. The starting border was made using 16 horizontal warp threads, with 4 threads per tablet and one thread passed through each perforation in alternating directions. The starting border's weft threads were used to create the vertical warp threads for this experiment (See Figure 12). The warp threads were alternatively tied to the front and back perforations on the crescents, creating a natural shed, similar to the set-up for warp twining. The crescent weights were hung side by side in a single row with 4 threads attached to each of the weights, except for the last weight which had 5 threads attached instead, as odd-numbered warps can help to create even weaving and better selvages (Follensbee, 2020, p. 7). This provided a tension of about 10-13 g per weight. As the weights are not twisted or manipulated in this method, the warp threads were tied to the crescents below the shed bar, to help keep the weights stationary and prevent them from tangling (See Figure 13). While the crescents provided a natural shed, a heddle bar was added to create the counter shed. This method was used to make a warp faced tabby weave (See Figure 14) with a starting border and was finished by knotting groups of warp threads together.

Once again, the crescents appeared to function well with this method. The shape of the crescents not only created a natural shed but also made it possible to create a tabby weave with only one row of loom weights (See Figure 15). As such, these crescents simplified the set-up process for warp-weighted weaving when compared to non-crescent shaped loom weights with one perforation, that often require two rows of loom weights and do not provide a natural shed. Despite this, the set-up process for this method was much more involved and time consuming than both of the other methods tested with these Iberian crescents. In large part, the set up was more involved because of the starting border and the increased number of warp threads and crescent weights that were used in this experiment. The set-up was further complicated by the addition of a heddle bar and the use of multiple threads on each of the weights that alternated between the two sheds. While the increased number of threads attached to each loom weigh made the warp tension used here lower than in the warp twinging method, this tension was still sufficient enough to keep the linen warp threads taut and did not noticeably impact the weaving process. Although more effort was required during the set-up, the weaving process itself was efficient and moved smoothly with the use of the heddle bar (See Figure 16). Adding more crescents, and as a result more warp threads, would make the set-up process longer but would have little effect on the weaving portion of this method. Compared to warp-twining, this method allowed for much less flexibility in the type of pattern that could easily be created but makes it possible to create wider fabrics with fewer loom weights. The fabric that resulted from this warp weighted weaving set-up turned out well and there were no issues with the fabric tapering inward or the selvages opening (See Figure 17).

Conclusions

The results of these experiments suggest that Iberian crescents could function effectively in more than one method of textile production. Of the methods tested, the crescents proved to be well- suited for both warp twining and warp-weighted weaving. In both of these methods, the crescents created a wide natural shed that aided in the weaving process, were heavy enough to provide sufficient tension for linen threads around or less than 1 mm thick and could be used to make a tabby weave. These experiments illustrate that the lightweight ceramic crescents found in the Alentejo region of Portugal could be used as loom weights or as warp twining tools to create textiles like those found in Iberia from the Late Neolithic and Chalcolithic, as all of these remains are linen tabby weaves made of threads of a comparable size (Alfaro Giner, 2012, pp.338-339; Soares et al., 2018, p.80; Gleba et al., 2021, p.4).

While these experiments have established that Iberian crescents could be plausibly used for warp twining or warp-weighted weaving, some additional functional insights were noted for each of these methods. In warp-twining, the shape, size, and weight of crescents provided no obvious disadvantages. It was possible to use this method to create a tabby weave with a quick and simple set-up that did not require a heddle bar. As many plaques with 2 perforations have similar functional dimensions and attributes, it seems likely that these objects could also be used in this twining method to create tabby weaves as well. This method also made it possible to easily switch to a different pattern, and, although only one alternative pattern was made in this experiment, Follensbee (2021, pp.6-7) has demonstrated the wide range of patterns that can be made with lightweight crescent twining tools. As such, it may be possible to use these crescents to create geometric patterns like those found on contemporary engraved slate plaques from Iberia, suggested by Lillios (2004, p.146) to represent textile patterns.

The Iberian crescents were also able to function as loom weights in the literal sense, providing sufficient tension to the warp threads, despite weighing less than other crescents found in Europe at this time. As all textile remains from the Late Neolithic or Chalcolithic in Iberia are tabbies, warp-weighted weaving with these crescents only required one row of loom weights, making for a more practical set-up. Furthermore, it is possible to use these crescents with this method to construct fabrics like the oldest loom woven fragments from Peñacalera Cave (Gleba et al., 2021, p.5) and the exceptional Chalcolithic tunics from Cueva Sagrada that feature a starting border and finishing fringe (Alfaro Giner, 2012, p.339), structural aspects typically associated with this type of weaving method. Once again, due to similarities in size, it seems plausible that some of the plaques with two perforations could also have been used as loom weights in this same way. As the plaques have already been shown to work well with tablet weaving (Rozzi, 2017, pp.54-55), it is also possible that other plaques with more perforations may have been used in collaboration with these crescents to create the starting borders for warp-weighted weaving.

Although it was possible to use these crescents in band weaving, this method was significantly less practical and a number of issues were caused by the shape and size of the Iberian weights. Despite identifying similar issues with gaps in the centre of the band, Grömer (2018, p.120) found that the thicker crescents from Austria could still potentially be a practical tool for this method because of the clear separation in sheds provided by these weights. As the thin, lightweight Iberian crescents did not provide this advantage, it seems unlikely that these crescents would have been used for this purpose. While the majority of crescents found in the Alentejo region of Portugal are comparable in size to those tested in these experiments, the more robust crescent weights found less frequently in this region (Costeira and Mataloto, 2018, pp.62- 63) could potentially work more practically in band weaving because of their greater thickness and weights (See Figure 18).

This experimental work has shown that lightweight crescent loom weights from Iberia, like those found in the Alentejo region of Portugal, have the potential to function effectively as loom weights and warp twining tools on a vertical loom to create tabby woven textiles like those found in southern Iberia at this time. While the lightweight ceramic crescents were the focus of this project, this research has identified some other possible insights into textile production practices at this time. First, this work indicates that in addition to tablet weaving, ceramic plaques could also be used in warp twining or as loom weights on a warp-weighted loom. Furthermore, while it was not practical to use the lightweight crescents for band weaving, the thicker and heavier versions of these artefacts may prove more practical for this method. Finally, this work suggests that it may be possible to create geometric patterns like those found on the engraved slate plaques from this period in Iberia with a warp twining method. While further experimental research will be necessary to explore these suggestions, this project provided some much-needed insight into the potential functional capabilities of the ceramic crescents from the Late Neolithic and Chalcolithic in southwestern Iberia.

Acknowledgements

This research was made possible with funding from the University of Iowa Department of Anthropology. I would like to thank Katina Lillios for her guidance, Agnete Lassen for her advice on experimental weaving, and Margaret Beck for teaching me how to fire ceramics and providing access to the kiln. I would also like to thank Billie Follensbee for her advice, interest, and encouragement of this research and Catarina Costeira for openly discussing her research with me and allow some of her images to be included with this article.

Keywords loom
weaving

Country Portugal
Spain

Bibliography

Alfaro, C., 1992. Two copper age tunics from Lorca, Murcia (Spain). In L. Bender-Jørgensen and E. Munksgaard, ed. *Archaeological Textiles in Northern Europe. Report from the 4th NESAT Symposium 1–5 May 1990 in Copenhagen*. Copenhagen, pp.20–30.

Alfaro Giner, C., 2012. Spain. In M. Gleba and U. Mannering, ed. *Textiles and Textile Production in Europe from Prehistory to AD 400.* Oxford: Oxbow Books, Ancient Textile Series Vol. 11, pp.334-346.

Basso Rial, R., Jover Maestre,F. and López Padilla, J., 2021. An undervalued archaeological resource: social aspects of Bronze Age textile production in the eastern Iberian Peninsula."*European Journal of Archaeology* 24 (3), pp.324-344.

Boaventura, R., 2001. O sítio calcolítico do Pombal (Monforte): Uma recuperação possível de velhos e novos dados*. Trabalhos de Arqueologia* 20. Lisboa.

Cardito Róllan, L. M., 1996. Las manufacturas textiles en la prehistoria: Las placas de telar en el Calcolítico Peninsular. *Zephyrus* 49, pp.125–145.

Costeira, C., 2010. *Os componentes de tear do povoado de S. Pedro (Redondo, Alentejo Central), 3o milénio a.n.e:* University of Lisbon. Unpublished Master Thesis. Volume II.

Costeira, C., 2013. Os componentes de tear do sítio arqueológico Alto de Brinches 3 (Serpa, Baixo Alentejo). In J. Jiménez Ávila, M. Bustamente and M. García Cabezas, ed. *Actas del VI Encuentro de Arqueologia del Suroeste Peninsular*. Villafranca de los Barros. pp.595–624.

Costeira, C. and Mataloto, R., 2013. Os componentes de tear do povoado de S. Pedro (Redondo, Alentejo Central). In J. Jiménez Avila, M. Bustamante-Álvarez, M. García Cabezas, ed. *Actas del VI Encuentro de Arqueología del Suroeste Peninsular*. Villafranca de los Barros. pp.625-667.

Costeira, C., and Mataloto, R., 2018. Loom weights and weaving at the archaeological site of São Pedro (Redondo, Portugal). In M. Siennicka, L. Rahmstorf, and A. Ulanowska, ed. *First textiles: the beginnings of textile manufacture in Europe and the Mediterranean*. Oxford: Oxbow Books. pp.59-68.

Firth, R., 2015. Mathematical analysis of the spindle whorl and loom weight data in the CTR database. In E. Strand and M. Nosch ed. *Tools, Textiles and Contexts: Investigating Textile*

Production in the Aegean and Eastern Mediterranean Bronze Age. Oxford: Oxbow Books: pp.153-190.

Follensbee, B., 2020. Testing Mesoamerican Lunate Artifacts as Possible Crescent Loom Weights. *EXARC Journal* 4: pp.1-15.

Follensbee, B., 2021. More testing of Mesoamerican lunate artifacts as possible loom weights, that also functioned as twining tools. *EXARC Journal* 3: pp.1-8.

Gleba, M., Bretones-García, M., Cimarelli, C., Vera-Rodríguez, J. and R. Martínez-Sánchez. 2021. Multidisciplinary investigation reveals the earliest textiles and cinnabar-coloured cloth in Iberian Peninsula. *Scientific reports* 11 (1): pp.1-11.

Gomes, S., 2013. Tecelagem e Pesca: os pesos. In A. C. Valera, ed. *As Comunidades agro pastoris na margem esquerda do Guadiana (2a metade do IV aos finais do II milénio AC)*. Évora, pp.109–126.

Gomes, S., 2019. Revisitar o estudo dos pesos de tear de Castelo Velho de Freixo Numão. As deposições como uma antologia de existências. *Digitar Extra 1: Olhares sobre Castelo Velho de Freixo de Numão: revisitar um recinto pré-histórico do Alto Douro ortuguês* Coimbra: CEAACP, pp.281-303.

Grömer, K., 2018. Late Neolithic weaving tools from Melk-Spielberg in Austria: experiments with crescent-shaped weights. In M. Siennicka, L. Rahmstorf, and A. Ulanowska ed. *First Textiles: The beginnings of textile manufacture in Europe and the Mediterranean*. Oxford: Oxbow Books: pp.117- 128.

Lassen, A., 2015. Weaving with crescent shaped loom weights: An investigation of a special kind of loom weight. In E. Strand and M. Nosch, ed. *Tools, Textiles and Contexts: Investigating Textile Production in the Aegean and Eastern Mediterranean Bronze Age*. Oxford: Oxbow Books: pp.127-137.

Lillios, K., 2004. Lives of stone, lives of people: re-viewing the engraved plaques of Late Neolithic and Copper Age Iberia. *European Journal of Archaeology* 7(2): pp.125-158.

Lillios, K., 2019. *The archaeology of the Iberian Peninsula: from the Paleolithic to the Bronze Age.* Cambridge University Press.

Marín-Aguilera, B., 2020. Spinning the world: a final comment. *Saguntum: Papeles del Laboratorio de Arqueología de Valencia.* Extra 20: pp.141-151.

Mårtensson, L., M. Nosch, and E. A. Strand. 2009. Shape of things: understanding a loom weight. *Oxford Journal of Archaeology* 28 (4): pp.373-398.

Olofsson, L., Strand, E. A., and Nosch, M., 2015. Experimental testing of Bronze Age textile tools. In E. Strand and M. Nosch, ed. *Tools, Textiles and Contexts: Investigating Textile Production in the Aegean and Eastern Mediterranean Bronze Age*. Oxford: Oxbow Books: pp.75-100.

Pereira, M., 2010. *Pesos de tear" e "Elementos de tear Na pré-história recente portuguesa: contributos para pensar o processo arqueológico*. Universidade do Porto. Unpublished Master's thesis. pp.1-24.

Pereira, M., 2012. Rethinking Past Practices: Two Contributions to the study of Loom elements. *Journal of Iberian Archaeology* Vol. 15: pp.1-26.

Rozzi, A., 2017. Tessitura a tavolette: osservazioni e sperimentazioni su reperti fittili. In D. Ratti and D. Alessi, ed. *ATTI: Secondo Incontro Studio Di Archeologia Sperimentale*. La Spezia: Servizi culturali del Comune, Vol. 2: pp.43-67.

Soares, A.M., Oliveira Ribeiro, M., L., Baptista, L., Esteves, and Valério, P., 2018. Prehistoric archaeological textiles from Portuguese territory: identification, analysis and dating. *Portuguese Journal of Archeology* 21 (1): pp.71-82.

Ulanowska, A., 2018. Experimenting with Loom Weights. More Observations on the Functionality of Early Bronze Age Textile Tools from Greece. In: M. Siennicka, L. Rahmstorf and A. Ulanowska, ed. *First Textiles: The Beginnings of Textile Manufacture in Europe and the Mediterranean.* Oxford: Oxbow Books. pp.163-173.

Corresponding Author

Victoria Priola
Department of Anthropology
University of Iowa
Iowa City, IA 52240
USA
E-mail Contact

Gallery Image

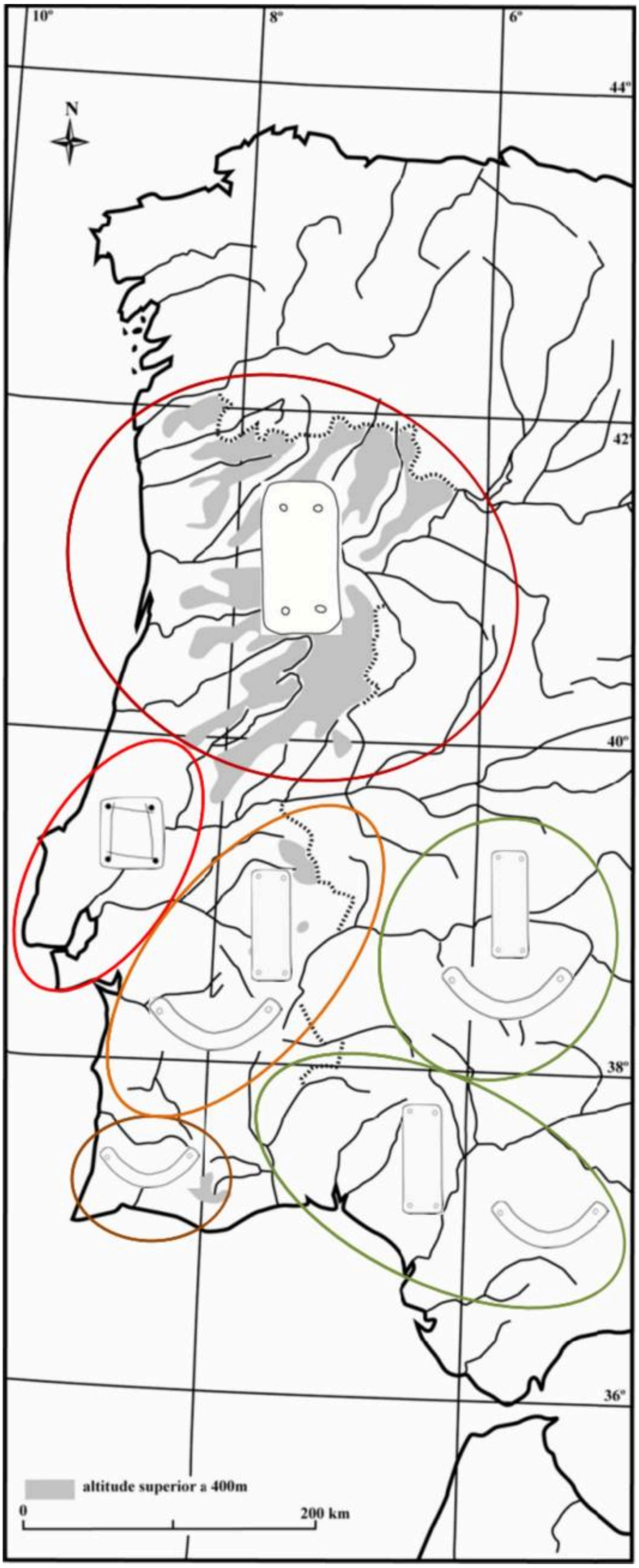

FIG 1. A MAP SHOWING THE DISTRIBUTION OF THE MAIN FORMS OF LOOM WEIGHTS (PLAQUES AND CRESCENTS) IN WESTERN IBERIA (COSTEIRA, 2010, P. 24). IMAGE CREATED BY CATARINA COSTEIRA.

FIG 2. A CERAMIC CRESCENT FROM THE SITE SÃO PEDRO LOCATED IN THE ALENTEJO REGION OF PORTUGAL (COSTEIRA, 2010, P. 100). PHOTO BY CATARINA COSTEIRA.

FIG 3. A REPLICA CERAMIC CRESCENT MADE FOR THESE EXPERIMENTS, BASED ON THOSE FROM THE SITE SÃO PEDRO. PHOTO BY VICTORIA PRIOLA.

FIG 4. THE WARP WEIGHTED LOOM CONSTRUCTED FOR THESE EXPERIMENTS. PHOTO BY VICTORIA PRIOLA.

FIG 5. TWO CRESCENTS HUNG WITH THE LONG SIDE FACING FORWARD FOR BAND WEAVING. PHOTO BY VICTORIA PRIOLA.

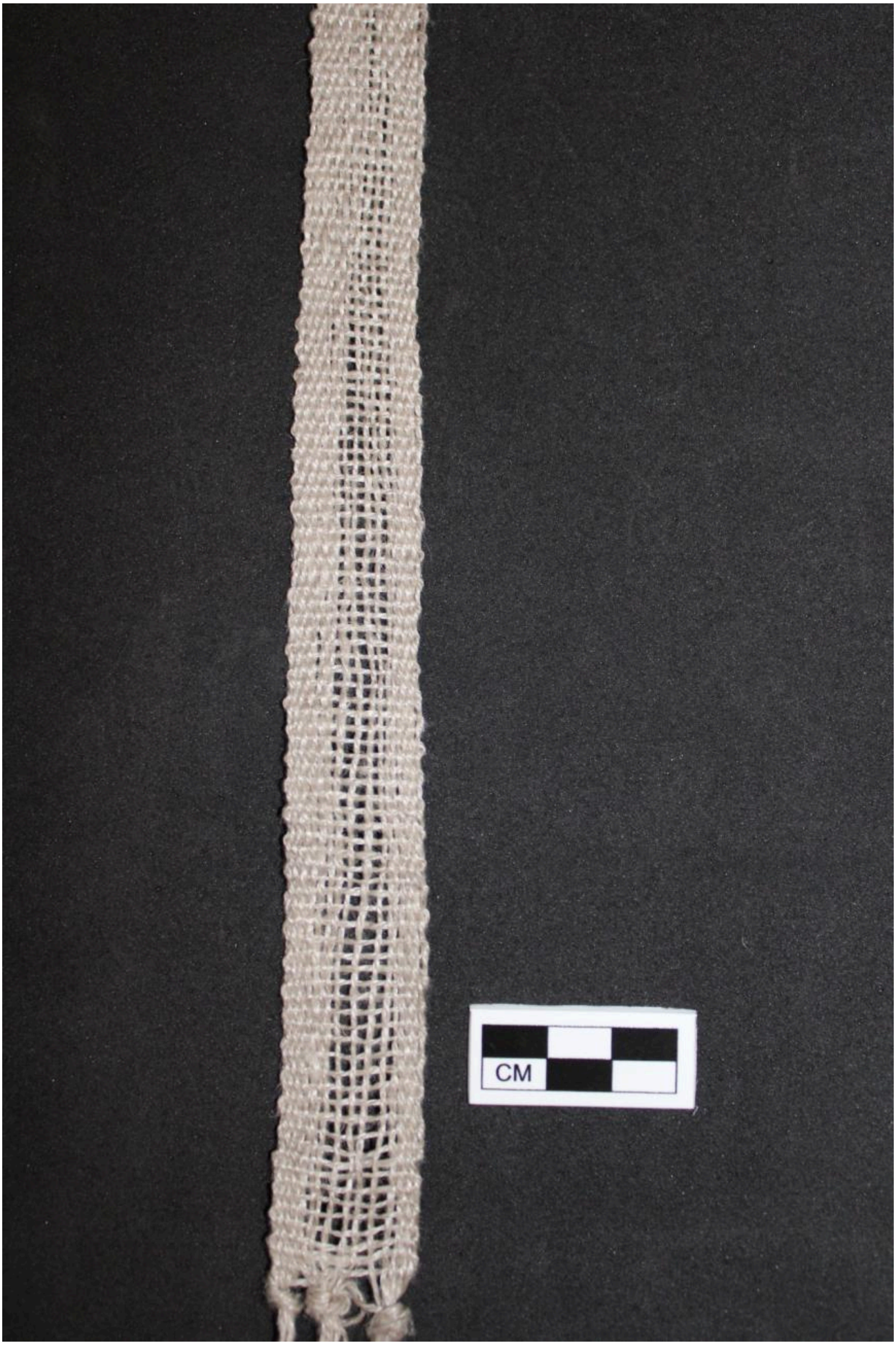

FIG 6. THE CENTER OF THE BAND BECAME INCREASINGLY OPEN WHILE USING THE CRESCENTS IN BAND WEAVING. PHOTO BY VICTORIA PRIOLA.

FIG 7. THE THIN CRESCENTS PROVIDED VERY LITTLE SEPARATION BETWEEN THE TWO SHEDS IN BAND WEAVING. PHOTO BY VICTORIA PRIOLA.

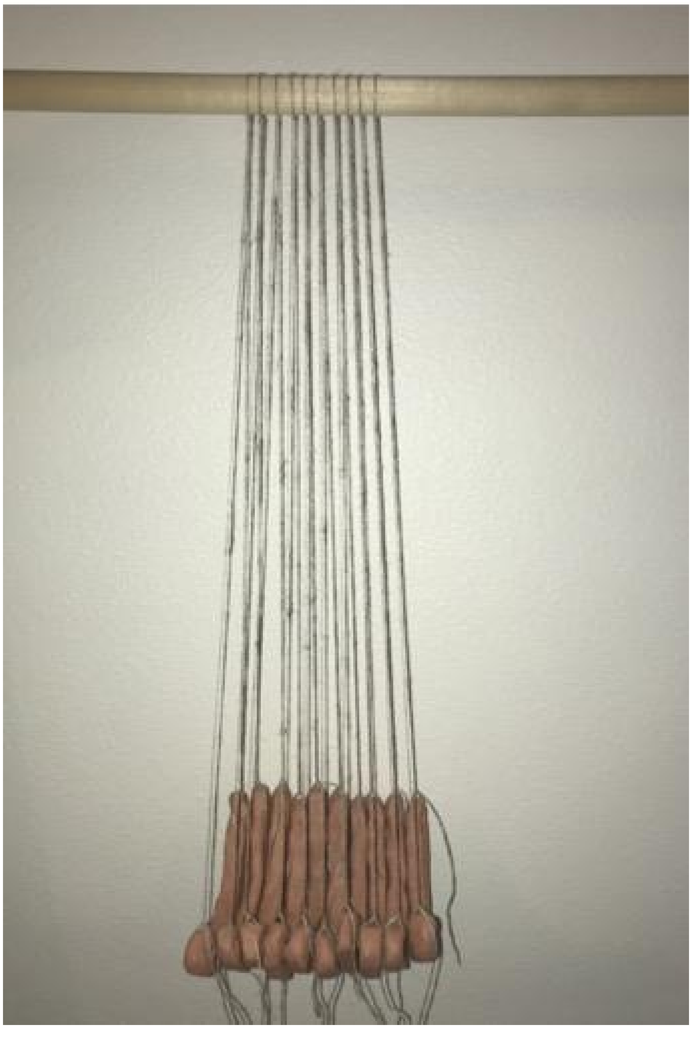

FIG 8. TEN CRESCENT WEIGHTS HUNG SIDE BY SIDE FOR WARP TWINING. PHOTO BY VICTORIA PRIOLA.

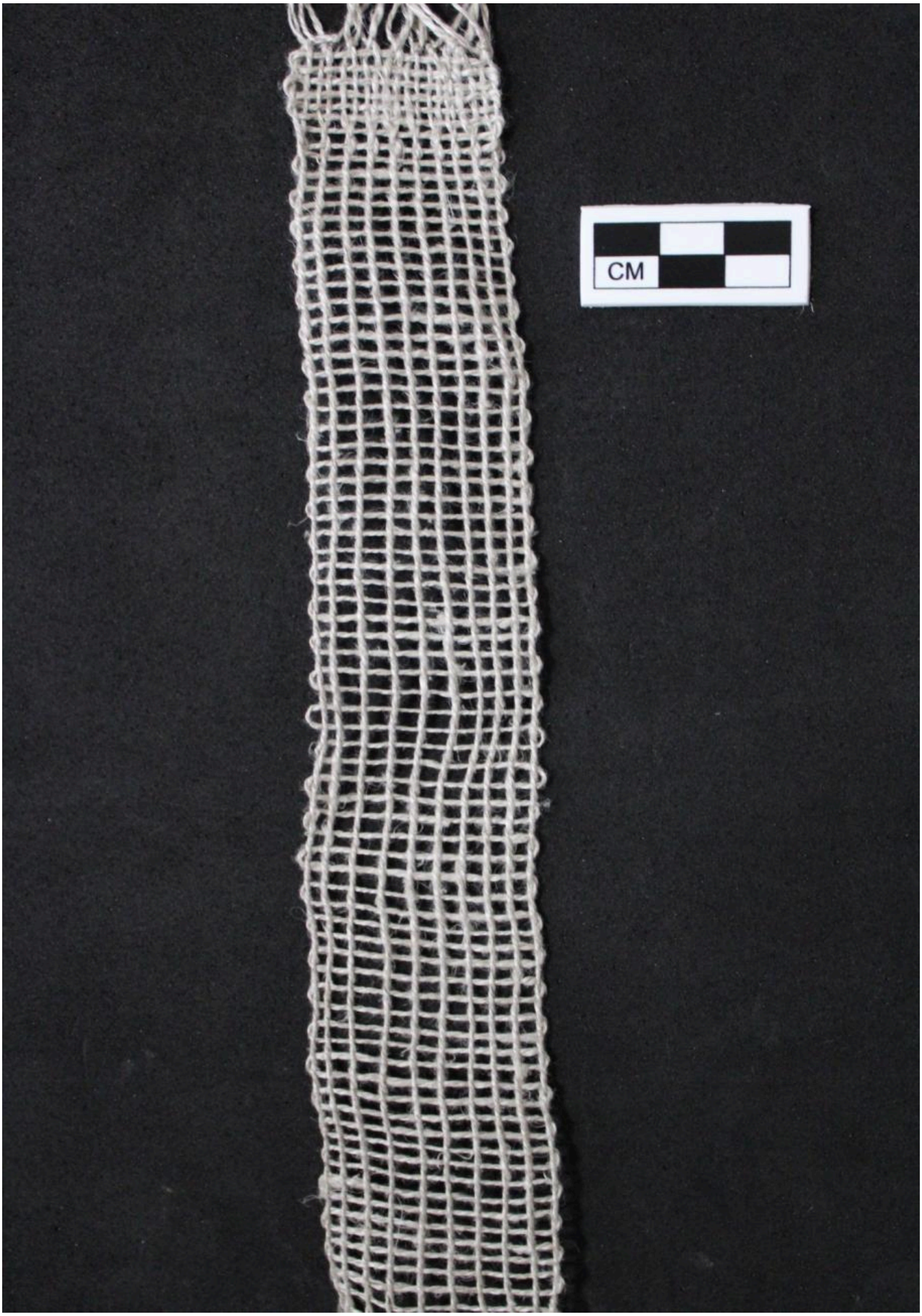

FIG 9. THE WARP TWINING METHOD WAS USED TO MAKE A TABBY WEAVE AND OPEN NETTING EFFECT. PHOTO BY VICTORIA PRIOLA.

FIG 10. WARP TWINING WITH CRESCENTS. PHOTO BY VICTORIA PRIOLA.

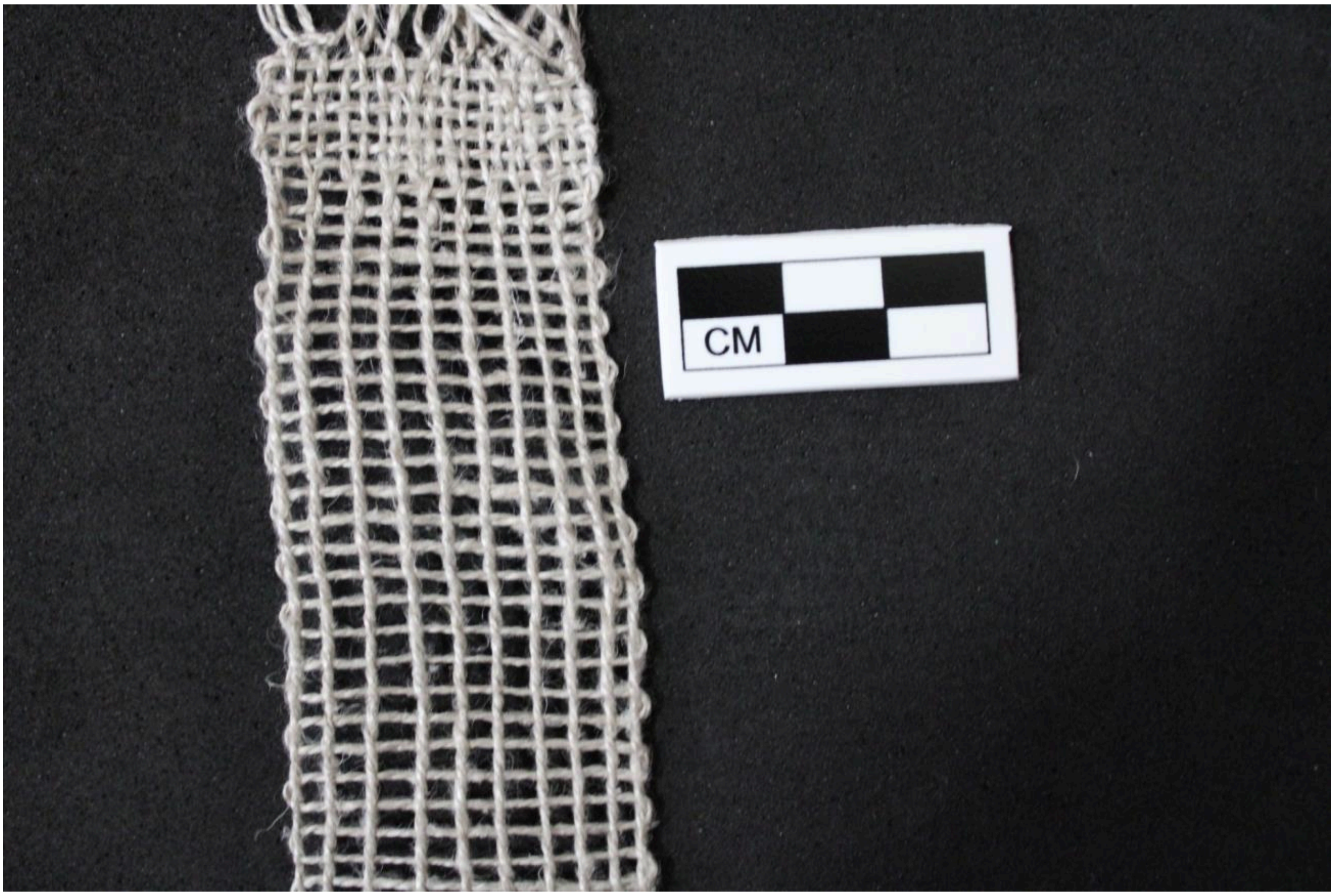

FIG 11. A CLOSER LOOK AT THE TABBY WEAVE AND OPEN NETTING CREATED WITH THE WARP TWINING METHOD. PHOTO BY VICTORIA PRIOLA.

FIG 12. THE STARTING BORDER MADE FOR THE WARP WEIGHTED WEAVING METHOD. PHOTO BY VICTORIA PRIOLA.

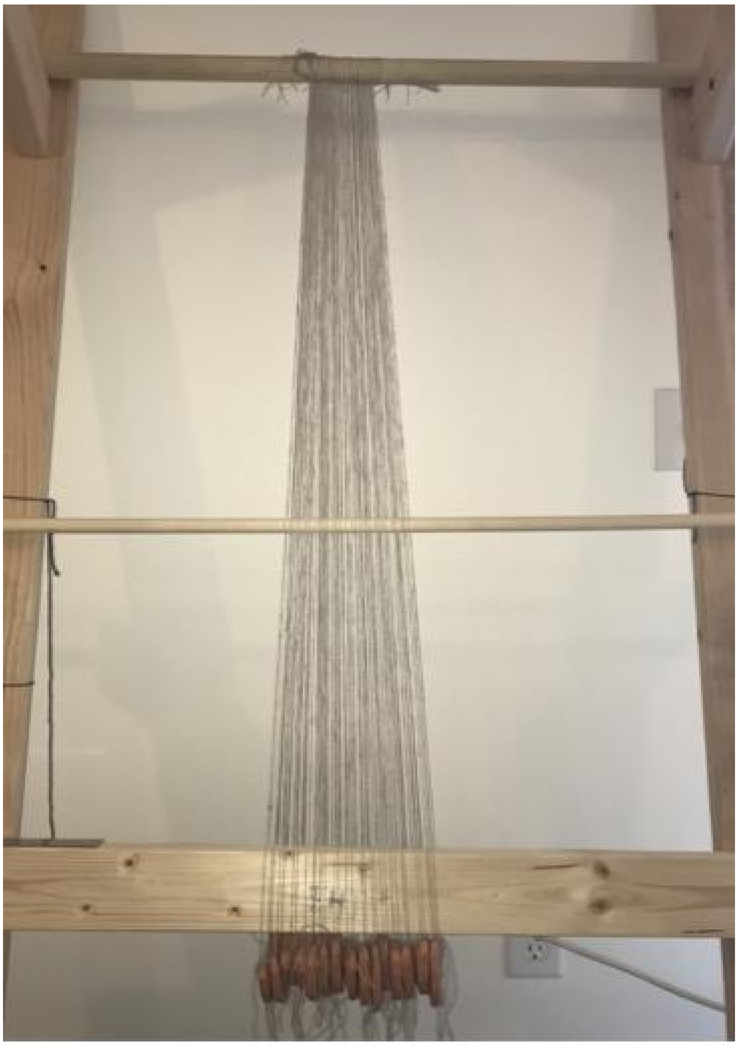

FIG 13. A SINGLE ROW OF CRESCENT WEIGHTS HUNG FROM THE WARP THREADS BELOW THE SHED BAR FOR WARP WEIGHTED WEAVING. PHOTO BY VICTORIA PRIOLA.

FIG 14. THE WARP FACED TABBY MADE WITH THE CRESCENTS IN WARP-WEIGHTED WEAVING. PHOTO BY VICTORIA PRIOLA.

FIG 15. THE NATURAL SHED CREATED BY THE CRESCENTS FOR WARP-WEIGHTED WEAVING. PHOTO BY VICTORIA PRIOLA.

FIG 16. THE COUNTER SHED CREATED BY THE HEDDLE BAR FOR WARP WEIGHTED WEAVING. PHOTO BY VICTORIA PRIOLA.

FIG 17. THE FABRIC CREATED WITH THE WARP WEIGHTED WEAVING METHOD, FINISHED BY KNOTTING THE BOTTOM OF THE WARP THREADS TOGETHER. PHOTO BY VICTORIA PRIOLA.

FIG 18. ONE OF THE LESS COMMON, HEAVIER AND THICKER CERAMIC CRESCENTS FROM THE SITE SÃO PEDRO, ALENTEJO, PORTUGAL (COSTEIRA, 2010, P. 101). PHOTO BY CATARINA COSTEIRA.