Textile tools from Archontiko, Greece

A total number of 33 objects, 27 loom weights and 6 spindle whorls, were recorded in the database. All objects have been found in House A and are dated to EBA (figure 1).

<table>
<thead>
<tr>
<th>Trench</th>
<th>SpW</th>
<th>LW</th>
<th>In all</th>
</tr>
</thead>
<tbody>
<tr>
<td>IG, house A</td>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>IG-ID, house A</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>IG-P, house A</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ID, house A</td>
<td>4</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>ID-Y, house A</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>In all</td>
<td>6</td>
<td>27</td>
<td>33</td>
</tr>
</tbody>
</table>

Figure 1. All recorded textile tools.

SPINNING AND SPINDLE WHORLS

Six objects are spindle whorls. As can be seen in the diagram below (figure 2), the whorls vary in weight from 25g to 68g, demonstrating that the spinners in Archontiko could have spun different types of yarn by choosing different whorls. The yarn spun with the 25g spindle whorl would have been thinner than the yarn spun with a spindle whorl weighing 70g if the same type of fibre were used. The yarn spun with the three heaviest whorls (55g-68g) must have been quite thick compared with the yarn spun with the lighter whorls, and suitable for coarser fabrics. There is no clear relation between the spindle whorl diameters and the whorl weight: the six whorls have more or less the same diameter. This suggests that the yarn spun with the lightest spindle whorl could be harder twisted than the yarn spun with the heavier whorls.

Archontiko, spindle whorls, weight/diameter, N=6

![Graph showing the relationship between weight and diameter of spindle whorls.](image-url)
Figure 2. Spindle whorls, weight and diameter.

WEAVING AND LOOM WEIGHTS

22 of 23 loom weights are made of clay and have a pyramidal truncated shape. One is made of stone and has an irregular shape. 17 weights are made of fired clay and five of unfired clay. On two loom weights the information is not available. The weight has been calculated on 24 objects, and it varies from 154g to more than 1100g. The thickness is recorded on 25 loom weights and varies from 41 mm to 88 mm (figure 3).

Figure 3. Loom weights, weight and thickness.

To elucidate our interpretation of the loom weights and to suggest the types of fabrics which we consider the most likely to have been produced with these specific loom weights we have chosen three loom weights with different weight and thickness from Archontiko. Please note that these suggestions are based on our experience and experiments but are on the other hand purely conjectural as to what is optimally possible.
Loom weight ARC-58: weight 280g, thickness 51 mm

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warp threads requiring</td>
<td>10g warp tension</td>
<td>20g warp tension</td>
<td>30g warp tension</td>
<td>40g warp tension</td>
</tr>
<tr>
<td>Numbers of threads per loom weight</td>
<td>28</td>
<td>14</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Number of threads per two loom weights (one in front layer, one in back layer)</td>
<td>56</td>
<td>28</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Warp threads per cm</td>
<td>11</td>
<td>5-6</td>
<td>3-4</td>
<td>2-3</td>
</tr>
<tr>
<td>TTTC's evaluation of suitability of the tool</td>
<td>TTTC choice</td>
<td>TTTC choice</td>
<td>Unlikely</td>
<td>Unlikely</td>
</tr>
</tbody>
</table>

Figure 4. Calculation of possible loom setups with loom weight ARC-58

12 loom weights were found in trench ID-Y. 11 are made of clay and one is made of stone. The weight of the clay loom weights varies from 220g to 337g and the thickness from 41 mm to 58 mm. These loom weights could have been used in the same setup as they all are within the same range of weight and diameter. ARC-58, analysed in figure 4, represents the average of the 11 clay loom weights (see figure 3).

The TTTC choice suggests a fabric with 5-11 warp threads per cm with 10g-20g tension on each warp thread.

The loom weight made of stone is considerably heavier (578g) than the other weights, and it would not be functional in the same loom setup as the other loom weights found in trench ID-Y. It is also the only loom weight made of stone from Archontiko. After examining the photo of it, we cannot exclude that this weight could have been used as a loom weight, although perhaps it is more likely to have been used in other functions, e.g. as a net sinker.

If we focus on the TTTC choice A in figure 4, we can hypothesise the following loom setup:

**Loom setup (ARC-58) calculated with 10g warp tension:**

Starting border (width of the fabric): 1 m

Number of loom weights needed: 40

Numbers of warp threads: 1100 threads, 2 m each = 2200 m

Weft 1: if a balanced tabby = 2200 m

Weft 2: if a weft faced tabby = 4400 m

Total amount of yarn with weft 1 (+ 2%) = 4488 m

Total amount of yarn with weft 2 (+ 2%) = 6732 m

The calculations demonstrate that the amount of yarn needed is substantial. According to the TTTC experiments it would take approximately hours 128-192 just to spin the thread needed to produce the fabric for this setup. Time for sorting and preparing the fibres is not included, nor time for preparing the setup, weaving and finishing.
Seven of eight loom weights from trench IG have a weight between 486g - 600g and their thickness varies from 55 mm to 63 mm. ARC-10 represents the average of the seven loom weights’ weight and thickness (figure 3). The eighth loom weight is much heavier (1134g) than the other weights and it would not be functional in the same loom setup as the other loom weights found in trench IG.

<table>
<thead>
<tr>
<th>Loom weight ARC-10: weight 550g, thickness 57 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warp threads requiring</td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Numbers of threads per loom weights</td>
</tr>
<tr>
<td>Numbers of threads per two loom weight (one in front layer one in back layer)</td>
</tr>
<tr>
<td>Warp threads per cm</td>
</tr>
<tr>
<td>TTTC’s evaluation of suitability of the tool</td>
</tr>
</tbody>
</table>

Figure 5. Calculation of possible loom setups with loom weight ARC-10.

The TTTC choice suggests a fabric with 5-10 warp threads per cm with 20-40g tension on each thread, which is quite a large span. The calculations thereby demonstrate that a loom weight of this particular size is flexible and can be used for several different qualities of fabrics and with a variation of yarn. It is possible to use all loom weights from this context in the same setup.

If we focus on the TTTC choice B in this example we can hypothesise the following loom setup:

**Loom setup (ARC-10) calculated with a 10g warp tension:**

Starting border (width of the fabric): 1 m
Number of loom weights needed: 36
Numbers of warp threads: 1000 threads, 2 m each = 2000 m
Weft 1: if a balanced tabby = 2000 m
Weft 2: if a weft faced tabby = 4000 m
Total amount of yarn with weft 1 (+ 2%) = 4080 m
Total amount of yarn with weft 2 (+ 2%) = 6120 m

The calculations demonstrate that the amount of yarn needed is substantial. According to the TTTC experiments it would take approximately 102-153 hours just to spin the thread needed to produce the fabric in this set up. Time for sorting and preparing the fibres is not included, nor time for preparing the set up, weaving and finishing.
Four of the loom weights from Archontiko are very heavy. Three of them are found in trench ID. When calculating a possibly loom setup with the heaviest loom weight from Archontiko, ARC-36, the TTTC choice demonstrates a coarse fabric with 5 warp threads per cm with 40g tension on each warp thread (figure 6).

<table>
<thead>
<tr>
<th>Loom weight ARC-36: weight 1179g, thickness 88 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warp threads requiring</td>
</tr>
<tr>
<td>Numbers of threads per loom weights</td>
</tr>
<tr>
<td>Numbers of threads per two loom weight (one in front layer one in back layer)</td>
</tr>
<tr>
<td>Warp threads per cm</td>
</tr>
<tr>
<td>TTTC’s evaluation of suitability of the tool</td>
</tr>
</tbody>
</table>

Figure 6. Calculation of possible loom setups with loom weight ARC-36.

If we focus on the TTTC choice D in this example we can hypothesise the following loom setup:

**Loom setup (ARC-36) calculated with 40 g warp tension.**

Starting border (width of the fabric): 1 m
Number of loom weights needed: 22
Numbers of warp threads: 700 threads, 2 m each = 1400 m
Weft 1: if a balanced tabby = 1400 m
Weft 2: if a weft faced tabby = 2800 m
Total amount of yarn with weft 1 (+ 2%) = 2856 m
Total amount of yarn with weft 2 (+ 2%) = 4284 m

The calculations demonstrate that the amount of yarn needed is substantial even for this coarse fabric. According to the TTTC experiments it would take approximately 57-86 hours just to spin the thread needed to produce the fabric in this set up. Time for sorting and preparing the fibres is not included, nor time for preparing the set up, weaving and finishing.

These three examples (figure 4, 5 and 6) suggest great variation in the types of fabrics that could have been produced with the loom weights from Archontiko. It is clear that these loom weights have been used for different qualities, from rather fine to coarse fabrics. Note that the textiles that can be produced with ARC-58 (figure 4) and ARC-10
(figure 5) have the same number of warp threads per cm, 5-10. The difference in the weight of the loom weights, however, suggests that the fabrics made with the two loom weights are visually quite different. ARC-58 weighs just 280g and needs no more than fine threads to hold its weight. The fabric will thus be light and fine, whereas ARC-10 requires a stronger thread, and the resulting textile will seem denser and coarser.

The number of finds does not correspond to the number of loom weights needed for these loom setups. Even if the width of a given fabric was considerably narrower, e.g. 50 cm, the number of loom weights is still too small. This means that the excavated loom weights make up only a fragment of the number of loom weights that must have existed in the Early Bronze Age in Archontiko.

Summary

Even if the number of tools from Archontiko is quite small, 33 objects, the analyses reveal considerable diversity in the production. The yarns produced with the spindle whorls would be suitable for several types of fabrics as suggested by the analyses of the loom weights.

An example: the thread spun with the whorls weighing 55g or more would probably function very well in the weaves with the heavy loom weights of more than 900g. The result would be a coarse textile with few but thick threads per cm.

The spindle whorls weighing between 25-40g could have been used for all fabrics produced with a warp thread with a tension of 20g or more. Note, however, that the type of fibre and fibre quality also can yield a great influence on the fabrics. If e.g. the Archontiko sheep had wool with very thin and long fibres, it would be possible to spin a relatively fine thread with the 25g spindle whorl. Also, if they were spinning plant fibres like flax or nettle, this spindle whorl would be suitable to spin a fine thin yarn.

As demonstrated above, the loom weights of less than 338g could also be used when producing a dense fabric with thin warp threads. It is, however, unlikely that such a warp thread could have been spun with any of the recorded spindle whorls since one probably needs a whorl with a weight of less than 10g (if spinning on a suspended spindle).

<table>
<thead>
<tr>
<th>Production quality</th>
<th>Fired clay</th>
<th>Unfired clay</th>
<th>Stone</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>good</td>
<td>12</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>medium</td>
<td>5</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>poor</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not available</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 7. Evaluation of the textile tools production quality.

The majority of the tools are considered to have been made in a good production quality (figure 7). All the loom weights (except the stone weight) and four of the six spindle whorls are of the same type regarding shape and material. This fact does not seem
coincidental, and suggests, perhaps, that great care was also taken in the production of the textiles.

To conclude: the textile production in Archontiko appears to have been well developed. The spinners and weavers knew how different types of tools affected the final products and also the tools themselves were well made. The analysis of the spindle whorls demonstrates that the spinners have spun different types of yarn from thin to thick qualities. The variation within the loom weights and the variation within the spindle whorls indicate that the people of Archontiko produced many different types of textiles from dense to coarse fabrics that could have been open, dense, weft faced and coarse.