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# Cloth in Crete and Cyprus

*Joanna S. Smith and Iris Tzachili*

Textile production on Crete and Cyprus was central to the economy of the household and long-distance exchange. Across the Mediterranean and in the Near East, textiles were normally second only to metals in value; sometimes they may have been prized above them.<sup>1</sup> Clothing served as a signifier of identity and social standing. However, because cloth fibres rarely survive in the archaeological record, the study of textiles outside Egypt relies less on the few remaining fragments and more on images, textual references, and the tools used to make fabric.

There are many technological similarities between Crete and Cyprus in the making of textiles, as in almost all of the eastern Mediterranean.<sup>2</sup> However, while both islands contributed to the trade in cloth and the transmission of artistic ideas through the textile arts, what sets Crete apart from Cyprus is its well documented centralised administration of the wool and cloth industry recorded in the Linear B tablets from Knossos. Nevertheless, Cyprus, during the LBA, provides detailed archaeological evidence for a large-scale textile workshop. Its location next to the large Temple 1 at Kition suggests that it operated on a scale far beyond that of the household workshops known elsewhere.<sup>3</sup> Additionally, specialised production at Maa-Palaeokastro is in the context of storage that is marked with standardised roller impressions, which may also point toward centralised administration.<sup>4</sup>

With the shifting of economic power to the non-palatial mercantile centres of the eastern Mediterranean, there was probably also a shift in the control over the manufacture of large scale fibre arts toward the harbour towns that are so often associated with well known weavers in texts. Evidence for a prominent textile industry featuring the importance of coastal areas continued into the Iron Age.

## RAW MATERIALS: FIBRES AND DYES

On Crete, the production of wool is known in detail through the Linear B tablets. The scale of sheep grazing and its overwhelming importance was described by John Killen in 1964,<sup>5</sup> who stressed that the chief economic purpose of these flocks was the production of wool. From Knossos there are some 1100 texts dealing with flocks, which accounts for one fifth of the total number of Linear B tablets from that site. The D series records the movements of huge numbers of sheep in detail,<sup>6</sup> some 100,000 animals according to

Killen.<sup>7</sup> The numbers of sheep, the replacement of old animals with young ones, and the displacement of the flocks for pastures is strictly controlled and recorded. Wool production is equally controlled. The palatial administration expects a total of 52,000 kg of wool. It is unknown how many pieces of cloth correspond to this quantity of wool since it would depend on the quality of cloth; on the whole some 5700 pieces of cloth are recorded at Knossos.<sup>8</sup>

Even if the evidence from the tablets is fragmentary, these numbers are indicative of the scale of production in a single year, for the tablets only preserve one or part of one annual cycle. It is important to note that the high degree of centralisation of the industry on Crete was not typical of other parts of the Mycenaean world: at Pylos this particular industry is decentralised.<sup>9</sup>

Thus, it is clear that in LM IIIA at Knossos, the palatial administration strictly controlled the flocks, their output of wool, and the people in charge of the

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- 1 Most important for understanding their value in gift exchange among rulers are the well-known 14th century BC letters from el-Amarna in Egypt. Among these letters are inventories of gifts, including two from Tusratta of the Mitanni (EA 22 and EA 25) (Moran 1992, 51–61, 72–84). These list blue-purple woollen shoes, coloured linen, leggings, Hurrian style shirts, a Tukris style shirt, red wool sashes, a city style shirt, a Hazor style garment, a blue-purple wool robe and cap, cloths of many colours, fabrics with cording at the top and bottom, bedspreads and blankets among the many elaborate textiles and garments. They appear after the listings of gold, silver and bronze objects, but before scented oils and oil-related items, and items of precious stones and wood. Cf. also *Od.* iv. 123–35, where a woollen carpet is brought out before items of silver and gold that were gifts to Helen. Among these gifts the first is a golden spindle.
  - 2 In Greece, Cyprus, Anatolia and the Levant, where the warp-weighted loom was used, there are many similar tools for the making of textiles: cf. Barber 1991, 91–113.
  - 3 Smith 2002.
  - 4 Smith 1994, 269–75; 2007b.
  - 5 Killen 1964.
  - 6 Hiller and Panagl 1986, 130; Olivier 1967, 1972; Palmer 1963, 177–5; Tzachili 1997, 49–56; Ventris and Chadwick 1973, 201–5.
  - 7 Killen 1962, 1964.
  - 8 Tzachili 2001a, 2001b.
  - 9 Hiller and Panagl 1986, 135–41; Ilievski 1968; Tzachili 1997, 56–60.

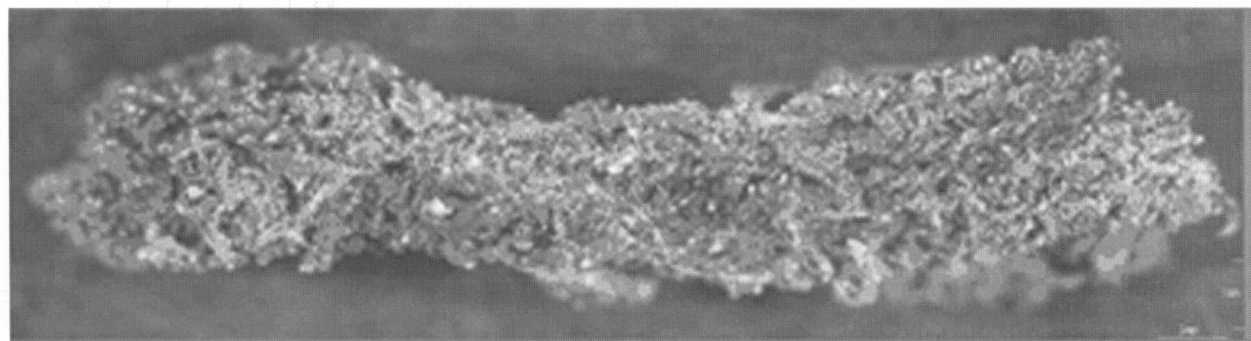
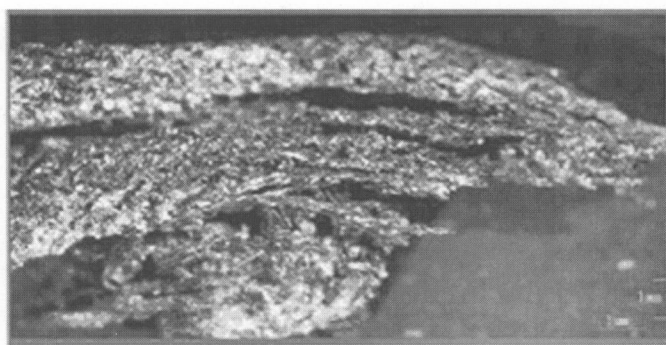
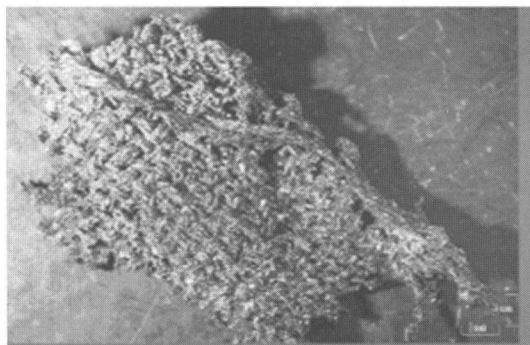


*Fig. 9.1 (top left). Thera: linen textile found in Pit M52/2 near Xeste III, Akrotiri. The tabby weave has twenty S-ply threads per cm, measuring 250 to 300 mm in diameter. The piece shown here, magnified 10x, has one thread visible that is loose and larger than the others, possibly a trace of embroidery. Photograph by Youli Spantidaki.*

*Fig. 9.2 (top right). Thera: linen textile found in Pit M52/2 near Xeste III, Akrotiri: see FIG. 9.1 for details. The piece here, magnified 10x, preserves fringes.*

*Fig. 9.3 (below). Thera: linen textile found in Pit M52/2 near Xeste III, Akrotiri: see FIG. 9.1 for details. The piece here, magnified 10x, is part of the decorative plying at the edge of the piece.*

animals and their products. Earlier, in MM III and LM I, the organisation as found in the Linear A texts seems different. It seems that fewer flocks of sheep are recorded and the wool and textiles are in smaller quantities. Only the figures on the tablets — whether Linear A or Linear B — are known, not the total production on Crete, including the possibly even greater family or community-based production.

In addition to Killen's pioneering work on wool, there is by now a large corpus of evidence for almost the whole process of cloth manufacture, including evidence for raw materials, thread making, textiles and dyes.<sup>10</sup> It has been stressed that the crocus gathering in the well-known painting from Akrotiri, apart from being part of a festival, had a practical aim, namely the use of the stigmas of the flower as a dye for the yellow-reddish colour of the dawn (*Ἡὸς κροκόπεπλος* — crocus-veiled dawn).<sup>11</sup> Furthermore, on fragments of textiles from Thera (FIGS. 9.1–9.3) traces of pigments indicate some of the colours of the textiles.<sup>12</sup> Purple dye was extracted from the murex.<sup>13</sup> New evidence for purple dye production during the MM IIB period comes from Pefka near Pacheia Ammos and other sites in eastern Crete.<sup>14</sup>

Flax and linen production is entirely different at Knossos. Unlike at Pylos on the Greek mainland, linen at Knossos is recorded only in small quantities in the N and L series tablets.<sup>15</sup> This is more likely from the less centralised nature of flax production than from its absence; but perhaps wool — particularly dyed wool and patterned textiles — had more commercial value. That the tablets do not offer the full picture finds support in the archaeological record, where the overwhelming majority of textiles found in mineralised form in the Aegean is linen.<sup>16</sup>

Flax seeds in particular have been found in the Aegean in LBA contexts and at non-Aegean sites even

<sup>10</sup> Jones 2003, 2005; Lillethun 2003; Sarpaki 2001.

<sup>11</sup> *Il.* viii. 1, etc. See also Douskos 1980.

<sup>12</sup> According to recent research by Youli Spantidaki and Christophe Moulherat (pers. comm. 2006).

<sup>13</sup> Burke 1999.

<sup>14</sup> Apostolakou 2008; Apostolakou *et al.* forthcoming; Betancourt *et al.* forthcoming; Brogan *et al.* forthcoming.

<sup>15</sup> Killen 1966; Tzachili 1997, 75–6.

<sup>16</sup> Tzachili 1997, 250–1.

earlier.<sup>17</sup> Converting flax into fibres for weaving linen was a labour intensive process and the fibres do not take well to dye without a mordant such as alum. To prepare flax, the stalks must be soaked and beaten in order to reveal the flaxen fibres inside that were spun and woven to form linen cloth.<sup>18</sup> Furthermore, Egypt, which was perhaps an important consumer of Minoan and probably also of Cypriot textiles, had a strong tradition of linen fabrics of its own.<sup>19</sup>

In Cyprus we have evidence for both woollen and linen fibres for textiles. While Cyprus lacks the detailed Bronze Age textual information available on Crete, inscriptions from the 1st millennium BC offer some clues, particularly regarding flax, which was a major crop by the 3rd or 2nd century. On inscribed clay vessels, we read about the company of Zeno, based in Soloi, whose flaxen products were shipped out of Salamis on the opposite side of the island. Along the way men stopped to make dedications at the sanctuary at Kafizin, a conical hill in the central part of the island.<sup>20</sup> A flax plant even appears on three of the jugs dedicated in the sanctuary.<sup>21</sup>

From the fragmentary pseudomorphic remains of textiles<sup>22</sup> and the weights of the textile tools used for weaving, it seems that linen was made on Cyprus from the 3rd millennium BC onwards. The oldest textile on the island, from Neolithic Khirokitia, was probably made from a flaxen or other vegetable product;<sup>23</sup> and flax seeds have been found on Cyprus in Neolithic and early Chalcolithic sites,<sup>24</sup> but not those of the Bronze or Iron Age. However, it is plausible that flax was a major crop of the island in the Bronze Age.<sup>25</sup>

Wool is considerably easier to dye than linen. Domesticated sheep were present on Cyprus from before the 2nd millennium BC.<sup>26</sup> Studies of their bones show that older animals formed parts of the flocks, which indicates that the animals were important for their milk and fleeces, and not just as a source of meat. This was also true on Crete. It is interesting to note that a shift toward increasing numbers of sheep and goat as opposed to wild animals in the diet of Bronze Age Cypriots occurred in the early part of the LBA, just when a more diversified tool kit for weaving appears in the archaeological record, suggesting that the importance of sheep and goat both for food and for their secondary products increased at this time.<sup>27</sup> This is also when the first evidence for central places appears on the island,<sup>28</sup> along with low-level regional administration,<sup>29</sup> and the earliest writing in Cypro-Minoan.<sup>30</sup>

Dyestuffs, including the rich red and yellow ochres from the Troodos mountains, and many native plants, such as madder for a red dye, would have been and still are easily available on Cyprus. Copper, plentiful on the island, was used as a dye at Ugarit in Syria<sup>31</sup> and may have served a similar purpose on Cyprus. It also served as a mordant to fix the dye to cloth. And the murex, whose gland when crushed and exposed to oxygen reveals a red-blue-purple dye, was prized highly

in the LBA and later.<sup>32</sup> Copious murex shells come from Cyprus, including the 6th century BC sanctuary at Polis-Peristeries in Cyprus (FIG. 9.4),<sup>33</sup> and some crushed murex also from LBA sites, including Hala Sultan Tekke.<sup>34</sup>

## PRODUCTION: TECHNIQUES, LOCATIONS AND PEOPLE

While the Linear B tablets indicate that the wool administered by the Palace at Knossos was for making textiles, we also learn about the production of textiles through the tools used to make them. Spinning and weaving tools such as spindle whorls and loom weights are among the most common finds at archaeological sites on both Crete and Cyprus. However in LM I in Crete spindle whorls are noticeably rare while loom weights are abundant. They come in different shapes and sizes.<sup>35</sup> Weavers on both islands used the warp-weighted loom. Whether looms such as the ground loom and vertical loom, in common use in the Levant and Egypt, were used is not known from the surviving evidence.<sup>36</sup> While the band loom and card-weaving may

17 Tzachili 1997, 67–8.

18 Barber 1991, 11–15.

19 Tzachili 2000, 2001a.

20 Mitford 1980, 251–63. See also Lejeune 2010, suggesting a 2nd century date for the inscriptions.

21 Mitford 1980, 196–7, 199–202, 206–7: 262, 266, 269 (K20, K41, K43).

22 E.g. Åström 1965; Pieridou 1967.

23 Le Brun 1994, 299–301.

24 Colledge 2003, 243; Murray 2003, 66. It is uncertain when cultivation of flax began, for from the seeds it is difficult to determine whether they are wild or domestic varieties (Van Zeist 1981).

25 Other vegetable fibres have been reported in EBA contexts at Pyrgos-Mavroraki (Lentini 2004, 41–4). This report includes cotton fibres, including dyed fibres. The final publication is not yet complete but, if these are cotton fibres, this would be the earliest and the only evidence for cotton in the Mediterranean in the Bronze Age (cf. Barber 1991, 32–3).

26 Croft 1996, 2003, 2006. On the LBA see e.g. Croft 1989; Halstead 1977; Hesse *et al.* 1975; Nobis 1985; Reese 2005. The pattern from the Bronze Age continues into the Iron Age: see e.g. Nobis 2000.

27 Spigelman 2008.

28 Peltenburg 1996.

29 Smith 2008, 60–1.

30 Godart and Sacconi 1979.

31 Van Soldt 1990, 349–50.

32 Reese 1980, 1987. There are reports of murex and other purple, blue, and red dyes from Pyrgos-Mavroraki (Lentini 2004, 38–40; Belgiorio 2009, 55).

33 On this sanctuary see Smith 1997.

34 Reese 1985, 348.

35 On the variety of loom weights from Crete see especially Burke 2010a, 2010b.

36 Barber 1991, 83–91, 113–16.



Fig. 9.4. Cyprus: murex shells crushed when fresh found in the bothros at Polis–Peristeries: CA II. Photograph by Smith.

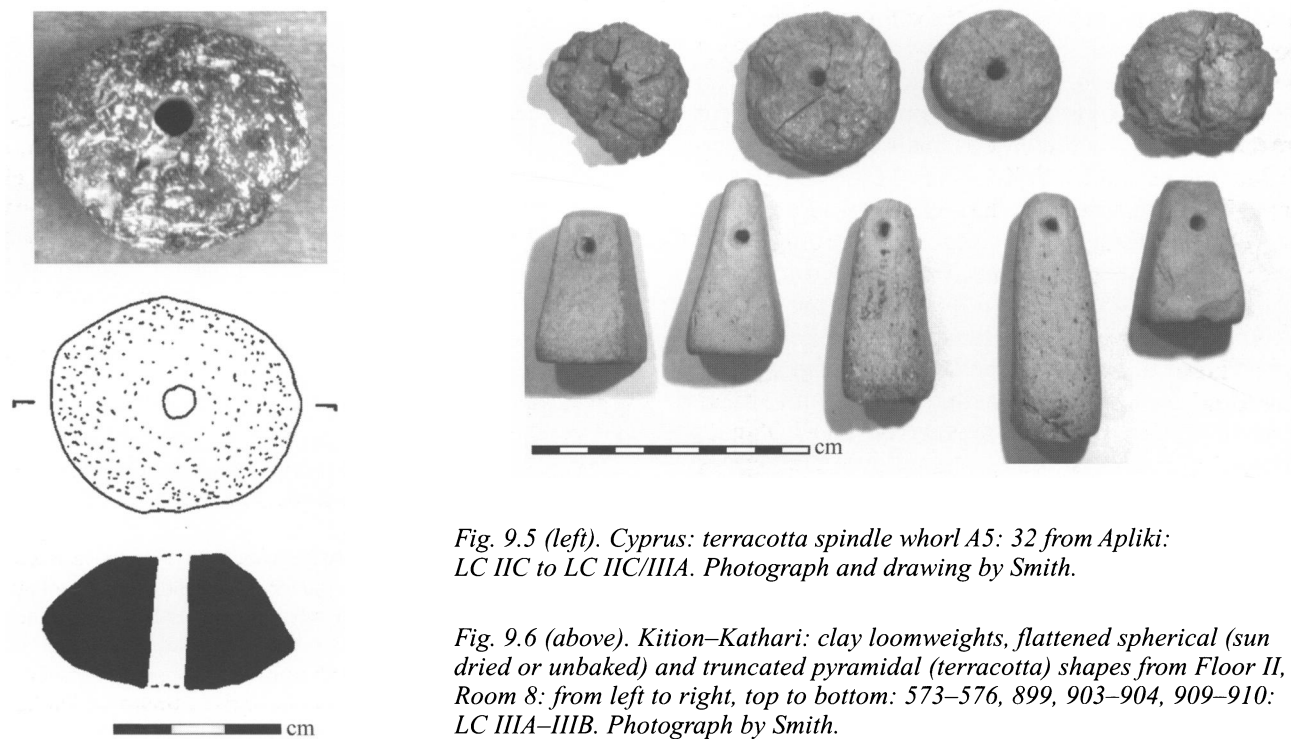


Fig. 9.5 (left). Cyprus: terracotta spindle whorl A5: 32 from Apliki: LC IIC to LC IIC/IIIA. Photograph and drawing by Smith.

Fig. 9.6 (above). Kition–Kathari: clay loomweights, flattened spherical (sun dried or unbaked) and truncated pyramidal (terracotta) shapes from Floor II, Room 8: from left to right, top to bottom: 573–576, 899, 903–904, 909–910: LC IIIA–IIIB. Photograph by Smith.

have been used to make narrow bands,<sup>37</sup> a braiding technique was in use at the end of the LBA that left material traces in the form of reel-shaped clay weights. Most people in the Mediterranean Bronze Age spun fibres with a spindle stick to which a whorl was attached at the lower end (FIG. 9.5). In studying whorls, it is most important to know the weight of the objects. A heavier whorl would have been for a heavier fibre, such as a flaxen fibre for linen; a lighter whorl would have been for wool. A whorl’s diameter is important, as it may indicate how rapidly the whorl and its spindle will turn, and hence the tightness of the fibre spun. Wear

marks and the diameter of the perforation help to reconstruct the position of the whorl for either a high- or a low-whorl spindle. Fabric, height, and decoration are also important.<sup>38</sup> Spinning is a portable activity, and so is less helpful for reconstructing where and at what scale textile manufacture took place. To understand that, it is

37 Barber 1991, 116–22.  
38 Andersson and Nosch 2003; Barber 1991, 39–78; Crewe 1998.

important to consider weaving tools. In the Aegean, Anatolian, Cypriot, and Levantine LBA, weavers used looms where the warp fibres were held down by weights (FIG. 9.6). These loom weights are found in large numbers and were made of low<sup>39</sup> and high fired (terracotta) clay and stone.

Again, in studying loom weights, it is their weight that is most important, for that will again indicate the potential warp fibre to which it was attached.<sup>40</sup> Sometimes a single weight secured multiple warp fibres. Generally, the heavier the weight, the heavier the fibre. In working with loom weights it is particularly informative to uncover sets of weights that might have been used together on a single loom. Sometimes the wooden loom will have been left in place when a site was abandoned or destroyed, leaving a row of weights on the ground and hence pointing to the width of the fabric being woven.<sup>41</sup> Sets of weights stored together can be similarly informative. Wear marks detail the working lives of the objects.<sup>42</sup>

Besides the spindle whorl and the loom weight, two other tools are of particular importance here. The first is a pointed bone tool, found at several LBA and a few Iron Age sites on Cyprus, which Smith has suggested were used for beating in the weft of textiles as in tapestry or kilim weaving (FIG. 9.7).<sup>43</sup> They have wear on the pierced end that shows that they hung from a fibre and were tugged. On the pointed end, it is clear that they rubbed against a fibre. Contextually they are strongly associated with weaving tools. Similar tools have been found at several contemporary sites from Cilicia to Egypt. Those at Gurob in Egypt<sup>44</sup> were found with fibres and several wooden spinning and weaving tools that would not survive in most Mediterranean climates.

These pierced tools were probably worn on a string around the neck, so that each weaver had one beater, a practice confirmed in discussion with a modern day weaver.<sup>45</sup> Those without a piercing tend to be smaller, have abrasion wear around the handles, and are found in groups, suggesting that they served both to guide a particular colour of weft fibre and to beat it in. There was a similar practice in large-scale tapestry workshops much later in time, for example in 19th century Europe.<sup>46</sup>

In making a tapestry, one thinks usually of the cartoons that guided Renaissance and later weavers.<sup>47</sup> However, one can also achieve a consistent pattern through counting, story telling or singing, as is known for example from Homeric epics in the Aegean<sup>48</sup> and Andean weavers in Peru.<sup>49</sup> Surviving tapestries come from Egypt. Among the earliest of these is a 15th century tapestry from the time of Tuthmosis IV bearing the name of his father Tuthmosis III in hieroglyphs.<sup>50</sup> Evidence from late 13th century BC Assyria suggests that more complex scenes including people, buildings, and animals were woven.<sup>51</sup>

In Egypt male weavers wove tapestries on a vertical loom in the New Kingdom, a weaving technique that seems to have originated in Syria.<sup>52</sup> However, tapestry

making need not require a large vertical loom or a palace authority for its creation. Warp-weighted and other smaller looms work just as well. Fragments of tapestries from contexts associated with nomadic cultures in Asia<sup>53</sup> lend support to the portable nature of both these products and their weaving technology.<sup>54</sup>

The second tool of interest is a waisted cylindrical object often called a spool or a reel, which appears to be important for making bands or cords. They are found among loom weights at Kition (FIG. 9.8) and several other Cypriot, Levantine and Aegean sites. Many reels were found in the LM III period on Crete, such as at Chamalevri (FIG. 9.9), and in other parts of the Aegean.<sup>55</sup> They date mostly to LM/LH IIIC at the very end of the Bronze Age. Those from Cyprus are also from the end of the Bronze Age, in the 12th and 11th centuries BC. Reels on Cyprus and Crete are similar in usually being unperforated. However, those on Cyprus are usually low fired or sun-dried, as are several doughnut shaped weights. Most pyramidal weights on

39 Low-fired clay weights are common at LBA sites on Cyprus. These might have been sun dried or were fired at very low temperatures. They are not of the durable terracotta of the many other weights. Testing has not yet been done to determine whether or not these were purposely subjected to heat.

40 On the warp-weighted loom and loom weights, see Barber 1991, 91–113.

41 As at Kition (Smith 2002, 300, fig. 11) and Apliki (Smith 2007a, 234–5, table 51).

42 Tzachili 1990, 381–5; 1997, 156–8.

43 Smith 2001.

44 Thomas 1981, 39–43. Also see the well documented evidence for use wear on such tools at Amarna in Kemp and Vogelsang-Eastwood 2001, 358–73.

45 Discussions were with Susan Edmunds during a series of four textile workshops that she ran for the Center for Archaeology at Columbia University in 2006–07: see her DVD (Edmunds *et al.* 2004).

46 For example, see an 1890 photo of tapestry production of the Merton Abbey workshops of Morris and Company in Phillips 1994, 118.

47 Campbell 2002, 41–9.

48 Tuck 2006.

49 Urton 1997, 96–137.

50 Barber 1986, 1991, colour pl. 1; Carter and Newberry 1904, 143–4, pl. 28: 46526–46529. On the tapestries from Tutankamun's tomb, see Pfister 1937 and Riefstahl 1944.

51 Barrelet 1977.

52 Barber 1991, 157–8, 161–2; but see Smith forthcoming *a* for a more complex picture.

53 Barber 1999, 62–4.

54 On tapestries in Cyprus, the Near East, Egypt, and even the Aegean, see Smith forthcoming *a* and *b*.

55 Andreadaki-Vlazaki and Papadopoulou 2005, 392, fig. 54; Barber 1997, 516. These weights have not only been found in LB contexts, but also at EB sites such as Myrtos–Fournou Koryfi (Warren 1972).

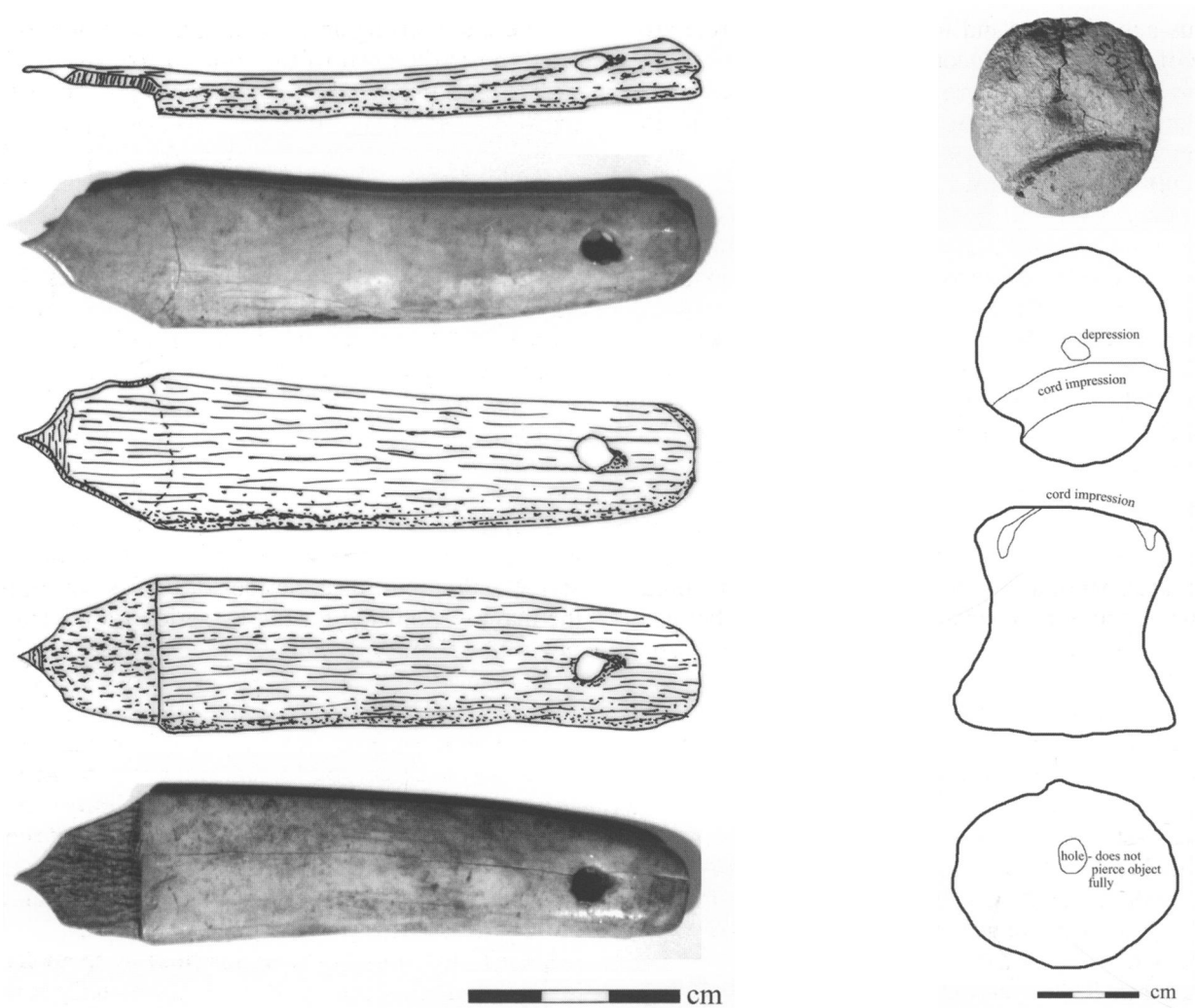


Fig. 9.7 (above left). Enkomi: bone beater 1949: 4060, from excavations of C. F. A. Schaeffer: LC IIIA. Photograph and drawing by Smith.

Fig. 9.8 (above right). Kition–Kathari: sun dried or unbaked clay reel 5047 from between Floors III and II, Room 121A: LC IIIA. Photograph and drawing by Smith.

Fig. 9.9 (below). Crete: terracotta reels from Chamalevri: LM IIIC (after Andreadaki-Vlazaki and Papadopoulou 2005, 389, fig. 54).



Cyprus and all reels and loom weights on Crete are made of fired clay (terracotta).

Elizabeth Barber has suggested that reels were used for band or cord weaving on a circular stand as in Japanese kumihomo.<sup>56</sup> Among low fired or sundried reels and loom weights at Kition, there is evidence for a connection with cords and bands from the impressions of such fabrics left in the clay of these objects (FIG. 9.8).<sup>57</sup> Evidence from Cyprus also shows that reels were used in groups or at least are found in groups or sets just as were loom weights. Whether they would have been used with a circular stand or were used in some other fashion,<sup>58</sup> they may well have been for making plaited or braided flat bands and round cords. As the number of reels used together increased, the pattern woven into a single band could have had more colours and an increasingly complex pattern. Again, cords of these kinds are not only the products of permanent workshops, but could also be made by nomadic groups. Bands could be sewn together to make a larger cloth, as Barber has shown for Aegean and other clothing.<sup>59</sup> Bands and cords could also serve as edging for fabrics with a wider surface area, such as are listed in the Amarna letters.<sup>60</sup>

On Crete particularly large numbers of textile manufacturing tools were found at sites such as Palaikastro,<sup>61</sup> Mochlos,<sup>62</sup> Pseira,<sup>63</sup> Malia,<sup>64</sup> Kommos<sup>65</sup> and Knossos.<sup>66</sup> At Palaikastro there were at least 100 loom weights of three different types. It is likely that textiles were woven in the home for the family, but also for a wider array of needs, including commercial needs accounting for the largest number of textiles made.

The L series of Linear B texts shows that the central administration controlled a network of workers making a variety of textiles and delivering them to the Palace. Pieces of cloth were stored and counted regularly. The administration at Knossos controlled the production of wool and thus the production of woollen garments. Wool was weighed and delivered to people in villages, and small and large towns. It was then spun in these locations and woven before being delivered to the Palace.<sup>67</sup> Thus, the production itself was decentralised. Workers are recorded in their localities, such as at pa-i-ti-ja (Phaistos), and according to the kind of cloth they were expected to deliver. Unlike the textiles made for household use, these textiles were made for palace use and probably also for export.

What is particularly interesting in comparing the evidence for textile production in Linear B with the archaeological deposits on Crete is that it appears that there was weaving both in minor localities and under strongly centralised palatial control. One has the impression, however, that the administration attempted to exert further control. Interesting evidence is provided by the Ak series of tablets, a list of personnel in Knossos.<sup>68</sup> In this series there is evidence of a 'school'. Young persons were sent to a teacher — di-da-ka-re, which is our first evidence for a word related to the verb διδάσχω in the texts. We also find de-di-ku-ja, one who is taught.

There are strong arguments that the object of the teaching is the craft of the loom. First, most of the (known) occupational terms of the people recorded in the series are connected with cloth-making: e-ne-re-ja (Ak 638), ko-u-re-ja (Ak 643), ne-ki-ri-de (Ak 780+7004+7045+7767), a-ra-ka-te-ja (Ak 5009+6037+8588), a-ke-ti-ri-ja (Ak 7001). Second, most of the ethnic names by which women are recorded in the Ak series are well known from other series for delivering textiles of different types: thus the pa-i-ti-ja (Ak 828) and the da-wi-ja (Ak 780+7004+7045+7767, Ak 621) in Le 641 deliver textiles of the type TELA+TE. The same is true for the women from qa-mo (qa-mi-ja Ak 613) and ri-jo-no (ri-jo-ni-ja Ak 624), as well as se-to-i-ja (Ak 634+5767), as appears from the Lc series recording deliveries of textiles (Lc 543, Lc 529, Lc 525).<sup>69</sup>

Furthermore, one of the collectors of the series, we-we-si-jo (Ak 622), appears also in the Lc series; and scribe 103, one of three scribes of the Ak series, is in the main responsible for the Lc series with deliveries of textiles from the same places as in the Ak series.<sup>70</sup> One could also add that the verb διδάσχω occurs in the Odyssey for teaching related to cloth-making.<sup>71</sup> So it is reasonable to assume that the young persons were to be taught the techniques of weaving, to acquire knowledge so that they might produce more commercially specialised textiles. Their products could have included cloth exported to Egypt for ceiling and wall hangings, images in imitation of which are preserved in Egyptian paintings at Malkata.<sup>72</sup>

This is the only form of instruction specifically recorded in the Linear B tablets. Usually young persons, ko-wo and ko-wa, or kouros and kore, son and daughter, are taught by their mothers and are recorded with them. In this situation one has the impression that their instruction was intensive — and

56 Barber 1997; see also Owen 1995. Moorey (1977) discusses reel-shaped objects as surfaces around which threads for band weaving would have been looped in Mesopotamia, but these are used singly, are set in a frame, have a central hole and are made of metal.

57 Smith 2002, 294–5, fig. 6.

58 Cf. Owen 2004.

59 Barber 1997.

60 See n. 1.

61 Sackett and Popham 1965, 304–5, fig. 19.

62 Soles *et al.* 2004.

63 Betancourt 1998.

64 Detournay 1975, 116–22.

65 Dabney 1996.

66 Burke 2003; Evans 1921, 248–9; Evelyn 1984; Hatzaki 2005, 122, 124.

67 Tzachili 1997, 125–9.

68 Killen 1972.

69 Killen 1966.

70 Landenius-Energren 1995.

71 *Od.* xxii. 421–3.

72 Barber 1991, 338–51; Tzachili 2000.

gave the administration direct control over even more of the textile production on the island.

On Cyprus, the tool kit of spindle with whorl and loom with loom weights was in use by the EBA and MBA Ages, as we see at Sotira–Kaminoudhia,<sup>73</sup> Marki–Alonia,<sup>74</sup> Alambra<sup>75</sup> and Pyrgos–Mavroraki,<sup>76</sup> probably as part of a tool kit brought in by settlers from Anatolia. Similarly warped and weighted looms with few but heavy weights are known from early LBA such as Episkopi–Phaneromeni,<sup>77</sup> where weights of c. 220, 500 and 1000 g were found. Jennifer Webb's study of the wear on the surfaces of the whorls at Marki indicates that they were used at the bottom of a spindle stick,<sup>78</sup> pointing to low whorl spinning on Bronze Age Cyprus, a technology that continued into the 1st millennium BC.

Increasingly large numbers of whorls and weights appear at LBA sites on Cyprus, particularly from the 13th to 11th centuries BC. It is important to note that, along with the larger numbers, we find an increasingly diversified and flexible tool kit for making textiles, including significantly lighter loom weights. Three sites exemplify the range of tools, places of manufacture, and scales of production at this time: Apliki,<sup>79</sup> Enkomi<sup>80</sup> and Kition, at both Chrysopolitissa and Kathari.<sup>81</sup> Other places such as Maa–Palaeokastro<sup>82</sup> are notable for the preponderance of clay reels in the tool kit. Other places such as Sinda<sup>83</sup> and Morphou–Toumba tou Skourou<sup>84</sup> appear to have sets of weights.

Even without texts to guide us, by considering contemporary parallels, historical information, and ethnographic evidence, it is possible to define the scale of production and the likely producers based on the location and portability of the tools used to make cloth.<sup>85</sup> First, a domestic context with impermanent facilities is most likely where cloth was made, normally by women, at home for household use. It is possible that work done in a domestic context indicates some level of household industry, where some products were meant for consumers outside the home, even a central authority — as recorded in the tablets from Knossos. It is hard to tell the difference archaeologically, but possibly the evidence for the range of textiles made or the possibility of a designated space within the home might point toward household industry.

Apliki and Kition–Chrysopolitissa are good examples of household areas with impermanent facilities for making textiles. Looms were set up in courtyards and the tools were stored after use in spaces with evidence for multiple activities. Enkomi Area III also has evidence for a household area, but some details point to a designated work area, some tools suggest speciality textiles, and the access to the building suggests that it might have been a storefront of sorts.

Apliki is known primarily in the literature as a mining site.<sup>86</sup> House A has a central courtyard and a long room for storage. The smaller rooms have debris from various activities, including particularly rich

evidence for weaving.<sup>87</sup> Groups of loom weights were found in a niche, a basket, and a deposit referred to as a nest, perhaps another basket. Along with the loom weights, there were bits of red and yellow ochre and some spindle whorls. Looms were not found, but there were wooden fragments, either from looms folded and stored or from the building structure. It is most likely that weaving took place in the courtyard and that the tools used together were stored away when not in use.

Kition, a large coastal city in southeast Cyprus, probably exceeded its smallest estimated area of 16 ha,<sup>88</sup> but it was probably not as large as the estimated 70 ha in the original excavation publications.<sup>89</sup> Along with its neighbour Hala Sultan Tekke, it has produced some of the most astonishing evidence for textile working from the LBA Mediterranean. Excavations in Area I, Kition–Chrysopolitissa, uncovered a courtyard with weights still in a row as fallen from a loom,<sup>90</sup> probably where it was used. Deposits from Floor IIIA through Floor I show that surrounding rooms had evidence for multiple activities and that groups of weights were stored inside when they were not in use.<sup>91</sup>

Enkomi is significantly larger than Apliki, with its grid of streets and a densely urban residential community. At about 14 ha within its walled settlement,<sup>92</sup> it is also smaller than Kition and farther from the coastline. Of particular interest are buildings in Porphyrios Dikaïos's Area III, Sector A. Here evidence for textile working was found from the 13th through the 11th century BC (Levels IB, IIIA, IIIB), interestingly also in close proximity to metallurgical work. An example is Level IIIA, with seven loom

73 Waltz and Swiny 2003, 397–411.

74 Webb 1996.

75 Mogelonsky 1996a, 1996b.

76 Belgiorio 2004, 27, figs. 33–4; 2009, 55.

77 Swiny 1986, 98–108, esp. 107–8 for loom weights.

78 Webb 1996.

79 Smith 2007a.

80 Courtois 1984; Dikaïos 1969, 231, 240, 253, 274, 290, 299.

81 Smith 2002.

82 Karageorghis 1988, 220, 222, 225, 227–8, 239–41, 248, 251–2.

83 Furumark and Adelman 2003, 105–10.

84 Vermeule and Wolsky 1990, 347–8, and 129–31 (the pit in M16) and 124–66 (Well 3). In the publication the potential of this material was overlooked, for they are described as 'commonplace and dull' (347).

85 See also Smith 2002, 284–5, fig. 1, with an adaptation of models used in studying pottery manufacture as in Sinopoli 1991, 99, and Van der Leeuw 1977, 70–1.

86 Kling and Muhly 2007; Taylor 1952.

87 Smith 2007a.

88 Smith 2009, 8–9.

89 Iacovou 2007, 12–13.

90 Smith 2002, 301–2, fig. 12.

91 Smith 2002, 299, fig. 7.

92 Iacovou 2007, 8.

weights found in close proximity, including a marked weight, and whorls, grinders, a tub, a trough and a hearth.<sup>93</sup> It appears that this was a designated work area, but with movable tools and furnishings for spinning, weaving, washing and perhaps dyeing. Similar evidence was found in other levels such as in a deposit from Level IIB published as a 'hoard' that looks like a set of loom weights and objects found in the 'court' of Level IIIB. The relatively open access to the front of the structure suggests a more public area, a storefront of sorts, while the less accessible passage to the work and domestic areas at the back emphasises their more private character.

Work outside the home is the second location for textile working. With large-scale permanent facilities, there is the increasing likelihood that men were involved as fullers, dyers, and weavers and that the products were intended for a variety of consumers, possibly filtered through a central authority. Vats for fulling have also been found on Crete, as at Petras, where they might also have been used for dyeing.<sup>94</sup> When fullers are recorded in the Linear B tablets they are always men.<sup>95</sup> On Cyprus, at Kition in Area II, Kition-Kathari, there is an excellent example of a large-scale, non-household-based work area.<sup>96</sup>

The focus of our interest lies west of Temple 1 and the better known Northern Workshops, where bronze melting and recycling took place.<sup>97</sup> With an area of at least 225 m<sup>2</sup>, the Western Workshops preserve evidence for a large textile workshop, possibly the largest outside Egypt for this period. Permanent installations, particularly vats for fulling, washing and dyeing, were found along with the entire panoply of tools for weaving fabrics of different thread counts and weights, both decorated and undecorated. The workshop installations increase in number and size during the about two centuries of use. Importantly, not only were groups or sets of weights found clustered together, but a row of weights was uncovered, not in a courtyard but in a room in a conceivably permanent location, where light from the outside would have illuminated the weaving work.<sup>98</sup>

Additional evidence for centralised and specialised production of textiles comes from Area III at Maa-Palaeokastro, where a large number of reels was found in a single building.<sup>99</sup> While Maa is a small place on a rocky peninsula north of modern Paphos, it has an ashlar building of square design that could be a version of other ashlar facilities on Cyprus that mark centralised storage or are otherwise public buildings associated with manufacturing and ceremonial activities. At this site, pithoi marked with two different figurally carved wooden rollers<sup>100</sup> attests to carefully managed administration. One of these designs is associated only with Building III, where the textile tools were found.<sup>101</sup>

While no deposits have been found from Iron Age Cyprus that suggest the specific location of a textile workshop, partly due to the lack of domestic deposits,

spinning and weaving continued naturally to be important parts of household and wider-scale production. In the Geometric period, the strong regional association of pottery styles that bear elaborate geometric patterns may reflect the activities of female potters and weavers.<sup>102</sup> One even depicts a warp-weighted loom with a kilim in the process of being woven.<sup>103</sup> By the end of the Geometric period, there is a divergence from the geometrically inspired designs for pottery as well as a greater standardisation among vessels; innovations in surface treatment and motifs as well as a movement away from a link to the textile industry may suggest that more men became involved in that industry at that time.<sup>104</sup>

Furthermore, by the Archaic period large dumps of murex shells indicate purple dye workshops active on the island, some located near urban sanctuaries as in ancient Marion. Some male dyers and fullers were even known on their tombstones by the names of their crafts.<sup>105</sup> Of course, by the 3rd or 2nd century BC, we learn of the flax grown by the company of Zeno based in Soloi. During the Iron Age those who are best known for the textile arts on Cyprus are male weavers and dyers. In addition to those mentioned, the best known are the Classical period weavers, Helicon and Acesas<sup>106</sup> from Salamis, who wove the first peplos, a tapestry design, for the Great Panathenaia.

93 Dikaios 1969, 50–1, 55, 98, 139–40, pls. 128, 134, 146–7, 155, 165, 174, 251, 254, 256; 1971, 644, 646–7, 656–7, 663–5, 694–5, 702–5, 736–7, 741, 744–5, 749–50, 753. For a full discussion of these and other inscribed loom weights, see Smith 1994, 212–32. The material from C. F. A. Schaeffer's excavations is published (Courtois 1984, 65–9), but the contextual associations among objects, important for understanding weaving contexts, are unclear.

94 Burke 2006, 287–8.

95 Ventris and Chadwick 1973, 123.

96 Smith 2002, 297–304, figs. 8–9, 13.

97 Karageorghis and Kassianidou 1999.

98 Smith 2002, figs. 11, 13.

99 On Building III, see Demas 1988, 27–35, 79–82.

100 Porada 1988.

101 For a discussion of these pithoi, the roller impressions, evidence for administration and evidence of textile tools, see Smith 1994, 267–75; 2007b.

102 This is discussed further in Smith 2009, 237–43.

103 One unprovenanced example even depicts a warp-weighted loom with a kilim in the process of being woven. It was given to the Akademisches Kunstmuseum of the University of Bonn in the 1990s and had been purchased originally on the art market, although the date of that purchase and its previous history have not been published: Aspris 1996; Boardman 2001, 13, fig. 4; Böhmer 2002, 77, fig. 132; Karageorghis 2006, 230–1, fig. 244; Mielsch 2003, 40–1, pl. 7.

104 See Smith 2009, 237–43 for discussion of this point.

105 Masson 1985, 87.

106 Ath. ii. 48b.

## TEXTILE PRODUCTS

Cloth served many purposes, including ship sails and furniture covers. Best known are the dresses worn by elegant girls in Minoan wall paintings. The details of these garments have been studied from the beginning of Minoan archaeology, even if their design is sometimes so complicated that there are differences of opinion about their feasibility. They are perhaps idealised forms of dress.

Akrotiri on Thera has produced textile fragments that seem to be part of the kind of cloth depicted in the wall paintings. One may have a decorated edge and another fringes, called on-nu-ke in the Knossos Linear B tablets.<sup>107</sup> There are also as yet unpublished fragments of unmineralised textiles from Chania.<sup>108</sup>

In the Linear B tablets from Knossos textiles have a number of names, such as tu-na-no, pa-we-a (pieces of cloth), ko-u-ra and pa-ra-ku-ja. These denote their diversity and perhaps their special value for trade.<sup>109</sup> But there is no convincing connection at this time between clothing depicted and what is listed in Linear B, except for colours such as re-u-ka, white, and po-ki-ro-nu-ka, multi-coloured.

To understand Minoan dress, it is important to emphasise its uniqueness in the eastern Mediterranean. This is best seen in comparison with Egyptian dress. In Egypt the dress and the body are conceived and realised as a whole and represented as such, with fluid lines without dramatic differences in colours or lines. The dress, whether draped or not, is made from one piece, monochrome or not, largely without differentiation according to the part of the body it covers. In Crete the dress is made of several pieces, which are layered. Different pieces, motifs, and colours create contrast, breaking the unity of the body. Minoan fashion produces a different image and conception of the human body and the human being.

Tzachili suggests that dresses on Crete were cut and sewn from several pieces and thus personalised.<sup>110</sup> The designs follow the body rigidly and intervene imposing narrow waists. It is as if the dress tried to reshape the body by separating its parts. The movements of elegant Minoan girls must have been restricted by their clothing, making it difficult to bend at the waist. This may be one reason why they dance differently from Egyptians. And, unlike in Egypt, proud Minoan ladies do not sit on the floor or the earth, but always on rocks or chairs.<sup>111</sup>

On Cyprus we have little in the way of representations of textiles in the Bronze Age. There are no wall paintings or large rock carvings. Figural images on pottery were largely made in Greece or in imitation of images on Greek wares. Smaller scale figures, such as on seals, have highly schematised dress that indicates something about the length and volume of clothing, but nothing about particular weaves or patterning. Many of these may also reflect non-local styles of dress.

While there is little in the form of surviving cloth, mineral salts in metal, such as bronze, will preserve a

pseudomorph of a textile, as on a dagger from EBA Vounous,<sup>112</sup> with the pattern of a linen fabric that once lay next to the dagger in the tomb. Sometimes there are traces of textiles in the soil. For example, in a 12th century BC man's burial from Hala Sultan Tekke, there is evidence that he was wrapped in a purple woollen shroud held together with buttons and a pin.<sup>113</sup> The fabric itself has decayed, leaving only the traces of its purple colour in the soil.

Geometric and figural patterns on ceramic vessels also preserve evidence for textile weaves, as has been shown for the Aegean by Barber.<sup>114</sup> Other ceramics such as those in White Slip from Cyprus are painted with bands of decoration often punctuated with rosette-like circles. A contemporary linen fabric from the 15th century BC tomb of Tuthmosis IV is a compelling parallel,<sup>115</sup> suggesting that further work with geometric patterns on Cypriot vessels may reveal more evidence for textile designs. As noted above, the elaborate geometric patterns on Iron Age pottery also probably preserve details of patterns in cloth, specifically kilims (FIG. 9.10). The relationship between pottery and textiles, where and how they were made, and the roles of women and men in those arts are strikingly parallel.

Making use of the archaeological record, we can further reconstruct the types of cloth produced. Sets and rows of weights at Apliki<sup>116</sup> and Kition<sup>117</sup> show that textiles of c. 40, c. 80, and c. 175 cm were woven. Some overlap in cloth width suggests some possible standardisation in widths, a feature of LBA textiles also known at Ugarit.<sup>118</sup> It is possible to estimate the width of fabrics easily when weights are found fallen as they hung on a loom, as was the case at the two Kition sites. At Apliki (and with other sets of weights) one can estimate the maximum width by measuring the length of the weights when placed in a row as they hung on the loom.<sup>119</sup>

107 These are being studied by Christophe Moulherat and Youli Spantidaki; we should like to thank them for permission to refer to their work.

108 This material is being studied by Susan Möller-Wiering. Her preliminary account ('Bronze Age textiles found in Crete') is available at [http://ctr.hum.ku.dk/research/tools\\_and\\_textiles/](http://ctr.hum.ku.dk/research/tools_and_textiles/).

109 Ventris and Chadwick 1973, 313–23.

110 Garments in the Aegean were often sewn from many woven or braided pieces (e.g. Barber 1997); without more fragments of cloth, it is difficult to demonstrate the exact balance of the extent to which garments were formed through folding and draping (e.g. Marcar 2005) and precisely cut designs.

111 Tzachili 2001a.

112 Pieridou 1967, 25, pl. 4: 1.

113 Niklassen 1983.

114 Barber 1991, 365–72; also Brown 1980.

115 Barber 1991, colour pl. 1.

116 Smith 2007a, 234–5, table 51; Smith *et al.* forthcoming a.

117 Smith 2002, 300, fig. 11; Smith *et al.* forthcoming b.

118 Van Soldt 1990, 332.

119 Mårtensson *et al.* 2009.

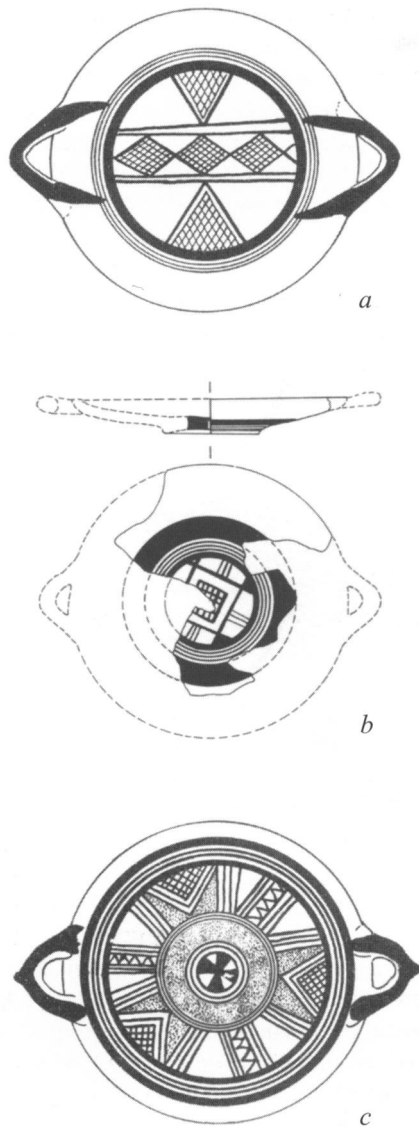


Fig. 9.10. CG wide and shallow dishes and bowl with decorated bases for display: (a) Lapithos, D. 19.8 cm, after SCE IV. 2, fig. 1: 1; (b) Kition-Kathari, D. 14.5 cm, after Karageorghis and Demas (1985, pl. 235); (c) Amathous, D. 20 cm, after SCE IV. 2, fig. 15: 9.

At Apliki the weights average 106–17 g in a set; dense tabby as well as open tabby weaves were woven. The open tabby weaves might have been weft faced or possibly woven instead as twill fabrics.<sup>120</sup> The weights were found together with polishers, rubbers, a whetstone and bronze gravers, all of which might have been used to grind dyestuffs, work the threads in a fabric, or smooth the cloth's surface. No tools for weaving patterned bands as edging or for beating in the weft for patterned weaves were found.

At Kition-Chrysopolitissa weights in a row for a cloth of 175 cm average 67 g each. Looking at all sets found at this site suggests that a range of dense and open tabby or possibly twill weaves were made. The

open tabby weaves differ from those at Apliki in being so open that they are likely to have been weft faced as in tapestry weaves. No permanent installations have been found. Weights, whorls, grinders, a bronze pin, reels and bone beaters contribute to the tools used here, suggesting that the textiles made were more elaborate in decoration than those at Apliki, perhaps in partial service for a central authority at Kition.

At Enkomi, in addition to bone beaters and reels that suggest a more diversified tool kit than the usual spindle whorl and loom weight, some loom weights have marks on the side, which could have been seen during weaving. These are found singly as parts of groups of otherwise unmarked weights — consistently throughout the life of the Area III workshop. Perhaps these marked weights were meant to highlight a point in the weaving to aid in a count of a pattern. The weights on average are somewhat lighter than those used at Apliki for the medium to heavy woollen fabrics, suggesting light to medium weight textiles. Unfortunately the one 'set', published as a 'hoard', contained no marked weight.

At Kition-Kathari to the west of Temple 1 loom weights and whorls are similar in their variety and weight to those from Apliki, Enkomi and Kition-Chrysopolitissa. The weight dimensions show that the range of cloth woven at Kathari compares especially well with Kition-Chrysopolitissa, including the likelihood of weft-faced weaves.<sup>121</sup> A row of weights shows that cloth at least 80 cm in width was being woven. In addition to a wide array of weaving tools, copious evidence for fulling and dyeing suggests that the textiles made here were not only patterned, but manufactured in large numbers on a large scale. The workshop's location is right at the then port area for the site, ready perhaps for export outside of Cyprus.

Even though we do not have the woven products of Cyprus, toward the end of the Bronze Age tapestries or kilims became an important product as did other colourful textiles, including woollen products dyed red-purple. A profusion of bands and cords, as were probably the products of Maa, suggest that clothing became more intricate, possibly moving toward the sewn and layered fashions of the Aegean or, as so often on Cyprus, creating a blended style combining the plain linen of Egypt or the colourful patterns of single fabric Levantine clothing with the bands that were so characteristic of Aegean-style clothing.

## CONSUMERS AND EXCHANGE

As noted at the beginning of this paper, textiles in the ancient Mediterranean world were normally second only to metals in value and sometimes may have been

<sup>120</sup> Smith *et al.* forthcoming *a*.

<sup>121</sup> Smith *et al.* forthcoming *b*.

valued more highly.<sup>122</sup> Some were made in the home for household use and were probably important parts of daily life as well as serving as parts of dowries and for festivals and other events. Textiles could be folded and stored away with relative ease and many probably had long lives, being in use for many generations. Where a central authority is involved, as at Knossos, some textiles were given as compensation for service as, for example, to the e-qe-ta. It is possible that during the LBA on Cyprus, toward the end of the 13th century BC, there was an emerging central authority that sponsored not only a central workshop as at Kition, but also requisitioned products made in the home. The growth in the size of the workshop at Kition suggests that this industry continued to grow throughout the 12th and 11th centuries BC.

Densely populated areas such as Knossos, Kition and Enkomi probably had a certain degree of market exchange, as barter even in advance of formal currency. We know from contemporary texts that values were calculated in relationship to weights of silver. The importance of textiles from both places for long distance exchange is obvious, both from Egyptian tomb paintings clearly inspired by Cretan textiles and the location of the textile workshop at the harbour of Kition, as in other harbours in the Mediterranean. Indeed, in both the Linear B archives and in Homer, the well-known weavers are from harbour towns — we know of Knidos, Miletos and Lemnos in Linear B and Sidon, Kerkyra and Lesbos in Homer. While textiles do not survive in shipwrecks such as that found off the coast of Turkey at Uluburun, we know that they were easily transportable and formed important parts of international shipments of goods throughout the Bronze and Iron Ages. We hope that we have put them back on the map.

## CONCLUSION

Crete and Cyprus, while they have different social and political histories, shared many common techniques of textile manufacture. Both produced fabrics of many varieties, including patterned textiles for export. Cyprus shares the tool kit for spinning and weaving with Crete, but also includes tools for making tapestries that were used along the eastern-most seaboard of the Mediterranean.

Both Crete and Cyprus show evidence for the centralisation of some portion of the textile industry, particularly the part involved with cloth for export. However, the centralisation on Crete is earlier and set apart from the harbour areas where ships carrying the trade items would have docked and set sail. The most elaborately decorated textiles were made when people had the work space and resources to weave on a regular basis, whether in the home or in a designated workshop.

Both also demonstrate the importance of harbour towns in textile manufacture, places where cultures converge, with people speaking many languages and

sharing ideas through image and object. The importance of harbour locations continued in the Iron Age, and it is no surprise that the Phoenicians, known for the purple dye already in use in the LBA, are central to that story and relate to both islands. Just as in the Bronze Age, they were able to express their identities through the portable medium of textiles. Clothing and decorated elite space was no longer a hallmark only of the palatial, but also of those on the move, it became a signifier of mercantile strength across the Mediterranean.

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