Kition, Cyprus: preliminary technical textile tools report

A total of 323 objects are recorded in the database. Of these, 289 are loom weights or spools, 15 are spindle whorls, and the remaining 19 objects are pointed tools. The majority (179) are dated to LC IIIA. 168 of the tools come from household contexts, while 98 are from workshop contexts and 57 come from 'other' contexts. The breakdown of the classes of tools by date, and then by general context (household/workshop/other) and date is shown below (figures 1 & 2).

Date	spindle whorls	loom weights	spools	pointed tools	Total
LCIIC-IIIA		14		2	**16**
LCIIIA	9	124	32	14	**179**
LCIIIA-B	4	70	3	1	**78**
LCIIIB				1	**1**
CGI	1	36	9	1	**47**
LC		1			**1**
unstratified	1				**1**
Total	**15**	**245**	**44**	**19**	**323**

Figure 1. Classes of tools recorded in the database, by date.

Household	spindle whorls	loom weights	spools	pointed tools	Total
LCIIC-IIIA		9		2	**11**
LCIIIA	1	59	3	2	**65**
LCIIIA-B	4	43	2	1	**50**
LCIIIB					**0**
CGI		32	8		**40**
LC	1	1			**2**
unstratified					**0**
Total	**6**	**144**	**13**	**5**	**168**
Workshop	**spindle whorls**	**loom weights**	**spools**	**pointed tools**	**Total**
LCIIC-IIIA					**0**
LCIIIA	8	37	28	5	**78**
LCIIIA-B		16	1		**17**
LCIIIB					**0**
CGI		1	1	1	**3**
LC					**0**
unstratified					**0**
Total	**8**	**54**	**30**	**6**	**98**
Other	**spindle whorls**	**loom weights**	**spools**	**pointed tools**	**Total**
LCIIC-IIIA		5			**5**
LCIIIA		28	1	7	**36**
LCIIIA-B		11			**11**
LCIIIB				1	**1**
CGI		3			**3**
LC					**0**
unstratified	1				**1**
Total	**1**	**47**	**1**	**8**	**57**
Overall Totals	**15**	**245**	**44**	**19**	**323**

Figure 2. Classes of tools recorded in the database, by general context and date.

Spinning at Kition

Of the 15 spindle whorls, four are biconical, four are conical, two are convex and five are spherical (figure 3). The majority of the whorls (nine) are dated to LC IIIA, and four come from LC IIIA-B deposits.

Date	biconical	conical	convex	spherical	Total
LCIIIA	2	3	2	2	9
LCIIIA-B	2			2	4
CGI				1	1
unstratified		1			1
Total	4	4	2	5	15

Figure 3. Spindle whorls, shape and date.

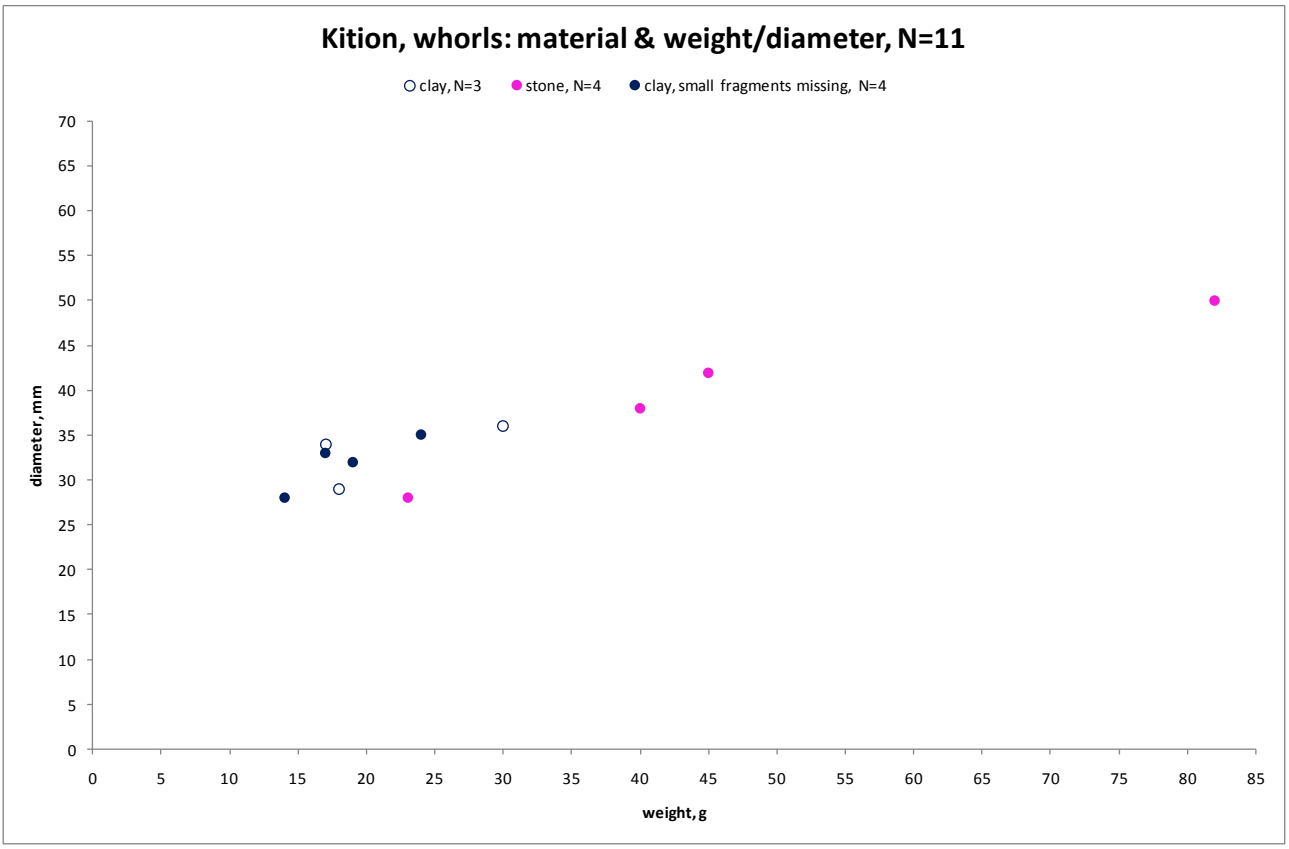
The two convex whorls, one of the spherical and one of the conical whorls are made of stone (all dated to LC IIIA), whilst ten are made of fired clay and one LC IIIA conical whorl is made of unfired clay (figure 4).

	stone	fired clay	unfired clay	Total
biconical		4		4
conical	1	2	1	4
convex	2			2
spherical	1	4		5
Total	4	10	1	15

Figure 4. Spindle whorls, shape and material.

One LC IIIA-B biconical whorl, KIT-Area I/710/1, has a double cone hole. This would have caused it to rotate unevenly if used as a spindle whorl, and it therefore would not have functioned well if used for this purpose. Similarly, the conical whorl, KIT-Area II/5077, is made of unbaked clay; the use of unbaked clay for spindle whorls is rare (although ethnographic examples are not unknown[1]), and would be far from optimal, given the wear caused by fitting the whorl on a spindle ready for use, the constant rotation during spinning, and the friction of the secured yarn against the whorl. If it was used as a whorl, it is likely to have had a short use life.

Seven of the fifteen objects classified as whorls are complete (three made of clay and four made of stone). A further four clay whorls are recorded as having 'small fragments missing', and these also fall within the same weight/diameter range as the complete whorls (figure 5). Three of the stone whorls lie at the upper end of the weight/thickness range, weighing 40+ g.



[1] See S D McCafferty & G G McCafferty 2000: Textile Production in Postclassic Cholula, Mexico. *Ancient Mesoamerica* **11**,42, for an example of the use of unbaked whorls in modern day Oaxaca.

Figure 5. Spindle whorls, material and weight/diameter (including those with 'small fragments missing').

The convex whorls (made of stone) are heavier than the other whorls, which all weight <50 g (figure 6).

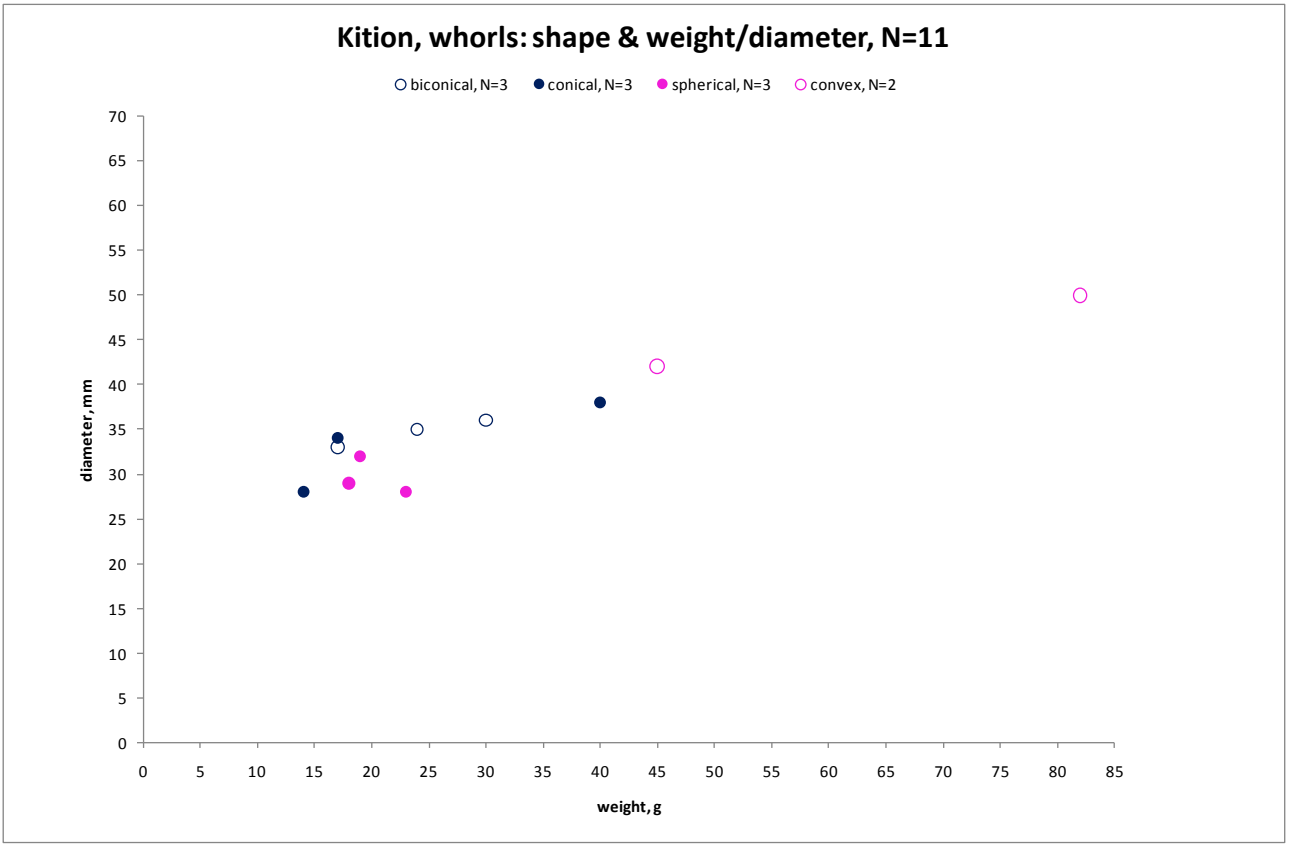


Figure 6. Spindle whorls, shape and weight/diameter (including those with 'small fragments missing').

Of the 11 complete/small fragments missing whorls, seven are from LC IIIA contexts, whilst two are from LC IIIA-B deposits and only one is from a CGI context (figure 7). The remaining whorl is from an unstratified deposit.

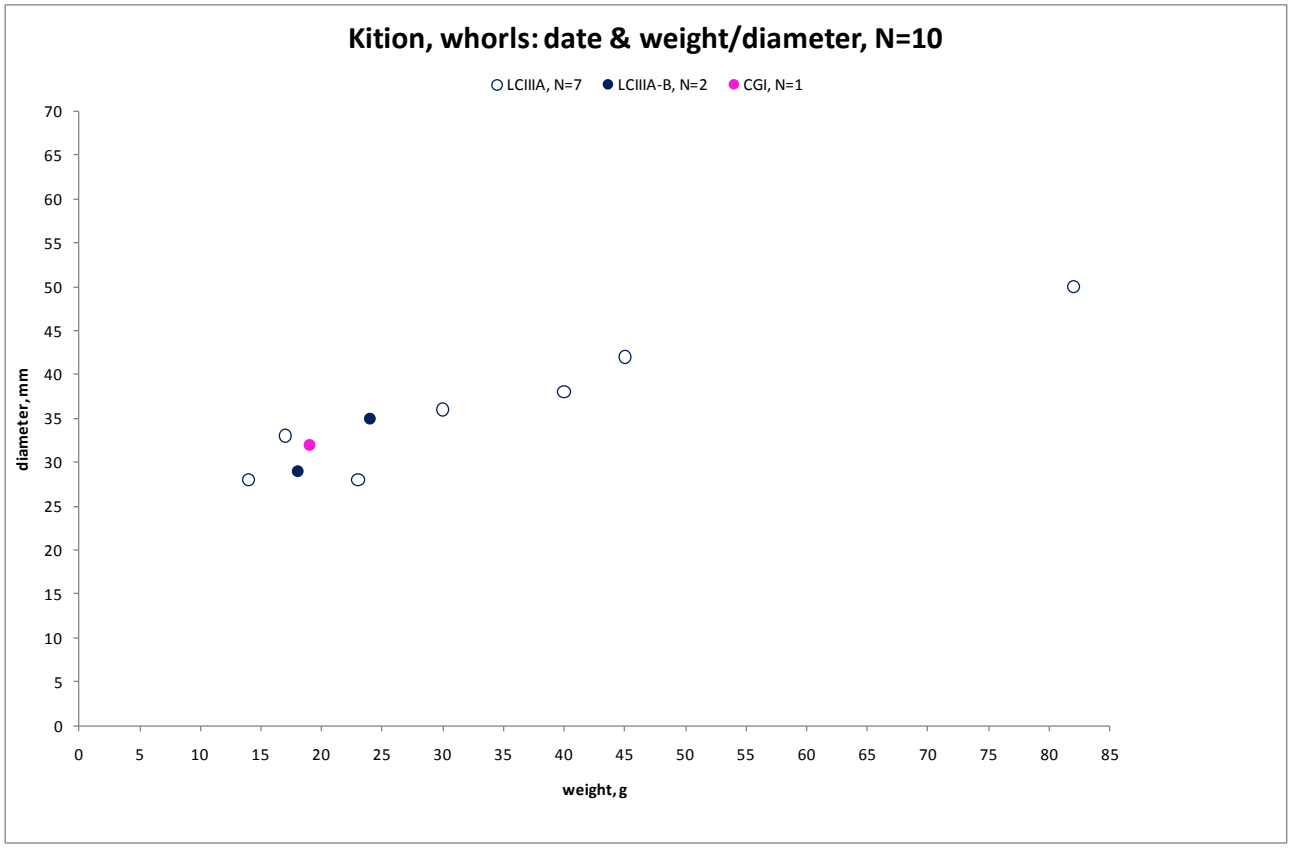


Figure 7. Spindle whorls, date & weight/diameter (including whorls with 'small fragments missing' and excluding the whorl from an unstratified deposit).

Six of the fifteen whorls were recovered from Area I, all of which come from household contexts; one is dated to LC IIIA, four are dated to LC IIIA-B, and one is dated to CGI. Of the nine whorls recovered from Area II, one is unstratified, and eight come from LC IIIA workshop contexts (figure 8).

Area I	**household**	**workshop**	**other**
LCIII A	1		
LCIIIA-B	4		
CGI	1		
Total	**6**		
Area II	**household**	**workshop**	**other**
LCIII A		8	
LCIIIA-B			
CGI			
unstratified			1
Total		**8**	**1**

Figure 8. Spindle whorls, context & date.

Four of the spindle whorls from Area I and six of the whorls from Area II are complete or have small fragments missing (figure 9; excluding the whorl from an unstratified context). The majority

of the whorls from the two areas fall within the same weight/diameter range, although the heavier whorl from Area II, weighing 82 g, should be noted.

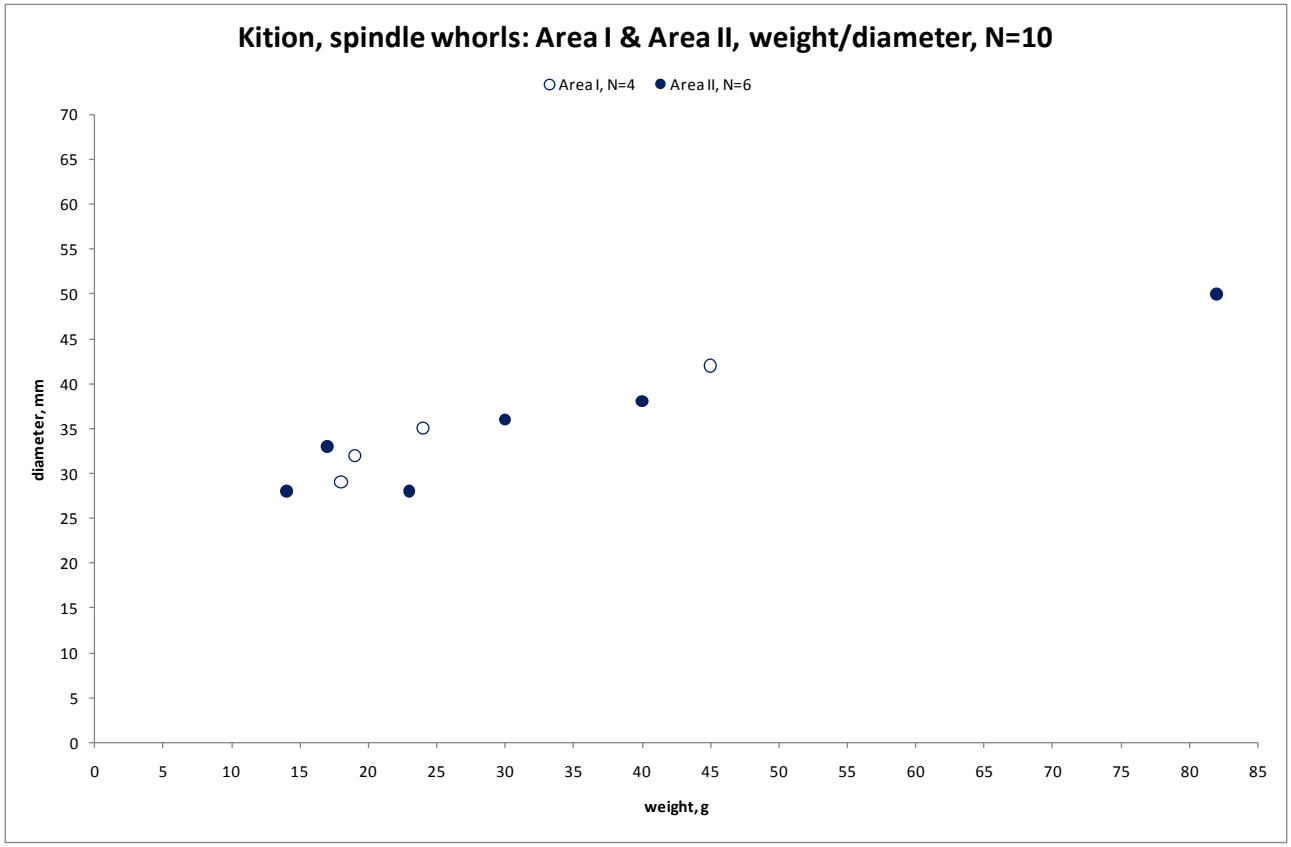


Figure 9. Spindle whorls, Area I & Area II, weight/diameter (including those with 'small fragments missing' and excluding the whorl from an unstratified context).

The lighter spindle whorls (if used on a suspended spindle), weighing 14-19 g, could be suitable for spinning a thread that would require a tension of c. 20-30 g in a loom set up. The heavier, 40-47 g whorls could be used to spin thick thread, while the 82 g whorl could produce a very thick thread.

The LC IIIA conical whorl, KIT-Area II/5112, made of low fired clay and with a partial weight of 120 g, should also be noted. It is possible that this may have been used for spinning twine (cf. Smith 2007: 230), but it is also possible that it may have functioned as a loom weight.

Weaving at Kition

Of the 289 loom weights registered in the database, 157 were recovered from Area I and 132 come from Area II (figure 10). The majority of the loom weights from both areas are dated to LC IIIA/LC IIIA-B. A variety of loom weight shapes are represented, but the cylindrical short, pyramidal/pyramidal truncated and spool types are the most frequent.

Area 1	conical	cube	cylindrical short	flat trapezoidal	pyramidal	pyramidal tr.	spherical	spool	Total
LCIIC-IIIA			2	2	1	4			9
LCIIIA	1		32		7	19		3	62
LCIIIA-B		2	25		7	8	1	2	45
CGI			24			8		8	40
LC						1			1
Total	**1**	**2**	**83**	**2**	**15**	**40**	**1**	**13**	**157**
Area II	**conical**	**cube**	**cylindrical short**	**flat trapezoidal**	**pyramidal**	**pyramidal tr.**	**spherical**	**spool**	**Total**
LCIIC-IIIA					1	4			5
LCIIIA	1		34	1	8	21		29	94
LCIIIA-B		1	8		7	11		1	28
CGI						3	1	1	5
LC									0
Total	**1**	**1**	**42**	**1**	**16**	**39**	**1**	**31**	**132**
Overall total	**2**	**3**	**125**	**3**	**31**	**79**	**2**	**44**	**289**

Figure 10. Loom weights, shape and date, by area.

The majority of the loom weights (274) are made from fired clay; 13 are made from unfired clay and the remaining two are stone (figure 11).

	fired clay	unfired clay	stone	Total
conical	2			2
cube	3			3
cylindrical short	118	7		125
flat trapezoidal	2		1	3
pyramidal	28	3		31
pyramidal tr.	78	1		79
spherical	1		1	2
spool	42	2		44
Total	**274**	**13**	**2**	**289**

Figure 11. Loom weights, material and shape.

91 of the loom weights have a complete weight/thickness recorded, and a further 73 are registered as having 'small fragments missing'; the two groups fall within a similar weight/thickness range (figure 12).[2] The majority of the loom weights weight <200 g, and would have been suitable for thread requiring <20 g tension. A smaller number weigh >200-355 g; the heaviest weight (355 g) would be suitable for use with thread requiring c. 15-35 g tension.

[2] None of the loom weights have a thickness recorded; the width measurement has been taken as the thickness except in the case of the spools and spherical rounded loom weight classes, where the height/diameter measurement has been used. In the absence of individual measurements for loom weights found in groups, the average thickness registered for the group has been applied to all the individual loom weights, but more accurate calculations could be made using the individual measurements.

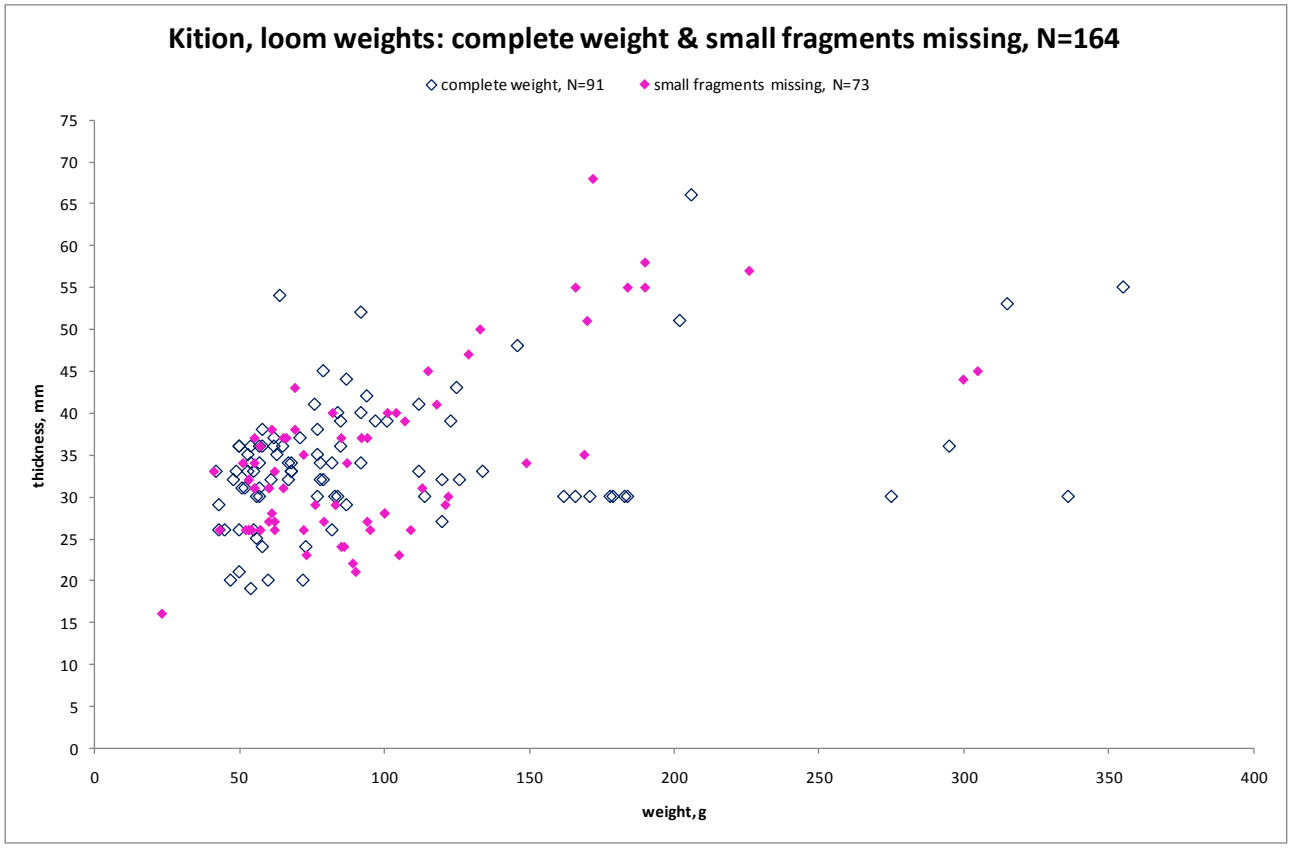


Figure 12. Loom weights with a complete weight and those with 'small fragments missing', weight/thickness.

The pyramidal/pyramidal truncated loom weights and the spools lie on a similar weight/thickness trajectory, although the pyramidal/pyramidal truncated weights lie at the lower end of the range, whilst the majority of the spools are at the upper end (figure 13). The cylindrical short weights, on the other hand, are generally thinner, and would be suitable for producing denser textiles than the other types. This category of loom weight also contains a number of heavier weights, weighing >275 g.

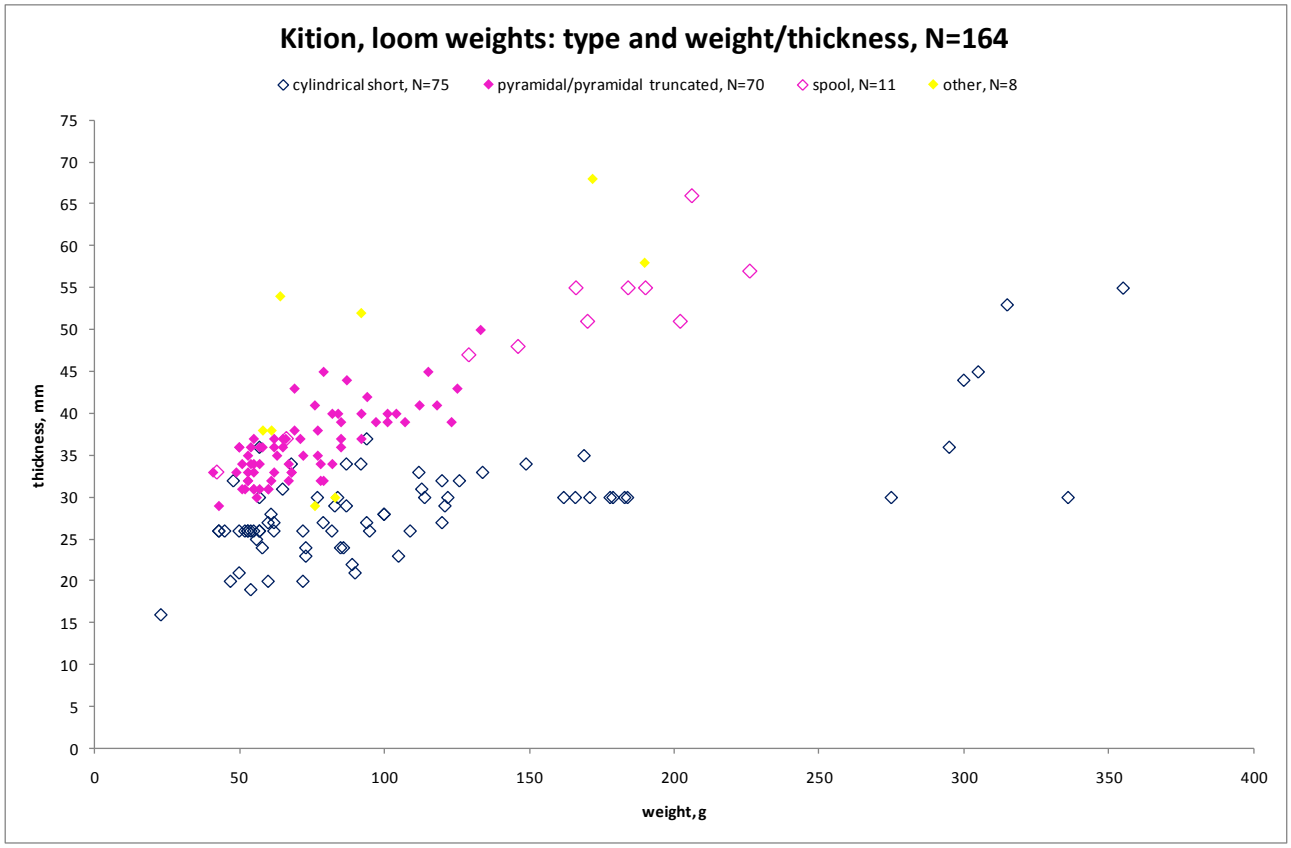


Figure 13. Loom weights, type and weight/thickness (the 'other' category groups together loom weight types with ≤ three weights).

The weight and thickness of the LC IIC-IIIA, LC IIIA, LCIIIA-B and CGI loom weights all fall within similar weight/thickness ranges (figure 14; excluding one loom weight only dated to LC). Although the LC IIC-IIIA loom weights with a complete/estimated weight appear to be more restricted in weight range, they are fewer in number, and it should be noted that one of the LC IIC-IIIA incomplete loom weights weighs 310 g.

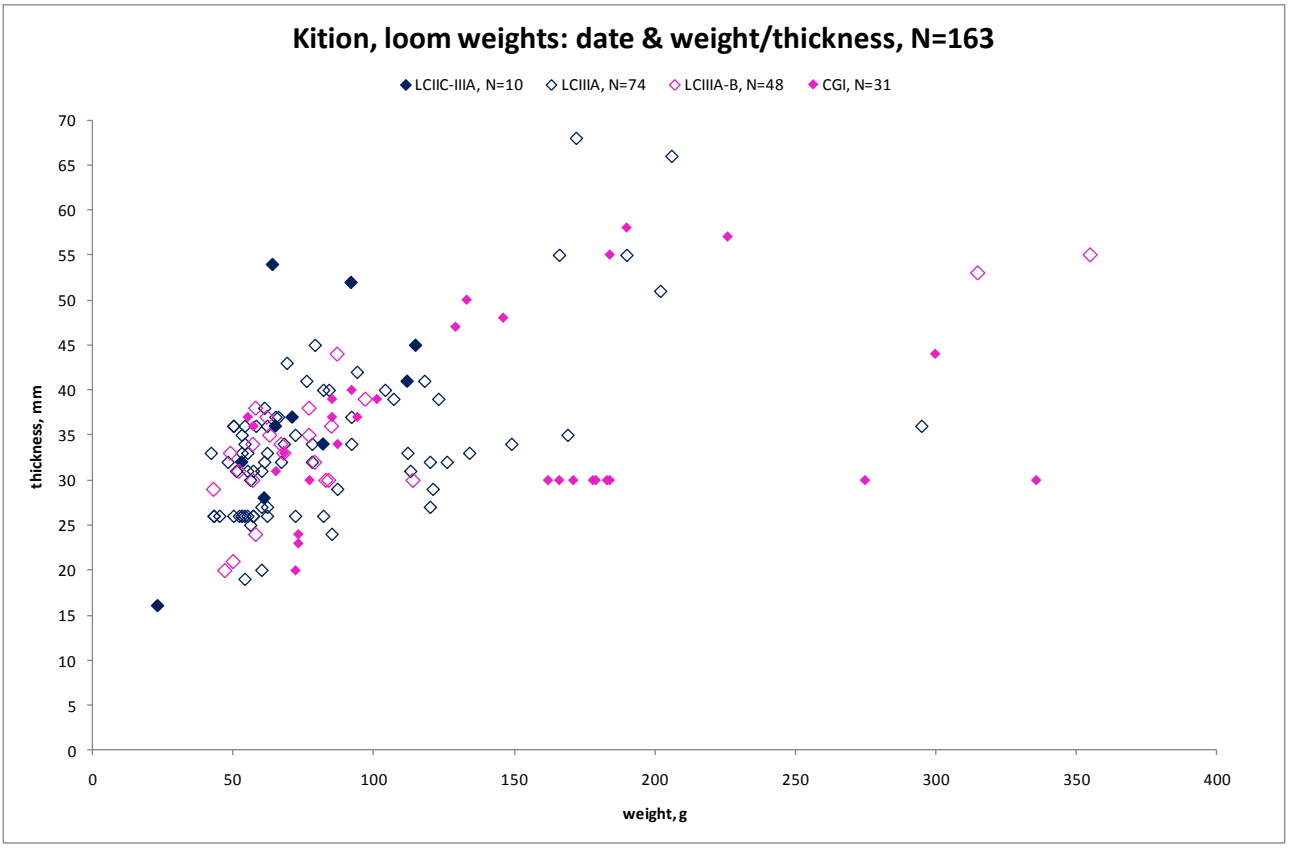


Figure 14. Loom weights, date & weight/thickness.

106 of the loom weights with a recorded weight (complete or 'small fragments missing') and thickness are from Area I, whilst the remaining 56 are from Area II (figure 15). The loom weights from the two areas fall within very similar weight/thickness ranges. The majority of the loom weights weighting >275 g are from Area I, but it should be noted that there are a number of partially preserved loom weights from Area II that also weigh >270 g.

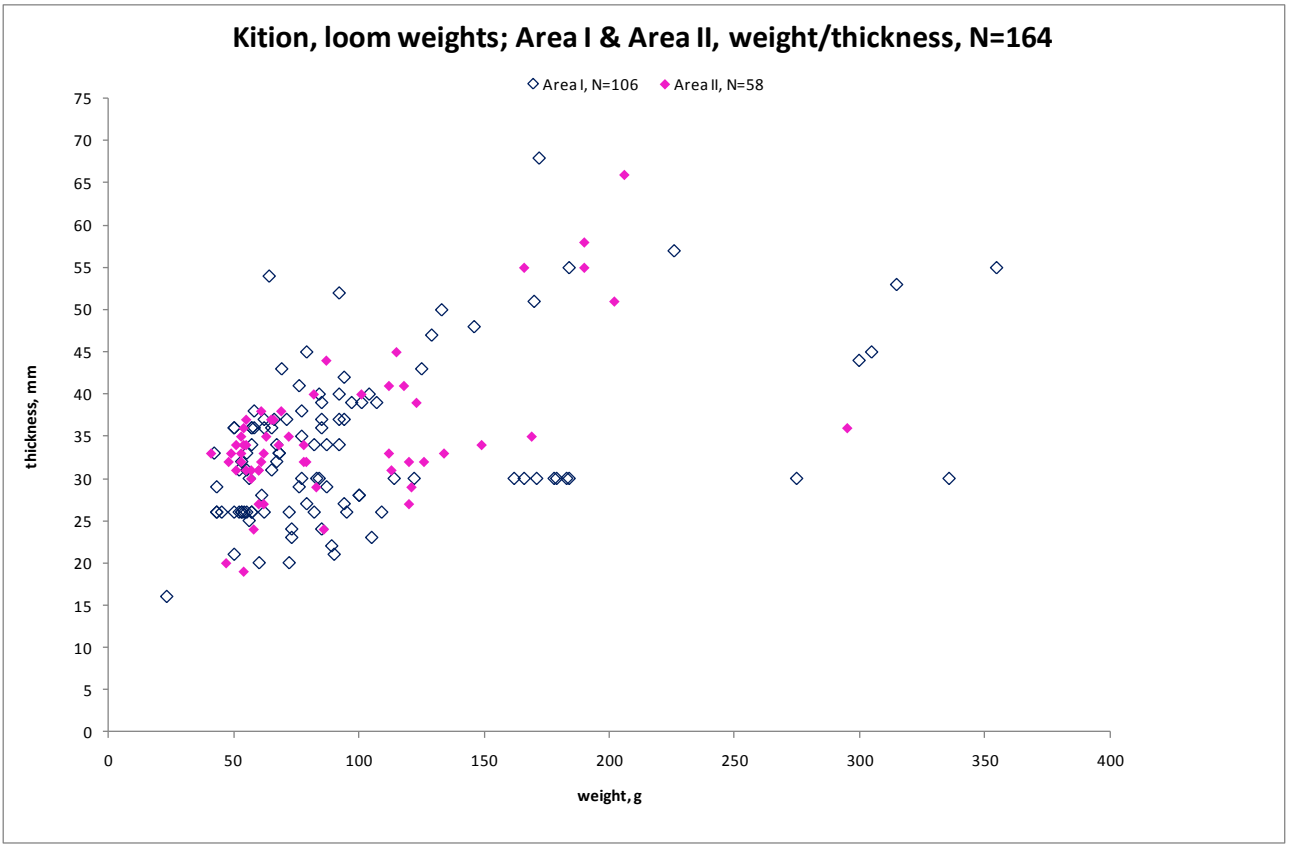


Figure 15. Loom weights, Area I & Area II, weight/thickness.

In Area I, 33 loom weights were recovered from Floor IIIA, Courtyard H (LC IIIA): one conical, 25 cylindrical short and seven pyramidal/pyramidal truncated. Twenty two of the cylindrical weights were found in a group, with a further five pyramidal/pyramidal truncated possibly lying in a row.[3] Of these, 17 are complete or have small fragments missing, with weights ranging between 43 g and 82 g (figure 16). Most of the incomplete weights are also likely to have fallen within a similar weight range, although a few are slightly heavier (with partial weights of 106 g, 109 g).

[3] Possibly only three pyramidal weights in the row; KIT-Area I/423/1a/1-2 added cf Smith 2002: Figure II underlined weights, but only three indicated in text, p 301.

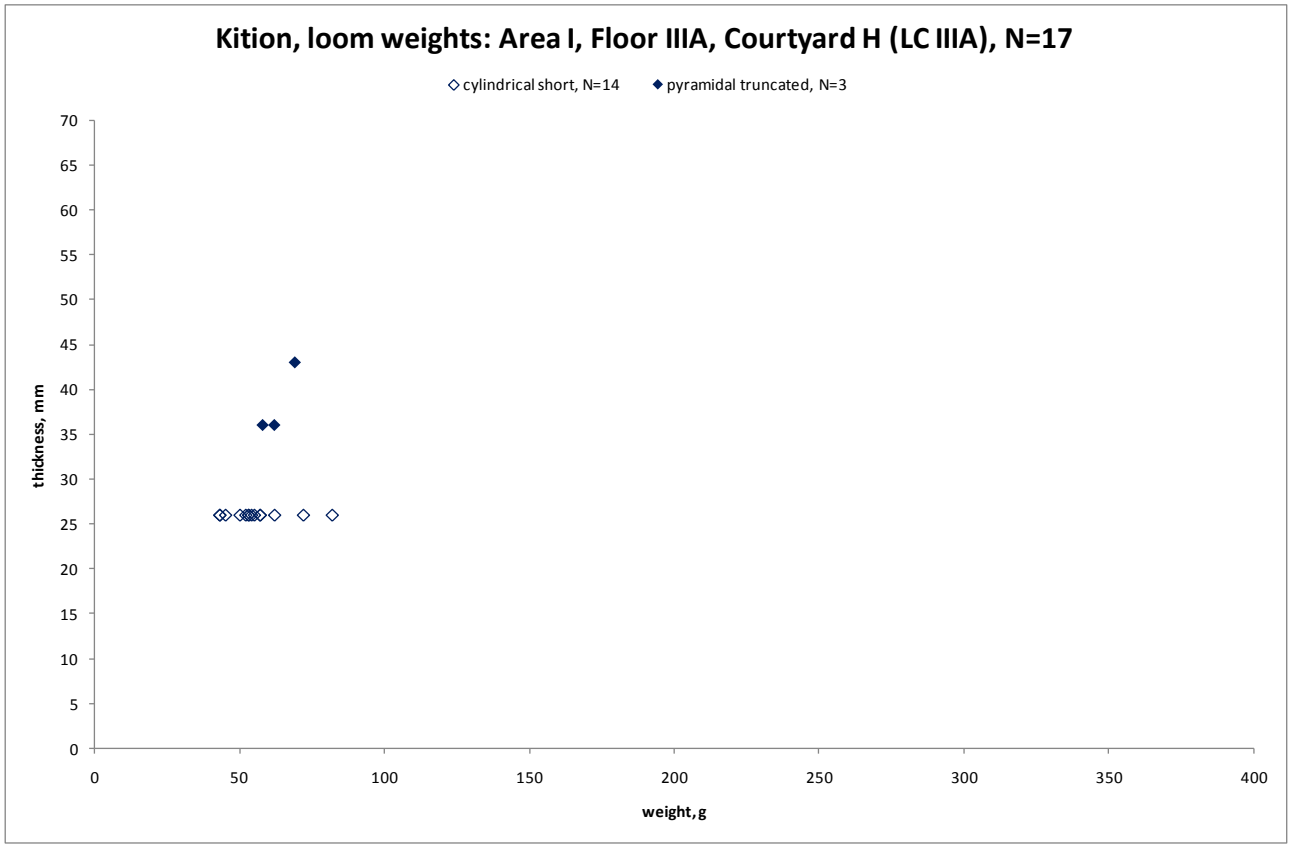


Figure 16. Loom weights, Area I, Floor IIIA, Courtyard H, weight/thickness (for the cylindrical weights, only the average thickness of the group is available).

If used in a tabby weave with very fine thread requiring 5 g tension, these loom weights would produce a fabric with c. 7-12 threads per cm (figure 17. NB however, that only the average thickness is available for the cylindrical short loom weights). In a twill weave using four rows of loom weights the thread count would be approximately double. The loom weights weighing <50 g would provide a slightly lower tension, unless fewer than 10 threads were fastened to each one. None of the complete/small fragments missing loom weights would be suitable for use with thread requiring 10 g tension. It is interesting to note that the two types of loom weights – cylindrical short and pyramidal/pyramidal truncated – in this deposit would function well together. The stone (white chalk) spindle whorl, KIT-Area I/423/2, possibly from this deposit (or from between floors IIIA and III), weighing 45 g, would not be suitable for spinning such fine thread, but with a height (thickness) of 2.6 cm, it would function well with the other weights if it was used as a loom weight.

LW shape	weight (g)	thickness (mm)	thr/cm 5g tabby
cylindrical short	43	26	7
cylindrical short	43	26	7
cylindrical short	45	26	7
cylindrical short	50	26	8
cylindrical short	52	26	8
cylindrical short	53	26	8
cylindrical short	53	26	8
cylindrical short	54	26	8
cylindrical short	55	26	8
cylindrical short	57	26	8
cylindrical short	57	26	8
cylindrical short	62	26	9
cylindrical short	72	26	11
cylindrical short	82	26	12
pyramidal	58	36	7
pyramidal	62	36	7
pyramidal	69	43	7

Figure 17. Loom weights, Area I, Floor IIIA, Courtyard H. Approximate threads per cm if used in a tabby weave using two rows of loom weights. NB for the cylindrical short weights this is based on the average thickness of the cylindrical short loom weights.

Seventeen loom weights were recovered from Area I, Floor II, Courtyard D (LC IIIA-B). Eleven of these were found in a group; eight cylindrical short, 2 cube and one pyramidal. Only four of the loom weights found together are complete or have small fragments missing. These range in weight from 76 g to 122 g, suggesting that, like the loom weights from Courtyard H, they would be optimal for use with thinner threads. However, five of the incomplete weights have partial weights of 220-295 g, and these would not be suitable for use with thread requiring <10 g tension. The spherical spindle whorl (KIT-Area I/433/4e) also recovered from this deposit with a partial weight of 41 g would be optimal for spinning much thicker thread than the loom weights could be used with (although it is possible that this object may have been used as a loom weight).

Fifteen loom weights dating to CGI were found in Area I, Floor I, Courtyard B. Eleven of these (cylindrical short) were in a group, nine of which had a complete weight. The majority of the complete loom weights (seven) weigh 166-184 g, while the remaining two weigh 275 g and 336 g respectively (figure 18. NB however, that only the average thickness is available).

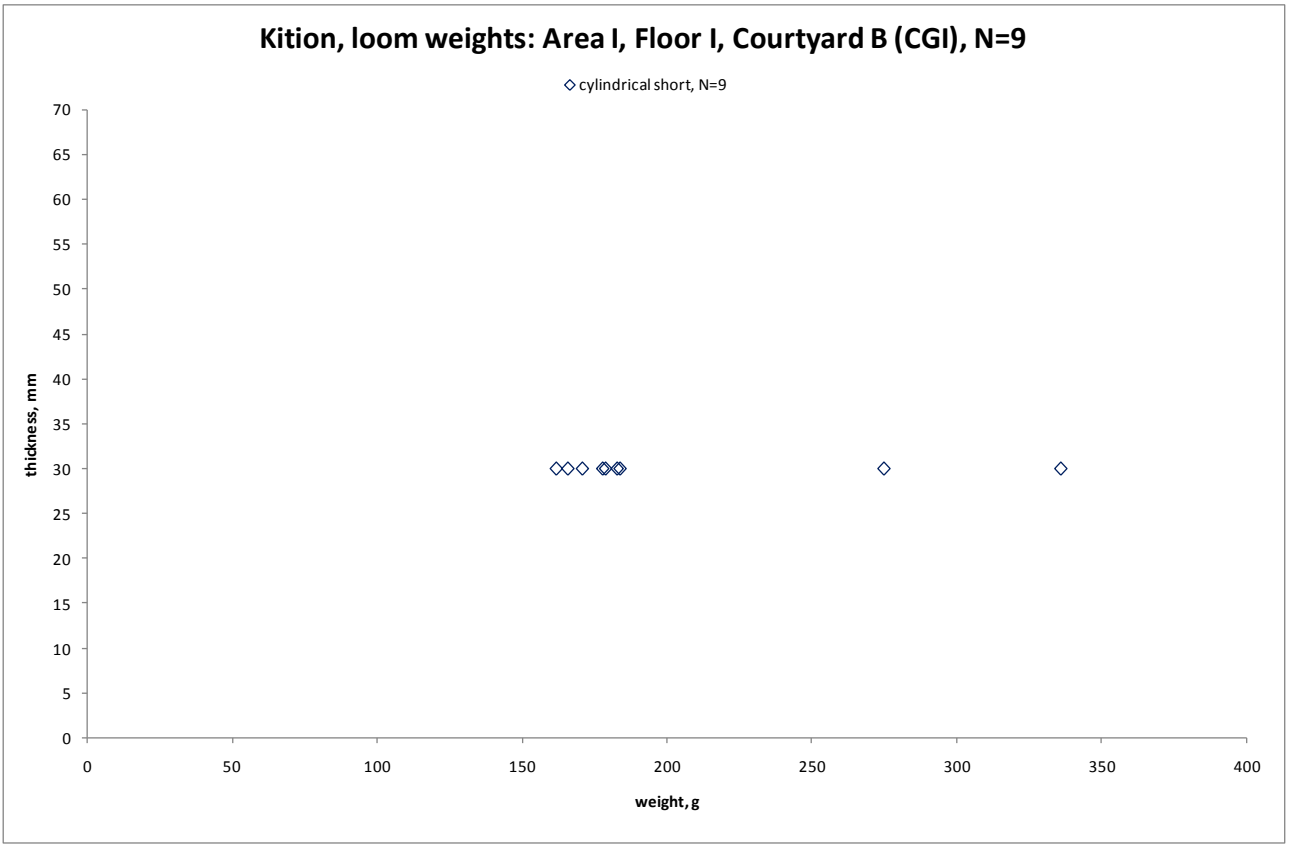


Figure 18. Loom weights, Area I, Floor I, Courtyard B (CGI), weight/thickness (only the average thickness of the group is available).

The nine complete loom weights would be suitable for use with thread requiring c. 10-15 g tension. In a tabby weave (two rows of loom weights), with thread needing 10 g tension the resultant fabric would have c. 8-12 threads per cm and with thread requiring 15 g tension the fabric would have c. 7-15 threads per cm (figure 19). If the two heaviest weights (275 g and 336 g) were excluded, the variation in the thread count would be significantly reduced. These two weights could also be used with thread requiring 20 g tension. The spindle whorl found with this group (KIT-Area I/557), weighing 19 g, could be suitable for spinning thread requiring c. 20-30 g tension.

LW shape	weight (g)	thickness (mm)	thr/cm 10g tabby	thr/cm 15g tabby
cylindrical short	171	30	11	7
cylindrical short	166	30	11	7
cylindrical short	183	30	12	8
cylindrical short	162	30	11	7
cylindrical short	184	30	12	8
cylindrical short	179	30	12	8
cylindrical short	336	30		15
cylindrical short	178	30	12	8
cylindrical short	275	30	8	12

Figure 19. Loom weights, Area I, Floor I, Courtyard B. Approximate threads per cm if used in a tabby weave using two rows of loom weights. NB this is based on the average thickness of the loom weights.

In Area II, 18 weights (13 cylindrical short and five spools) were found on Floor III, Room 118 (LC IIIA); eight of the cylindrical short weights were found in a group. Only three of these have a complete weight, which ranges from 48 g to 126 g. The weights of the incomplete weights (70-132 g), suggests that the weight range of the group would have extended further, however. The object classified as a spindle whorl (KIT-Area II/5112) found with this group, with a partial weight of 120 g, would not be suitable for spinning the thread to be used with the loom weights, but if it was used as a loom weight it would fit well with the other loom weights in the deposit.

Ten loom weights (five pyramidal, four cylindrical short and one spool) were additionally recovered from Area II, Floor II, Room 8 (LC IIIA-B). Seven of these (four cylindrical short and three pyramidal/pyramidal truncated) were possibly in a row. Of these, three cylindrical short and three pyramidal/pyramidal truncated are complete or have small fragments missing and weigh 47-86 g (figure 20).

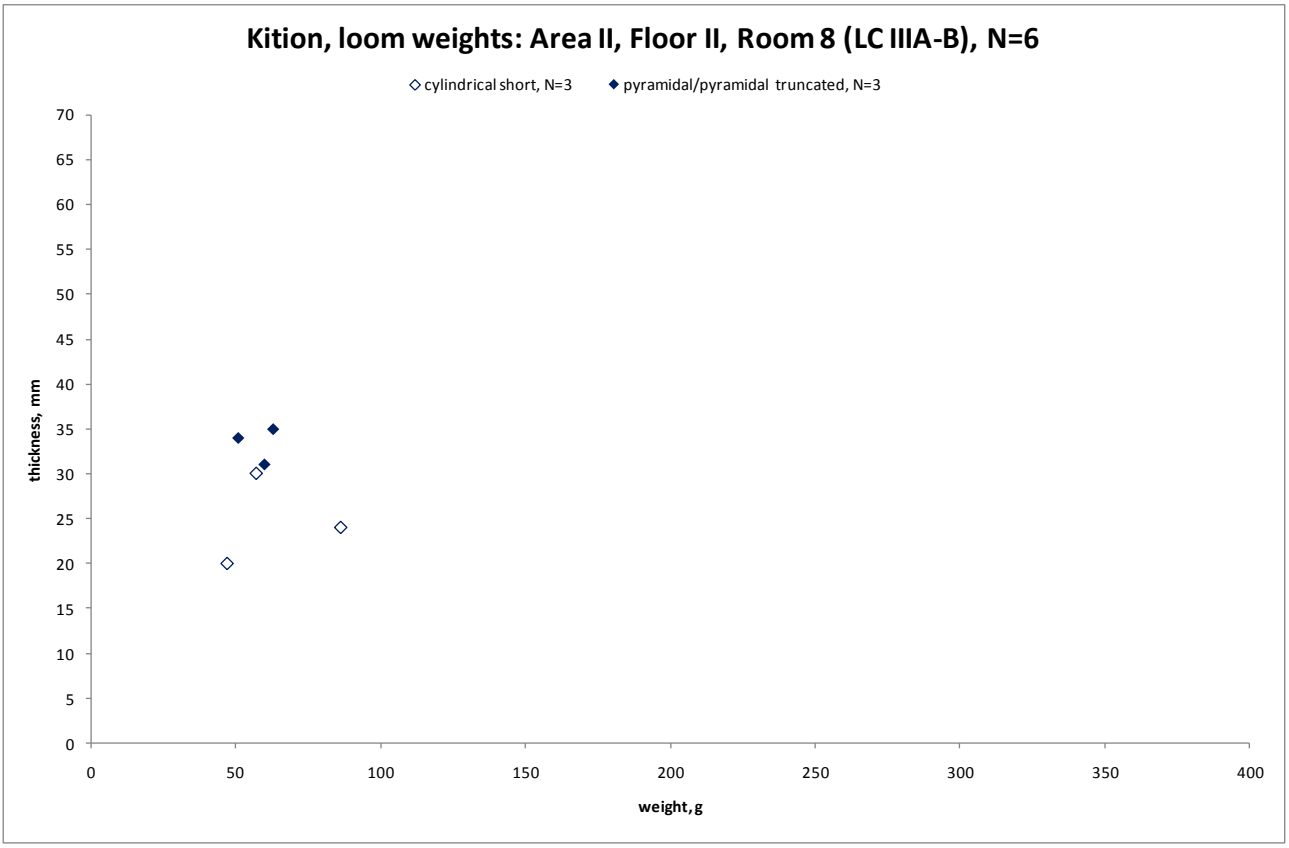


Figure 20. Loom weights, Area II, Floor II, Room 8 (LC IIIA-B), weight/thickness.

Although the group contains two types of weights (cylindrical and pyramidal), they could function together if used in a tabby (two row) set up with thread requiring c. 5g tension, but the variation in the thread count, 6-14 threads per cm, is high, largely as a result of the cylindrical weight

weighing 86 g, which would be suitable for producing a denser weave than the other weights in the group (figure 21).

LW shape	weight (g)	thickness (mm)	thr/cm 5g tabby
cylindrical short	47	20	9
cylindrical short	57	30	7
cylindrical short	86	24	14
pyramidal	63	35	7
pyramidal	51	34	6
pyramidal	60	31	8

Figure 21. Loom weights, Area II, Floor II, Room 8. Approximate threads per cm if used in a tabby weave using two rows of loom weights.

Spinning and weaving at Kition

None of the spindle whorls recovered from Areas I and II would be optimal for spinning fine thread requiring c. 5-10 g tension. The lightest whorls (14-19 g) could be suitable for spinning thread needing c. 20-30 g tension. It is possible that the heaviest spindle whorls were used for spinning twine (cf. Smith 2007: 230), but it is also possible that they were used as loom weights rather than as spindle whorls.

Most of the loom weights weigh <200 g, with the majority of these weighing <150 g. This indicates that they would have been most suited for use with thread requiring <20 g tension, with a concentration of loom weights that were optimal for use with thread needing <15 g tension. If used to produce tabby fabrics, many of the resultant textiles would be relatively open, however, unless they were weft faced. Although very few twill textiles dating to the Bronze Age have been recovered from the eastern Mediterranean region, the analyses of the loom weights indicate that the possible production of twill textiles cannot be ruled out. Fewer loom weights could be used with thread needing >20 g tension and none would be suitable for use with thread requiring >35 g tension. On the whole, the cylindrical short loom weights, being generally thinner than the pyramidal/pyramidal truncated loom weights with the same weight, would produce a denser weave. However, there is some overlap between the two groups, as can be seen in the case of the group of loom weights from Area II, Floor II, Room 8.

Although the loom weights from Area I were recovered from household contexts, whilst those from Area II come from workshop or 'other' contexts, the tools suggest that there was no significant difference in the range of textiles produced in the two areas.