THEBES, TECHNICAL TEXTILE TOOLS REPORT

239 objects are recorded in the database; of these, one four-hole pierced 'button' and two unpierced sherds have been excluded from the analysis, as it is considered that these items are not textile tools. The breakdown of the remaining classes of tools by date, and then by general context/date is shown below (Figures 1 & 2). [1]

	SpW	Conulus	KS-whorl	Pierced sherds	Pierced disc	LW	Spool	Pointed tools	Needles	Total
EH	17	1		2		6			3	29
MH	4									4
LH	79	46	1	17	1	6	21	17	4	192
Mixed/unknown	3	3		2				3		11
Total	103	50	1	21	1	12	21	20	7	236

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

[1] It should be noted that five clay spindle whorls have been re-classified as pierced sherds, since they have a double cone perforation: THE40723, THE41620, THE41626, THE41627, THE41629 (see comments on pierced sherds, below).

Palace, workshop	SpW	Conulus	KS-whorl	Pierced sherds	Pierced disc	LW	Spool	Pointed tools	Needles	Total
Mixed/unknown		1		1				3		5
surface layer		2								2
MH	2									2
MH-LHIIIB-C	3									3
LH							1			1
LHIIA-IIIA2?				1						1
LHIII?	2	3								5
LHIIIB							1	2		3
LHIIIB?						1	7			8
LHIIIB, late?							2			2
LHIIIB2						1				1
LHIIIB2 late	32	10	1	4			4	5	1	57
LHIIIB2 late?	2									2
LHIIIB2-C	2									2
Total	43	16	1	6	0	2	15	10	1	94
Palace, other	SpW	Conulus	KS-whorl	Pierced sherds	Pierced disc	LW	Spool	Pointed tools	Needles	Total
MH?	1									1
MH	1									1
LHIIIA2	1			2			1	3		7
LHIIIA-B	6									6
LHIIIB?				1						1
LHIIIB2	3	4		1			2	1		11
LHIIIB2 late	15	7		5		4	2	1	1	35
LHIIIC early	5	7						1	1	14
LHIIIC middle	11	15					1	3	1	31
Total	43	33	0	9	0	4	6	9	3	107
Citadel, workshop	SpW	Conulus	KS-whorl	Pierced sherds	Pierced disc	LW	Spool	Pointed tools	Needles	Total
LHIIIB2late				2	1					3
LHIIIB2 late?				1						1
mixed				1						1
Total	0	0	0	4	1	0	0	0	0	5
Settlement, household	SpW	Conulus	KS-whorl	Pierced sherds	Pierced disc	LW	Spool	Pointed tools	Needles	Total
EHI-III	4					1				5
EHII late	13	1		2		5		1	3	25
Total	17	1	0	2	0	6	0	1	3	30
Overall Totals	**103**	**50**	**1**	**21**	**1**	**12**	**21**	**20**	**7**	**236**

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

The majority of the tools (171) were recovered from LH IIIB-C contexts, with the greatest number (98) coming from LH IIIB2 late contexts.

Spinning at Thebes

154 items in the database are classified as spindle whorls, conuli or kylix-stem whorls; one pierced bone disc and 21 pierced sherds are additionally recorded (including one that is recorded as a possible loom weight). 149 of these had a recordable weight and diameter (Figure 3; this number excludes the pierced sherd that is possibly a loom weight, and two fragmentary items with a calculated weight).

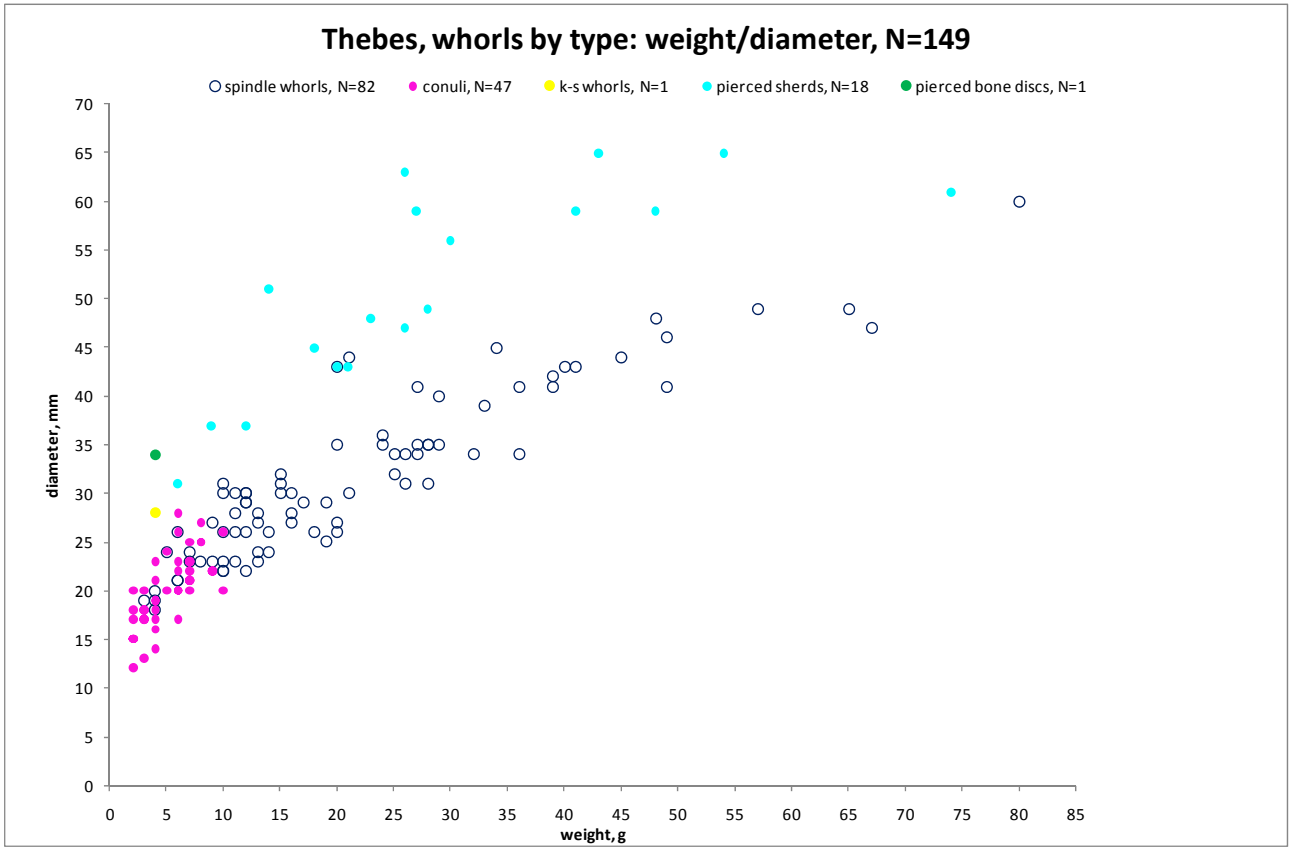

Figure 3: Spinning tools, weight & diameter.

It should be noted that both the conulus and spindle whorl categories include objects made of stone and clay that have a weight equal or less than 8 g, so these two categories overlap to some extent.

Many of the pierced sherds are irregular in shape, and have drilled, double cone shaped holes; because of this, they would have rotated unevenly if used as spindle whorls. Although they may have functioned as whorls, they would not have been optimal for this purpose, and they have therefore been excluded from the technical analyses of the spinning tools. A variety of shapes are present among the remaining whorls, although the majority are conical in form (Figure 4). Conical whorls are present in EH, MH and LH Thebes; in the LH III period, most of the conical whorls are made of stone. All of the dated stone whorls come from LH III contexts, but it should be borne in mind that there are very few whorls of any kind from earlier contexts recorded in the database.

Context date		clay	stone	bone	Total
EH	biconical				0
	concave conical				0
	conical	7			7
	convex	1		1	2
	cylindrical				0
	discoid				0
	spherical				0
	various shapes with hollow top	9			9
Total		17	0	1	18
Context date		clay	stone	bone	Total
MH	biconical				0
	concave conical				0
	conical	3			3
	convex				0
	cylindrical				0
	discoid				0
	spherical	1			1
	various shapes with hollow top				0
Total		4	0	0	4
Context date		clay	stone	bone	Total
LH III	biconical	10	11		21
	concave conical	1	34		35
	conical	17	49		66
	convex		1		1
	cylindrical				0
	discoid		2		2
	spherical	1			1
	various shapes with hollow top				0
Total		29	97	0	126
Context date		clay	stone	bone	Total
Mixed/unknown	biconical	1			1
	concave conical				0
	conical		4		4
	convex				0
	cylindrical				0
	discoid				0
	spherical		1		1
	various shapes with hollow top				0
Total		1	5	0	6
In all		**51**	**102**	**1**	**154**

Figure 4: Spindle whorl shape and material, by date.

Excluding the pierced sherds, there are 131 whorls with a weight and diameter that could be recorded. Figure 5 shows that the nearly all of the stone whorls (88) weigh less than 30 g, whereas the clay whorls are spread more evenly over a wider weight range.

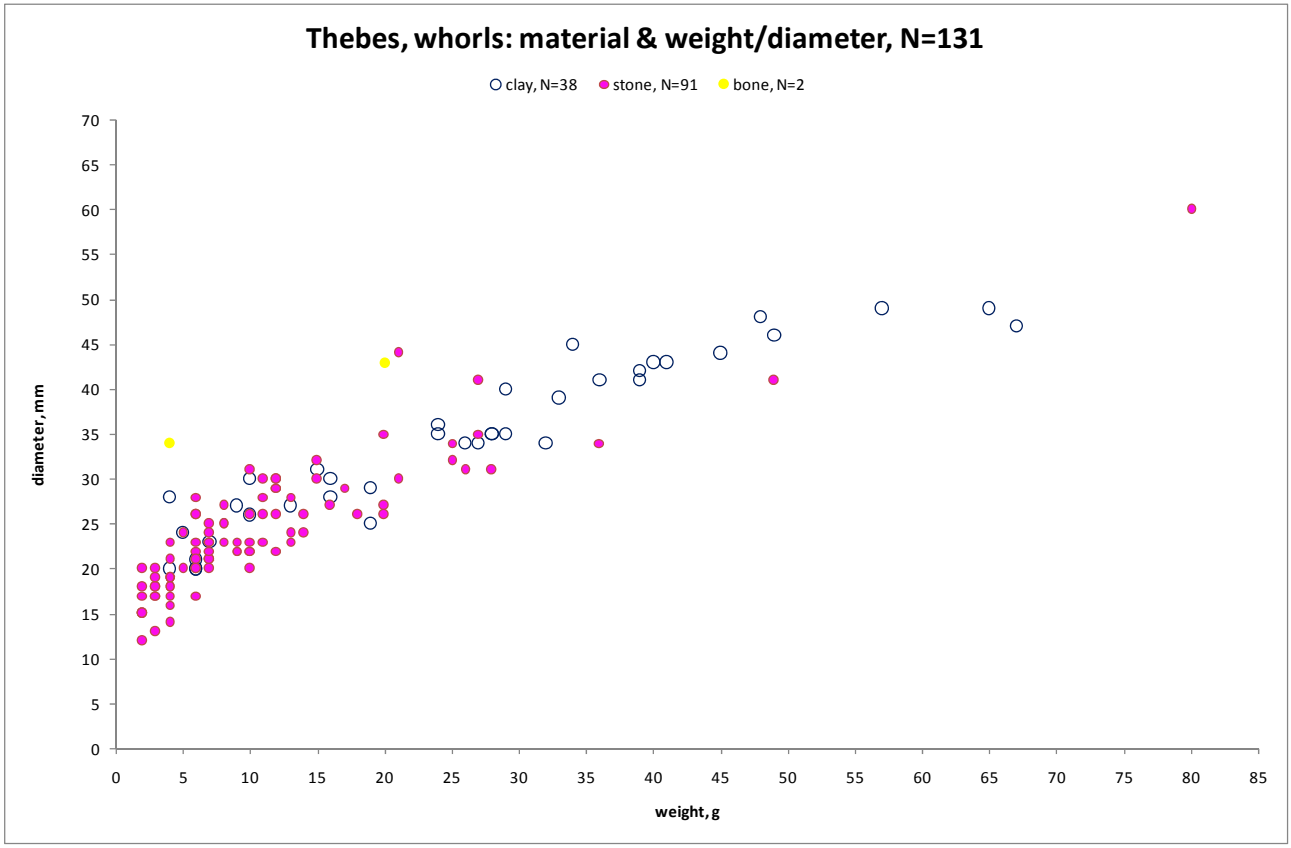

Figure 5: The relation between spindle whorl material and weight/diameter.

There is no clear connection between spindle whorl shape and weight/diameter, although it can be observed that the conical whorls are spread more evenly over a wider weight/diameter range than the other types (Figure 6).

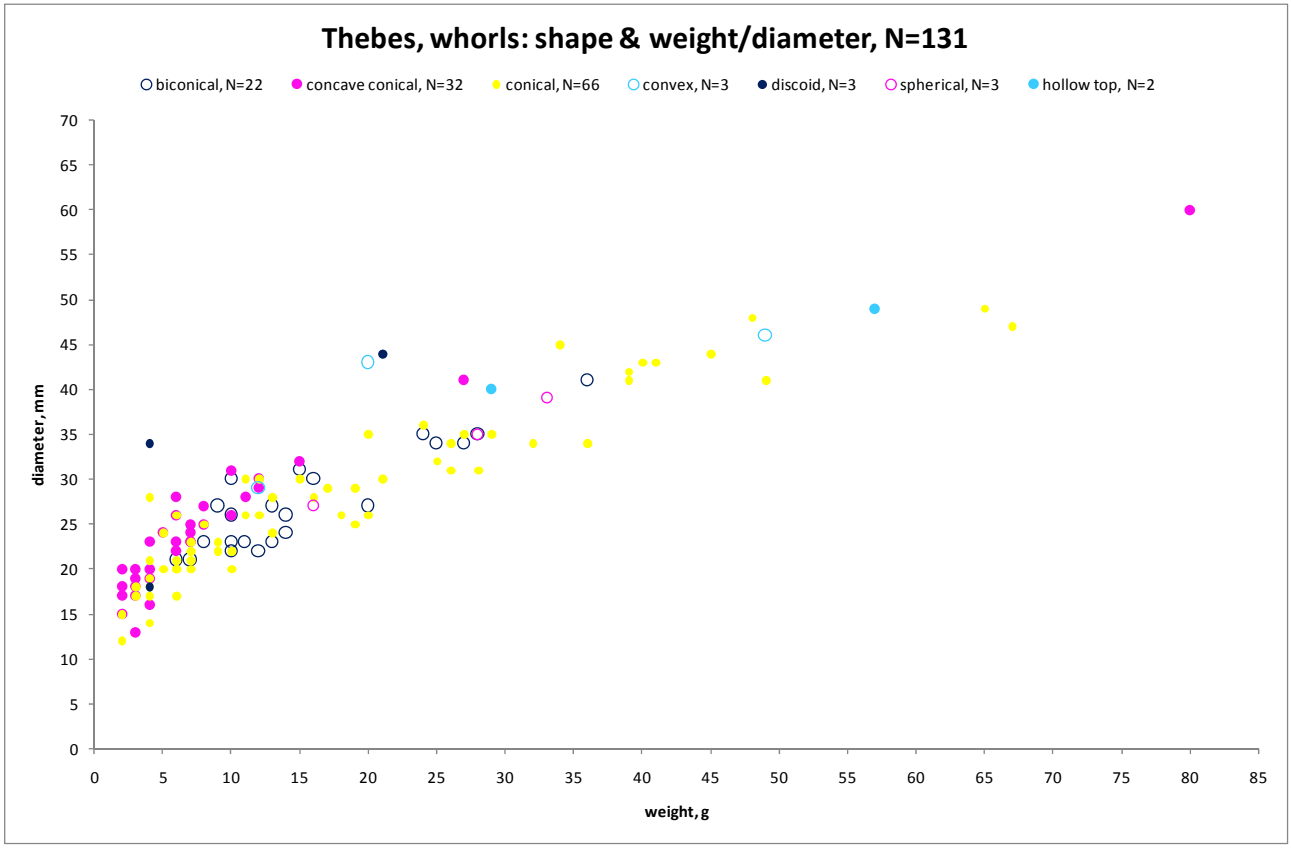

Figure 6: The relation between spindle whorl shape and weight/diameter.

Similarly, there is no clear relationship between the date and the associated weight/diameter range of the spindle whorls, although the large number of LH III whorls weighing less than 15 g should be noted (Figure 7).

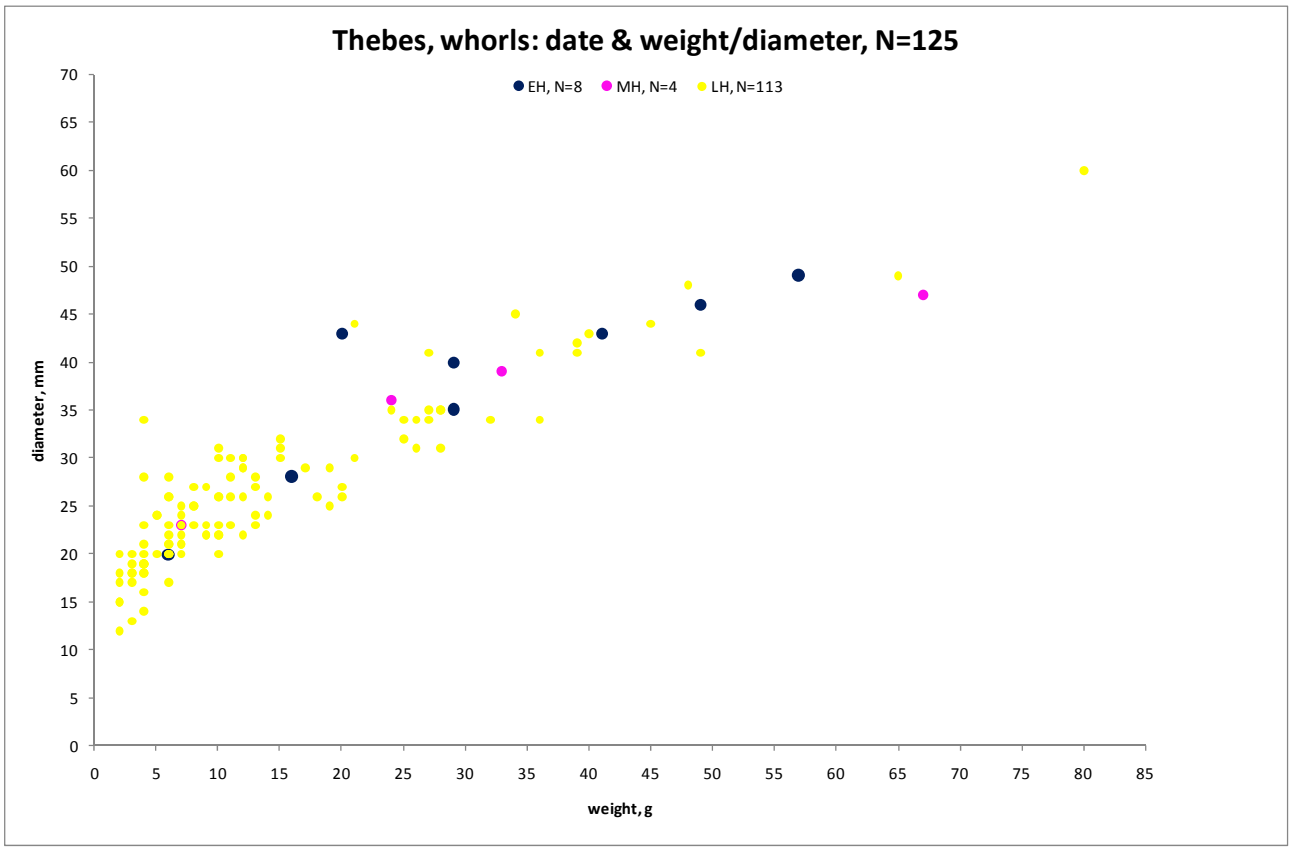

Figure 7: The relation between spindle whorl shape and weight/diameter.

99 of the 113 LH III spindle whorls with a recordable weight and diameter are from LH IIIB/LH IIIC contexts; there is no significant difference between the weight/diameter range of the whorls from LH IIIB contexts and those from LH IIIC contexts (Figure 8).

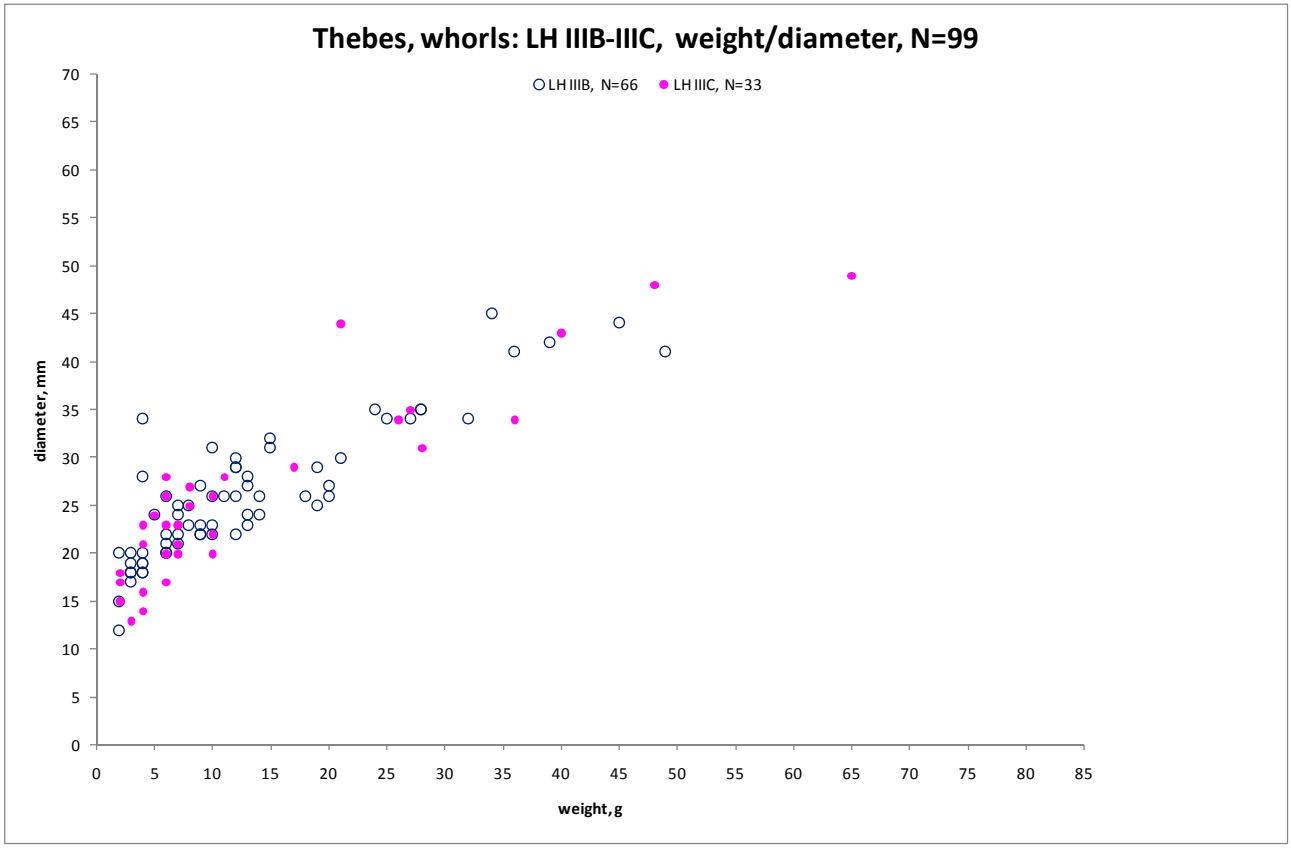

Figure 8: The relation between spindle whorl date and weight/diameter, LH IIIB/C.

Within the individual excavation areas (Figure 9), it is interesting to note, however, that in the case of the Soteriou excavation plot, the weight/diameter range of the whorls is much narrower (but still covering a range); all of the whorls from LH IIIB2 late contexts from this area weigh 13 g or less. This would suggest that a narrower range of yarn types was being spun in this location, hinting at a more focused production of particular thread types. It is therefore also extremely interesting to note that this group of whorls was additionally associated with possible washing installations, a clay 'bath tub', and a number of Linear B tablets recording quantities of wool.

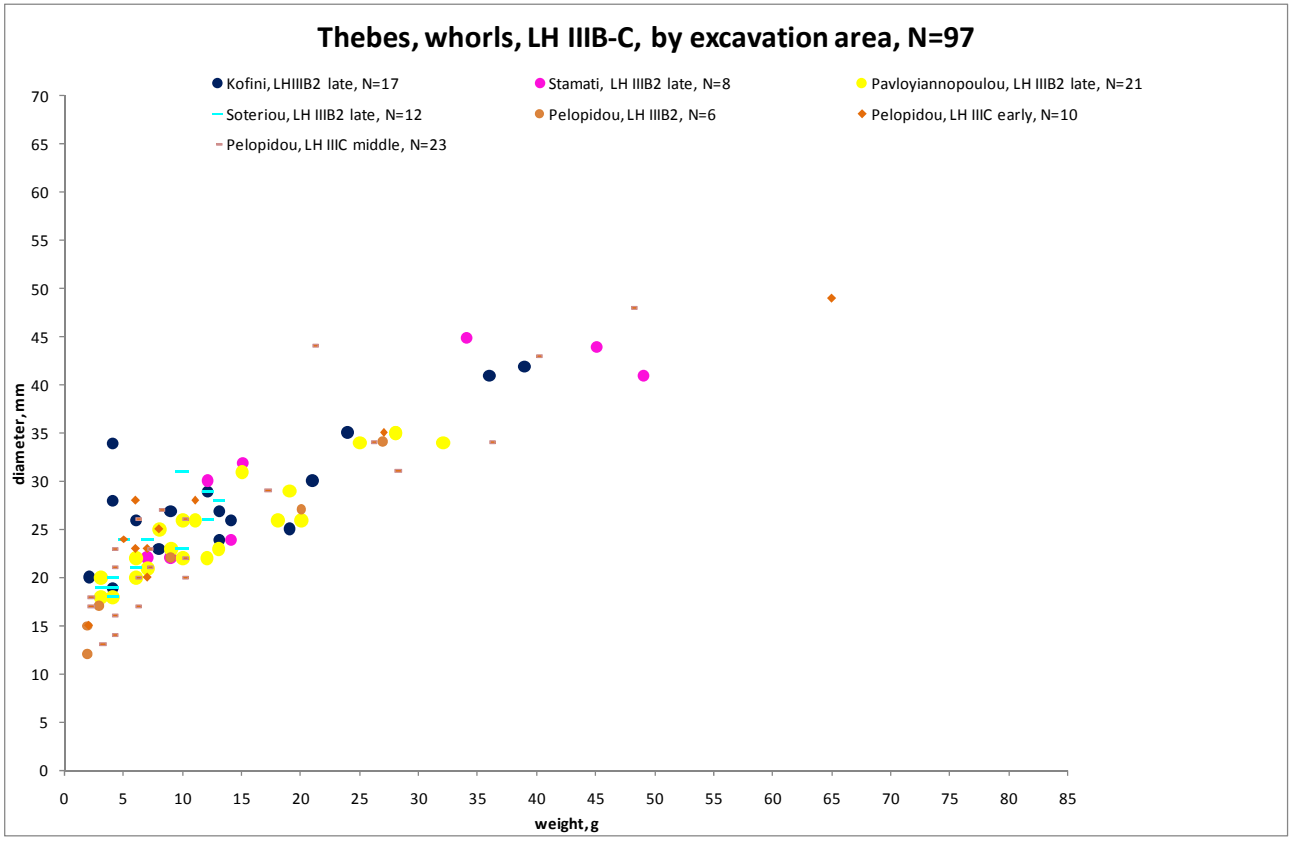

Figure 9: The relation between spindle whorl date and weight/diameter from individual excavation areas, LH IIIB-C (excluding the Loukou plot, with only 2 whorls).

Spinning in Thebes - summary

The range of whorl weights in all periods indicates that a large range of yarn types, from very thin to thick, was being spun at the site throughout the Bronze Age. The large number of LH III whorls with a weight of below 15 g suggests that there was a greater focus on spinning thinner thread during this period, but, because of the low numbers of whorls recovered from earlier periods, it is not possible to say whether this was also the case in the EBA and MBA.

Weaving at Thebes

A total of 33 loom weights are recorded on the database. Six of these were recovered from EH contexts, whilst 27 come from LH contexts (Figure 10). No loom weights were found in MH contexts. Five of the EH weights are cylindrical in form, whilst the sixth is pyramidal truncated. These shapes are not present among the LH loom weights; the majority (21) of the LH loom weights are spool-shaped, and a few discoid and torus weights are also recorded.

	cylindrical long	discoid	pyramidal t.	spool	torus	Total
EHI-III			1			1
EHII late	5					5
EH total	5	0	1	0	0	6
LH				1		1
LHIIIA2				1		1
LHIIIB				1		1
LHIIIB?		1		7		8
LHIIIB late?				2		2
LHIIIB2		1		2		3
LHIIIB2 late		1		6	3	10
LHIIIC middle				1		1
LH total	0	3	0	21	3	27
Overall total	**5**	**3**	**1**	**21**	**3**	**33**

Figure 10: Loom weight type/date.

The majority of the loom weights (25) are made of fired clay, but 7 of the 21 spools are manufactured from unfired clay (Figure 11). One of the three torus weights is additionally made of stone.

Context date		unfired day	fired day	stone	Total
EH	cylindrical long		5		5
	discoid				
	pyramidal truncated		1		1
	spool				
	torus				
	EH total	0	6	0	6
LH	cylindrical long				
	discoid		3		3
	pyramidal truncated				
	spool	7	14		21
	torus		2	1	3
	LH total	7	19	1	27
	Overal Total	**7**	**25**	**1**	**33**

Figure 11: Loom weight type/material.

Sixteen of the 27 LBA loom weights are from securely dated LH contexts, all within LH III; the majority (10) come from LH IIIB2 late contexts (figure 12).

Context date		unfired clay	fired clay	stone	Total
LHIIIA2	cylindrical long				
	discoid				
	pyramidal truncated				
	spool	1			1
	torus				
LHIIIB	cylindrical long				
	discoid				
	pyramidal truncated				
	spool		1		1
	torus				
LHIIIB2	cylindrical long				
	discoid		1		1
	pyramidal truncated				
	spool	2			2
	torus				
LHIIIB2 late	cylindrical long				
	discoid		1		1
	pyramidal truncated				
	spool	3	3		6
	torus		2	1	3
LHIIIC middle	cylindrical long				
	discoid				
	pyramidal truncated				
	spool	1			1
	torus				
	Total	7	8	1	16

Figure 12: Loom weights from securely dated LH contexts.

Twenty five of the 33 loom weights had recordable weights and thicknesses (Figure 13; fragmentary loom weights with a calculated weight have been excluded from the analyses). Although there are only very limited numbers of each type, it can be noted that the discoid loom weights lie within one weight/thickness range (with the two torus weights also lying along a similar weight/thickness trajectory), while the cylindrical and spool weights lie within a separate weight/thickness range (the single pyramidal weight also lies within this range). The majority of the spools (13) weigh less than 100 g, however, whereas the cylindrical weights weigh 103-164 g. With the working assumption that between 10 and 30 threads are the optimal number of threads to be tied to a single loom weight, the group of spools weighing less than 50 g (if they were used as loom weights) would only be suitable for use with extremely fine thread requiring less than 5 g tension each, or for use with threads requiring approximately 5 g tension, but with less than 10 threads fastened to the spool.

The thinner, discoid weights would be more suitable for weaving fabrics with a higher number of warp threads per centimetre. The spools weighing 50+ g and the cylindrical weights would have been better suited for weaving fabrics with slightly fewer warp threads per centimetre (see discussion below).

It should be noted that all of the loom weights with a recordable weight and thickness weigh less than 200 g; therefore, none of them would be ideally suited for use with threads requiring 20 g tension, or more (although it should also be noted that there is one incomplete torus weight weighing 421 g in an LH IIIB2 context, which would have been suitable for use with much thicker thread).

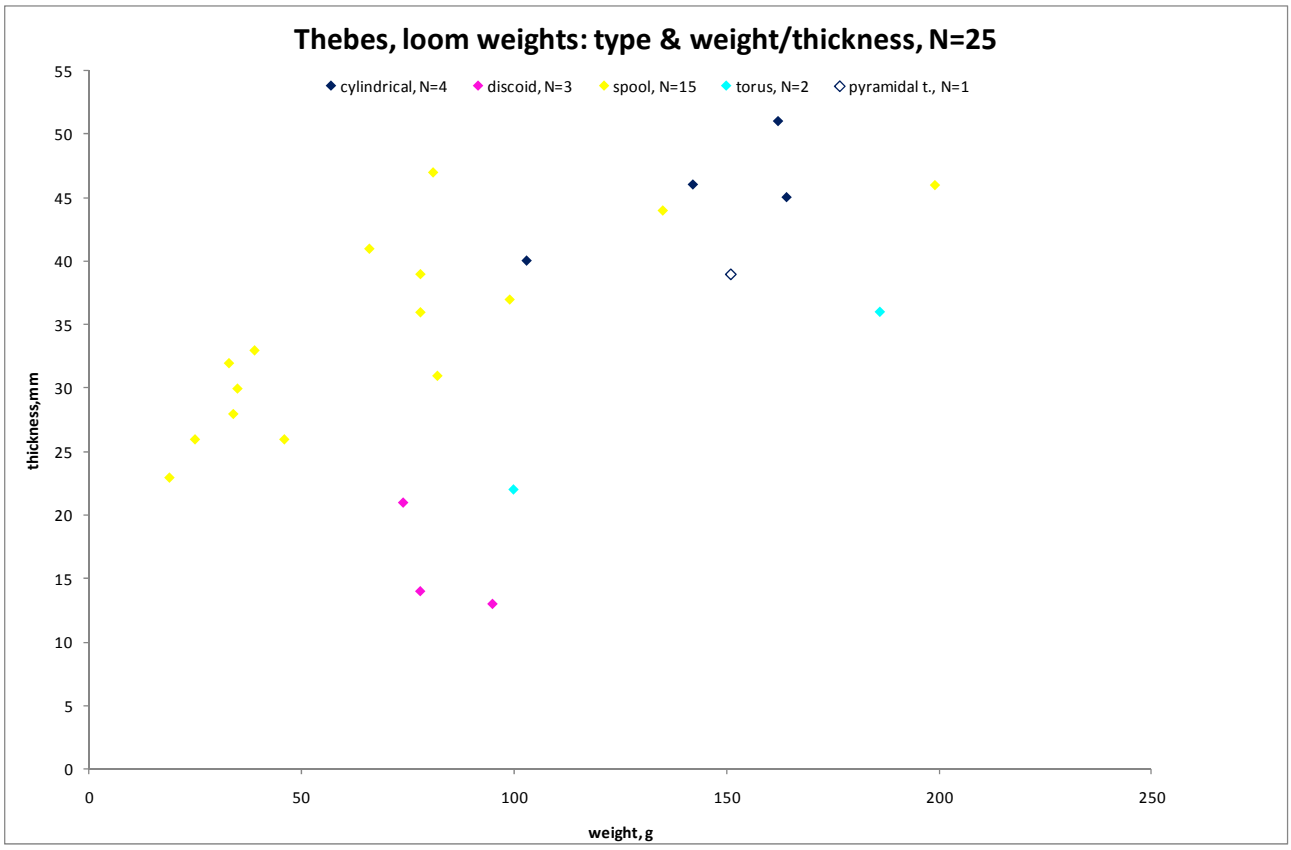

Figure 13: Loom weight type and weight/thickness.

A comparison of the weight and thickness of the loom weights by date (Figure 14) shows that the LH III loom weights (discoid, spool and torus) therefore cover a wider weight/thickness range than the EH loom weights (cylindrical and pyramidal truncated). Sixteen of the 19 LH III weights additionally weigh 100 g or less. Furthermore, it can be seen that for the LH III period, there are

loom weights that lie within both of the two broad weight/thickness ranges, whereas the EH loom weights only fall within one of these ranges.[2]

Except for the two heaviest weights (199 g with a thickness of 46 mm, and 186 g with a thickness of 36 mm, respectively), all of the LH III loom weights would be best suited for use with thin threads, only requiring up to 10 g tension. Used in a tabby weave with two rows of loom weights and with thread requiring 5 g tension, the thinner, discoid loom weights could be used to produce a fabric with 14-29 warp threads per cm; using the spools weighing 50+ g in the same weave and with thread also requiring 5 g tension, on the other hand, would result in a textile with 6-12 warp threads per cm.

The two lightest of the EH loom weights (weighing 103 g with a thickness of 40 mm, and 142 g with a thickness of 46 mm, respectively), would also be best suited for use with threads requiring up to 10 g tension; used in a tabby weave with two rows of loom weights and thread requiring 5 g tension, the fabric produced would have 11-12 warp threads per cm. Thus in a balanced tabby, using the spools and cylindrical weights would result in a more open textile than if using the discoid weights, although it should be noted that the fabrics produced may also have been weft faced (i.e. more weft threads than warp threads per cm).

The remaining three EH loom weights (two cylindrical and one pyramidal truncated) would work well with slightly thicker threads, requiring 10-15 g tension; used in a tabby weave with two rows of loom weights and with thread requiring 10 g tension, the two cylindrical weights could be used to manufacture a textile with 6-7 threads per cm, whereas in the case of the pyramidal weight the resultant fabric would have 8 warp threads per cm.

[2] One spool with a general 'LH' context has been omitted, with a weight of 39 g and a thickness of 33 mm; it would sit within the larger weight/thickness group, however.

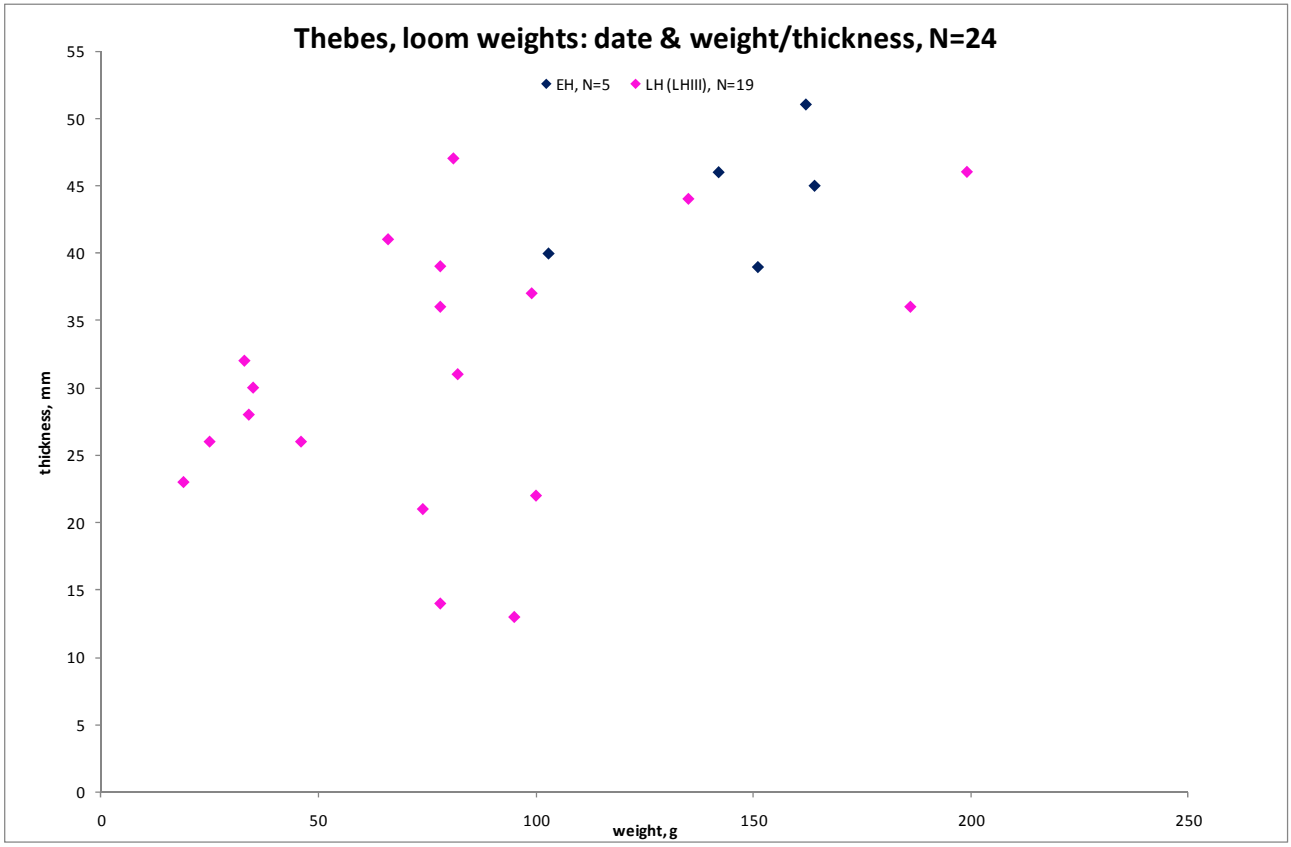

Figure 14: Loom weight date and weight/thickness.

There are no clear weight/thickness groupings among the LH loom weights within individual excavation areas (Figure 15). It is interesting to note that all of the weights from the Christodoulou and Pelopidou plots weigh less than 100 g, but since the number of loom weights from each area is so low, it is not possible to say whether this is just due to survival factors.

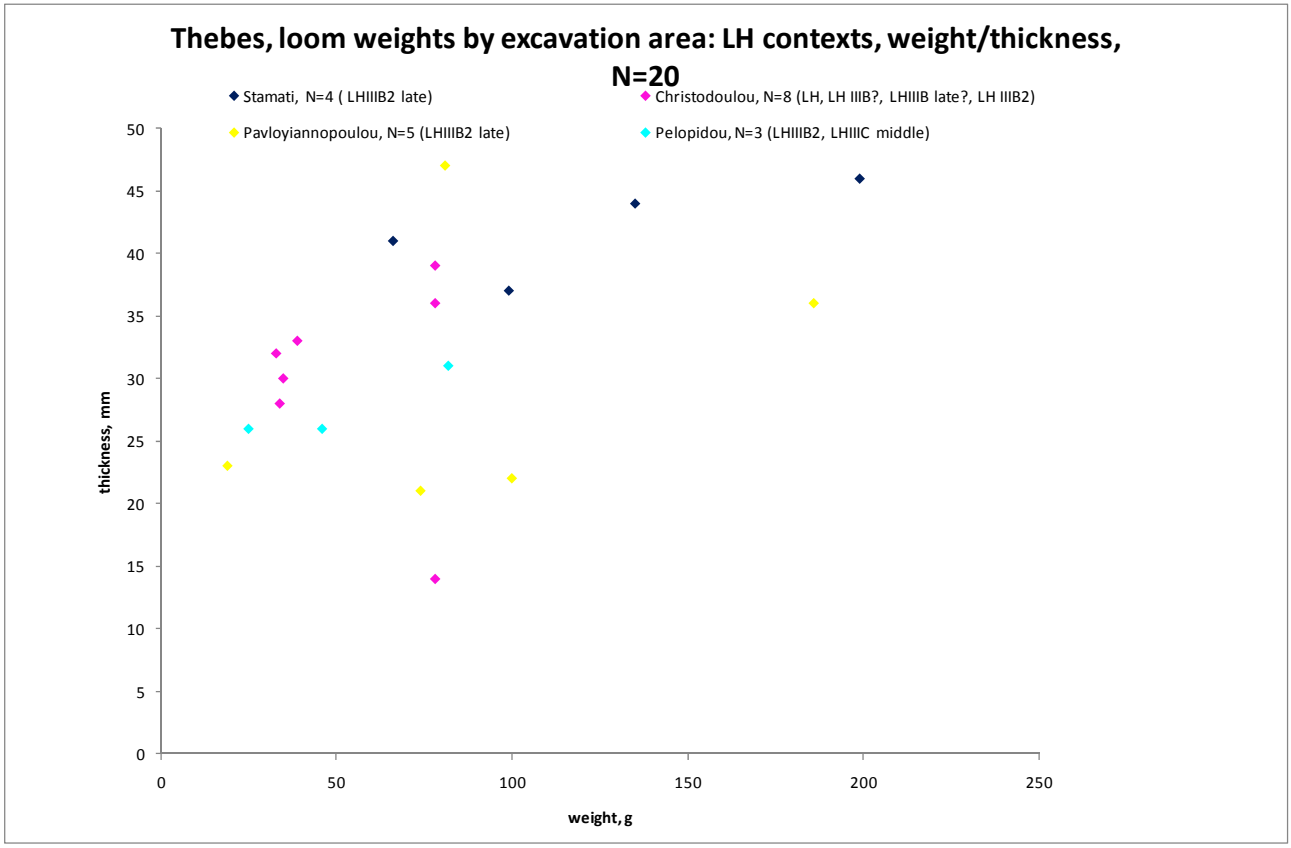

Figure 15: Loom weights by excavation area, LH contexts and weight/thickness.

Spinning and weaving at Thebes

Nearly all of the loom weights from Thebes, dating to both the EH and the LH periods, are best suited for use with thin threads, with most of them being optimal for use with threads requiring up to only 10 g tension (≤ 0.2 mm in diameter); a few would be more suitable for threads requiring 15-20 g tension (0.3-0.4 mm in diameter). The number of whorls weighing around 15 g or less would correspond well with the production of this range of thread types. However, it is interesting to note that in both the EH and the LH periods there are a number of heavier spindle whorls, that would be more suitable for spinning thicker threads which would need correspondingly higher tension. This is true both in the case of the general weight ranges observable in the graphs above, and in the case of loom weights and spindle whorls dating to the same period from the individual excavation areas (Figure 16). Loom weights suitable for weaving a fabric with these thicker threads are not present among the textile tools from the site (although the incomplete torus weight weighing 421 g in an LH IIIB2 context in the Pavloyiannopoulou area should again be noted). It is possible that this is the result of recovery factors, or that another type of loom was being used to weave the heavier fabrics.

	whorls	loom weights
Museum, EHII late	6-57g	103-164g
Pavloyiannopoulou, LHIIIB2 late	3-32g	19-186g
Stamati, LHIIIB2 late	7-49g	66-199g

Figure 16: Loom weights and spindle whorls, comparison of weight ranges within individual excavation areas (for dated contexts where there are more than three loom weights/spindle whorls).