LOOM WEIGHTS AND WEAVING AT MOCHLOS, CRETE, PRELIMINARY REPORT

A total number of 97 objects were recorded in the database (figure 1)[1]. The majority of the tools is dated to LM IB. According to the context description, the tools are primarily from workshops (figure 2). In this report we will focus mainly on the functionality of the loom weights and especially from workshops.

Object date	spinning bowl	loom weight	naturally perforated weight	biconically perforated weight	awl	needle	pin	tool	implement	In all
LM I		1	8							9
LM IB	6	64		5	1	1	2	2	1	82
LM IB?		2								2
Not available		4								4
In all	6	71	8	5	1	1	2	2	1	97

Figure 1. Total number of objects from Mochlos recorded in the CTR database.

Object date	Settlement type	Context type	spinning bowl	loom weight	perforated weight	In all
LM I	settlement	household		1	1	2
		workshop			7	7
LM IB	settlement	household	1	4	1	6
		workshop	5	60	4	69
LM IB?	settlement	household		1		1
Not available	settlement	other		3		3
In all			6	69	13	88

Figure 2. Chronological and contextual distribution of the recorded objects from Mochlos based on object date.

LOOM WEIGHTS AND WEAVING AT MOCHLOS

71 objects are recorded in the database as loom weights. Thereof 60 loom weights are dated to LM IB and derive from workshops. Furthermore, 13 perforated stone weights are included in the analysis. 8 of the perforated stone weights are dated to LM I.

[1] All tools are recorded from Soles, J. S. and Davaras, C. eds. (2003), *Mochlos IA, Period III. The sites*; and Soles, J. S. and Davaras, C. eds. (2004), *Mochlos IC, Period III. The small finds*

Object date	Type	fired clay	stone
LM I	discoid rounded	1	
	not available		8
LM IB	discoid elliptical	40	
	discoid rounded	17	1
	flat trapezoidal	4	
	other	1	
	spherical rounded	1	
	not available		5
LM IB?	discoid rounded	1	
	other	1	
Not available	discoid elliptical	1	
	discoid rounded	3	
In all		70	14

Figure 3. Loom weights and perforated stones: the relationship between date and type/material.

As can be seen in figure 3, the majority of the loom weights is made of fired clay and have a discoid elliptical shape. These loom weights are also generally from workshops (figure 4). Only one loom weight has a spherical rounded shape. 9 of the stone weights are naturally perforated and 5 are intentionally perforated. Information about their shape is not available.

Context type	Type	fired clay	stone
Workshop	discoid elliptical	38	
	discoid rounded	16	1
	flat trapezoidal	4	
	spherical rounded	1	
	not available		11
Household	discoid elliptical	2	
	discoid rounded	3	
	other	1	
	not available		2
In all		65	14

Figure 4. The context types of the loom weights and perforated stones and the relationship between type and material.

Context	Type	fired clay	stone
Building A, room 2	discoid elliptical	1	
	flat trapezoidal	2	
	spherical rounded	1	
	not available		1
Building A, room 4	discoid elliptical	3	
	discoid rounded	1	
	flat trapezoidal	2	
	not available		3
Building B, room 8	discoid elliptical	4	
	discoid rounded	1	
	not available		1
In all		15	5

Figure 5. Loom weights and perforated stones from building A, room 2 and room 4 and loom weights from building B, room 8, the relationship between type and material.

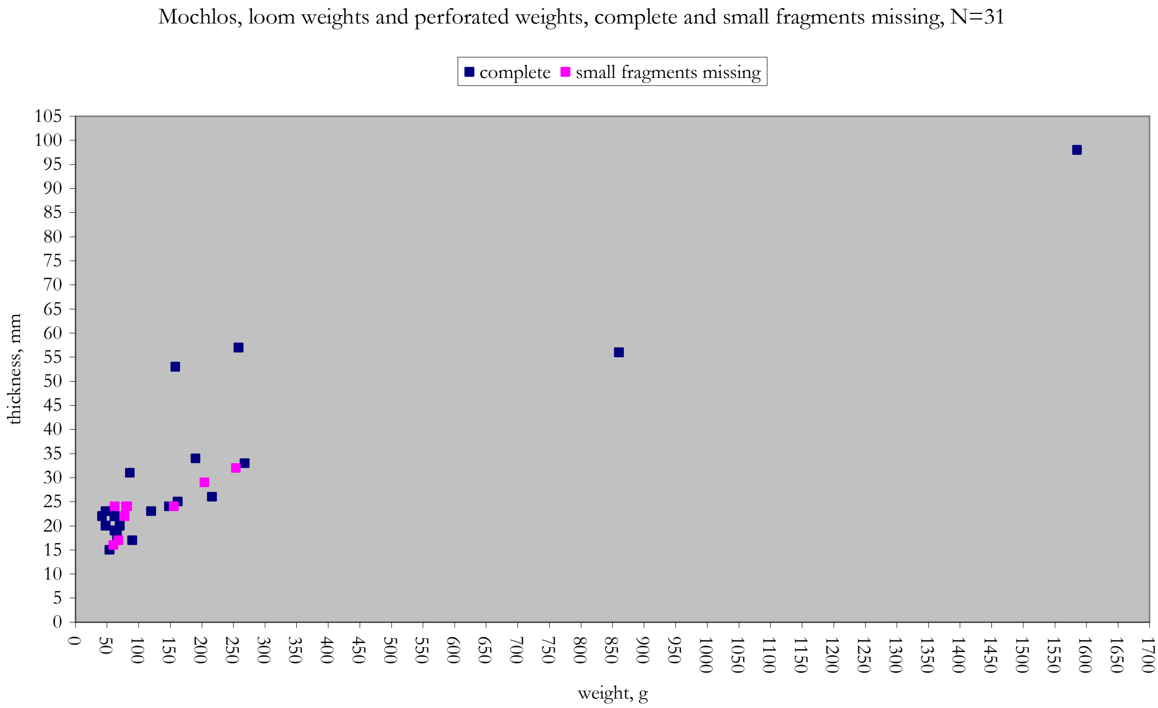

Figure 6. Complete loom weights/perforated weights and loom weights/perforated weights with small fragments missing: weight/thickness.

22 weights (15 loom weights and 7 perforated stones) are completely preserved and on 9 loom weights only small fragments are missing (figure 6). We estimate that the weight of the missing fragments is so relatively low that it would not affect the finished product. We have therefore decided to include the weights with small fragments missing in the analysis, even though they do not have a calculated weight.

Material – type and weight/thickness

As can be seen in figure 7, the weights made of stone vary more in weight and thickness than the weights made of fired clay. Similarly, loom weights with a discoid elliptical shape vary more in weight/thickness than loom weights with a flat trapezoidal shape or a discoid rounded shape (figure 8). Especially the loom weights with a trapezoidal shape form a homogenous group, even though they are not from the same find context: 2 are from Building A, room 2, and 2 others are from Building A, room 4.

It should be noted that the stone weights could also have been used for other purposes, for example as net sinkers, and it is likely that at least the heaviest of these weights did not function as a loom weight. The spherical loom weight differs in weight and thickness from the other loom weights (figure 8).

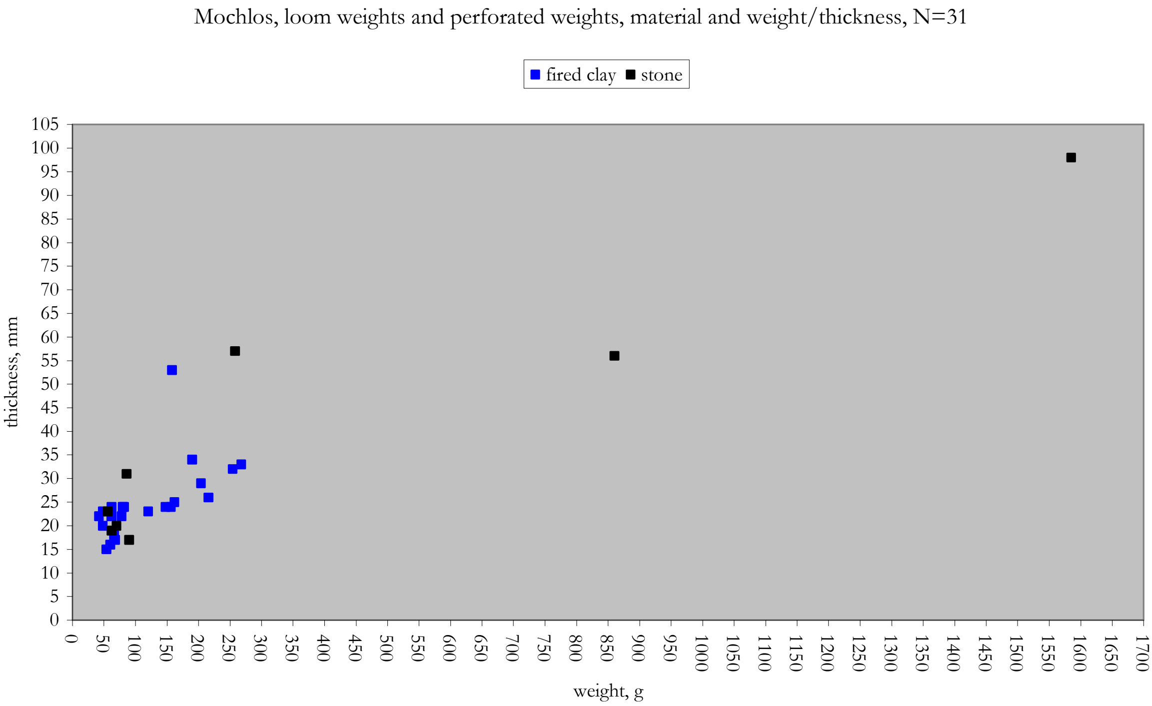

Figure 7. Loom weights and perforated weights: material and weight/thickness

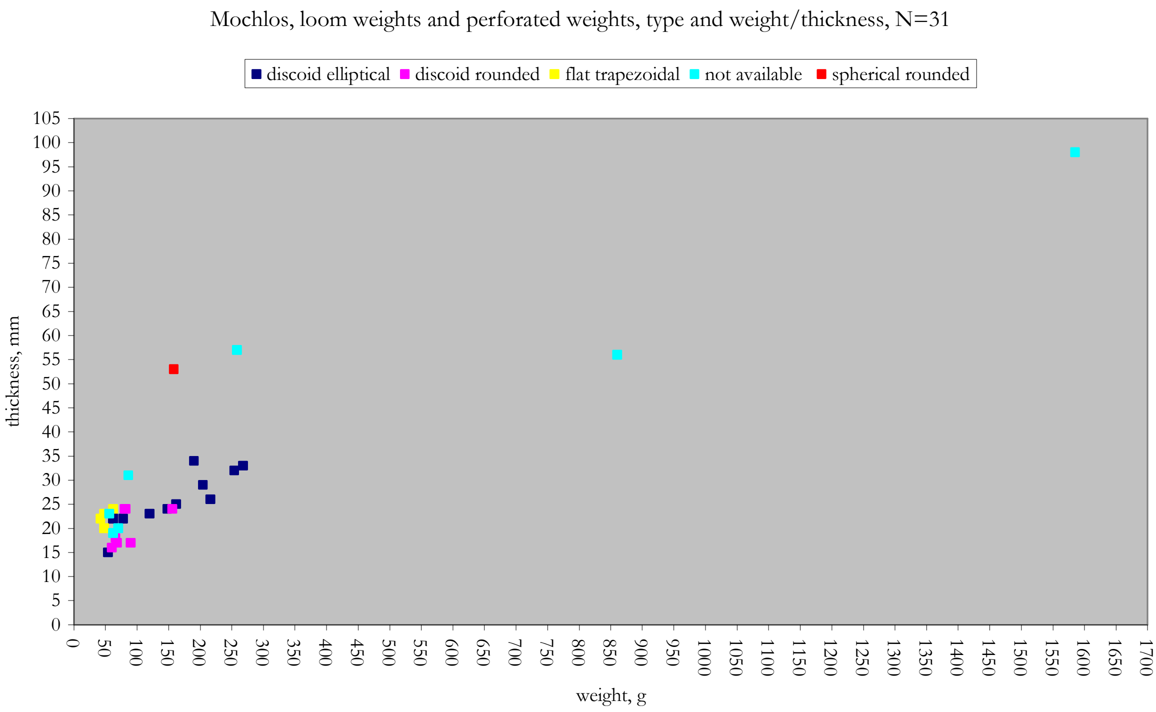

Figure 8. Loom weights and perforated weights: type and weight/thickness

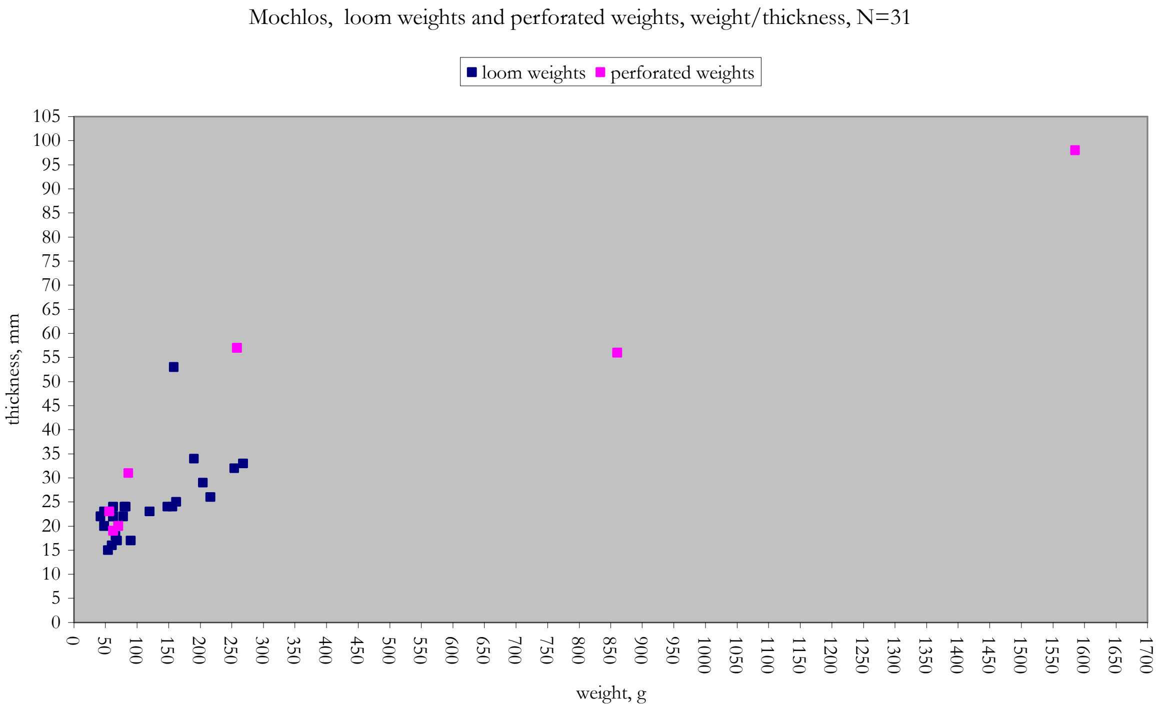

Figure 9. Loom weights and perforated weight: weight/thickness.

As can be seen in figure 9, the loom weights span from 42g to 268g and their thickness varies from 15 mm to 53 mm, while the perforated stone weights vary in weight from 56g to 1585g and in thickness from 19 mm to 98 mm.

Three of the perforated weights (all naturally perforated) and one loom weight differ from the other weights in weight and/or thickness (figure 9).

Some loom weights and perforated weights are from the same workshop and room and we will focus on them in the following analysis.

Figure 10. loom weights/ perforated weights: the relations between context and weight/thickness.

Building A, room 2

5 loom weights are from the Artisan's Quarter, building A, room 2. Three loom weights, with intact weight and diameter, are from the floor deposit. These loom weights vary in weight from 48g to 158g and in thickness from 20 mm to 53 mm. A perforated stone weight (weight: 56g, thickness: 23 mm) is also from this room but no description of where in the room this weight was found is available to us (figure 10).

To elucidate our interpretation of these loom weights we have calculated possible loom setups based on loom weight MOC-IC.153. Please note that these suggestions are based on our experience and experiments but are on the other hand conjectural as to what is optimal.

Loom weight MOC-IC.153, weight 62 g, thickness 24 mm				
	A	B	C	D
Warp threads requiring	10g warp tension	20g warp tension	30g warp tension	40g warp tension
Number of warp threads per loom weight	6	3	2	1
Number of warp threads per two loom weights (one in front layer, one in back layer)	12	6	4	2
Warp threads per cm	5	2-3	1-2	1
TTTC's evaluation of suitability of the tool	TTTC choice	Unlikely	Unlikely	Unlikely

Figure 11. Calculation of possible loom setups with loom weight MOC-IC.153.

The calculation demonstrates that loom weight MOC-IC.153 would function best with a warp thread requiring 10g tension (A) (figure 11). The fabric produced with this loom setup would have 5 threads per cm in warp and weft (if weft faced 10 threads per cm in weft).

The types of fabrics that could have been produced with this loom weight and a warp thread requiring 10g tension (A) would be of a fine quality with very thin threads. A balanced tabby would have an open weave, whereas a weft faced fabric would be denser (figure 12).The two fabrics would thus be visually quite different, although woven with the same thread and loom weight

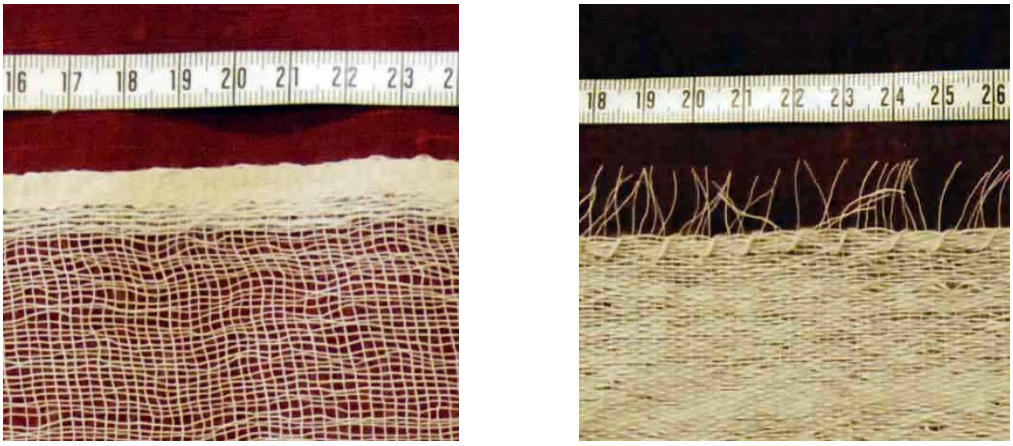

Figure 12. Two fabrics, both woven with threads requiring 10g warp tension. Left: a tabby with app. 5 warp threads per cm and 8 weft threads per cm. Right: a weft faced tabby with app. 6 warp threads per cm and 15 weft threads per cm. (Mårtensson *et al.* 2007).

For TTTC choice A (figure 11) we suggest the following loom setup:

Loom setup for MOC-IC.153 calculated on 10g warp tension (A)
Starting border (width of the fabric): 100 cm
Number of loom weights needed: 82
Numbers of warp threads: 500 threads, 2 m each=1000 m
Weft 1: if a balanced tabby = 1000 m
Weft 2: if a weft faced tabby = 2000 m
Total amount of yarn with weft 1 (+ 2%) = 2040 m
Total amount of yarn with weft 2 (+ 2%) = 3060 m

The calculations demonstrate that the amount of yarn needed is substantial. According to the TTTC experiments it would take approximately 58-87 hours to spin the thread needed to produce the fabric in this setup. Time for sorting and preparing the fibres is not included, neither is time for preparing the setup, weaving and finishing.

Furthermore, to produce a fabric with a width of 1 meter the calculations demonstrate that 82 loom weights are needed. This number is quite substantial but even if the fabric was just 25 cm in width one would have needed approximately 22 loom weights of this type.

The weight and thickness of one of the other preserved loom weights (MOC-IC.154 weight 48g thickness 20 mm) from same floor deposit indicate that it would have been functional in the same weave. It is also interesting to note that it would be possible to produce more or less the same type of fabric with loom weight MOC-IC.155, which is spherical and has a weight of 158g and thickness of 53 mm (figure 13).

Loom weight MOC-IC.155 weight 158g, thickness 53 mm				
	A	B	C	D
Warp threads requiring	10g warp tension	20g warp tension	30g warp tension	40g warp tension
Numbers of warp threads per loom weight	16	8	5	1
Numbers of warp threads per two loom weights (one in front layer, one in back layer)	32	16	10	
Warp threads per cm	6	3	2	
TTTC's evaluation of suitability of the tool	TTTC choice	Unlikely	Unlikely	Unlikely

Figure 13. Calculation of possible loom setups with loom weight MOC-IC.155.

Building A, room 4

9 loom weights are derived from the Artisan's Quarter, building A, room 4. Three loom weights with intact weight and diameter were discovered in the floor deposit. These loom weights vary in weight from 42g to 156g and in thickness from 22 mm to 24 mm. Two complete perforated weights (weight 56g and 860g, thickness 31 mm and 86 mm respectively) are also from this room but there is no description where in the room this weight was found (figure 10).

To elucidate our interpretation of these loom weights we have calculated possible loom setups on loom weight MOC-IC.130. Please note that these suggestions are based on our experience and experiments but are on the other hand conjectural as to what is optimal.

Loom weight MOC-IC.130 weight 156g, thickness 24 mm				
	A	B	C	D
Warp threads requiring	10g warp tension	20g warp tension	30g warp tension	40g warp tension
Number of warp threads per loom weight	15-16	8	5	4
Number of warp threads per two loom weights (one in front layer, one in back layer)	30-32	16	10	8
Warp threads per cm	13-14	6-7	4	3
TTTC's evaluation of suitability of the tool	TTTC choice	TTTC choice	Possible	Unlikely

Figure 14. Calculation of possible loom setups with loom weight MOC-IC.130.

The calculation demonstrates that loom weight MOC-IC.130 would function with both a warp thread requiring 10g tension (A) and a warp thread of 20g tension (B) (figure 14). The fabric produced with loom setup A would have 13-14 threads per cm in warp and weft, but if weft faced 26-28 threads per cm in weft. The fabric produced with loom setup B setup would have had 6-7 threads per cm in warp and weft, but if weft faced 12-14 threads per cm in weft.

The types of fabrics that could have been produced with this loom weight (choice A and B) would be of fine quality with very thin or thin threads. However, the fabrics would be visually different. The first fabric, woven with a warp thread requiring 10g tension (A), would be denser while the second fabric (B) would be more open. If the fabrics were weft faced they would differ even more.

We suggest the following loom setup for TTTC choice A (figure 14):

Loom setup for MOC-IC.130 calculated on 10g warp tension (A)
Starting border (width of the fabric): 100 cm
Number of loom weights needed: 82
Numbers of warp threads: 1300 threads, 2 m each=2600 m
Weft 1: if a balanced tabby = 2600 m
Weft 2: if a weft faced tabby =5200 m
Total amount of yarn with weft 1 (+ 2%) = 5304 m
Total amount of yarn with weft 2 (+ 2%) = 7956 m

The calculations demonstrate that the amount of yarn needed is substantial. According to the TTTC experiments it would take approximately 151-227 hours to spin the thread needed to produce the fabric in this setup. Time for sorting and preparing the fibres is not included, neither is time for preparing the setup, weaving and finishing.

Also in this example the need of loom weights is substantial: 82 loom weights. If the width of the fabric was only 25 cm the setup would require 22 loom weights.

The other two intact loom weights from this context are lighter. The fabric produced with these weights would probably be similar to the fabric produced with MOC-IC.153 (figure 9). If the heavy perforated stone weight (860g) where used as a loom weight the warp thread would be much thicker: threads requiring a warp tension of 30, 40 or 50 g warp tension, and the produced fabric much coarser.

Building B room 8

Four loom weights, thereof 3 complete, derive from Building B, room 8, floor deposit. The loom weights vary in weight from 204g to 268g and in thickness from 26 mm to 33 mm.

To elucidate our interpretation of these loom weights we have calculated possible loom setups on loom weight MOC-IC.101. Please note that these suggestions are based on our experience and experiments but are on the other hand conjectural as to what is optimal.

Loom weight MOC-IC.101 weight 268g, thickness 33 mm				
	A	B	C	D
Warp threads requiring	10g warp tension	20g warp tension	30g warp tension	40g warp tension
Number of warp threads per loom weight	27	13	9	7
Number of warp threads per two loom weights (one in front layer, one in back layer)	52	26	18	14
Warp threads per cm	15-16	8	5-6	4
TTTC's evaluation of suitability of the tool	TTTC choice	TTTC choice	TTTC choice	Possible

Figure 15. Calculation of possible loom setups with loom weight MOC-IC.101.

The calculation demonstrates that loom weight MOC-IC.101 would function well with both a warp thread requiring 10g tension (A), a warp thread of 20g tension (B) and also a warp thread of 30g tension (C) (figure 15). A warp thread of 40g tension (D) is also a possibility for MOC-IC.101. The fabric produced with this loom setup would have had 4 threads per cm in warp and weft (if weft faced 8 threads per cm in weft).The fabric produced with loom setup A would have 15-16 threads per cm in warp and weft, and if weft faced 30-32 threads per cm in weft.

The fabrics that could have been produced with this loom weight would be of different types and depending on which warp thread the weavers chose, the fabrics would be visually very different. However, all fabrics would probably be quite dense compared to the fabrics that could have been produced with MOC-IC.153 (figure 11) and MOC-IC.130 (figure 14)

When focusing on TTTC choice B (figure 13), we suggest the following loom setup:

Loom setup (MOC-IC.101) calculated on 20g warp tension (B)

Starting border (width of the fabric): 100 cm

Number of loom weights needed: 62

Numbers of warp threads: 800 threads, 2 m each=1600 m

Weft 1: if a balanced tabby = 1600 m

Weft 2: if a weft faced tabby = 3200 m

Total amount of yarn with weft 1 (+ 2%) = 3264 m

Total amount of yarn with weft 2 (+ 2%) = 4896 m

The calculations demonstrate that the amount of yarn needed is substantial. According to the TTTC experiments it would take approximately 82-122 hours to spin the thread needed to produce the fabric in this setup. Time for sorting and preparing the fibres is not included, neither is time for preparing the setup, weaving and finishing.

Also in this example the need of loom weights is substantial: 62 loom weights. If one produced a fabric with a width of 50 cm one would need 32 loom weights for this setup.

The weight and thickness of the other two preserved weights from this context indicate that they would have been functional in the same weave setup. These loom weights are very versatile since they can function in many different setups and thereby function in the production of many different types of fabrics.

TEXTILE PRODUCTION IN MOCHLOS LM IB, A SUMMARY

The absence of spindle whorl is not necessarily an indication of the lack of spinning activity. The spindle whorls could have been made of perishable materials and the spinners in Mochlos could also have used a spinning technique that does demand a spindle whorl, just a spindle made of wood. One cannot, however, exclude the yarn was spun somewhere else.

The analysis demonstrates that many types of fabrics, from very fine to quite coarse, could have been produced in Mochlos during LM IB. The production of these fabrics would have taken a considerable period of time to make and demand well prepared raw materials, even-spun threads and a developed knowledge on weaving techniques. The need of a varied production of many types of yarn must have been substantial.

The perforated stone weights could have functioned as loom weights and, as the analysis has demonstrated, these weights could have functioned well together with loom weights that have derived from the same context.

In conclusion: even if the number of recorded textile tools from Mochlos is not substantial, the loom weights under investigation indicate a varied textile production. The study of loom weights that derive from same context furthermore makes it possible to discuss what actually could have been produced at different buildings and rooms. These results can be compared to similar analyses on contexts and loom weights at Mochlos but also to other sites, in and outside Crete. The results will allow us to discuss not only the textiles themselves but also organization, influences etc.