



From Texts to Textiles in the Aegean Bronze Age

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Publication date:
2012

Document version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Nosch, M-L. B. (2012). *From Texts to Textiles in the Aegean Bronze Age*. Paper presented at KOSMOS. *Jewellery, Adornment and Textiles in the Aegean Bronze Age. 13th international Aegean conference held at Copenhagen, April 2010/13eme rencontre égéenne, Copenhague, avril 2010, Copenhagen, Denmark.*

AEGLAEUM 33

Annales liégeoises et PASPiennes d'archéologie égéenne

KOSMOS

JEWELLERY, ADORNMENT AND TEXTILES IN THE AEGEAN BRONZE AGE

**Proceedings of the 13th International Aegean Conference/
13^e Rencontre égéenne internationale, University of Copenhagen,
Danish National Research Foundation's Centre for Textile Research,
21-26 April 2010**

Edited by Marie-Louise NOSCH and Robert LAFFINEUR

PEETERS
LEUVEN - LIEGE
2012

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FROM TEXTS TO TEXTILES IN THE AEGEAN BRONZE AGE*

Textile production is one of the world's oldest crafts. Textiles were made long before pottery and metallurgy. The development of the textile craft closely follows that of agriculture: plant fibres such as flax, hemp, and nettle were utilized for early textile production. Animal fibres such as hair and wool from goat and sheep require animals, thus animal husbandry. The genetic development in the Bronze Age from the hairy to the more woolly sheep,¹ and from brown and black wool to white wool opened up new technological possibilities and innovations such as fulling, felting and dyeing.² In the Aegean, there are rich and varied sources for the investigation of all these aspects of textiles.³

Producing a textile includes several steps in a fixed order, each with its own tools and techniques:⁴ plant fibres such as flax, nettle and hemp require:

- Sowing
- Harvesting
- Rippling
- Retting
- Breaking
- Scutching

Plant fibre work-spaces could consist of pits or larger humid areas for retting, outdoor work-spaces for the dusty breaking, scutching and hackling of fibres, with wooden tools or simply knives. After these processes, which may last days or even weeks, plant fibres subsequently undergo procedures similar to animal fibres, that is:

- Sorting
- Spinning
- Weaving
- Finishing
- Sewing

Furthermore, this *chaîne opératoire* could also include numerous optional stages such as dyeing the wool, yarn or cloth; other cloth types are fulled or felted after weaving; decorative elements can be added according to the function of the cloth and the desire of the users; finally, cloth would often need mending and is frequently re-tailored into new items of clothing, with new functions.

The Mycenaean textile industry has been investigated by several scholars, who have analysed the Linear B texts relating to the administration of textile production,⁵ textiles in

* My sincere thanks to Eva Andersson Strand, Joanne Cutler, Margarita Gleba, Françoise Rougemont, Susan Möller-Wiering, Maurizio Del Freo and Cécile Michel for their collaboration and assistance. This paper is dedicated to Youlie Spantidaki.

1 M. RYDER, *Sheep and Man* (1983).

2 *Prehistoric Textiles*.

3 Interdisciplinary analyses are: B. BURKE, *From Minos to Midas. Ancient Cloth Production in the Aegean and in Anatolia* (*Ancient Textiles Series* 7, 2010); *Prehistoric Textiles*. C. MICHEL & M.-L. NOSCH (eds), *Textile Terminologies in the Ancient Near East and Mediterranean from the Third to the First Millennia BC* (*Ancient Textiles Series* 8, 2010). E. ANDERSSON STRAND and M.-L. NOSCH (eds), *Tools, Textiles and Contexts* (*Ancient Textiles Series*, forthcoming).

4 E. ANDERSSON STRAND, "The basics of textile tools and textile technology – from fibre to fabric," in MICHEL & NOSCH (*supra* n. 3) 10-22.

5 J. KILLEN, "The Wool Industry in Crete in the Late Bronze Age," *BSA* 59 (1964) 1-15; ID., "The Knossos Lc (Cloth) Tablets (Summary)," *BICS* 13 (1966) 105-111; ID., "Two Notes on the Knossos Ak Tablets," in M.S. RUIPÉREZ (ed.), *Acta Mycenaea. Proceedings of the Fifth International Colloquium on Mycenaean Studies*,

iconography,⁶ costumes, accessories and dress codes,⁷ textile terminologies,⁸ the technical and practical aspects of Mycenaean textile crafts,⁹ the relationship between Minoan and Mycenaean textile production,¹⁰ as well as the archaeological evidence.¹¹ Nevertheless, textile production remains a rather blind spot on the cultural and economic map of the Aegean, although we are well aware that it was a vital part of a producing, consuming, trading, and living society of the past.

In the Mycenaean period, textile production was already an age-old craft with more than 4000 years of tradition. The basic technology of twisting fibres into a thread and inserting the

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- Salamanca, 30 March-3 April 1970. II. Minos* 12 (1972) 425-433. ID., "A Problem in the Knossos Lc(1) (Cloth) Tablets," *Hermathena* 118 (1974) 82-90; ID., "The Knossos Ld(1) Tablets," in E. RISCH and H. MÜHLESTEIN (eds), *Colloquium Mycenaicum. Actes du sixième colloque international sur les textes mycéniens et égéens tenu à Chaumont sur Neuchâtel du 7 au 13 septembre 1975* (1979) 151-181; ID., "The Textile Industries at Pylos and Knossos," in T.G. PALAIMA, C.W. SHELMEIRDINE (eds), *Pylos Comes Alive. Industry and Administration in a Mycenaean Palace* (1984) 49-63. ID., "The Linear B Tablets and Mycenaean Economy," in A. MORPURGO DAVIES, Y. DUHOUX (eds), *Linear B: A 1984 Survey* (1985) 241-305. ID., "Some Thoughts on *ta-ra-si-ja*," in S. VOUTSAKI, J. KILLEN (eds), *Economy and Politics in the Mycenaean Palace States. Proceedings of a Conference held on 1-3 July 1999 in the Faculty of Classics, Cambridge* (2001) 161-180. J.L. MELENA, *Studies on Some Mycenaean Inscriptions from Knossos Dealing with Textiles. Minos Suppl.* 5 (1975); M.-L. NOSCH "The Geography of the *ta-ra-si-ja*," *Aegean Archaeology* 4 (1997-2000) 27-44. EAD., "L'administration des textiles en Crète centrale, hors des séries Lc/Le/Ln," *BCH* 122 (1998) 404-406. EAD., "Acquisition and Distribution: *ta-ra-si-ja* in the Mycenaean Textile Industry," in C. GILLIS, C. RISBERG and B. SJÖBERG (eds), *Trade and Production in Premonetary Greece. Acquisition and Distribution of Raw Materials and Finished Products. Proceedings of the 6th International Workshop, Athens 1996* (2000) 42-62; R. FIRTH, M.-L. NOSCH, "Scribe 103 and the Mycenaean Textile Industry at Knossos: The Lc(1) and Od(1)-Sets," *Minos* 37-38 (2002-2003) 121-141. M.-L. NOSCH, "More Thoughts on the Mycenaean *ta-ra-si-ja* System," in M. PERNA (ed.), *Fiscality in Mycenaean and Near Eastern Archives. Proceedings of the Conference held at Soprintendenza Archivistica per la Campania, Naples 21-23 October 2004. Studi egei e vicinorientali* 3 (2006) 161-182. See also *infra*, notes 13, 14 and 16.
- 6 A. MARCAR, "Aegean costume and the dating of the Knossian frescoes," in G. CADOGAN, E. HATZAKI, A. VASILAKIS (eds), *Knossos: Palace, City, State: Proceedings of the Conference in Herakleion organised by the British School at Athens and the 23rd Ephoreia of Prehistoric and Classical Antiquities of Herakleion for the Centenary of Sir Arthur Evans's Excavations at Knossos, BSA Studies* 12 (2004) 225-238. B. JONES, "New Reconstructions of the 'Mykenai'a' and a Seated Woman from Mycenae," *AJA* 113.3 (2009) 309-337. EAD., "A Reconsideration of the Kneeling Figure Fresco from Hagia Triada," in P. BETANCOURT, M.C. NELSON, H. WILLIAMS (eds), *Krinoi kai Limenes: Studies in Honor of Joseph and Maria Shaw, Prehistory Monographs* 22 (2007) 151-158, color plate 18.1-18.5. EAD., "The Clothes-Line: Imports and Exports of Aegean Cloth(es) and Iconography," in *EMPORIA*, 707-715, Plates CLXXVIII-CLXXXII.
- 7 A. MARCAR, "Fashion changes during the Aegean LBA: their nature and potential significance," in E. TAMPAKAKI, A. KALOUTSAKIS (eds), *Pepragmena Th' Diethnous Kritologikou Synedriou, Elounta, 1-6 Oktovriou 2001. A3: Proistoriki Periodos, Techni kai Latreia* (2006) 159-172. EAD., "Reconstructing Aegean Bronze Age Fashions," in L. CLELAND, M. HARLOW, L. LLEWELLYN-JONES (eds), *The Clothed Body in the Ancient World* (2005) 30-43. B. JONES, "Veils and Mantels: An Investigation of the Construction and Function of the Costumes of the Veiled Dancer from Thera and the Camp Stool Banqueter from Knossos," in K. FOSTER, R. LAFFINEUR (eds), *METRON. Measuring the Aegean Bronze Age. Proceedings of the 9th International Aegean Conference, Yale University 18-21 April 2002, Aegaeum* 24 (2003) 441-450, Plates LXXXIV-XC.
- 8 M. LEJEUNE, "Le nom grec de la laine," in A. ERNOUT (ed.), *Mélanges de linguistique et de philologie grecque offerts à Pierre Chantraine (Études et commentaires* 79, 1972) 93-104. E. BARBER, "The Clues in the Clothes. Some Independent Evidence for the Movement of Families," in R. DREWS (ed.), *Greater Anatolia and the Indo-Hittite Language Family. Papers presented at a Colloquium hosted by the University of Richmond, March 18-19, 2000 (Journal of Indo-European Studies, Monograph Series* 38, 2001) 1-14. M. DEL FREO, M.-L. NOSCH, F. ROUGEMONT, "The Terminology of Textiles in the Linear B Tablets, including Some Considerations on Linear A Logograms and Abbreviations," in MICHEL & NOSCH (*supra* n. 3) 336-371.
- 9 E. ANDERSSON, M.-L. NOSCH, "With a Little Help of My Friends: Investigating Mycenaean Textiles with Help from Scandinavian Experimental Archaeology," in *METRON (supra* n. 7) 197-208.
- 10 P. MILITELLO, "Textile industry and Minoan palaces," in *Ancient Textiles*, 35-45. V.P. PETRAKIS, in this volume.
- 11 S. MARINATOS, *Kleidung. Archaeologia Homerica* vol. 1 A (1967). M.E. ALBERTI, "The Minoan Textile Industry and the Territory from Neopalatial to Mycenaean Times: Some First Thoughts," *Creta Antica* 8 (2007) 243-263. BURKE (*supra* n. 3); L. MÅRTENSSON, M.-L. NOSCH, E. ANDERSSON STRAND, "Shape of things: Understanding a loom weight," *OJA* 28.4 (2009) 373-398. E. ANDERSSON STRAND, L. MÅRTENSSON, M.-L. NOSCH, L. RAHMSTORF, "New Research on Bronze Age Textile Production," *BICS* 51 (2008) 171-174. M.E. ALBERTI, V. ARAVANTINOS, M. DEL FREO, I. FAPPAS, A. PAPADAKI, F. ROUGEMONT, in this volume.

threads into a binary system – the textile – did not change over these four millennia. During the Neolithic and Bronze Ages, strategies towards better fibres, more fibres, pigmented fibres, have influenced the craft.¹² However, the major change in the Bronze Age Mediterranean textile production is not a technological shift but a political and cultural one which transformed and structured a domestic household production into standardised, centralised palace production.

When we investigate this “Mycenaean Textile Industry” from a textual point of view, we deal with the palace controlled, recorded – and preserved – documentation of the last administrative years of each of the Mycenaean palaces respectively. It is indeed a very narrow lens through which we perceive “The Mycenaean Textile Industry.” Furthermore, textual textile evidence mainly comes from Knossos and Pylos, while the other Mycenaean palaces Tiryns, Mycenae, Thebes,¹³ and Midea have yielded only very few texts on textile industry – and on other sectors of the economy for that matter.¹⁴ The available evidence is fragmentary, unequally preserved and is limited to matters of palace production and other types of production in which the palatial scribes had an interest.

The iconographic evidence is yet more restricted: here we see primarily elite costumes, stylized, and often revealing a symbolic world. Evidently, scholars have questioned the extent to which the costumes are realistic and representative. Textile scholars, however, have shown that the textile technology of the Bronze Age is perfectly adapted to elaborate patterns and tailored costumes. The wall paintings yield further items of unique information, which may not be evinced from other sources, namely the colours and dyes.

Finally, the archaeological evidence for textile production has been known to archaeologists since the very beginnings of Aegean archaeology. Spindle whorls, loom weights and needles are attested at about every Mycenaean site. According to the archaeological and scientific traditions at the time of publication – as well as the preferences and interests of the excavators – textile tools have been recorded to varying degrees in excavation reports and work on ancient technology.¹⁵

In Mycenaean studies, however, textile production is studied intensively from an epigraphical point of view since more than half of all Linear B tablets deal with textile production in terms of resources – flax and wool – and the monitoring of the palaces’ textile workers¹⁶ and textile production.¹⁷ Wool production¹⁸ and the manufacture of cloth is one of the major economic sectors of craftsmanship, perhaps the most important, at least regarding the need for administrative monitoring and the need for labour; furthermore, the textile sector is also one of the best documented, in particular at Knossos, where near to 2000 tablets concern textile production. The D-series at Knossos, which documents shepherds and their flocks of sheep, alone contains 984 tablets or fragments of such. 231 tablets in the L-series record cloth manufacture, 171 fragments in the Ak and Ai series record textile workers, and 84 Od fragments record wool.¹⁹ At Pylos, it is in particular the flax fields, the production of

12 *Prehistoric Textiles.*

13 M.-L. NOSCH, “The Textile Industry at Thebes in the Light of the Textile Industries at Pylos and Knossos,” in I. RADOVÁ, K. VÁCLAVKOVÁ-PETROVICOVÁ (eds), *Graeco-Latina Brunensia. Festschrift in honour of A. Bartoněk* (2001-2002) 177-189; EAD., “Les allocations de laine enregistrées dans les tablettes en Linéaire B de Thèbes,” *Kadmos* 48 (2009) 77-92. M. DEL FREO, F. ROUGEMONT, “Observations sur la série Of de Thèbes,” presented at the 5th *International Congress of Boeotian Studies, Thebes 10-13 September 2005* (forthcoming).

14 On the Argolis textile production in the Linear B archives, see C. VARIAS GARCIA, in this volume.

15 J. CARINGTON SMITH, “Spinning and Weaving Equipment,” in W. MCDONALD, N.C. WILKIE (eds), *Excavations at Nichoria in Southwest Greece. Volume II: The Bronze Age Occupation* (1992) 674-711. L. CREWE, *Spindle Whorls: A Study of the Form, Function and Decoration in Prehistoric Bronze Age Cyprus* (1998).

16 J. KILLEN, “Epigraphy and Interpretation in Knossos WOMEN and CLOTH Records,” in *Texts, Tablets and Scribes. Studies in Mycenaean Epigraphy and Economy offered to E.L. Bennett, Jr. (Minos Suppl. 10, 1988)* 167-183; J. CHADWICK, “The Women of Pylos,” in *Texts, Tablets and Scribes (op. cit.)* 43-95. M.-L. NOSCH, “Kinderarbeit in den mykenischen Palästen,” in F. BLAKOLMER & H. SZEMETHY (eds), 8. *Österreichischer Archäologentag, vom 23. bis 25. April 1999. (Wiener Forschungen zur Archäologie 4, 2001)* 37-43.

17 For references, see above note 5.

18 KILLEN (*supra* n. 5, 1964); On the Od wool records from Knossos, see M.-L. NOSCH, *The Knossos Od Series. An Epigraphical Study* (Österr. Akad. Der Wiss., *Phil.-Hist. Klasse, Denkschriften*, 347. Band, 2007); on the Of wool records from Thebes, see NOSCH (*supra* n. 13, 2009). DEL FREO, ROUGEMONT (*supra* n. 13).

19 There are in addition 39 Xe fragments by the prolific textile scribe 103, which most probably concern textile

wehanos cloth and also the procurement of cloth via taxation which is well documented. About one hundred tablets record flax in the Na series, and 520 pieces of *wehanos* *146 are expected in the Ma taxation records.²⁰

Through this rich Linear B documentation, we can follow textile crops, the birth of lambs, targets for wool yields per animal, collectors' work, the assignment of wool to workers, the receipt of finished fabrics, distribution of cloth or clothing to dependent personnel, and the storage of cloth in the palatial magazines.

The extraordinary coherence in the various Mycenaean palace administrations is very clear in the textile domain. The textile techniques and textile occupational designations are identical from one palace to another; and the textile types exist in the same range – *wehanos*, *te-pa*, *pa-we-a*, *pu-ka-ta-ri-ja* – and are recorded by the means of exactly the same ideograms and abbreviations.

The abundance of textual documentation, however, conveys a tendency to view Mycenaean textile production as purely a matter of industry, standardised production, targets, rations and textile workers with slave status. We tend to forget that the craft of weaving in most cultures is culturally embedded into cosmological and mythological narratives. Most probably this is also the case in the Mycenaean period despite the silence of the tablets on this aspect due to their purely documentary nature. It is also worth noting that the rich textile terminology in the Linear B tablets is deeply rooted in language and not just terms invented for bureaucratic reasons.²¹ Terms for textiles, tools, and techniques existed long before the Linear B administration was set, and the textile terminology continued to undergo semantic shifts and permeate into the Greek dialects of the 1st millennium BC.²²

Greek textile terminologies

The Indo-European languages share textile terms for wool, and agree on distinguishing between braiding or plaiting, *plekein*, on the one hand, and weaving, *hyphaimo*, on the other. A third term for the weaving implement itself, namely the loom, *histos*, is also found throughout the Indo-European languages, and in Linear B it occurs as an occupational designation, *i-te-we* and *i-te-ja-o*. It is worth noticing its root **sta-* from *histamai*, inferring a stable implement, the upright loom. In classical Greek it was also the term for the mast on a ship; the original sense, however, is clearly '(standing) loom', and it is significant that the Greeks, when introducing the sail into the shipbuilding technology, chose to place a 'loom' on the ship, being a wooden construction onto which a textile is fixed.

Elizabeth Barber contextualizes the linguistic knowledge within Aegean and Near Eastern history and archaeology. She argues that since the Indo-Europeans share the same term for the woolly, spinnable animal fibres – *wool* in English, *Wolle* in German, *eiros* in Greek, *hulana* in Hittite, this suggest that around 4000 BC, when the woolly sheep started to develop its coat, the Indo-European speakers were still living together:²³

"The fact that the word from which English wool comes (which is semantically opposed to hair and other fibres) is attested in Hittite as *hulana*, laryngeal and all, warns us right off that Anatolian, Celtic, Germanic, Indo-Iranian, Balto-Slavic, Armenian, Greek, Latin, and the rest must still have been fairly unitary when woolly sheep began to spread rapidly up from the Fertile Crescent around 4000 BC. Here, then, is our first strong linguistic tie to datable events: Anatolian and the other groups must not yet have parted company at roughly 4000 BC, if indeed they lived north of, say, Baghdad."

It is also an overlooked aspect of Mycenaean textile production that it is not at all unique in the Aegean Bronze Age palace economies. Systematic comparisons with the Near Eastern

administration as well.

20 F. ROUGEMONT, "Flax and Linen Textiles in the Mycenaean palatial economy," in *Ancient Textiles*, 46-49. M. PERNA, *Recherches sur la fiscalité mycénienne* (2004).

21 DEL FREO, NOSCH, ROUGEMONT (*supra* n. 8) 336-371.

22 *Prehistoric Textiles*.

23 BARBER (*supra* n. 8) 6.

and Egyptian texts yield both further background information, more details on the technical vocabulary and linguistic connections: The Greek word for a long shirt, *khiton*, *ki-to* in Linear B, derives from the Semitic root *ktn*; the Akkadian term for linen is *kitûmbut*; the Old Assyrian *kutânum* textile is made of wool and the Arabic *el koton* and English word for cotton today has the same root. This example illustrates, on the one hand, how connected some textiles terms are across time and space, but it also illustrates with how much care we must conduct the etymological and terminological enquiry with constantly changing semantics as the common thread. Textile terms travel fast, and over long distances!

Textile tools

Textile tools are most often studied in terms of their proper manufacture and decoration, and less as tools for textile production. The earliest evidence for the warp-weighted loom comes from Central Europe ca 5500 BC, but the terminology for changing the shed and more advanced mechanization of the loom does not seem to be of Greek origin: the term for the heddles (*mitos*) is of Semitic origin, and the words for the heddle bar (*kanon*) and shed bar (*kairos*) are also of non Indo-European origin.²⁴

Textile tools found in archaeological excavations have traditionally been paid only cursory attention, and studies have mostly been limited to the publication of a tool catalogue. During the past decade, however, several important studies focusing on the interpretation of textile tools have been carried out.²⁵ Preserved textile tools of fired clay include spindle whorls, loom weights and spools. Metal tools such as needles are also sometimes found, along with bone tools such as combs, needles, and distaffs. Through ethnographic studies we have gained knowledge of tool function, about the different processes such as fibre preparation, and about weaving techniques.²⁶

In 2005-2009, the Danish National Research Foundation's Centre for Textile Research (CTR) developed a new analytical tool for the analysis of data on Bronze Age textile tools from the Eastern Mediterranean area.²⁷ This entailed the design of a database, which has allowed us to process and compare large amounts of data recorded by our collaborators. The analysis of the data is further being combined with experimental testing by skilled craftswomen. More than 10,000 Bronze Age textile tools have been analysed so far and our international team has thus established solid ground for analyses and comparisons. This research tool enables the functional analysis of tools, combined with contextual data and the tools' distribution patterns, and makes it possible to assess the nature and level of textile production and its changes and developments in and between different sites and regions. While the Linear B texts provide toponyms and the number of women and children, the new method enables us to suggest how and where textile production was organized and carried out, what types of textiles were produced, and how long it took.

Textile processes attested in Linear B, in archaeological contexts and combined with experimental tests and textile craft knowledge

The textile tool types used at the time of the Linear B records had already been in use for several millennia, and continued to be in use for a further two to three millennia. The textile techniques, too, had been in place for thousands of years and remained so until the medieval period.

24 *Prehistoric Textiles*, 281: "The terms for the mechanization of the weaving process are also without Indo-European etymologies"; BARBER (*supra* n. 8) 7.

25 *Prehistoric Textiles*; E. ANDERSSON, *Tools for Textile Production from Birka and Hedeby (Birka Studies 8, 2003)*. M. GLEBA, *Textile Production in Pre-Roman Italy (Ancient Textiles Series 4, 2008)*; MÅRTENSSON, NOSCH, ANDERSSON STRAND (*supra* n. 11).

26 M. HOFFMAN, *The Warp-Weighted Loom. Studies in the History and Technology of an Ancient Implement (Studia Norvegica 14, 1964)*.

27 MÅRTENSSON, NOSCH, ANDERSSON STRAND (*supra* n. 11).

Combing

Raw wool fibres necessitate both cleaning, sorting and combing. The verb used in the 1st millennium BC is πέκω, “comb” and the verb is attested indirectly in Linear B through the occupational designation *pe-ki-ti-ra*₂, “female combers.” Combing is the Bronze Age technique which provides clean, parallel and long fibres, while carding is an Iron Age technology which mixes long and short fibres. Combs are attested archaeologically.

In experimental tests undertaken by the CTR, the laborious processes of cleaning, sorting and combing were tested. After sorting and cleaning, a 2.7 kg fleece had been reduced to 1.1 kg of rather homogeneous wool, thus only 40% of the raw wool was left. Then the wool was combed with wooden combs and the wool was fastened in the comb and pulled out with one hand into a band of fibres. The wool was now ready for spinning. In this process 22% of the wool was discarded. Thus 858 g of wool would remain. That is only 32% of the 2.7 kg of raw wool (Pl. XVIIIa).

It took about 6 hours for the two experienced CTR textile technicians to prepare 170 g of wool, thus ca 15 g pr person pr hour.

Spinning

There are women termed *a-ra-ka-te-ja* “female spinners,” attested at Thebes, Pylos and Knossos, and they are recorded with their children.²⁸

Spinning takes time: it is *de facto* one of the most time-consuming processes in textile production. The spinning of plant fibres and animal fibres is more or less equally time-consuming, and also depends on the spinners’ skill and preference. The degree of preparation of the fibre will allow more or less smooth spinning. The weight of the spindle and spindle whorl defines the diameter of the thread, and spinning on a light spindle whorl requires skill, good fibre quality, well-prepared fibres, and considerable spinning time for the very fine threads. Training, experience and sharp eyes are important for a good spinner. The average annual production thus depends on a variety of technical and human parameters (Pl. XVIIIb).

However, it is possible to provide some figures for this vital stage of production: based on numerous tests by highly experienced spinners, the average output of thread/h is:

- ca. 50 m of yarn/h (spun on an 18 g whorl)
- ca. 40 m of yarn/h (spun on an 8 g whorl)
- ca. 35 m of yarn/h (spun on an 4 g whorl)

These estimates only take the actual spinning time into account; time for the cleaning, sorting and preparation of the wool has to be added.

At Pylos, there are two records of groups of spinners preserved.

PY Aa 89 (S60-H4/Archives room)

a-ra-ka-te-ja MUL 37 ko-wa 26 ko-wo 16 TA 1

“37 women spinners, 26 girls, 16 boys, one supervisor”

PY Aa 240 (S240-H1/Archives room)

a-ra-ka-te-ja MUL 21 ko-wa 25 ko-wo 4 TA 1[

“21 women spinners, 25 girls, 4 boys, one supervisor”

There must have been many more workers occupied with spinning. However, if we focus only on these 58 women and 71 children, we can hypothesise the following work capacities:

Assuming an adult to be 1 spinner unit and a child to be 0.5 spinner unit, these two tablets record 93.5 spinner units. Spinning 300 days in a year, 10 hours a day, these women and children would produce the following annual output:

- ca. 14025 km of yarn/year (spun on an 18 g whorl), or
- ca. 11220 km of yarn/ year (spun on an 8 g whorl), or
- ca. 9815.5 km of yarn/ year (spun on an 4 g whorl)

28 TH Of 34, KN Ak 5009, Lc(1) 531, PY Aa 89, Aa 240, Ad 380, Ad 667.

The CTR spinners have, in numerous tests, arrived at the following spinning outputs: of 100 g of clean and prepared wool they could spin:

- 623.5 m on an 18 g spindle whorl, or
- 1031 m on an 8 g spindle whorl.

This can be compared to a Thebes tablet in which one or more spinners receive 1 unit of wool, equivalent to 3 kilos (Pl. XVIIIc).

TH Of 34 (303/Epam. str.)
 .1 a-pi-qo-ro , ne-wa , ko-tu-ro₂, DA , LANA 3 [[PA 1]] []
 .2 a-ra-ka-te-ja , pa-ra-ja LANA 1 []
 “Servant(s), young, the DA supervisor Κότυλος, 3 units of wool
 Spinner(s), old, 1 unit of wool”

If we assume that this was 1 unit of raw wool which required treatment, and which would reduce the weight to about 1.5 kilos of clean, combed wool, then it would yield

- 9352.5 m if spun on an 18 g spindle whorl, or
- 15465 m if spun on an 8 g spindle whorl.

If there were only one spinner recorded on the tablet (the Linear B form *a-ra-ka-te-ja* does not allow determining singular or plural forms), then it would take her 187 hours to spin 9352.5 m on an 18 g spindle whorl, or 387 hours to spin 15465 m on an 8 g spindle whorl. Thus, one Mycenaean unit of wool can produce yarn to the equivalent of 10-15 km of yarn, or even more if spun on a very light spindle whorl, or alternatively, even more coarse yarn, if the wool is less cleaned and sorted and the spinner employs all the raw material.

Weaving

Most parts of the warp-weighted loom are not preserved archaeologically, the exception being the loom weights. The Linear B documents furthermore preserve attestation for both male and female weavers: *i-te-ja-o*, feminine genitive plural form, “of the female weavers” (PY Ad 684), and *i-te-we*, masculine dative singular (*histewei*) “for the male weaver,” or nominative-accusative plural form (*histewes*) “male weavers” (PY Un 1322) (Pl. XVIIIId).²⁹

Late Bronze Age Aegean clothing – epigraphy, epics and iconography

Men, women and children would dress in garments according to their gender, age and status. It is striking that within the Mycenaean repertoire of textiles and garments, no reference is made to the gender of the users. Mycenaean garments and textiles are from an administrative point of view entirely unisex. This contrasts strongly with the iconographic world of Late Bronze Age frescoes. “The most valuable corpus of material which enables the evaluation of the degree of rigidity of gender boundaries in Late Bronze Age Greece are depictions of male and female clothing,” writes Georgina Muskett.³⁰ “The use of dress to emphasise gender had a strong tradition in Mycenaean Greece, with certain styles of dress restricted to one sexual category appearing to reinforce differences between males and females within the types of behaviour depicted in art.”³¹ A clear gender division is evident in the iconic clothing: female ceremonial costumes of short-sleeved bodice and ankle-length flounced skirt, while men wear breechcloth with a codpiece to display their gender. There are, however, also examples of men and women clothed in the same type of costume.³² This is in particular the tunic type of

29 Another possible indirect piece of evidence for textile tools if Bronze Age tablet weaving. The belt termed *the Girdle of Ramses* on exhibit at the City Museum in Liverpool is considered a table-woven band and dated to 1200 BC. See M. SHUETTE, “Brettchenweberei,” *Ciba-Rundschau* 128 (1956). The belt was reconstructed in 1931 by Margrete Scharlau-Staudinger with tablet-weaving techniques. On tablet-weaving, see also *Prehistoric Textiles*.

30 G. MUSKETT, “Gender boundaries in Late Bronze Age Greece: The contribution of Dress,” in C. GALLOU, M. GEORGIADIS, G. M. MUSKETT (eds), *Dioskouroi. Studies presented to W.G. Cavanagh and C.B. Mee on the anniversary of their 30-year joint contribution to Aegean Archaeology* (2008) 90.

31 MUSKETT (*supra* n. 30) 90.

32 MUSKETT (*supra* n. 30) 90.

garment, which may be worn by both women and men in Mycenaean iconography. Muskett suggests that this rather unisex garment type was the clothing of every-day life, and this contrasts with the strongly gendered garments, breechcloth, skirts, bodices etc., which function in an iconographic environment of cult and rituals.³³ However, even within the ritual world depicted in Mycenaean art, gender is not rigidly defined, and examples of ambiguous signs blur the traditional idea of strict gender division as seen in bodies and clothing.³⁴

Hans van Wees has emphasised a similar striking element of Homeric costume.³⁵ The standard costume elements are embedded into gender: women wear *peplos* and veil – men wear tunic and cloak. This pattern transgresses social hierarchies since Odysseus and his swineherds too wear the male costume of tunic and cloak, while princesses, goddesses and *amphipoloi* all wear *peplos* and veil. The costume elements are thus rather gender markers than status markers. “Status distinctions therefore have to be made within a largely uniform dress code,” writes van Wees,³⁶ and “gender differentiation was evidently so important that it outweighed distinctions of status.”³⁷

Homeric textile and costume display gender but also have other vital societal functions. Beate Wagner-Hasel has highlighted how textiles play an important role as gifts and as a gender-specific communication between women.³⁸ Nausikaa’s mother, the queen Arete, recognizes the tunic and cloak which Nausikaa gave to Odysseus: they are the result of her own craft made together with her maids (*Od.* 7.234-5). She also understands her daughter’s message through the gift of cloth: that this is a foreigner worthy of marriage. The textiles and garments thus serve as means of communication between women – mother and daughter – in a ‘language’ which is not understandable by men. “The intended audience for displays of weaving skill consists primarily of the women,” van Wees concludes.³⁹ Likewise, in *Od.* 15.126-130, Helen gives a *peplos* to Telemachus. She proudly claims that she made the *peplos* herself, thereby making a display of her own skill. She furthermore instructs him not to keep the garment but to pass it on to his mother Penelope who must in turn pass it on to his wife when he marries.⁴⁰

The standardised and mass-produced Mycenaean textiles and garments recorded in the Linear B tablets thus seem quite different from the gendered, sophisticated and individualised costumes of the frescoes and the epic world.

Producing Mycenaean textile: time and resources

Nearly all men, women and children would directly or indirectly participate actively in the Mycenaean textile production, either in home production, or in the palace-organised production. Textile researchers have measured how time-consuming textile production is, and it can be concluded that this activity must have formed a constant occupation for the majority of any population in prehistory.

In a series of systematic tests we have calculated the time needed to make a textile. Spinning is one of the most time-consuming processes, but also the cleaning, sorting and preparation of the yarn need many hands. This knowledge can be combined with the Linear B evidence. It requires 5 units of wool to make 3 *pa-we-a*, thus ca. 1.67 unit of wool per piece or 5 kg

33 MUSKETT (*supra* n. 30) 93: “Accordingly, differences in costume were seemingly apparent only when Mycenaean men and women were involved in ceremonial activities.”

34 MUSKETT (*supra* n. 30) 95. See also the scene from the *Iliad* which illustrates the cross dressing and the passage from the female to the male world via the changing of clothes: The goddess Athena prepares for war and therefore removes her *peplos* and instead dresses in a tunic (*Il.* 5.734-736, 8.385-387).

35 H. VAN WEES, “Clothes, Class and Gender in Homer,” in D. CAIRNS (ed.), *Body Language in the Greek and Roman Worlds* (2005) 12.

36 VAN WEES (*supra* n. 35) 13.

37 VAN WEES (*supra* n. 35) 16.

38 B. WAGNER-HASEL, *Der Stoff der Gaben. Kultur und Politik des Schenkens und Tauschens im archaischen Griechenland* (2000).

39 VAN WEES (*supra* n. 35) 21.

40 On the topic of weaving and women, see E. BARBER, *Women’s Work. The First 20,000 Years: Women, Cloth, and Society in Early Times* (1994). M.-L. NOSCH, “Women, weaving, and plotting,” in D. NAKASSIS, J. GULIZIO (eds) *KE-RA-ME-JA: Studies presented to X Y*, forthcoming.

of raw wool. If we follow the CTR experimental testing, then the 5 kg should in the cleaning and sorting processes be reduced to 32% of the original weight, thus 3.4 kg of prepared clean wool. The combing would reduce this further with 22 % to 2.65 kg of wool ready to be spun. Our spinners, based on numerous tests, arrived at the following spinning outputs: of 100 g of wool they could spin 623.5 m on an 18 g spindle whorl, or 1031 m on an 8 g spindle whorl (Pl. XIXa).

If we employ these data on the Mycenaean *pa-we-a*, it would mean that the 2.65 kg of prepared wool would yield 16,522.75 m if spun on an 18 g spindle whorl, or 27,321.5 m if spun on an 8 g spindle.

These are astonishingly large figures for one piece of cloth. Keep in mind that a *pa-wo* is the smallest of the standardised Mycenaean textile types. A textile of wearable size does not need that much yarn. 2 km of thread is sufficient to weave 1 m² cloth with a thread count of 10 threads/cm². *Pa-we-a* are fairly standardised textiles, produced in very high numbers, they are given to people such as the *e-ge-ta*, and a *pharos* in 1st millennium Greek is a cloak. It seems likely that a *pa-wo* is a textile which could be wrapped around the body or worn as a cloak.

We could hypothesise that the Mycenaean cloth type *pa-wo* would be such a textile of ca 2 m² and ca 10 threads pr cm. This would require only 4 km of thread to weave one piece of *pa-wo*, and would take 80 h to spin 4 km of yarn (18 g whorl), and 100 h to spin 4 km of yarn (8 g whorl). This compares to the 16-27 km which may be spun from the wool assigned for one *pa-wo*.

The figure shows that 1000 m of yarn spun on an 8 g spindle whorl weighs ca 100 g. The hypothesised *pa-wo* textile made of 4 km yarn and measuring 2 m² would thus have a weight of 400 g. This is less than 10% of the raw wool allocated for 1 *pa-wo*. What happens to the rest of the wool? One possible solution is that the allocation of wool for a textile in the *ta-ra-si-ja* production circuit included wool for remuneration of the textile worker(s).⁴¹

Textile fibres

The Linear B evidence only informs us of two types of textile fibres: wool from lambs or primarily from castrated wethers, and flax grown on palace-controlled land. These two types of textile resources are very well attested and seem to play an overwhelming and predominant role.

However, the confrontation of the written evidence with the scarce archaeological textile remains tells another story: the Greek-Swedish excavations at Khania have unearthed tiny carbonised pieces of plaited band (Pl. XIXb-d).⁴²

Analyses by Youlie Spantidaki, Christophe Moulherat⁴³ and Susan Möller-Wiering yielded surprising results which we would not have expected from the Linear B evidence. The band is only 6 mm wide and plaited in a sophisticated technique, quite different to the standardised typologies of large textile items in the Linear B ideograms. Quite unexpectedly, the band is not made of sheep wool: the warp is of plant fibre, probably linen, the weft is made of bundles of animal fibre, probably goat hair, and an additional thread sewn into the band is made of plant fibre, probably nettle. This testifies to a technological situation far more complex than attested by Linear B, and it also testifies to the diversity of textile fibre material available to the population. Indeed, the standardised mono-fibre technology in the Linear B tablets seems to reflect a highly monitored, specialised and focused production type; it does not reflect the technical capacities of the population nor the available fibre resources.

41 I thank Paul Halstead and John Bennet for discussing this perspective with me in Sheffield, June 2010.

42 CTR thanks Maria Vlasaki and Erik Hallager for drawing our attention to this exceptional find, and we are grateful for the permission to study it.

43 C. MOULHERAT, Y. SPANTIDAKI, "Cloth from Kastelli Chania," *Arachne* 3 (2009) 8-15.

Conclusion: Textiles in the Aegean society and economy

In the Late Bronze Age, textiles were produced in palace workshops, as is evidenced in the written Linear B documentation from Pylos.⁴⁴ Other palace administrations set up systems of assigned textile work to villagers, in which the palace flocks were also monitored by local herdsmen or by sanctuaries,⁴⁵ and flax was grown on palace land and integrated into centrally monitored textile production. The different Mycenaean palace systems testify to various modes of organisation, but were extremely similar in their control mechanisms and in their administrative traditions. Thus in the Mycenaean textile administration we perceive a mixture of inherited, decentralised systems combined with strong, centralised administrative practices.

Textile production, however, did not only take place in these palace workshops but also in every Bronze Age household. The Linear B administration only testifies to how production is administered and organised at a palace level and at a regional level, while textile tools and contexts shed light on textile production in the domestic sphere.⁴⁶

There are still numerous questions open to debate: we agree that textiles were produced all over the Aegean with a common technology. The textile tool situation is, however, intriguing, as several scholars have noted: why this abundance of spindle whorls on the Greek continent but quasi absence of loom weights?⁴⁷ Why does Crete yield numerous looms weights in all shapes, types and weight classes but near to no spindle whorls? I believe that future studies of textile tools will shed new light on these intriguing questions. Textiles are now widely recognised by scholars as an important and integral part of Bronze Age Mediterranean and regional trade networks, simply because textile production in pre-industrial societies is one of the most important means of converting domestic labour into transportable values.

Marie-Louise NOSCH

44 CHADWICK (*supra* n. 16).

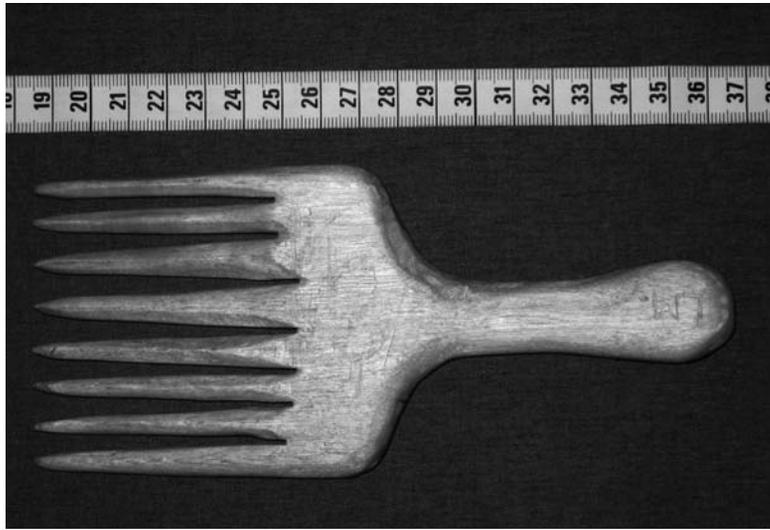
45 J.-P. OLIVIER, “KN:Da-Dg,” in *Texts, Tablets and Scribes* (*supra* n. 16) 219-267; M.-L. NOSCH, “Schafherden unter dem Namenspatronat von Potnia und Hermes in Knossos,” *Wiener Forschungen zur Archäologie* 3 (2000) 211-215; F. ROUGEMONT, “Textile Production and the Mycenaean Sanctuaries,” in C. GILLIS, B. SJÖBERG (eds), *Trade and Production in Premonetary Greece: Crossing Borders. Proceedings of the 7th, 8th and 9th International Workshops, Athens 1997-1999* (2008) 287-303.

46 ANDERSSON, NOSCH (*supra* n. 9); B. BURKE, “Textile production at Petras: The evidence from House 2,” in TAMPAKAKI, KALOUTSAKIS (*supra* n. 7) 279-295.

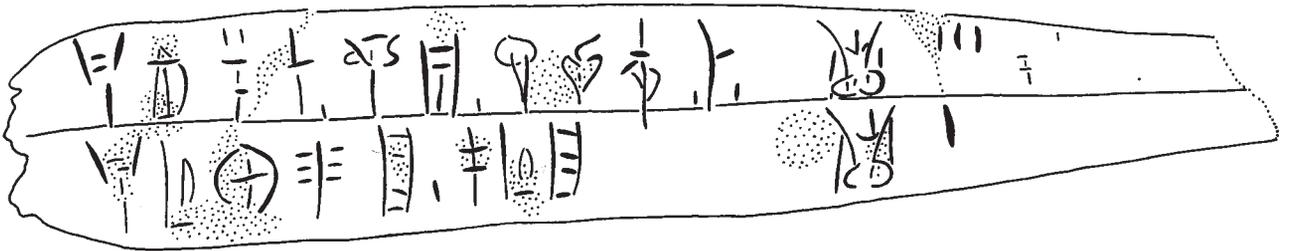
47 *Prehistoric Textiles*. B. BURKE, “The Organization of Textile Production on Bronze Age Crete,” in *TEXNH* 413-422.

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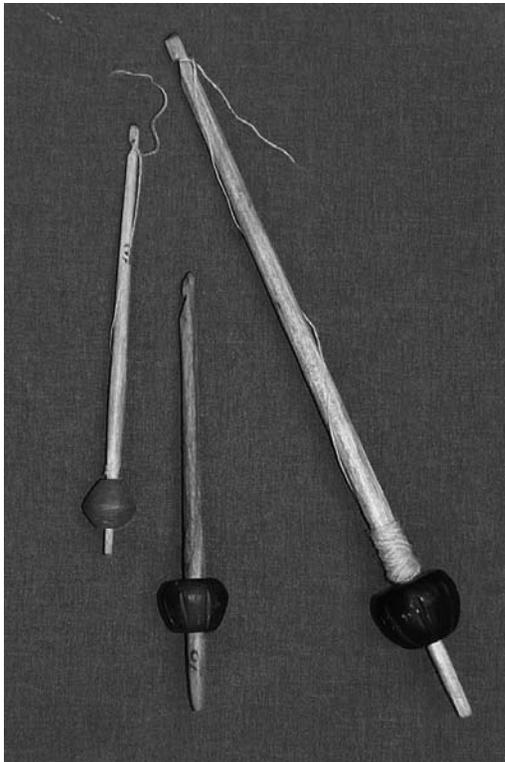
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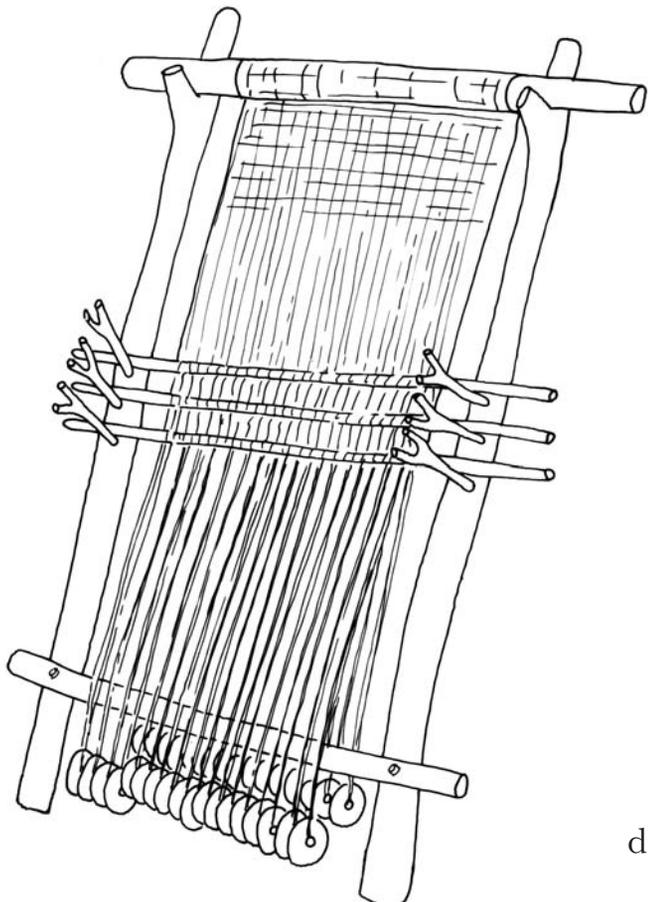
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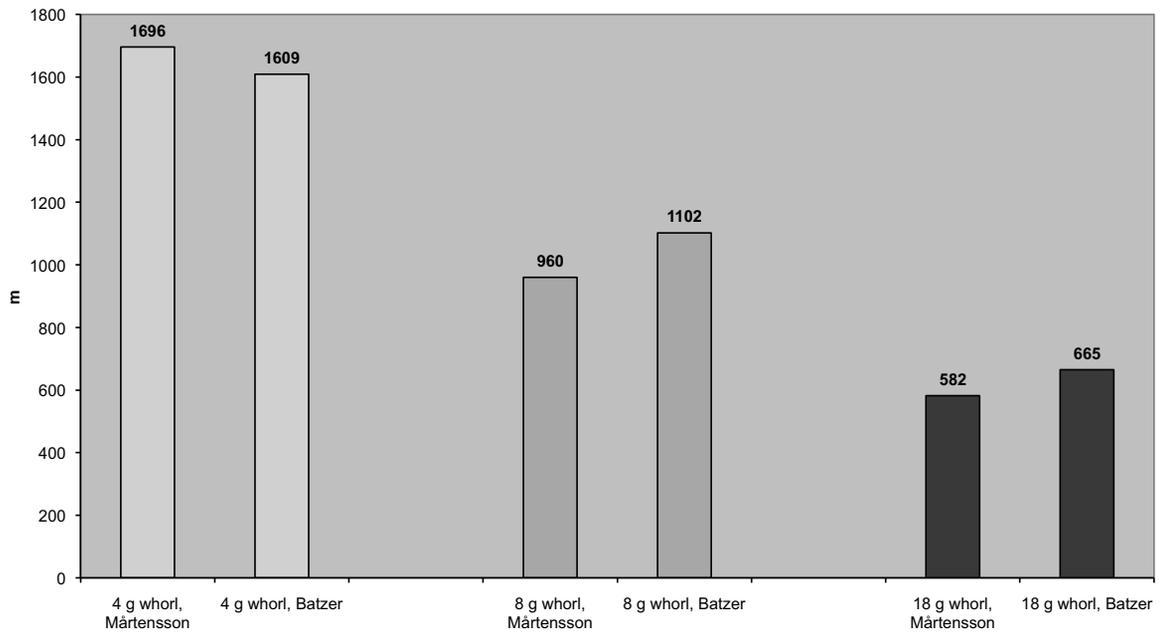


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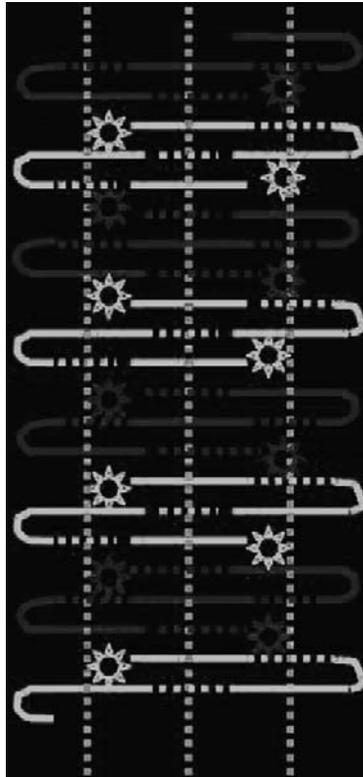
metre yarn/100 g spun wool



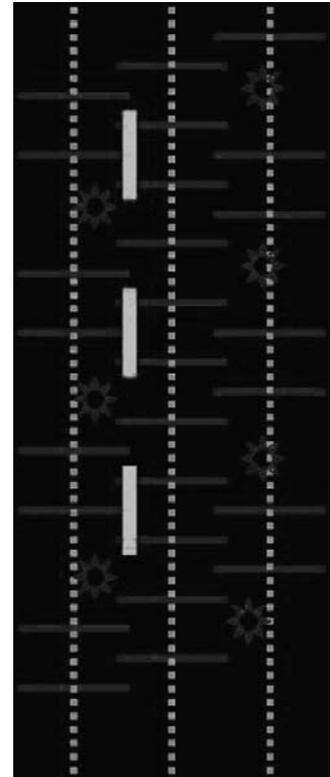
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