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The Fabric for a City: Development of Textile Materials During thUrbanization Period in Mediterranean Europe

Margarita Gleba
University College London, mygleba@yahoo.com

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Introduction

Textile production and consumption defined the development of productive and commercial activities of ancient societies at least since the Neolithic. The generic term 'textile', however, covers a wide range of finished products, made from a variety of raw materials and any textile is a result of complex interactions between resources, technology and society.[1] Plants such as flax, and animals such as sheep were among the most important resources for making textiles. The technologies of their transformation into usable fibre were complex and significantly influenced the economy of textile production throughout history.

Textile quality, appearance and performance are dependent on the material of which the textile has been made, that is fibre. It is hardly surprising that textile fibre exploitation has had a great impact on subsistence strategies of past societies, which were transformed when plant fibre was supplanted by animal fibre during Bronze Age.[2] The quick adoption of sheep wool as preferred textile fibre in the Old World during the Bronze Age was largely conditioned by the fact that plant fibre acquisition and processing were time and labour consuming. It has even been argued that control over sheep flocks and wool production led to the development of complex and hierarchical social systems.[3] Textile fibre investigation, hence, is more than just identification of material source. By studying fibre on a microscopic level we can come closer to understanding issues of selective breeding/ cultivation, processing of fibres, and their wear, and how they affected social, economic and organizational make-up of past civilizations.

Investigations of the Swiss Neolithic textiles have demonstrated that much can be learned about flax processing and development of flax fibre through the analyses of linen textiles.[4] Thus, careful examination of prehistoric fibres resulted in a discovery that they were only partially retted and then spliced rather than spun into yarn, demonstrating that complete retting, combing and draft spinning of flax was introduced in central Europe only during Middle-Late Bronze Age or even later.

Meanwhile, analyses of wool fibre fineness have been used to define the fleece type of prehistoric sheep, enabling comparisons with fleeces from modern sheep, particularly the so-called primitive sheep breeds, and leading to conclusions about ancient sheep types.[5] Assessment of fibre quality is based on the diameter measurement of 100 fibres per thread and statistical analyses resulting in a distribution histogram (see Figs. 3-4). Michael Ryder established an evolutionary scheme for wool development based on fibre diameter measurements.[6] Early varieties of sheep had coats containing more hair and kemp than wool. Woolly sheep are believed to have developed by the middle of the 4th millennium BCE.[7] Ryder demonstrated that, over the course of time, selective breeding has produced increasingly finer and more uniform wool.

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[1] Andersson et al. 2010.
[2] Bender Jørgensen 1992, 120; Rast-Eicher 2005, 128.
[3] McCorriston 1997; also cf. Arbuckle 2012, with an overview of earlier literature.
[4] Rast-Eicher and Thijsse 2001; Leuzinger and Rast-Eicher 2011.
[5] E.g. Ryder 1983; Walton Rogers 2007, 10-14; Rast-Eicher 2008.
[6] Ryder 1964; 1969; 1983.
[7] Ryder 1983, fig. 3.36.

North Mediterranean area is a particularly interesting area for textile fibre investigations. Ancient literary sources indicate that by the beginning of the Common Era, different qualities of wool and linen were available to Roman consumers and many of the best fibres were produced in Italy, from where they spread throughout the Roman Empire in the form of sheep, raw materials or finished textiles.[8] The standardization of fibres observed during the Roman period reflects a long period of evolution, based on the selection and development of processing technologies, going back to the Neolithic period and Bronze Age when fibre exploitation began and developed. Until now, however, little research has focused on archaeological fibres from the north Mediterranean area, demonstrating a great lacuna in our knowledge of ancient fibres and the impact their use and development had on the societies that used them.

Plant fibres

Tree fibres were common in the prehistoric period but, since the Neolithic period, flax *(Linum usitatissimum L.)* has been one of the most widely used textile plants.[9] In fact, many of the earliest known textiles are made of flax, as illustrated for example by the 7th millennium BCE finds at Nahal Hemar[10] in Israel and textiles from Çatal Hüyük in Anatolia, radiocarbon dated to *c*. 6000 BCE.[11] In Europe, flax was cultivated by the second half of the 7th millennium BCE.[12]

Recent studies demonstrate that, in Europe, not only during the Neolithic and Early Bronze Age (ca. 2nd millennium BCE) but possibly well into the Iron Age (ca. 1st millennium BCE), plant fibres were transformed into yarn by splicing rather than draft spinning. Splicing involves partial or no retting of the plant and direct removal of fibre bundles from the plant (**Fig. 1**), which are subsequently joined at the ends (**Fig. 2**). Draft spinning, on the other hand, requires complete retting of the plant in dew or water in order to decompose the parts of the plant that surround the fibres, followed by thorough processing of the fibres and spinning by continuous drafting using a spindle. Splicing was used in ancient Egypt throughout its history,[13] but only recently was identified in European prehistoric textiles.[14] Besides the Swiss material, several textiles and yarns from Italy dating to the 7th century BCE[15] have plied yarns composed of single, usually unspun strands of spliced flax fibre bundles. An even later example from Greece has Egyptian-style splices clearly visible along extremely thin threads of the textile.[16]

This shift appears to coincide with urbanization and population growth, as well as increased human mobility across the Mediterranean during the first half of the 1st millennium BCE. The 7th through 5th centuries BCE in particular saw movements of large quantities of goods (trade) and numbers of people (migration and colonization) between the Near East, Greece, Italy and Spain. Such movements required many more and larger and faster ships, all of which largely relied on wind power and therefore sails. Retting and draft spinning technology would have allowed faster processing of larger quantities of plant materials and a creation of a more homogenous yarn, and consequently textiles, such as those needed for sails.

[8] Vicari 2001; Gleba 2008, 68-69, 74.
[9] See Harris in this volume.
[10] Schick 1988.
[11] Vogelsang-Eastwood 1988.
[12] Rast-Eicher 2005, 119.
[13] Barber 1991, 47; Granger-Taylor 1998; Kemp and Vogelsang-Eastwood 2001, 70-80.
[14] Leuzinger and Rast-Eicher 2011.
[15] Gleba in prep.
[16] Spantidaki 2013, 98-99 and *passim*.

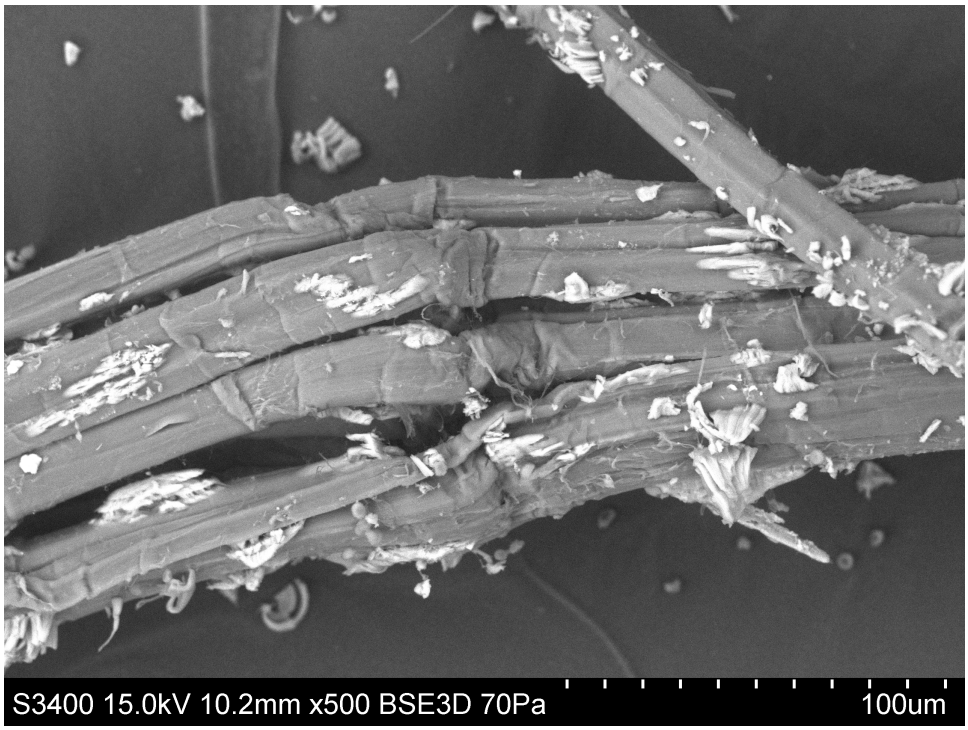

Figure 1. SEM micrograph of flax fibre bundles from a Middle Kingdom Egyptian textile preserved on a bronze mirror found in Abydos Tomb 291 (Inv. UC18094). Bundles are indicated by the characteristic dislocations occurring at the same spot along the length of individual fibres. Image reproduced with permission of The Petrie Museum of Egyptian Archaeology, UCL. Image by Margarita Gleba.

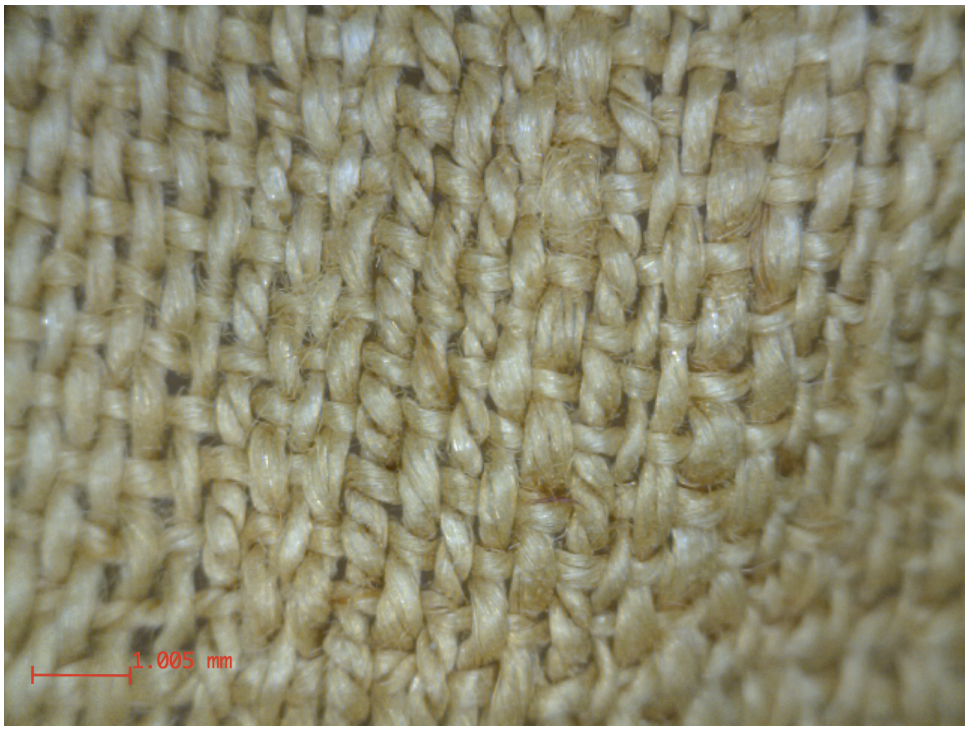

Figure 2. An Egyptian textile from Gizeh (Inv. UC55054) woven with spliced yarn. Splices appear as plied areas along the individual threads. Image reproduced with permission of The Petrie Museum of Egyptian Archaeology, UCL. Image by Margarita Gleba.

Animal fibres

Wool, a hair fibre obtained from the coat of sheep, has been and still remains one of the major raw materials for textile making.[17] Selection has been imposed on sheep populations since the domestication process commenced in the Fertile Crescent approximately 10,500 calibrated radiocarbon years BP.[18] The earliest direct evidence for the use of wool fibre to produce textiles, however, consists of the textile remains made of sheep wool found at Shahr-i Shōkhta, eastern Iran,[19] and, possibly, at Novosvobodnaya in the northern Caucasus,[20] both dated to the 4th millennium BCE, long after flax has been in use.

The early primitive wool had very fine underwool and very coarse kemps, which had to be removed before spinning and weaving (**Fig. 3**). It was relatively short, necessitating the production of a rather thick yarn and fulling of the resulting textiles. As wool cannot be spliced into a usable yarn, it had to be drafted and twisted into thread. Initially, wool was likely twisted into yarn by hand or using an implement such as a hooked stick, but eventually a more efficient method was invented using a suspended spindle weighed down with a spindle whorl made out of wood, bone, or, more frequently clay or stone.[21]

The results of recent investigations of pre-Roman wool fibres suggest that major changes in wool fibre development took place across Europe sometime around or before the turn of the 1st millennium BCE (i.e. around the turn from the Bronze Age to the Early Iron Age).[22] By the 1st millennium BCE, the kemp has all but disappeared and the resulting fleeces became a little coarser but much more uniform (**Fig. 4**). This robustness as well as increased length allowed spinning much finer yet stronger yarn, particularly suitable for the production of twill weaves, which developed during the Bronze Age and became the predominant type of weave during the Iron Age in most of Europe.[23] The studies also suggest that during the 1st millennium BCE several distinct wool qualities coexisted possibly reflecting the use of several sheep types. Sheep with fine fleeces, that likely served as the precursors of the modern Merino appeared in the Mediterranean in the second half of the 1st millennium BCE.[24] Different types of wool would have been used for textiles of different qualities and purposes.

Textile fragments preserved in rich 'princely' burials of the first half of the 1st millennium BC in Italy and Greece demonstrate that textile craft had reached sophisticated levels both technically and aesthetically by that time. However, the two regions were following different textile traditions.[25] Italian Iron Age are predominantly twills, often spin- or shadow-patterned, dyed, and decorated with complex decorative tablet-woven borders as well as appliques in gold, glass and amber. Iron Age textiles from Greece are mostly weft-faced tabbies, and are remarkable for reaching weft thread counts of 100 and more threads per cm; they were also decorated with elements in various precious materials. The finest materials were used for the production of these textiles in both Italy and Greece, yet they likely required different qualities of wool and, therefore, different varieties of sheep.[26]

[17] Ryder 1983; Barber 1991, 20-30.
[18] Peters et al. 2005.
[19] Good 1999; Costantini 2009.
[20] Shishlina et al. 2003.
[21] Barber 1991, 41-44.
[22] Rast-Eicher 2008; Gleba 2012; Rast-Eicher and Bender Jørgensen 2013.
[23] Bender Jørgensen 1992, 120; Rast-Eicher 2005, 128.
[24] Ryder 1983, 155; Rast-Eicher 2008, 139; Gleba 2012.
[25] Gleba in press.
[26] See recent study by Sandford 2014 on biometric differences between sheep in Italy and Greece in the early first millennium BCE.

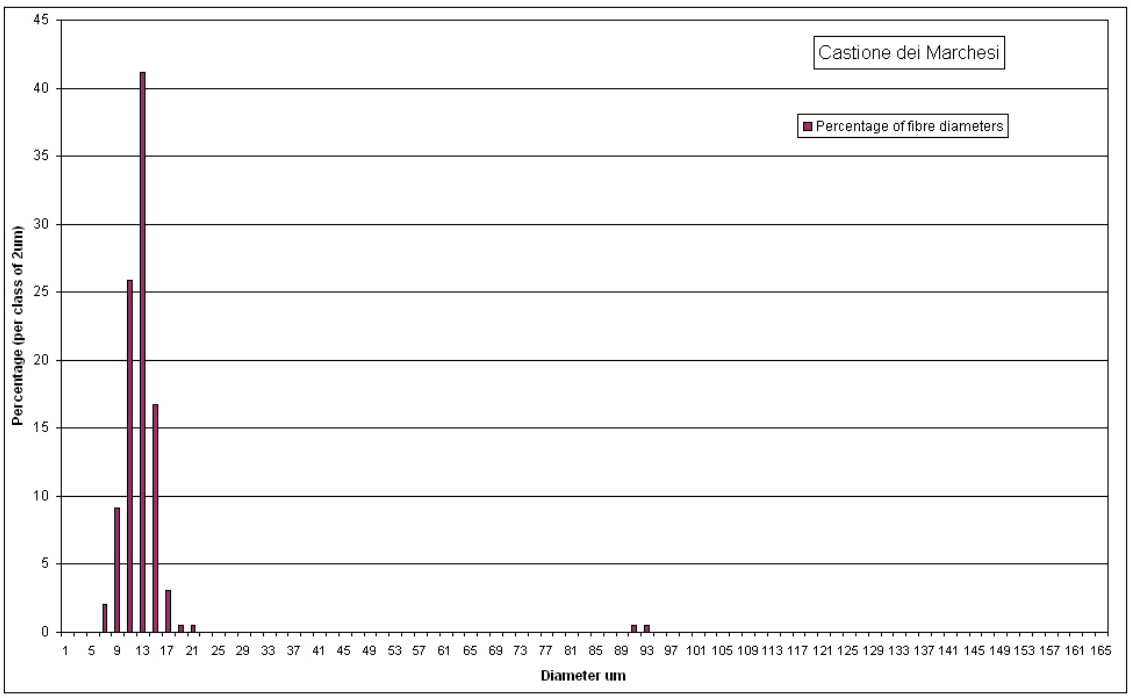

Figure 3. Histogram of wool fibre distribution diameters of a textile from Castione dei Marchesi, Italy, dated to the Middle Bronze Age. Note the very tall and narrow curve with most diameters averaging about 13 microns, and a few much thicker outliers around 90 microns – a distribution characteristic of Bronze Age wools. Image by Margarita Gleba.

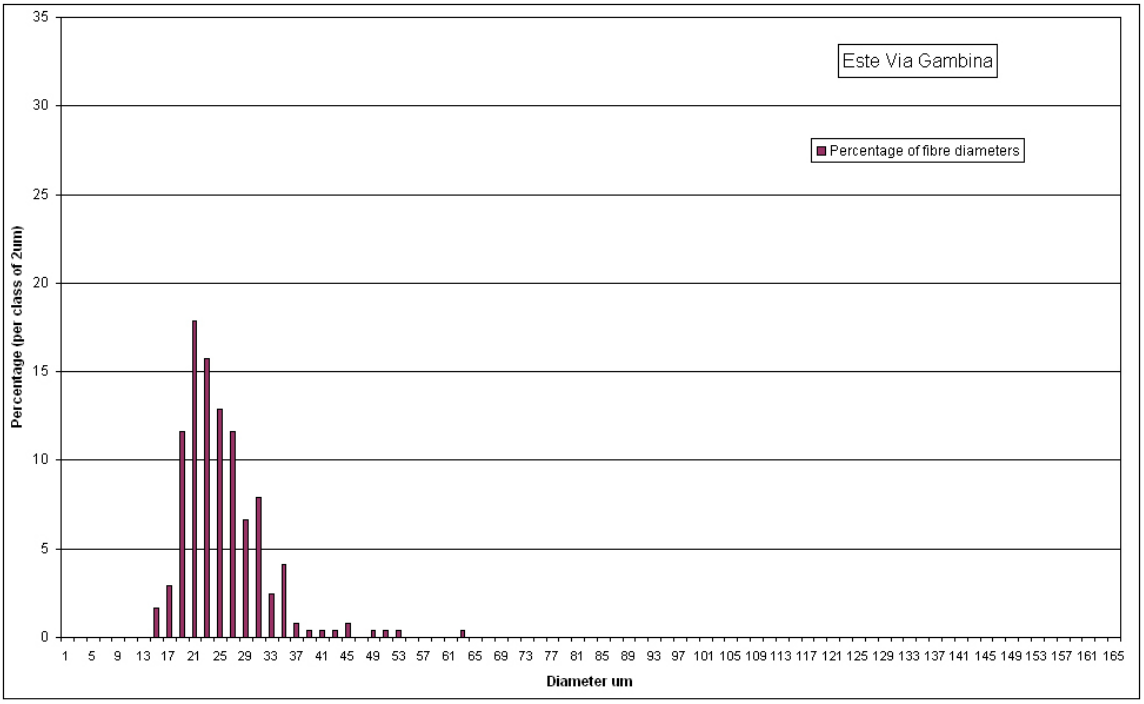

Figure 4. Histogram of wool fibre distribution diameters of a textile from Este, Italy, dated to the 6th-4th century BCE. Note a much lower, wider and skewed to the left curve with most diameters averaging about 21 microns, and a few not much thicker outliers – a distribution characteristic of Iron Age wools. Image by Margarita Gleba.

Fabric for a City

The beginning of the 1st millennium BCE in the northern Mediterranean area was a time of geopolitical and social restructuring, resulting in the formation of proto-urban communities.[27] A rapid and growing socio-economic transformation followed during the second half of the 9th and the first quarter of the 8th century BCE. By the mid-7th century BCE, large proto-urban settlements emerged, which were natural places for "markets" and craft production, fed by the dominant rank's demand for luxury goods and status markers.[28] Textiles were undoubtedly among the most important of these status markers.

But textiles were not only used for clothing. The houses in the rapidly growing cities required soft furnishings and were decorated by hangings and rugs. Movement of people and goods across the Mediterranean Sea and along the rivers was powered by numerous ships requiring vast quantities of linen sails. The diversification of textile fibres and optimization and their processing developed hand in hand with growing urban populations and their increased long-distance movements, demonstrating the importance of textile production and consumption in the formation of north Mediterranean urban centers during the Iron Age (1000-500 BCE).

This is hardly surprising given that intensive production and consumption of textiles was at the heart of urbanization throughout the history of the world. Written sources provide abundant evidence of the importance of textile production and consumption in the formation of the political systems synonymous with urbanization in the Bronze Age Mesopotamia[29] and the Aegean.[30] The lords of the Inka state extracted heavy tribute of cloth from its peasants, which in turn clothed and sheltered the army, dressed its citizens and filled its storehouses.[31] In Medieval times, cloth industry was by far the most important and influential crafts in the economy of towns.[32] In 18th century England, the Industrial Revolution was fuelled by the desire of the nobility and aspiring middle classes to invest in cloth and clothing, with its penchant for self-promotion and political investiture.[33] Albeit, in contrast to these examples, no written evidence survives to provide comparable evidence for the Iron Age northern Mediterranean, the study of archaeological material such as textiles and fibres they are made of is beginning to demonstrate the importance of textiles in the larger social and economic developments of the cultures that inhabited this area and whose urban model we follow to this day.

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[27] See e.g. Pacciarelli 2001 for chronology and discussion of the development of proto-urban settlements in Italy.
[28] Pacciarelli 2001, 284.
[29] E.g. McCorriston 1997; Wattenmaker 1998.
[30] E.g. Killen 1984; 2007.
[31] E.g. Murra 1989; Costin 2011.
[32] E.g. Ling Huang & Jahnke 2014.
[33] Schneider & Weiner 1989.

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