Tracing Textile Production in the Bronze Age - Early Iron Age Iberian Peninsula: an Introduction

MARGARITA GLEBA

McDonald Institute for Archaeological Research. University of Cambridge. mg704@cam.ac.uk

Abstract:

The paper provides a short overview on textile preservation, analytical techniques, production sequence, and contexts of production in the Bronze-Early Iron Age Iberian Peninsula. It is intended as a background for the terminology and an introduction to the different stages of textile production as well as various sources and methods that can enlighten our understanding of textiles and their economic, social and historical role in ancient Iberian Peninsula.

Key words*: pre-Roman Iberia, Archaeological Textiles, Textile Preservation, Textile Analysis, Textile* Chaîne Opératoire.

Resumen:

Este artículo proporciona una visión general de la conservación de tejidos, las técnicas analíticas, la secuencia de producción y los contextos de producción en la Edad del Bronce y del Hierro de la Península Ibérica. El objetivo es servir de base terminológica y como una introducción a las diferentes etapas de la producción textil, así como a diversas fuentes y métodos que pueden iluminar nuestra comprensión de los tejidos y su papel económico, social e histórico en la antigua Península Ibérica.

Palabras clave: *Iberia Prerromana, Tejidos Arqueológicos, Conservación Textil, Análisis de Tejidos, Cadena Operatoria del Tejido.*

INTRODUCTION

Textiles represent one of the earliest human technologies, so it is hardly surprising that textile production and consumption defined the development of productive and commercial activities of ancient societies inhabiting Iberian Peninsula at least since the Neolithic. Carmen Alfaro's fundamental 1984 volume *Tejido y Cesteria en la Penisula Iberica* and her continuing work in the field of textile research has paved the path for modern archaeological textile studies in Spain (for a complete list of her works, see Garcia Sanchez and Gleba 2018). In archaeology, however, textiles and other perishable materials have often been relegated to the marginalized zone of specialist and specialized subject. One of the reasons for this regrettable situation is that textile investigation frequently does not go beyond fibre identification and technical description of the object, while qualitative, quantitative and contextual interpretations of often highly technical analysis are lacking (also see Alfaro in this volume; but *cf*. Bender Jørgensen 1986; 1992; Barber 1991). The lack of dialogue between textile researchers and scholars in other fields has often been the main obstacle to integrating the knowledge gained from textile analysis into the overall interpretation of a particular site or broader aspects of human activity. Consequently, discussions of the topic of textiles in general archaeological literature do not utilize the available resources to their full potential. In addition, textile production has not been considered as an essential element of economy and social history of past societies, due to its predominantly domestic nature and a direct link with women's sphere of life (Jover Maestre *et al*. in this volume; Rísquez Cuenca *et al*. in this volume).

It is the aim of this issue to make textile research a more user-friendly field for researchers working on the archaeology and history of Iberia by bringing together several different approaches to archaeological textile investigation in Spain. The studies included here present the diversity of methods and approaches that can be applied to the investigation of ancient textile production, and demonstrate the potential of archaeological textiles and related sources for the investigation of ancient Iberian economy, technology and agriculture.

The following summary on textile preservation, analytical techniques, production sequence, and contexts of production is intended to provide a background for the terminology and issues discussed in the various articles collected in this issue.

TEXTILE PRESERVATION IN IBERIA

Being organic materials, textiles are subject to a much more rapid decomposition than objects made of ceramics, stone or metal. Nevertheless, textiles survive in archaeological contexts of Spain much more frequently than is commonly believed, and the quantity of material is constantly increasing thanks to improved excavation and conservation procedures (Alfaro 2012). Dry conditions, the presence of salt, waterlogging and temperatures below 0°C preserve textiles almost unaltered. In contrast, charring and mineralisation in the presence of metals (in particular copper and iron) or calcium substantially alter the physical and chemical structure of the organic material (Gleba and Mannering 2012: 2-3). Yet, even in this altered state textile remains are invaluable repositories of information about how they were made and of what materials.

While rare, prehistoric textiles and fibres have been recovered in various states of preservation across Iberia, primarily from burial contexts which often provide conditions that are conducive for textile survival (fig. 1). The earliest finds are not strictly speaking textiles, but rather basketry items. Esparto mats, cords, shoes, and other objects are well documented across Neolithic, Chalcolithic, Bronze and Iron Age sites in Spain and they remain in use today (Ayala and Jiménez 2007; Buxo 2010). The best known are the baskets and sandals from the Neolithic site of La Cueva de los Murciélagos in Albuñol (Alfaro 1984).

Some of the earliest loom-woven textiles have been found at Cueva Sagrada I at Lorca dating *ca*. 2200 BC, where two almost complete linen tunics were recovered with a female body (Alfaro 2005). Numerous charred linen fragments come from the Chalcolithic Age settlement of Los Millares (fig. 1, a), while in the Bronze Age burials of the Argaric Culture linen textiles are often preserved in association with bronze objects (fig. 1, b; Alfaro 1984; Jover Maestre and López Padilla 2013; Jover Maestre *et al*. in this volume). Presence of wool has been suggested in the Bronze Age Tomb 121 at Castellón Alto belonging to the so-called Man of Galera (Molina *et al*. 2003: 157; Rodríguez-Ariza *et al*. 2004: 14).

Textile finds are less numerous for the first millennium BC, but they demonstrate more variety in materials and techniques. Charred textiles have been found in burials at Carmona, possibly dating to the seventh-sixth century BC

Fig. 1: Selection of archaeological textiles from Spain (Images: a-d: M. Gleba; e-f: B. Marín-Aguilera with permission of the Museo Arqueológico Nacional, Museo Arqueológico de Alicante, the Hispanic Society of New York, and the CSIC).

(fig. 1, d; Alfaro 1984; Alfaro and Tébar 2007), and at La Albufereta (fig. 1, d; Alfaro 1984; Verdú 2015: 417-418) and El Cigarralejo (Hundt 1968; Alfaro 1984: 119-121, 138-141), both dating to the fouth century BC. Recently, excavations at Casas del Turuñuelo in Estremadura yielded an important collection of charred textile finds, that include esparto mats, wool and linen textiles, as well as linen thread and flax fibre bundles (fig. 1, e-f; Marín-Aguilera *et al*. 2019). Another wool textile was recovered at an Iberian sanctuary at La Nariz (Moratalla, Murcia) and is dated to the second century BC (Alfaro and Ocharan 2014). Numerous Roman finds are beyond the chronological scope of the present volume, but they often present continuity from the preceding periods (Alfaro 1984).

While textiles are relatively rare finds in archaeological contexts of Spain, certain textile tools are ubiquitous on many archaeological sites of Iberia. Implements associated with spinning (spindle whorls) and weaving (loom weights) were frequently made of fired clay or stone and survive well. They have been recovered in burials (Gomes 2017), sanctuaries, and settlements (Berrocal-Rangel 2003; Berrocal-Rangel *et al*. in this volume; Jover Maestre *et al*. in this volume; Marín-Aguilera 2019; Marín-Aguilera *et al*. 2019; Prados Torreira and Sánchez Moral in this volume).

ANALYTICAL METHODS

Archaeological textiles can be subjected to a wide variety of analytical techniques, resulting in important discoveries regarding their materials, techniques, date and provenance, thereby providing data about their function, movement, meaning and role in past societies (Good 2001; Andersson Strand *et al*. 2010). Much of the basic textile analytical work is done with a simple hand lens or a low-power microscope. Textiles have a precise structure which can be accurately described, and over the last half a century an internationally-agreed terminology has been established (Emery 1966; Alfaro 1984; Seiler-Baldinger 1994; Barber 1991; Grömer 2016). The application of increasingly more standardized analytical protocols to the investigation of archaeological textile finds is finally allowing more synthetic approaches to their study across time and space.

The standard structural analysis of a textile includes determination of raw material (wool, flax, esparto, etc.); thread parameters such as diameter of warp and weft (expressed in mm), thread twist direction in warp and weft, and tightness of twist angle (hard, medium or loose); and weave characteristics such as the type of textile weave or binding (plain weave/tabby, twill, satin, etc.), thread count in warp and weft (expressed in number of threads per cm), as well as presence of edges, weaving mistakes and other diagnostic features (fig. 2). These empirical features can inform our understanding of cultural aspects of textile production and use and, from close study of many individual examples, much wider conclusions can be drawn about regional and chronological trends.

The generic term 'textile' covers a wide range of finished products, made from a variety of raw materials. Plants such as flax and esparto, and animals such as sheep were among the most important resources for making textiles in pre-Roman Spain. The technologies of their transformation into usable fibre were complex and significantly influenced the economy of textile production in every period. In order to understand the procurement and preparation of the raw material, it is necessary to be able to identify the raw material used for the production of textiles.

The method of choice in textile fibre identification has traditionally been Transmitted Light Microscopy (TLM) which allows determination of gross morphology of textile fibres in both longitudinal and cross sections. Optical microscopy is however not always conclusive on its own. Fibres in poor condition, very dark fibres, soiled or covered with consolidant may be very difficult to identify, while mineralised and charred samples are impossible to analyse with this method. In recent years, Scanning Electron Microscopy (SEM) has been increasingly used for textile fibre identification as it allows a wide magnification range up to x10,000 and produces a greyscale 3D mage of the sample's surface topography (Rast-Eicher 2016). Comparison of archaeological samples with known references allows identification of species of plants and animals used to obtain the fibre (fig. 3).

Once the textile fibre has been identified, the next step is to analyse its preparation and quality. In terms of plant fibres, it is possible to determine how well the raw material was retted and whether the fibre was prepared for splicing or draft spinning (Gleba and Harris 2019). For sheep wool, it is possible to assess both the original composition of original fleece and its subsequent preparation through combing or other methods. Assessment of fibre quality is based on a technique used in the modern

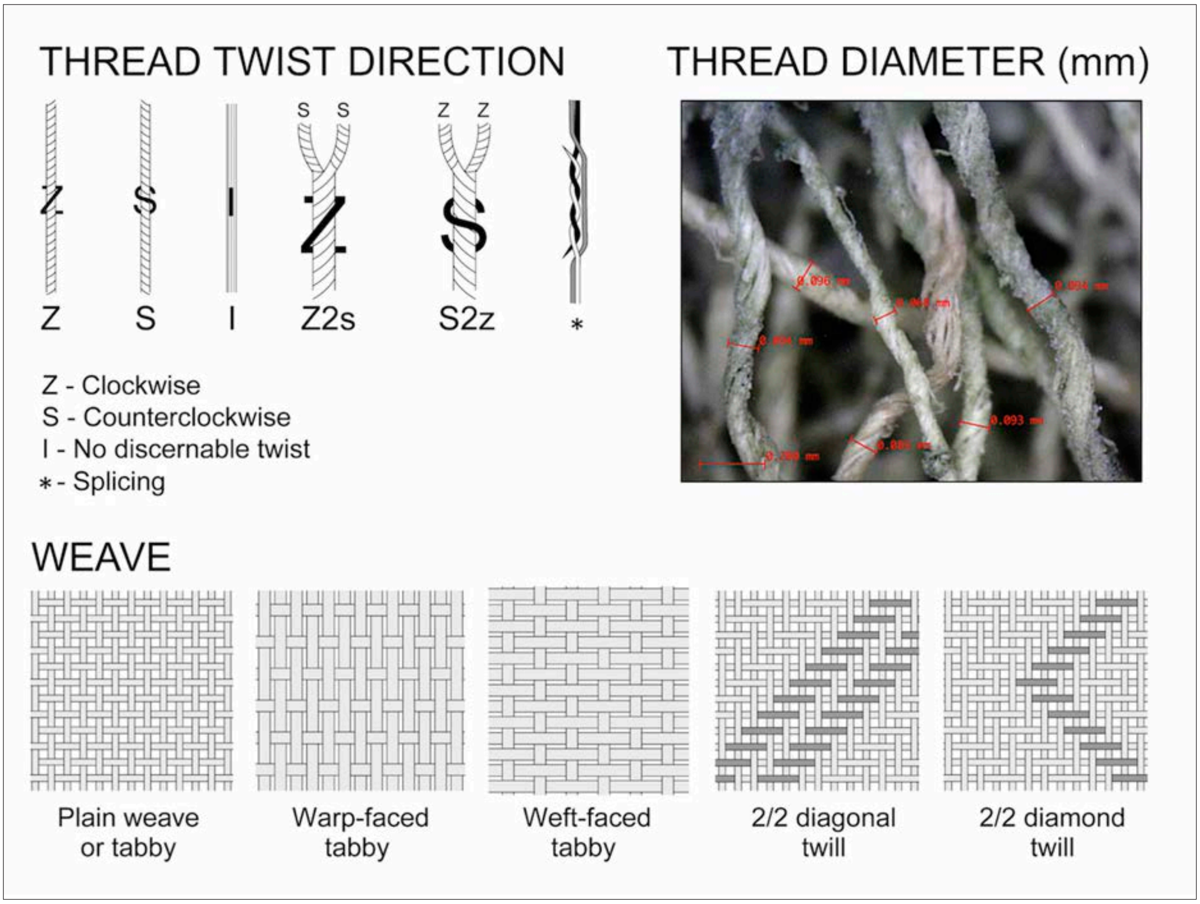

Fig. 2: Structural textile parameters (Image: V. Herring and M. Gleba).

textile industry and consists of the diameter measurement of 100 fibres per thread or staple, and statistical analyses resulting in a distribution histogram (Ryder 1983; Rast-Eicher 2008; Gleba 2012).

Addition of color has been an integral part of textile making, with important consequences in pattern design and meaning (Cardon 2007). The identification of active dye components and their combination is key to understanding dyeing technology, exchange, aesthetics, value, and meaning. Before the advent of synthetic dyes in the 19th century, all dyes were natural, made from various plants and animals. Dye identification can be significant for tracing the origins of textiles, particularly in combination with fibre analysis, since dyes were generally produced from locally available species. Currently the best method for dye and mordant analysis is high- or ultra-performance liquid chromatography (HPLC/UPLC), which allows the identification of the chemical dye components and, by their comparison with known references, their biological sources (Vanden Berghe *et al*. 2009).

In addition to the investigation of textiles themselves, study of textile tools has developed into an important subfield of textile archaeology. Until relatively recently, textile tools have rarely been given attention in archaeological literature beyond general observations or, at best, the publication of an object catalogue (but see Castro Curel 1980; Berrocal-Rangel 2003). Spinning and weaving implements constitute the single most important and plentiful type of evidence for the assessment of the scale of production and the technology of the textile industry in the past. Spindle whorls indicate the use of suspended spindles (Barber 1991). Likewise, loom weights suggest the presence of a vertical warp-weighted loom (Barber 1991) and can be used to hypothesise about the level of textile production. The latest methods, developed at the

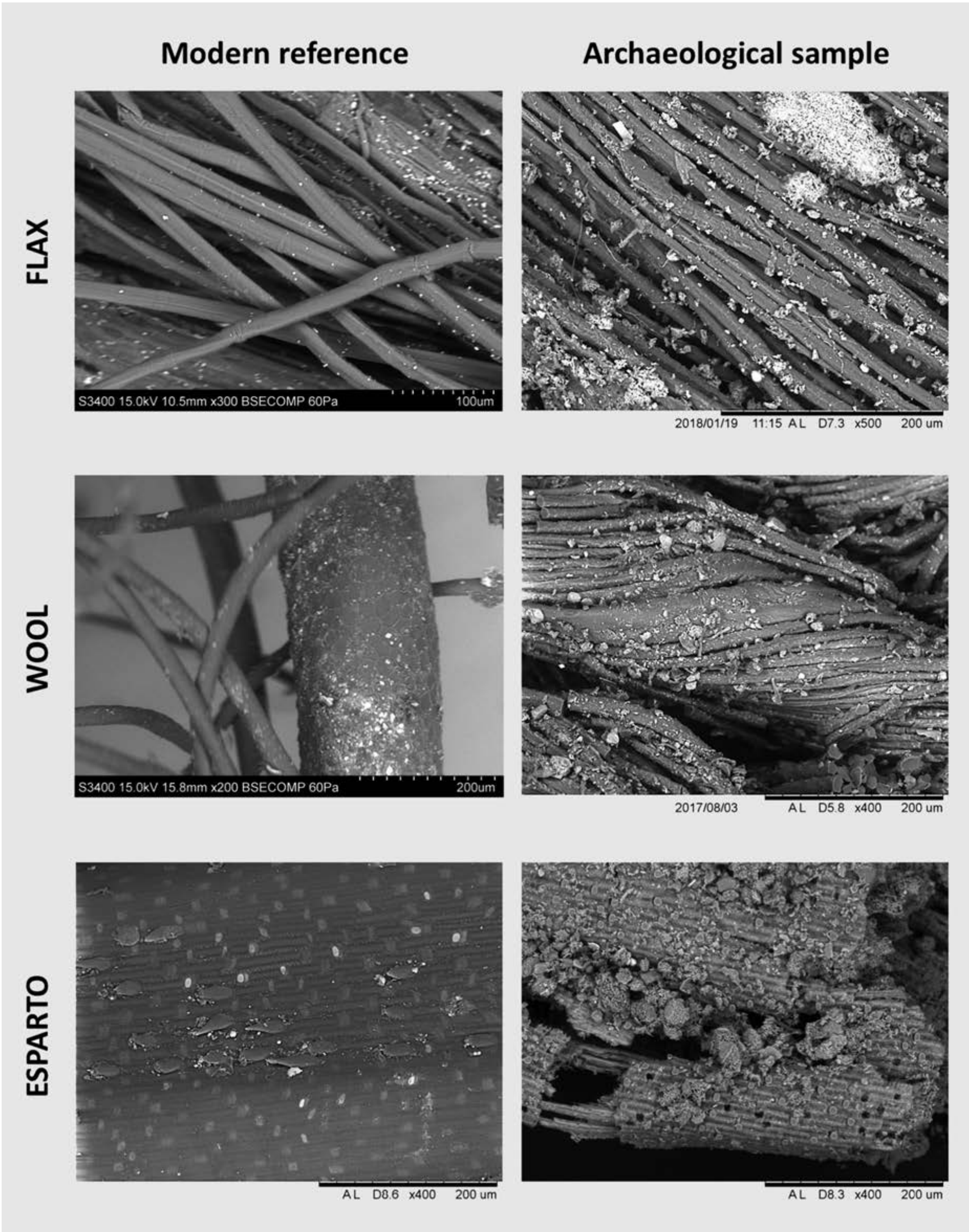

Fig. 3: Scanning Electron Micrographs of most common fibres in pre-Roman Iberia with reference samples shown on the left and archaeological samples on the right (Images: M. Gleba).

Centre for Textile Research at the University of Copenhagen in Denmark also allow to extrapolate the qualities of textiles that could have been woven using loom weights of specific weight and thickness (Andersson Strand and Nosch 2015).

TEXTILE *CHAÎNE OPÉRATOIRE*

In order to produce a textile, a number of operations have to be performed to transform the raw material into a finished product. The sequence of textile production involves the choice of raw material and its transformation, using various tools and 'recipes for actions', until a final product is obtained. Each of these processes requires a particular set of tools. The following sections provides a general overview of archaeological evidence (textiles and textile tools) for the various stages of textile production, forming a basis for the terminology used throughout this volume.

FIBRE PROCUREMENT AND PREPARATION

Textile production begins with the procurement and preparation of the raw material, i.e. fibre. Analyses of extant textiles indicate extensive use of esparto, flax (*Linum usitatissimum*), and sheep wool as the main fibre raw materials across the Iberian Peninsula since prehistoric times. Archaeobotany and archaeozoology can provide important information about the availability and exploitation of these resources. Being a species native to the Iberian Peninsula, the use of esparto for matting and basketry goes back at least to the Neolithic period. Esparto mats, cords, basketry items and shoes are well documented across Chalcolithic and Bronze Age sites in Spain and continue in use until the present day (Ayala and Jiménez 2007; Buxo 2010). Unlike the native esparto grass, flax is believed to have been introduced to the Iberian Peninsula as part of the Neolithic package by the early third millennium BC, as indicated by the appearance of flax seeds in the archaeobotanical record (Jover Maestre and López Padilla 2013: 150).

In contrast to plant fibres, to date there is little direct evidence of the exploitation of animal-based fibres in the Iberian Peninsula until the Roman period, even though radiocarbon-dated bones demonstrate the presence of domestic sheep in Iberia by approximately 5400 BC (Zilhão 2001). Archaeozoological evidence in the form of sheep bones permits analysis of slaughter patterns, which may indicate whether animals were kept for wool or meat, as well as transhumance (Valenzuela-Lamas *et al*. 2016). A predominance in the flock of adult animals, in particular castrated males, generally indicates wool production. The study of bone assemblages, landscape, and transhumance patterns can give valuable information about the development of society's strategies in wool production and identify sites and regions with specialized production (Estaca-Gómez *et al*. in this volume), or assist with examining the spread of different sheep varieties.

Little is known about the methods and tools used for fibre processing since many techniques were manual or involved the use of implements made in perishable materials.

MAKING THREAD

Once the fibres have been obtained and prepared, they could be converted into a yarn. Different methods were used in the past to create yarn and they can be generally divided into two categories: splicing methods and draft spinning (Barber 1991). The technologies are mechanically and conceptually different requiring different tools and different organisation of production.

The more familiar spinning process utilises twisting and drawing out, or drafting, of the fibres (Alfaro 1984; Barber 1991; Grömer 2016). During spinning, yarn acquires tensile strength, which is a prerequisite for weaving a textile. In order to achieve control over the fineness and evenness of the thread, the fibres must be drawn and twisted simultaneously and with the same speed. The suspended or drop spindle accommodates these requirements very efficiently. Such a spindle consists of a rod or a spindle shaft and weight known as spindle whorl, a symmetrical, centrally pierced object which functions as a fly-wheel. Since most spindle shafts in antiquity were made of wood, often, the only evidence for spindle use consists of the less perishable spindle whorls, which were made from fired clay, stone, bone, glass and other materials. Raw fibre during spinning has to be organised in some way – the solution is a distaff, which may be hand-held or fixed. A hand-held distaff is depicted on a painted ceramic fragment from la Serreta (Alcoy, Alicante), which also demonstrates that the spindle whorl was attached at the bottom of the shaft, that is, in a low-whorl position (Prados Torreira and Sánchez Moral in this volume).

The fibres can be twisted in two directions, producing different structural effects. For convenience, yarn is described as z-twisted if it is spun clockwise, and s-twisted if counter-clockwise (fig. 2). The vast majority of the yarns from Iron Age textiles found in Iberia are z-twisted. Two or more threads may be plied together to produce thicker and/or stronger yarn.

Until recently, it was regarded that all prehistoric linen textiles in Spain were made with draft spun and plied yarn, but the latest research suggests that, in fact, they are all spliced (Gleba and Harris 2019). In contrast to draft spinning, during which the combed and prepared fibres are fixed on a distaff and are continuously drawn to receive a twist imparted during the rotation of a spindle, in splicing, pre-formed plant fibre bundles stripped from plant stalks were twisted together – spliced, so that the ends of the fibres would overlap. Draft spinning likely developed with the use of wool, that is, many millennia after splicing technology developed.

The technique of yarn making as well as the quality of the raw material would have had a profound effect on the quality of the resulting yarn and textile. Thus, splicing allowed creating extremely fine yarns. Early wool was very fine but also short, resulting in soft but thick yarn that would have been particularly prone to fulling. During the Early Iron Age, fleeces with longer fibres developed allowing the spinning of very fine yarn. Yet, discovery of a wool twill with plied yarn in both warp and weft at Casas del Turuñuelo suggests that maybe even in the fifth century BC, some types of wool still had relatively short fibres, requiring plying of the yarn (Marín-Aguilera *et al*. 2019).

Whether produced by draft spinning or splicing, thread making constituted the bottleneck of textile production with multiple spinners working to produce enough thread for the next stage, weaving.

WEAVING

A sufficient quantity of yarn having been produced, weaving can begin. Weaving is accomplished on a loom, a special frame that keeps the stationary warp system in place, while allowing the weft to be passed in between warp threads. In Spain, and more widely across Europe, a warp-weighted loom has been documented from prehistoric times and until the Roman Imperial period, when it was gradually supplanted by a vertical two-beam loom (Barber 1991). The warp-weighted loom was made up of two upright beams that stood at a slight angle to the vertical plane, and a single horizontal or cloth beam, to which warp was attached. In a warp-weighted loom, as suggested by its name, the warp is kept taut by the weights attached at the bottom to groups of threads. Since weights were often made of stone or clay, they survive well in the archaeological contexts and allow us to trace the presence and sometimes even location of a warp-weighted loom on sites (Jover Maestre *et al*. in this volume; Berrocal Rangel *et al*. in this volume; Rísquez Cuenca *et al*. in this volume).

The basic woven textile is constructed by interlacing two thread systems at right angles. The static system is generally called warp. The perpendicular movable system is called weft. The textile is then defined in terms of weave (fig. 2). The simplest form of weaving, plain weave or tabby, is produced by weft threads passing over and under alternate warps. Due to specific material properties, textiles made of plant fibres were primarily woven in plain weave or tabby, while wool fabrics were made in a wider variety of weaves. It is not surprising, thus, that the vast majority of prehistoric textiles in Spain, being linen, are woven in tabby. In the more complex twill weave, weft threads pass over and under warps in a regular staggered pattern, each row being stepped to one side of the row above, creating a diagonal effect. The variants include a plain diagonal, chevron, herringbone, lozenge and more complex diamond twills. The earliest twill-woven wool textiles found to date in Spain come from Casas del Turuñuelo in Estremadura and are dated to the fifth century BC (Marín-Aguilera *et al*. 2019). Later examples are known from La Albufereta (Alfaro 1984; Verdú 2015: 417-418) and La Nariz, Moratalla, Murcia (Alfaro and Ocharan 2014).

Another technique, tablet weaving, has been identified at El Cigarralejo (Hundt 1968; Alfaro 1984: 119-121, 138-141). Tablet weaving involves passing threads through holes in the corners of (usually) square tablets, which, when rotated forward or back in different combinations, create patterns (Collingwood 1996). This method is suitable for weaving narrow bands, such as belts, heading bands for the warp of a warp-weighted loom, or decorative borders for the base textile. Tablets themselves were recovered in the same tomb, as were possible thread spacers.

DYEING

The use of colour is probably no less ancient than the weaving of textiles themselves, as humans strove to improve their aesthetic quality. The primary material to be dyed was wool, although linen was occasionally coloured as well. The simplest way of imparting colour onto any material is by staining, which could be accomplished using mineral pigments or with plant extracts and does not require any special equipment. There is some indication that linen textiles in prehistoric Iberia were occasionally coloured in this way using mineral pigments such as cinnabar or ochre during the Early Bronze Age (López Padilla *et al*. 2013: 274-276; Martínez García in this volume). Pigments, however, are insoluble in water and do not chemically bind to the textile. As such, they cannot produce a long-lasting colour. True dyeing, on the other hand is a chemical process creating more permanent bonds between the fibre and the dyestuff, resulting in colourfast hues. Dyeing can be imparted in various ways (Cardon 2007). Direct dyes are water-soluble and can bind chemically to the substrate itself. Vat dyes, on the other hand, are generally water-insoluble and have to be chemically altered to a soluble and often colourless form. Once the soluble form is bound to the fabric, treatment with air regenerates the original dye yielding a very stable or fast colour.

Almost all dyes are organic materials. A variety of plants could have been used for dyeing (Cardon 2007). Reds and oranges were some of the most sought after and expensive colours. The roots of *Rubiaceae* family of plants, native to southern Europe, were probably the earliest and most commonly used. In fact, the earliest evidence of dyeing in Iberia, on a textile from Cueva Sagrada I at Lorca, dating *ca*. 2200 BC, indicates the use of madder (*Rubia tinctorum* L.).

The colour blue could be obtained from woad (*Isatis tinctoria* L.). The earliest evidence for the use of woad in Europe comes from Hallstatt in Austria (Grömer 2016: 152). Yellows could be obtained more easily and from a larger variety of plants, such as weld or dyer's weed (*Reseda luteola* L.), dyer's greenweed (*Genista tinctoria* L.), and others. Neither blue nor yellow dyes have so far been identified in any of the pre-Roman textiles found in Spain, but it is likely that they were used and their absence is largely due to poor conditions of preservation. Extensive use of coloured textiles in Iberian period is certainly documented by the iconographic sources such as Dama de Baza.

Among ancient dyes, in a category of its own stands Royal or Tyrian purple, the most famous dye of antiquity, obtained from a variety of marine molluscs, such as *Hexaplex trunculus* (old name *Murex trunculus*), *Bolinus brandaris* (old name *Murex brandaris*), *Stramonita haemastoma* (old name *Purpura haemastoma*). To date, the only evidence for purple-dyed pre-Roman textile in Spain consists of shellfish purple traces mixed with plaster and gold and silver threads found inside a sixth century BC monumental tomb in Cádiz – the remains of what is believed to have been the sumptuous garment of a Phoenician priest (Dominguez-Bella *et al*. 2011). The use of shellfish purple to dye textiles also leaves important, albeit indirect, archaeological evidence in the shape of shells, accumulations of which have been used to identify purple production sites across the Mediterranean (Marín-Aguilera *et al*. 2018). In Spain, malacological evidence indicates that shellfish purple dyeing technology may have arrived with the Phoenician settlers in the first millennium BC (García Vargas in this volume).

Although here discussed at the end of the operational sequence, it is important to point out that dyeing was usually carried out at the fleece or skein stage to ensure maximum dye penetration. Apart from the textiles themselves, archaeological evidence for dyeing activities consists of tools used to prepare the pigments and dyes, such as grinders and mortars, vessels and vats used in the dyeing process, heating installations, etc.

CONCLUSION

Textiles are rarely preserved in archaeological contexts of Spain, often leading to an incomplete and even biased picture of their role in past cultures. When textiles do survive, however, a wide range of interdisciplinary methods and approaches can be applied to them, leading to information regarding their date, raw materials, and provenance. Indirect evidence consisting of archaeological textile tools, iconography, as well as archaeobotanical and archaeozoological remains can provide additional evidence about textile production, use, and economy of the resources. These empirical data obtained from the extant archaeological textile finds inform cultural aspects, such as the role of gender in cloth manufacture, long-distance trade in textiles, and the use of textiles for signaling identities.

ACKNOWLEDGMENTS

The research leading to these results has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP/2007-2013-312603) and was carried out within the scope of the project *Production and Consumption: Textile Economy and Urbanisation in Mediterranean Europe 1000-500 BCE (PROCON)*. Access to material was kindly provided by National Archaeological Museum Madrid, Archaeological Museum of Alicante, Institute of Archaeology Merida, and the Hispanic Society of New York.

BIBLIOGRAPHY

ALFARO, C. (1983): Fragmentos textiles del sarcófago antropomorfo femenino de Cádiz, *Homenaje al Profesor Martín Almagro Bach*, Madrid, 281-289.

ALFARO, C. (1984): *Tejido y cestería en la Península Ibérica. Historia de su técnica e industrias desde la Prehistoria hasta la Romanización*, Bibliotheca Praehistorica Hispana XXI, Madrid.

ALFARO, C. (2005): Informe sobre los restos textiles y de cestería procedentes de Cueva Sagrada (Lorca, Murcia), *El cerro de la Virgen de la Salud (Lorca)* (J. J. Eiroa, ed.), Murcia, 227-246.

ALFARO, C. (2012): Spain, *Textiles and Textile Production in Europe from Prehistory to AD 400* (M. Gleba; U. Mannering, eds.), Oxford and Oakville, 334-348.

ALFARO, C. (2014): Wool fabrics from Arditurri Roman mines, Oiartzun (Basque Country, Spain), *A stitch in time: essays in honour of Lise Bender Jørgensen* (S. Bergerbrant; S. H. Fossoey, eds.), Gothenburg, 171-188.

ALFARO, C.; OCHARAN, J. A. (2014): Fragmento de tejido ibérico (s. II a.C.) del Santuario Rupestre de La Nariz (Moratalla, Murcia), *In amicitia. Miscel·lània d'estudis en homenatge a Jordi H. Fernández* (C. Ferrando; B. Costa, eds.), Eivissa, 35-51.

ALFARO, C.; TÉBAR, E. (2007): Phoenician textiles of Carmona (Seville) in the Hispanic-Society collection (New York), *Archäologische Textilfunde - Archaeological Textiles, NESAT IX* (A. Rast-Eicher; R. Windler, eds.), Ennenda, 65-70.

ANDERSSON STRAND, E. (2010): The basics of textile tools and textile technology: from fibre to fabric, *Textile terminologies in the ancient Near East and Mediterranean from the third to the first millennia BC* (C. Michel; Marie-Louise Nosch, eds.), Oxford, 10-22.

ANDERSSON STRAND, E. B.; FREI, K. M.; GLEBA, M.; MANNERING, U.; NOSCH, M.-L.; SKALS, I. (2010): Old textiles – new possibilities, *European Journal of Archaeology* 13 (2), 149-73.

ANDERSSON STRAND, E.; NOSCH, M.-L. (eds.) (2015): *Tools, Textiles and Contexts. Investigating Textile Production in the Aegean and Eastern Mediterranean Bronze Age*, Oxford.

AYALA, M. M.; JIMÉNEZ, S. (2007): Útiles de esparto en la Prehistoria reciente: evidencias arqueológicas, *Historia y sociabilidad. Homenaje a la profesora M. C. Melandreras Gimeno* (J. B. Vilar, A. Peñafiel, A. Irigoyen, eds.), Anales de Historia Contemporánea 24, Murcia, 171-196.

BARBER, E. J. W. (1991): *Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Age with Special Reference to the Aegean*, Princeton.

BELTRAN-LLORIS, M. (1976): *Arqueología e historia de las ciudades del Cabezo de Alcalá, de Azaila (Teruel)*, Monografías Arqueológicas 19, Zaragoza.

BELTRAN-LLORIS, M. (1979): *El poblado ibérico de Castillejo de la Romana (La Puebla de Hijar, Teruel)*, Madrid.

BENDER JØRGENSEN, L. (1986): *Forhistoriske textiler i Skandinavien. Prehistoric Scandinavian Textiles*, Copenhagen.

BENDER JØRGENSEN, L. (1992): *North European Textiles until AD 1000*, Aarhus.

BERROCAL-RANGEL, L. (2003): El instrumental textil en Cancho Roano: consideraciones sobre sus fusayolas, pesas y telares, *Cancho Roano VIII. Los Materiales Arqueológicos I* (S. Celestino, ed.), Badajoz, 213-297.

BUXO (2010): The prehistoric exploitation of esparto grass (*Stipa tenacissima* L.) on the Iberian Peninsula: characteristics and use, *Of Plants and Snails* (C. C. Bakels, K. Fennema, W. A. Out, C. Vermeeren, eds.), Leiden, 41-50.

CARDON, D. (2007): *Natural Dyes. Sources, Tradition, Technology and Science*, London.

CASTRO CUREL, Z. (1980): Fusayolas Ibéricas, antecedentes y empleo, *Cypsela* 3, 127-146.

COLLINGWOOD, P. (1996): *The Techniques of Tablet Weaving*, McMinnville (OR).

COSTA, B. (2011): Mapa de los yacimientos purpurígenos de la Islas Pitiusas. Formentera (2005-2007), *Purpureae Vestes III. Textiles y tintes en la ciudad Antigua* (C. Alfaro, J.-P. Brun, P. Borgard, R. Pierobon-Benoit, eds.), Valencia, 261-268.

DOMINGUEZ-BELLA, S.; MARCH, R. J.; GENER J. M.; MARTÍNEZ, J. (2011): Análisis de restos orgánicos de la tumba púnica de la Casa del Obispo, Cádiz. Reconstruyendo la memoria fenicia en el occidente del Mediterráneo, *Gadir y el Círculo del Estrecho Revisados* (J. C. Domínguez, ed.), Cádiz, 307-319.

EMERY, I. (1966): *The Primary Structures of Fabrics. An Illustrated Classification*, Washington, DC.

GARCIA SANCHEZ, M; GLEBA, M. (eds.) (2018): *Vetus Textrinum. Textile in the Ancient World. Studies in Honour of Carmen Alfaro Giner*, Barcelona.

GLEBA, M. (2012): From textiles to sheep: investigating wool fibre development in pre-Roman Italy using scanning electron microscopy (SEM), *Journal of Archaeological Science* 39, 3643-3661.

GLEBA, M. (2017): Tracing textile cultures of Italy and Greece in the early first millennium BC, *Antiquity* 91 (359), 1205-1222. DOI: https://doi.org/10.15184/aqy.2017.144

GLEBA, M.; HARRIS, S. (2019): Plant fibre technology: identifying splicing in archaeological textiles, *Archaeological and Anthropological Sciences* 11, 2329-2346. DOI: https://doi.org/10.1007/s12520-018-0677-8

GLEBA, M.; MANNERING, U. (2012): Introduction: Textile Preservation, Analysis and Technology, *Textiles and Textile Production in Europe from Prehistory to AD 400* (M. Gleba, U. Mannering, eds.), Oxford and Oakville, 1-26.

GOMES, B. F. (2017): Fusayolas de la necrópolis de Olival do Senhor dos Mártires (Alcácer do Sal, Portugal): tipología, función y simbolismo, *Saguntum-PLAV* 49, 43-59.

GOOD, I. (2001): Archaeological Textiles: A Review of Current Research, *Annual Review of Anthropology* 30, 209–226.

GRÖMER, K. (2016): *The Art of Prehistoric Textile Making – The development of craft traditions and clothing in Central Europe*, Veröffentlichungen der Prähistorischen Abteilung 5, Vienna.

HUNDT, H. J. (1968): Die verkohlten Reste von Geweben, Geflechten, Seilen, Schnüren und Holzgeräten aus Grab 200 von El Cigarralejo, *Madrider Mitteilungen* 9, 187–205.

JOVER MAESTRE, F. J.; LÓPEZ PADILLA, J. A. (2013): La producción textil durante la Edad del Bronce en el cuadrante suroriental de la Península Ibérica: materias primas, productos, instrumentos y procesos de trabajo, *Zephyrus* LXXI, 149-171.

MARÍN-AGUILERA, B. (2019): Weaving rural economies: commoners and elites' textile production in the Middle Guadiana Valley, Spain (7th-5th centuries BC), *World Archaeology* 52 (2), 226-254.

MARÍN-AGUILERA, B.; IACONO, F.; GLEBA, M. (2018): Colouring the Mediterranean: production and consumption of purple-dyed textiles in pre-Roman times, *Journal of Mediterranean Archaeology* 31 (2), 127-154.

MARÍN-AGUILERA, B.; RODRÍGUEZ-GONZÁLEZ, E.; CELESTINO, S.; GLEBA, M. (2019): Dressing the sacrifice: earliest evidence of wool fabrics in Iberia from Casas del Turuñuelo, Spain, *Antiquity* 93 (370), 933-953.

MOLINA, F.; RODRÍGUEZ -ARIZA, M. O.; JIMÉNEZ BROBEIL, S.; BOTELLA, M. (2003): La sepultura 121 del yacimiento argárico de El Castellón Alto (Galera, Granada), *Trabajos de Prehistoria* 60 (1), 153-158.

RAST-EICHER, A. (2008): *Textilien, Wolle, Schaffe der Eisenzeit in der Schweiz*, Antiqua 44, Basel.

RAST-EICHER, A. (2016): *Fibres. Microscopy of Archaeological Textiles and Furs*, Budapest.

RODRÍGUEZ-ARIZA, M. O.; MOLINA, F.; BOTELLA, M. C.; JIMÉNEZ-BROBEIL, S. A.; ALEMÁN, I. (2004): Les restes parcialment momificades de la sepultura 121 del jaciment argàric de Castellón Alto (Galera, Granada), *Cota Zero* 19, 13-15.

RYDER, M. L. (1964): Fleece evolution in domestic sheep, *Nature* 204 (4958), 555-559.

RYDER, M. L. (1983): *Sheep and Man*, London.

SEILER-BALDINGER, A. (1994): *Textiles, A Classification of Techniques*, Washington, DC.

VALENZUELA LLAMAS, S.; JIMENEZ-MANCHON, J.; EVANS, J.; LÓPEZ, D.; JORNET, J.; ALBARELLA, R. (2016): Analysis of seasonal mobility of sheep in Iron Age Catalonia (north-eastern Spain) based on strontium and oxygen isotope analysis from tooth enamel: First results, *Journal of Archaeological Science: Reports* 6, 828-836.

VANDEN BERGHE, I.; GLEBA, M.; MANNERING, U. (2009): Towards the Identification of Dyestuffs in Early Iron Age Scandinavian Peat Bog Textiles, *Journal of Archaeological Science* 36 (9), 1910-21.

VERDÚ, E. (2015): *La necrópolis ibérica de l'Albufereta (Alacant). Ritos y usos funerarios en un context de interacción cultural*, Alicante.

ZILHÃO, J. (2001): Radiocarbon evidence for maritime pioneer colonization at the origins of farming in west Mediterranean Europe, *Proceedings of the National Academy of Sciences of the United States of America* 98, 14180-14185.