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INTERWEAVING TRADITIONS:

CLOTHING AND TEXTILES IN BRONZE AND IRON AGE IBERIA

EDITED BY

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Summary

EDITORS' PREFACE

In the past few years the field of archaeological textile research has witnessed a major dynamism as demonstrated by numerous conferences and publications on the topic, as well as establishment of large-scale interdisciplinary collaborative programmes. New scientific methods have been or are being developed within archaeology to gain new knowledge about ancient textiles on an unprecedented scale.

Compared to Central and Northern Europe, textile research in Spain and Portugal has been a rather neglected field until recently. The reason most often cited for the absence of studies on ancient textiles in both countries is their extremely poor preservation. Textiles, however, are much more common finds than generally thought and survive in original organic state but also as carbonised and mineralised traces, as well as in the form of imprints. In addition, there are numerous other sources of evidence, such as textile tools, archaeobotanic and zooarchaeological remains, as well as iconographic and written sources, which permit us to gain valuable information about many and varied aspects of textile production in ancient Iberia.

This special volume of *Sagvntvm* stems from an interdisciplinary workshop organised on 17 February 2017 by the European Research Council funded 5-year project PROCON - *Production and Consumption: Textile Economy and Urbanisation in Mediterranean Europe 1000-500 BCE* (FP/2007-2013-312603; PI Margarita Gleba) based at the University of Cambridge in the UK. The workshop gathered specialists in textile archaeology, conservation, archaeobotany and zooarchaeology in order to bring together and to discuss the various methods and approaches to ancient textile and fibre studies in Spain. We hope that this issue will demonstrate the potential of archaeological textiles and related sources for the investigation of ancient Iberian economy, technology and agriculture and encourage new research directions in this subject.

We would like to thank all the speakers for participating in this workshop, whose enthusiasm and insightful discussion eventually led to the publication of this volume. We are grateful to Andrés Carretero Pérez and Carmen Marcos Alonso for hosting the workshop at the National Archaeological Museum in Madrid, as well as to Carmen Cacho Quesada, Ruth Maicas Ramos and Eduardo Galán for their support and active participation in the workshop. We appreciate the preliminary language editing of the papers by Jeremy Bennett, and the work of the reviewers who improved the quality of the articles of this volume. The European Research Council generously financed both the workshop and its publication, for which we are deeply thankful.

Preface:
Studies of Ancient Textiles in Spain

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INTRODUCTION[1]

Fibres and textiles, dated to different periods and from diverse contexts, provide us with invaluable information about textile production despite the perishable nature of these objects. Organic materials are always more or less deteriorated when excavated. In spite of this, their importance from the point of view of the history of ancient technologies is enormous, for they allow us to reconstruct human crafts, customs, fashions, and everyday life in general. Moreover, they greatly complement Classical written sources on the topic of textile production and consumption.

The recovery of organic materials is improving thanks to the care with which objects are currently unearthed and to their subsequent conservation. In most cases, they are small fragments that do not look very attractive, but which, under the expert eye, offer an invaluable amount of information. The degree of preservation varies depending on the environment surrounding the object (e.g. humidity levels, presence of metal objects, constant temperature, etc.). Two elements are fundamental for the successful analysis of textile fragments: their careful excavation and a good conservation treatment. A complete formal and historical study of the excavated material is the next step. At this stage, the textile researcher should not only focus on the physical description of the object, but also on the social and cultural meaning of the find, that is, the role that the textile could have played in the human environment in which it was created. All these steps require a collaboration between different specialists: archaeologists, conservators, specialists in fibres and textiles, and historians.

Throughout the time that I have personally dedicated to the study of ancient fibres, ropes, baskets, nets, and fabrics, I have been involved in the analysis of many finds that exemplify the points made above. Any organic archaeological object, no matter how damaged it may appear when excavated, provides invaluable information regarding the technologies with which it was made, the intention of its use, and even its economic, religious, and social significance.

The study of ancient textiles is not an easy task and often requires an expert who, once the find and its context have been described, would delve into issues of greater complexity. Reaching a proficient level of knowledge in this field of expertise is a long and complex process

and, until recently, few specialists were available. However, the situation seems to be changing and interest in ancient textiles has lately increased. A wonderful teacher, recently deceased, once told me: *If you study textiles you will never get a university position*. Fortunately, he was wrong. Indeed, he even ended up devoting some of his later work to the study of purple and ancient fashion. Textiles retain wear traces in the shape of dirt spots and/or damage, providing significant symbolic and religious information (Alfaro 2015). In ancient times, fabrics were used to wrap precious objects deposited as grave goods such as weapons or tableware (Alfaro 2004; Médard and Sindonino 2014), and to cover the bodies of the dead (e.g. *Munigua bustum*) (Alfaro 2005), or contained hallucinogenic seeds such as *Papaver somniferum* (Alfaro 1980) – all examples of usage that inform us about community rituals and emotions.

Despite that, most scholars traditionally have not paid much attention to textiles. I still remember with amazement the answer that an expert in sindonology gave me, after requesting my analysis of a sacred textile, when I asked: *But, if this cloth had not wiped, according to you, the face of Jesus Christ when he was going to the Golgotha... What would you think of it? – It would be a cloth without any interest*. This cloth, however, was recently well studied (López-Amo 1999; 2000). Fortunately, this is no longer the norm and increasing numbers of archaeological textiles become protagonists in their own right, because any ancient cloth usually exerts on those who find it a kind of attraction and veneration that does not awaken with other objects.

Millions of textiles, baskets, and ropes that were used across the Mediterranean, central and northern Europe during antiquity have been unfortunately lost. Thus, the originally massive presence of fibres, fabrics, ropes, etc. represents today the tiny percentage of findings in most excavations – if any – if we compare textiles and basketry with other everyday life material culture.

TEXTILE STUDIES IN SPAIN

Archaeological textile remains in Spain were initially studied very unevenly and only briefly mentioned in general descriptions of excavated sites or object collections, in a very perfunctory manner and without a clear methodology (Martínez Santa-Olalla 1933; Beltrán 1979; Catalán and Rojas 2009; Gutiérrez and Hierro 2010). In contrast, in the rest of Europe the study of textiles has been considerably more advanced (e.g. see regular publications of *NESAT – North European Symposium for Archaeological Textiles*). In Spain, there was a lack of methodology for the study of this type of material culture, and even today that methodology is not consistently applied. This is perhaps because textile studies demand full-time dedication, even though there is a great variety of approaches within the field. Additionally, there is a lack of publications focused on specific textile topics (but see Uscatescu 1994, on fullonicae and dye workshops). Recent PhD dissertations currently in print will give an important impulse to this field of research.

Some previous studies laid the foundation for our understanding of important historical questions regarding textiles in Roman times. Álvaro d'Ors, the great Spanish Roman historian, in his *Epigrafía Jurídica de la Hispania Romana* published in 1953, was of great help to understand Roman legislation on all types of productive activities. The large corpora *Corpus Glossariorum Latinorum* (*CGL*) and *Corpus Inscriptionum Latinarum* (*CIL*) also provided a lot of information on craft activities in the Roman world. I also believe that the work of my old professor Miquel Dolç, *Hispania y Marcial* (1953), is still very useful to approach the study of wool in the Roman Baetica province. García y Bellido, in his work *España y los españoles hace 2000 años según la Geografía de Estrabón* (1968) used an interesting ethnographic approach to the study of wool and textile economy. Maluquer de Motes studied the spatial distribution of textile production in archaeological sites.

Other useful publications dealt with textile finds or textile tools. Among the most interesting in terms of methodology are articles by Camps Cazorla on Visigothic textiles (1934; see Cabrera 2017 for a more recent study), Martínez Santa-Olalla (1933) who studied a textile fragment adhering to the back of a belt, and Ardanaz (2000). In the field of textile tools, relevant are works of Vidal and López (1952) on the spindle whorls from San Miguel de Liria in Valencia; Castro Curel (1980), who analysed the distribution of Iberian loom weights and spindle whorls; and Delibes de Castro *et al*. (1995) who also worked on Celtiberian spindle whorls. Francisco Presedo discovered the Dama de Baza (Lady of Baza), an outstanding find for the study of textile iconography in Spain, and E. Llobregat (1972) studied the textile tools of some Iberian sites such as the Bastida de Les Alcuses (Moixent, Valencia) from a gender perspective.

There have also been important studies relating to the later chronological periods, especially Late Antiquity, e.g. by J. Pinar and Ll. Turell of the Museum of Montserrat (2007). Dominique Cardon published her extraordinary PhD dissertation *La draperie au Moyen Age: essor d'une grande industrie européenne* in 1999, which included several Spanish case studies. Paulino Iradiel, from the University of Salamanca and then from that of Valencia, led in the 1990s a group of researchers that included textile specialists for the Late Medieval and Early Modern period. Ricardo Franch studied the social aspects of textiles and silk in Valencia in the 17th and 18th centuries (2016). Cristina Partearroyo has been a great expert on Nasrid textiles, the study of which began in the 1950s with the efforts of M. Gómez-Moreno, and continues to this day (Partearroyo 2005; Borrego *et al*. 2017).

Generally, however, scholars were not fully dedicated to the subject of textiles, but mentioned textile production as part of their general interpretation of a site or specific period. In fact, until the beginning of the 21st century I believe that there was little interest and opportunity for scholars from different fields to join their efforts in a project such as *DressID: Clothing and identity. New Perspectives on Textiles and Dyes in the Roman Empire* (2008-2013), funded by the Culture Programme of the European Commission. This project involved seven participating countries, and resulted in numerous meetings and colloquia on specific textile topics, as well as large number of publications, mostly in English. The closest initiative in Spain continues to be the triennial international symposium *Purpureae Vestes* (Ibiza 2002, Athens 2005, Naples 2008, Valencia 2011, Montserrat 2014, Padua-Este-Altino 2016, Granada 2019), with six of the seven symposia that already took place published and the last one in press (Alfaro *et al*. 2004; Alfaro and Karali 2008; Alfaro *et al*. 2011; Alfaro *et al*. 2014; Ortiz *et al*. 2016; Busana *et al*. 2018; Bustamante *et al*. in press). At the same time, three important topical colloquia on textiles were held in Spain: *Mujer y Vestimenta: Aspectos de la identidad femenina en la Antigüedad* (Alfaro *et al*. 2011); *Luxury and Dress: Political Power and Appearance in the Roman Empire and its Provinces* (Alfaro *et al*. 2013), and *Tiarae, Diadems and Headdresses* (Alfaro *et al*. 2014).

The proceedings of these meetings, together with the publications of the *DressID* project, involved numerous researchers in diverse disciplines (philologists, chemists, physicists, anthropologists, archaeologists, historians, Roman law scholars, etc.). Until the implementation of the *DressID* Project, textile specialists in Europe were connected to each other via small meetings that involved a limited number of researchers that mostly focused on the study of textiles as objects (e.g. *NESAT - North European Symposium for Archaeological Textiles*, *Dyes in History and Archaeology*, *Textiles of the Nile Valley*, and occasional sessions dedicated to textile studies at the annual meetings of the European Association of Archaeologists). These regular meetings continue, but the latest trend is to organise specific small colloquia that are later published as an edited volume. The participation in these encounters of Spanish researchers has increased since the recent years (Joan Ramón Torres, Manel García Sánchez, Miguel-Angel Andrés, Estíbaliz Tébar, Benjamín Costa, Sergi Moreno, Laura Rodríguez-Peinado, Silvia Saladrigas, Pilar Borrego Macarena Bustamante, Ana Cabrera, Lluis Turell, Mª Sagrario Carrascosa, Juan de Dios Hernández, Antonio Tejera, Mª Esther Chávez, Ana Roquero, Ifigenia Quintanilla, Enrique Parra, Ángela Arteaga, Manuel Albaladejo, Albert Ribera, Carmen Rueda, Mª Julia Martínez, Jónatan Ortiz, R. González-Villaescusa, María Antón Peset, Darío Bernal, L. A. Hidalgo, L. Roldán, J. Blanquez, F. Prados, B. Raissouni, A. El Khayari, J. J. Díaz, Macarena Bustamente, A. M. Sáez, J. J. Cantillo, M. Lara, J. M. Vargas, Antonio Ferrer, Irene Ruiz de Haro, Enrique Gutierrez Cuenca, J. Antonio Hierro Gárate, and the group of colleagues from the Universidad Politécnica de Valencia (S. Vicente, E. M. Montesinos, L. Fuster, and D. J. Yusá).

THE DEVELOPEMENT OF THE WORKSHOP

Textile studies in Spain have experienced a boom in the initial period of the 21st century, especially with the discoveries of new textile fragments at several archaeological sites. The workshop *The fabric of society: Textile production, rituality and trade in the Late Bronze - Early Iron Age Iberian Peninsula*, held at the National Museum of Archaeology in Madrid in February 2017, demonstrated the significant advances of this field of studies in Spain over the recent years. The topic of the workshop focused on a very specific historical period – the Late Bronze Age and the Iron Age in the Iberian Peninsula, although some speakers went beyond these chronological limits due to the limited number of textile remains in the Iberian Peninsula.

After the warm welcome of the Director of the National Archaeological Museum, Dr. Andrés Carretero Pérez, Margarita Gleba and Beatriz Marín-Aguilera (University of Cambridge, UK) opened the workshop with an introduction of the project *Production and Consumption: Textile Economy and Urbanisation in Mediterranean Europe 1000-500 BCE (PROCON)* funded by the European Research Council. Margarita Gleba, the principal investigator of the project, offered a brief overview of textile production in the northern Mediterranean from 1000-500 BC, focusing on various aspects of textile preservation, analytical methods, raw materials and techniques. Following the extensive analyses of textiles and textile-related materials in Italy and Greece, PROCON project aims to review evidence for textile production in the Iberian Peninsula during the same period, with the collaboration of Iberian archaeologists and projects. Beatriz Marín-Aguilera presented preliminary overview of PROCON's research and results in Spain to date.

The rest of the workshop was divided into four sections. The first, on *Sources of evidence*, comprised two papers by Marisa Ruiz-Gálvez (Universidad Complutense de Madrid) and Mª J. Martínez (Universitat de València). The first of them was dedicated to the interesting question of pottery decoration and its possible connection with textile weaves, especially in the early Bronze Age Iberia and during the Phoenician contact in the Iron Age. María Julia Martínez, a specialist in vegetable dyes and their production, delved into written sources and juxtaposed them with the dyed textile remains found in the Iberian Peninsula. The purple-red colour, often associated with blood, could be achieved, according to her, with madder (*Rubia* sp.), the seeds of which are frequently found at archaeological sites.

The second session focused on *Raw Materials* and featured five papers. Ruth Maicas and Eduardo Galán (both from the National Museum of Archaeology) reviewed the important collections of basketry and textiles at the National Museum of Archaeology in Madrid. Ramón Buxó (Museu d 'Arqueologia de Catalunya–Girona) focused on the exploitation of flax and esparto grass in the Iberian Peninsula in the Late Bronze and Iron Ages (Buxo 2010). A large group of collaborators from the Universidad Complutense de Madrid (UCM) and the Cádiz City Council led by José Yravedra presented the results of their excavations at the Phoenician site of the Teatro Cómico in Cádiz, where the analysis of sheep bones suggests the possibility of the secondary use of wool for textile production, while the presence of muricid shells suggests shellfish purple production. Verónica Estaca-Gómez, together with José Yravedra (both from the UCM), further deepened our understanding of livestock economy in the territory of the Carpetania (central Iberian Peninsula), demonstrating the importance of sheep and goat herds for textile economy as indicated by the slaughter patterns. The session concluded with a paper by Enrique García Vargas (Universidad de Cádiz), who focused on the production and trade of purple dye in the Iberian Peninsula during the Iron Age, suggesting that purple dye and purple-dyed textiles were as important for trade as silver in that period across the Mediterranean.

Textile production and maintenance activities was the title of the third block of papers. Carmen Rísquez, Carmen Rueda, Ana B. Herranz, and Miriam Vilches (Universidad de Jaén) discussed textile production among Iberian societies in light of what is now known as 'maintenance activities.' Their work is of importance for anyone studying spinning and weaving in this vast territory. Irene Ruiz de Haro (Universidad de Granada) concentrated on the material culture of textiles in the Late Bronze and Early Iron Period, with special interest on the textiles, their uses and symbolism among the Phoenicians in Andalusia. Francisco Javier Jover (Universitat d'Alacant) and Juan Antonio López Padilla (Museo Arqueólogico de Alicante) presented an overview of the textile remains dated to the second millennium BC, found in the excavations in the Iberian southeast. Their work reaffirms the importance of textile production during the Bronze Age. Assumpció Malgosa (Universitat Autònoma de Barcelona) presented the recently found goatskins and ropes that were used to wrap the deceased in the Talayotic cave known as Cova des Pas (Ferreries, Menorca) (Fullola *et al*. 2007; Guerrero *et al*. 2006; 2007). This last paper connected very well the third session with the last one on *Textiles and rituality*, which included two papers.

Luis Berrocal-Rangel (Universidad Autónoma de Madrid), Sebastián Celestino and Esther Rodríguez (Instituto de Arqueología de Mérida–CSIC) presented two buildings covered by *tumuli*, Cancho Roano (Zalamea de la Serena, Badajoz) and La Mata (Campanario, Badajoz), which ceased to be active at the end of the fifth century BC. The outstanding numbers of textile tools found in both archaeological sites are connected with the recent discovery at the site of Casas del Turuñuelo

(Guareña, Badajoz), another *tumulus* that will definitely advance our knowledge regarding the Iron Age of this region (see Marín-Aguilera *et al*. 2019 and Marín-Aguilera 2019 for the latest textile research on the Extremadura region). Lourdes Prados Torreira (Universidad Autónoma de Madrid) delved into the subject of textiles and rituals in the Iberian Culture, based on the numerous spindle whorls, loom weights, needles and other textile tools found in funerary and religious contexts. This material culture approach correlates well with the representation of clothing (veils, mantles, etc.) in Iberian iconography and sculpture, which predominantly represent women.

All papers were well elaborated and provided an overview of old and newly excavated findings. Perishable material remains such as fabrics, ropes and baskets were placed at the forefront of archaeological research for the Late Bronze Age and the beginning of the Iron Age, with special attention to the Iberian culture. The workshop revealed the current state of textile studies in Spain from an archaeological standpoint.

The aim of studying textile fragments, baskets, nets, etc. is to further advance the discussion on the economic and social life of the people who lived in the Iberian Peninsula during a very long period of time. In order to do so, it is necessary to go beyond textile technology or very detailed descriptions of textile contexts and fragments. A comprehensive interpretation of textile activities should always include the social, economic, and religious circumstances of the historical period in which those textiles were manufactured and people used them.

NOTES

1. Translated to English by Beatriz Marín-Aguilera and edited by Margarita Gleba and Beatriz Marín-Aguilera.

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I would like to thank the organisers of the workshop *The fabric of society: textile production, rituality and trade in the Late Bronze - Early Iron Age Iberian Peninsula*, who have made a great effort in gathering wonderful scholars together. I am grateful to Margarita Gleba, because with her expertise she can really contribute to the study of ancient textiles in Spain; and to the young promise of research in textile archaeology, Beatriz Marín-Aguilera for her diligence in the organisational aspects of the colloquium.

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

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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

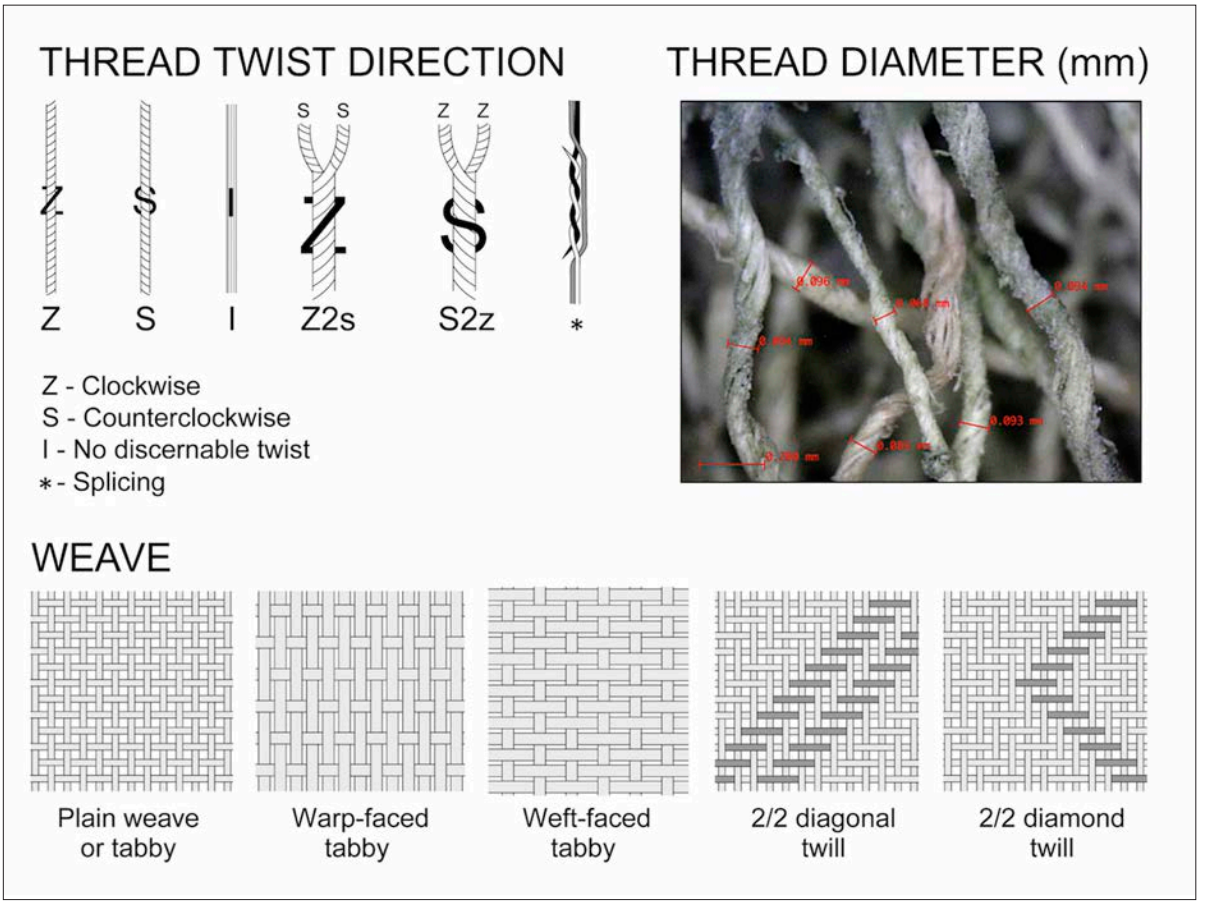

Fig. 2: Structural textile parameters (Image: V. Herring and M. Gleba).

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

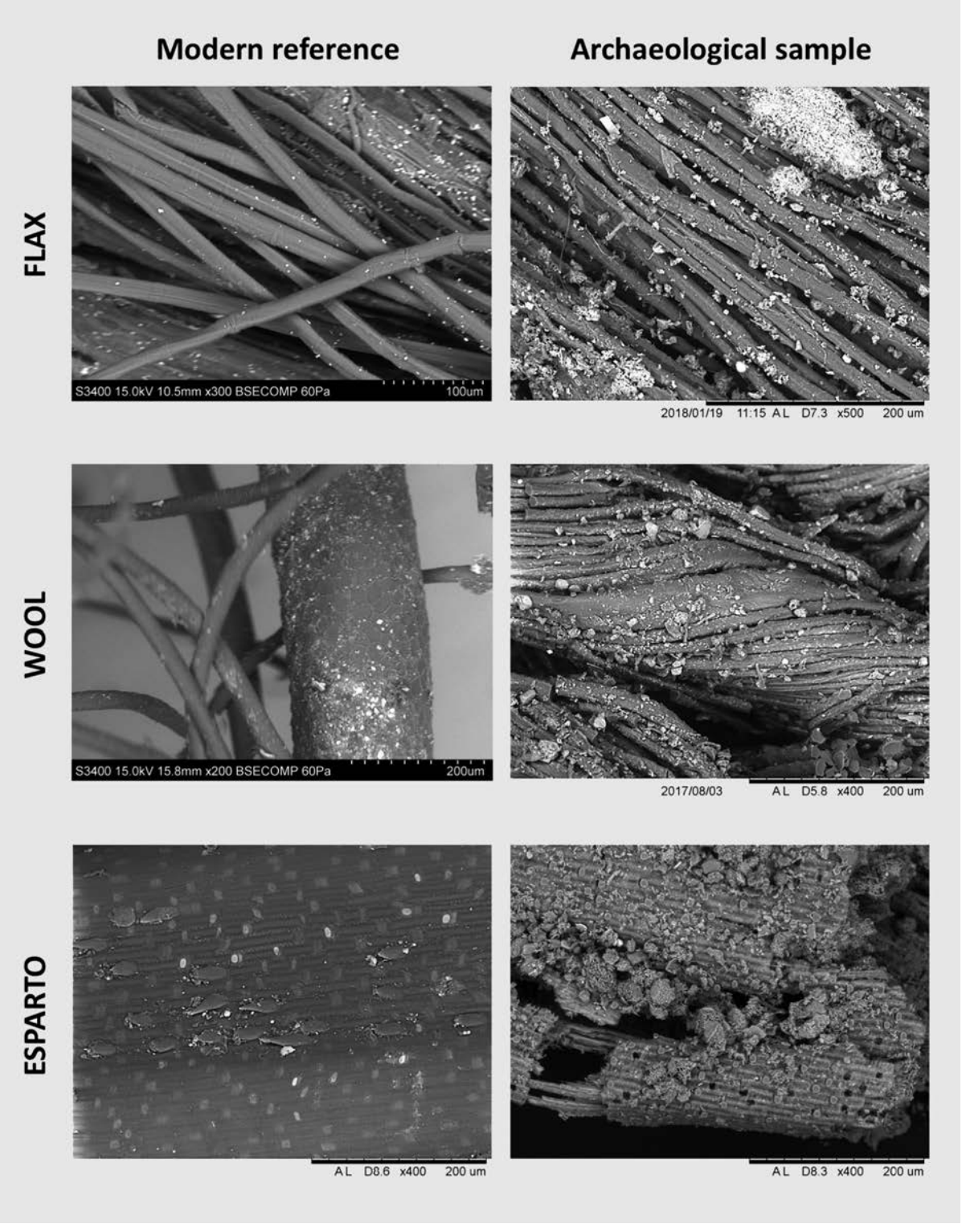

Fig. 3: Scanning Electron Micrographs of most common fibres in pre-Roman Iberia with reference samples shown on the left and archaeological samples on the right (Images: M. Gleba).

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.

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Shellfish Purple Production in Iberia and the Balearic Islands in the Pre-Roman Period: Archaeological Evidence in its Mediterranean Context

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Abstract:

This paper tries to synthesize the archaeological evidence known to date regarding the production of purple dye in Phoenician and Punic Iberia from the very beginning of the Phoenician colonization (ninth century BC) until the Roman arrival in the region (by the end of the third century BC). This paper begins with a technological (including purple mollusc fishing methods), biochemical and archaeographic synthesis about purple dye production techniques in antiquity, before focusing on th Iberian evidence. In order to facilitate the techno-cultural and geographical background of the Iberian evidence, this paper discusses the most significant evidence known until now for the pre-Roman Mediterranean purple dye production sites and their industrial facilities.

Key words: *Purple Dye, Protohistory,* Ars Purpuraria*, Archaeology of Production, Ancient Technology.*

Resumen:

Este trabajo pretende sintetizar las evidencias arqueológicas conocidas hasta hoy sobre la producción de purpura marina en la Iberia fenicia y púnica desde los mismos inicios de la colonización fenicia (s. IX a. C.) hasta la presencia romana en la región (fines del s. III a. C.). Con carácter previo a la presentación y estudio de la evidencia arqueológica se realiza un estudio tecnológico (incluyendo métodos de pesca de los moluscos purpurígenos), bioquímico y arqueográfico acerca de la tecnología de la producción de púrpura en la Antigüedad. Igualmente, para facilitar la contextualización tecno-cultural y geográfica de la evidencia ibérica se presentan y describen brevemente los principales establecimientos conocidos de fabricación de tinte púrpura en el Mediterráneo prerromano y sus instalaciones industriales.

Palabras clave: *Púrpura, Protohistoria,* Ars Purpuraria*, Arqueología de la Producción, Tecnología de la Antigüedad.*

INTRODUCTION

Shellfish purple is the oldest natural, colourfast dye known to humans. It is produced from the secretions of marine molluscs, which are subject to a process that turns these secretions into a water-soluble dye that can effectively and permanently colour textile fibres. The *chaîne opératoire* involves the following steps: capturing the molluscs; extracting their hypobranchial gland; generation of the dye through fermentation; and, reduction and dyeing of fabrics.

Archaeological evidence for the production of purple is scarce, apart from accumulations of shells which, if found broken in a certain way, may be an indication of dyeing. However, these shells were often reused for building or lime extraction (Alberti 2008), so their discovery can be used to argue for the presence of dye production somewhere near, but are not, strictly speaking, a direct evidence for purple production.

Recent years have seen the excavation of a number of purple-making facilities dated to the pre-Roman and Roman periods. This new evidence has revealed important information concerning the purple-making process. At the same time, biochemical research has also contributed to increasing our understanding of what was in fact a relatively simple process (Koren 2005). As such, we are now in a much better position to detect and interpret artisanal facilities, which would otherwise go unnoticed, despite the presence of shell middens.

This work presents archaeological evidence for the production of purple in the Iberian Peninsula and on Ibiza in the pre-Roman times. The period under consideration extends from the arrival of the Phoenicians, who were apparently responsible for bringing this technique to the West, to the effective Romanisation of Hispania, in the last quarter of the second century BC, during the Republican period. This evidence is presented within a predominantly Mediterranean setting (even if some of the evidence was found in Atlantic settings). Similar, and not necessarily well known, evidence from other Mediterranean regions is also presented. I do not aim to be exhaustive, but rather to select locations which best complement the Spanish evidence and which correspond well with the identification criteria outlined by Alberti (2008), Susmann (2011) and MacDonald (2017).

Finally, the evidence is contextualised within the *chaîne opératoire* of purple dye (for purple dye productions infrastructures, see Macheboeuf 2008), starting from the capture of the molluscs and ending with the transformation of their secretions, which is now much better understood thanks to the application of biochemical research and experimental archaeology to past productive processes (Ruscillo 2005). The evidence is placed within a sequence of steps which, in my opinion, must be the key reference for the interpretation of evidence of purple-making in the Iberian Peninsula and the Balearics.

THE CAPTURE OF PURPLE MOLLUSCS

Different techniques can be used to capture purple molluscs, chiefly members of the *Muricidae* (*Bolinus brandaris, Hexaplex trunculus*) and *Rapaninae* (*Stramonita haemastoma*) families. *B. brandaris* and *H. trunculus* are adapted to sandy sea beds, while *S. haemastoma* thrives on rocky soils, which means that, while all species can be manually collected by divers, only *B. brandaris* and *H. trunculus* can be obtained by means of rakes and other trawling techniques. Purple molluscs, which are voracious predators, can also be attracted into fish traps by using other molluscs as bait.

Ancient sources mention the use of fish traps for capturing *Muricidae* (*cf.* García Vargas 2004), but recent experimental studies (Ruscillo 2005; Alfaro and Mylona 2014) suggest that this technique would not provide shellfish in sufficient numbers unless it was complemented with the manual collection by divers of specimens congregated around, but not inside, the trap. In fact, rather than a trap as such, the device was conceived as a 'meeting point.' For this reason, the technique did not involve the use of closed traps, but could be carried out with a combination of open devices to which bait was affixed and close monitoring by expert divers.

PURPLE DYE PRODUCTION: THE BIOCHEMICAL PROCESS

Purple is obtained from the molluscs but is not itself present in their hypobranchial glands (Clark *et al*. 1993: 196). Contrary to common belief, the gland does not secrete the dye, but rather releases *precursors*, a series of organic substances that, after being chemically reduced in anaerobic conditions, turn into purple. The main component of purple is 6,6'-dibromoindigo, but it also

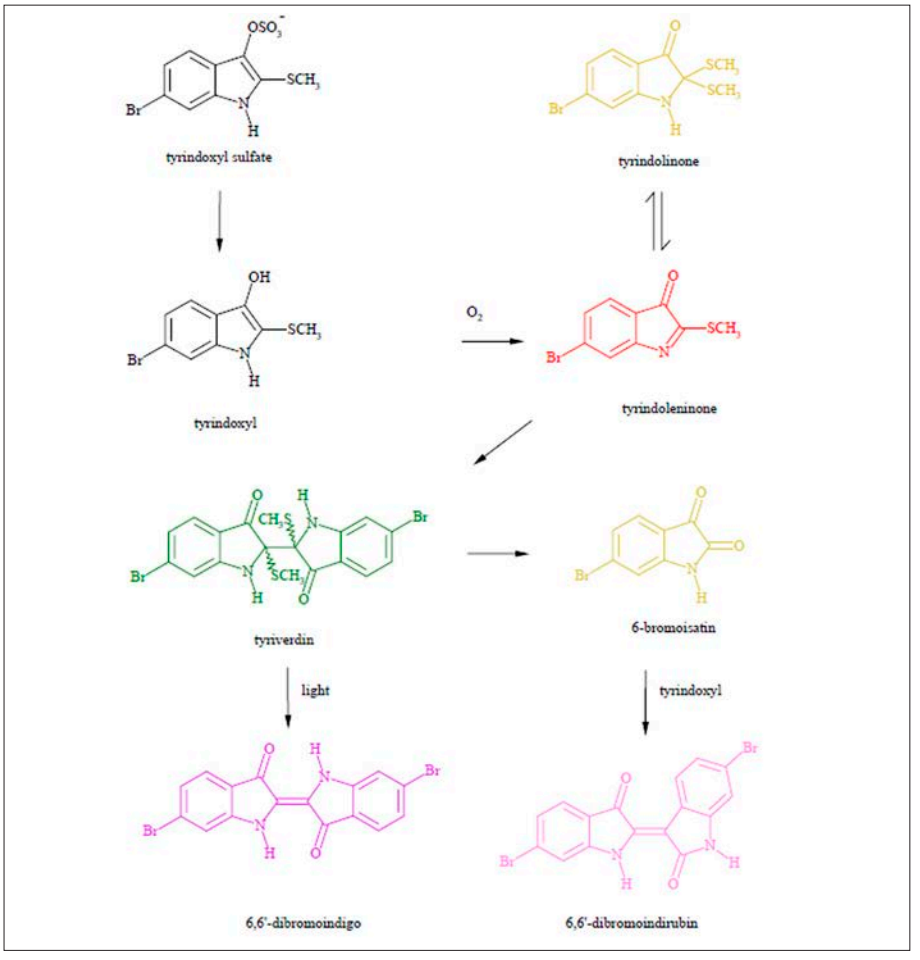

Fig. 1: The chemical process of shellfish purple dye (Cooksey 2001: fig. 11, reproduced with permission).

comprises other components such as 6-monobromoindigo, which is the main component in purple made from *H. trunculus* (*infra*).

Mollusc-based purple production is a 'lost craft'; that is to say, these processes have not been continued since Late Antiquity (Fernández Uriel 2010), thereby forcing us to enquire into the technical procedures and biochemical mechanisms (fig. 1) involved in purple production (*vide* recently Koren 2013 and Sukenik *et al*. 2017).

Regarding the latter, although some details are uncertain, chemical and archaeological experimentation have gone a long way to clarify the process by which the precursors secreted by the hypobranchial glands of the molluscs are synthesised into the dye.

The main precursor (fig. 2) in *Bolinus brandaris* is tyrindoxyl sulfate (Koren 2005), while *Hexaplex trunculus* contains four poorly defined precursors that result in blue (indoxyl sulphate) and purple compositions (Cooksey 2017). In the case of *B. brandaris*, for instance, the precursor reacts in the presence of certain enzymes such as purpurase, turning into tyrindoxyl which in turn dimerises into tyriverdin. The proteolysis of tyriverdin yields dibromoindigotin and dimethyl disulphide, which are responsible for the strong smell of the products.

The oxidation of tyriverdin (through exposure to air and light) leads to the formation of the molecule 6,6'-dibromoíndigo (DBI), the colour of which tends to be red. Non-dimerised indoxyls, that is, those which are not replaced in position 2 (Michel *et al*. 1992; Fernández Uriel 2010: 155) form indigotine (IND) and monobromoindigotin (MBI), which are the molecules responsible for bluish and purplish colours respectively (fig. 3). The presence of both IND and MBI is greater in *H. trunculus*, but they appear in different proportions within the same species. That is, some *H. trunculus* are richer in IND and

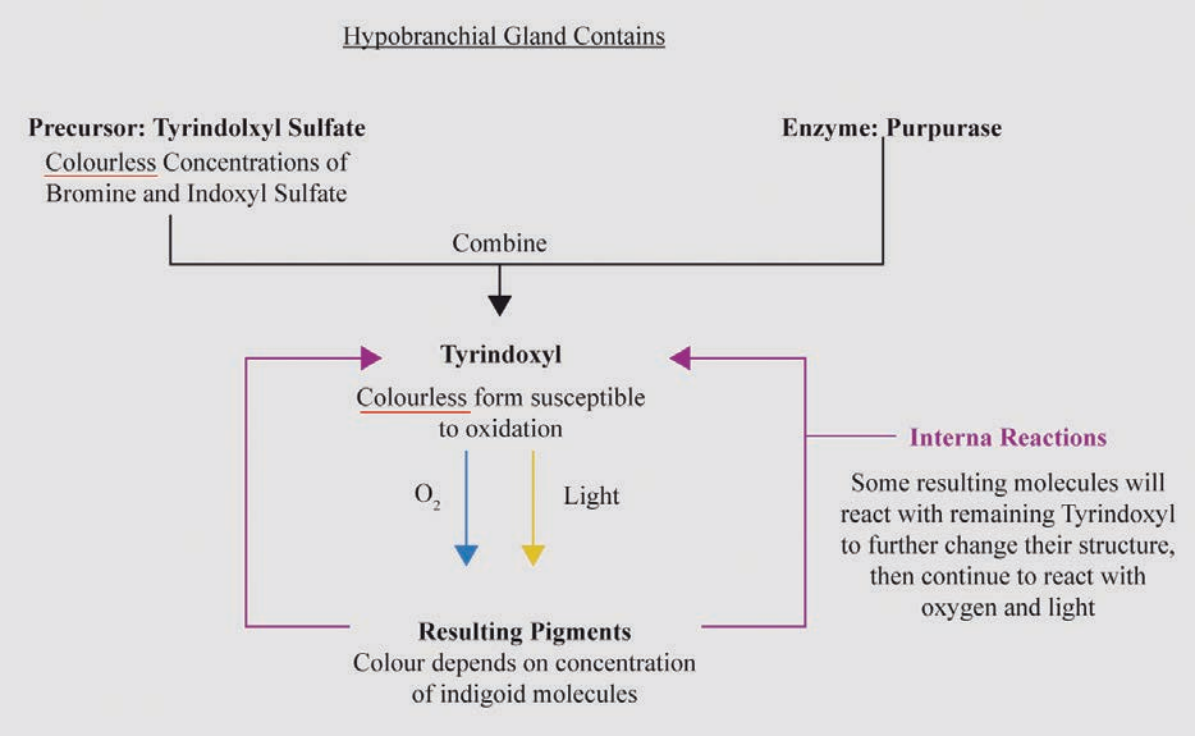

Fig. 2: Flow chart to demonstrate the chemical changes when the gland is punctured (MacDonald 2017: fig.9, reproduced with permission).

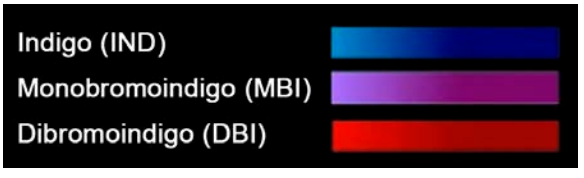

Fig. 3: Colour ranges (see online version) created from the different indigoids (MacDonald 2017: fig.10, reproduced with permission).

poorer in MBI, while for others the opposite is the case. IND is responsible for the blue colour and MBI for the purple colour (Koren 2008: 88). The proportion of MBI and IND in *H. trunculus* depends on a variety of factors: geographical provenance, age and sex of the animal, exposure to sunlight (males produce IND in dark conditions but females do not), the presence of contaminants and hygiene, etc.

'Natural' purple obtained by exposing the secretions to natural light, i. e., direct dying, can be used to dye fabrics, but this is only a superficial colour treatment, less intense and durable. In order to obtain a more penetrating dye the reaction must be controlled.

PURPLE DYE PRODUCTION: THE TECHNICAL PROCESS

The production of an intense and durable dye is a more complex process, chiefly known to us through an account by Pliny the Elder (*Naturalis Historia* 9.63). According to his description, the glands were kept in salt water for three days. Afterwards, they were heated in a lead container; the proportions of the solution were one hundred amphorae of water to five hundred pounds of glands, and the heat was moderate, constant and direct. Heating continued for seven days without interruption.

Pliny the Elder's 'recipe' is not entirely explicit and presents some translation problems, not only with regard to the proportions but also to other important technical details, such as the use of a *plumbum* container, which could refer to lead or tin (*plumbum nigrum* and *plumbum album*, respectively), and the apparent contradiction between the use of the verb *fervere* (to boil) and the need, verified experimentally, to keep temperature below 50ºC in order to obtain a bright colour (Koren 2008; MacDonald

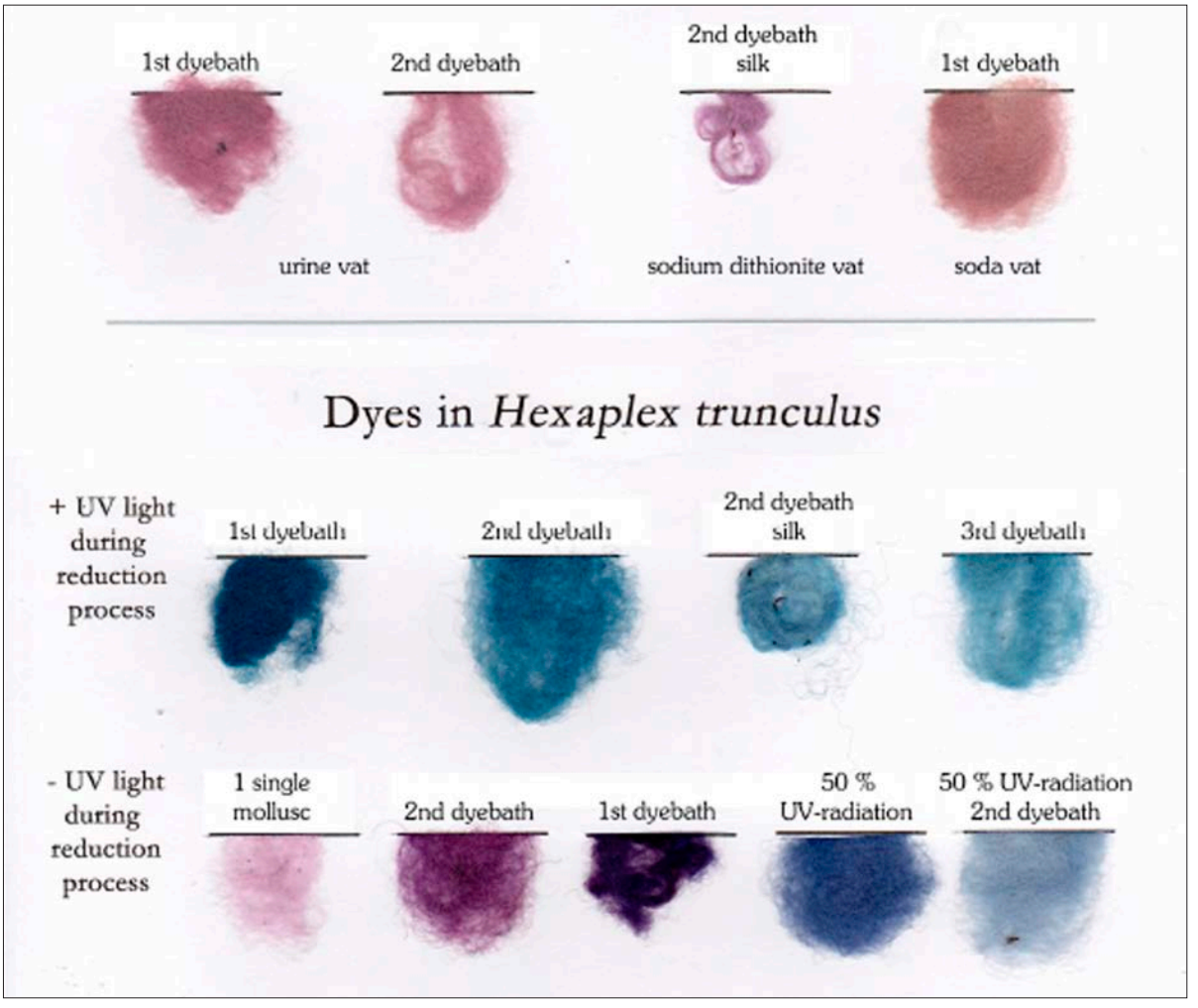

Fig. 4: Colour samples (see online version) on wool and silk from the experimental series with purple snails *Bolinus brandaris*' and *Hexaplex trunculus*' made by F. Meiers (2013: fig. 9, reproduced with permission).

2017: 27). Furthermore, some instructions are completely lacking, such as whether the water should be brine or not, and whether any other ingredients are to be added to the mixture.

The latter issue is crucial, because the heating of the glands, previously soaked in salt water for three days, takes place in this heated solution, as Pliny clarifies. The three-day soaking period produces the necessary bacteria concentration to reduce the precursor in anaerobic conditions. The reduction prevents the immediate formation of the colouring agents, DBI, MBI and IND, which are reactivated later by exposing the compound to sunlight. Reduction to a leuco base (a colourless compound resulting from the reduction of a colourant, which can be turned back into a dye through oxidation), however, does not suffice to guarantee the quality of the dye, which must not only be durable, but also soluble in water to allow for the impregnation of the fabric.

Solubility of the leuco base depends on the environment in which the dye is reduced at constant heat. The solution must be liquid and alkaline, with pH remaining below 9 (Koren 2005: 140-141). The heat must remain constant between 40-45ºC. Pliny the Elder's use of the word *fervere* must be understood in this sense, but no mention of the alkaline environment is made in either the description in *Naturalis Historia* or similar 'recipes', such as that mentioned in the Talmud (Koren 2013). The use of salt water, for instance sea water, may

be enough to keep a low pH (Koren 2013: 58; but see *contra* MacGovern and Mitchell 1990: 155; Macheboeuf 2007 for salted *murex* as food). In recent experiments, various alkaline substances have been tried, such as urine, natron, potash (calcium carbonate), wood ash and lime (Koren 2005: 145). Each of these generates a different reaction and, therefore, a different colour. The use of different containers can also have an effect on colour (Meiers 2013).

Over the last two decades, significant progress has been made concerning the origin of shellfish-based dyes in the Mediterranean and in the determination of archaeological markers that suggest the presence of a purple dye workshop.

Concerning the origins of the industry, evidence suggests that some of the earliest production centres were located in the Aegean, specifically on Crete. The production sites at Kouphonisi, Karoumes, Palaikastro, Chrysi and maybe Kommos are dated to the early second millennium (Middle Minoan, *ca*. 18th-17th centuries BC) (Alberti 2008: 76; Apostolakou *et al*. 2016). In nearly all of these sites, murex middens are associated with a variety of structures, so they can be included in Alberti's group A[1]. Other Middle Bronze Age Aegean contexts, in which evidence for purple production has been found, are possibly at Kastri on Kythera in Greece, and at Tavşan Adaçi and Troy on the Turkish coast (Kremer 2017).

ORIGINS OF THE PURPLE-DYE INDUSTRY IN THE AEGEAN AND THE LEVANT

Tracing the origins of purple production on the Levantine coast, which was believed to be the region where this activity first emerged until the Cretan evidence was discovered, is trickier. The earliest evidence may be that of Minat-el-Beida, the harbour of Ras-Shamra in Syria, where shell middens have been found in association with various structures and ceramic containers stained with

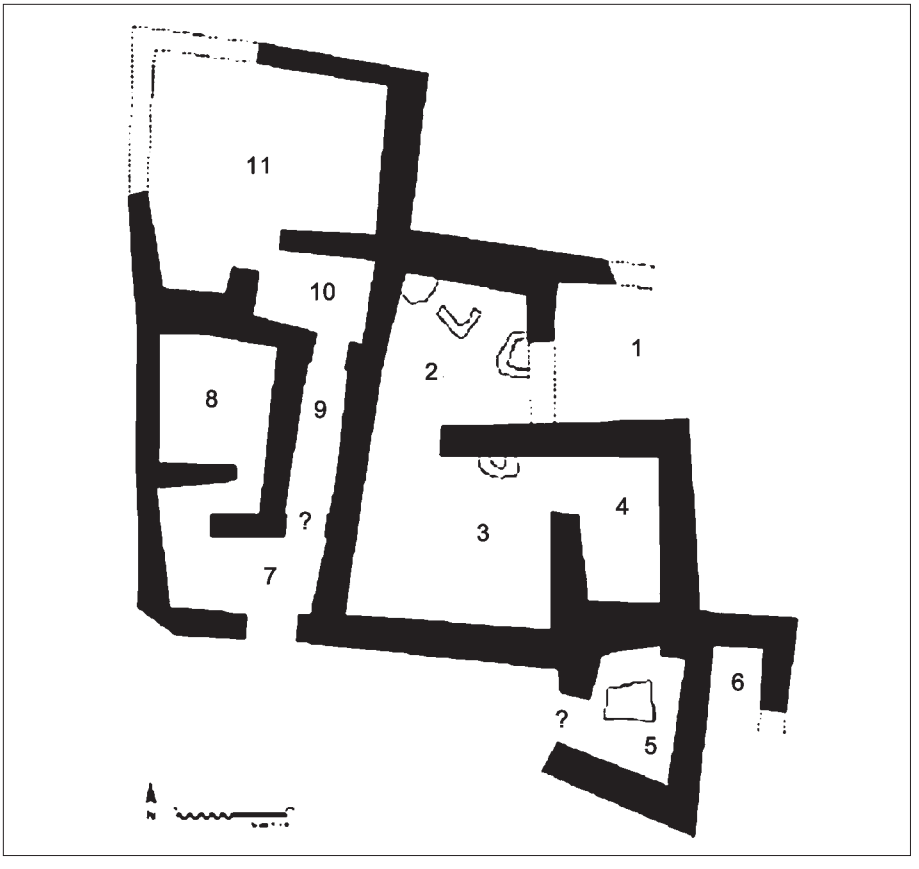

Fig. 5: Chryssi. Site plan of Building B1 (Apostolakou *et al*. 2016: fig. 5, reproduced with permission).

purple dye (Kalaitzaki *et al*. 2017). These finds include the site in Alberti's category A (*supra*). The evidence found in Sarepta (previously dated to the 13th century BC) has been recently argued to be coetaneous to that in Ras-Shamra; in this case, the evidence comprises shell middens (chiefly of *H. trunculus*) and fragments of stained pottery vessels, which themselves may be securely dated to the 13th century BC (Reese 2010). The 13th century BC is also the date assigned to the stained pottery fragments at Tel Akko in Israel, where all three mollusc species have been documented.

At Tell Abu Hawam, also in Israel, which is roughly coetaneous with Tel Akko, a large quantity of shell remains has been found, which suggests the presence of a workshop – Alberti's B group – while Tyre and Sidon have yielded similar evidence, including both *B. brandaris* and *H. trunculus*, with dates that cannot be earlier than the second half of the third millennium BC and which continue into the Roman imperial period and beyond (Kalaitzaki *et al*. 2017).

For obvious historical and cultural reasons, the earliest evidence of purple production in the Phoenician colonies in the Central and Western Mediterranean – in sites such as Motya, Carthage, Ibiza and Cadiz – is linked to the Levantine production centres, although some Central Mediterranean workshops appear to have a connection with the Mycenaean world, for instance Coppa Nevigata in Italy (Cazzella *et al*. 2004; 2012).

PRODUCTION TECHNOLOGY: ARCHAEOLOGICAL MARKERS

Wherever direct archaeological evidence of purple extraction has been found (i.e. beyond mere coastal shell middens), the remains attests to an invariably simple technology. The infrastructure of purple production generally includes pits and hearths located in the vicinity of heaps of intentionally broken shells and purple-stained ceramic fragments. However, it is rare to find all these features in the same location.

The simplest productive model is illustrated by the remains found on the island of Chryssi, off the coast of Crete, one of the earliest known workshops, dated to the 18th–17th centuries BC (Apostolakou *et al*. 2016). This site, which is well-preserved and has been extensively excavated, provides a good account of the spatial organisation of purple production and of the structures involved

Fig. 6: Chryssi. The hearths of the Building B1 (room 3: Apostolakou *et al*. 2016: fig. 6A, reproduced with permission).

in the activity. The fact that the site does not appear to have been used also for dyeing fabrics (an activity which was carried out in Pefka, on the coast opposite Chryssi: Apostolakou 2008; Apostolakou *et al*. 2016) suggests an activity mostly related to dye extraction (Apostolakou *et al*. 2016).

Building B1 at Chryssi (fig. 5) is divided into 11 rooms, the central four of which (rooms 1-4, of which Room 3 is in all likelihood a courtyard) seem to have been exclusively dedicated to the manufacture of purple dye, while the surrounding rooms appear to have had residential and other uses.

Room 3 was covered in vegetal ash (almond and olive tree), while Rooms 2 and 3 were furnished with stone slabs, mills and stone hammers used to crush the shells. The excavation of Room 3 also yielded two hearths and the *in situ* remains of ceramic containers used to heat the dye (along with the leuco base), as well as stone hammers, a triton shell, and jars and cups, which could have been used to add liquid (basic solution) to the ingredients and, eventually, to scoop out the finished dye (fig. 6).

The excavators suggest a *chaîne opératoire* that began with the crushing of the shells in Room 2 and ended with the heating of the purple dye in Room 3, where most of the evidence for combustion is found, although the excavation of the room also yielded stone hammers (Apostolakou *et al*. 2016: 203).

Although Chryssi was exclusively dedicated to producing dye, the processing of shellfish and dyeing of fabric could also be done in the same place.

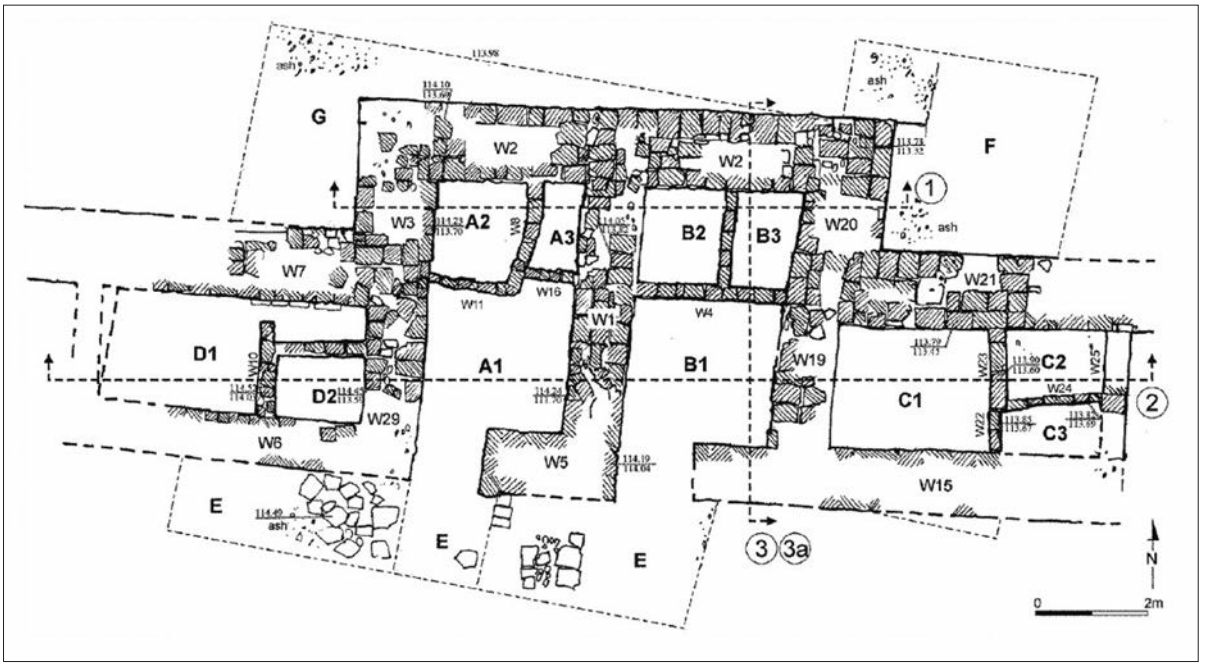

Fig. 7: Horbat Shim'on. Plant of phase 1 (Dagan and Cassuto 2016: fig. 4A, reproduced with permission).

Fig. 8: Tell Dor. The southern pit looking west (Nitschke *et al*. 2011: fig. 7, reproduced with permission).

A similar case is presented by the Minoan site (MM II) of Pefka on Crete, which, despite having been recently interpreted as a fabric-dyeing establishment (Apostolakau *et al*. 2016), also seems to contain evidence for the production of dyes. This included not only *H. trunculus*-based purple, but also plant-based dyes, such as those obtained out of weld (*Reseda luteola*) and madder (*Rubia* sp.). The site has also yielded traces of lanolin, interpreted as evidence of the washing of wool (Koh *et al*. 2016).

The site of Horbat Shim'on in Israel (fig. 7), dated to the eighth century BC, has yielded evidence of the entire process being carried out in one complex, the dyeing of the fabric occurring in a separate room (Room C), which contained mortars, pestles, stone hammers and stone containers (Dogan and Cassuto 2016).

Other Mediterranean sites, such as Tel Dor and Tel Mor, in Israel, present similar facilities dated to the Iron Age (Kalaitzal *et al*. 2017), although the remains are not as well contextualised and characterised as in the previous examples.

At least two, chronologically distinct, areas in the industrial quarters of Tel Dor have been related to purple dye production (Stern and Sharon 1986; Nitschke *et al*. 2011):

- Area G includes a shell-filled pit found in association with ceramic containers and fragments of calcite, one of the ingredients potentially used in the production of the leuco base (*supra*), which is a likely indication of dye extraction. These structures, originally detected in 1986 (Stern and Sharon 1987) have not been excavated, or at least no publication yet exists following their discovery.

- Area D1, later relabelled as Area D-5, was also detected in 1986, and has been excavated and published in some detail (Nitschke *et al*. 2011). The area includes at

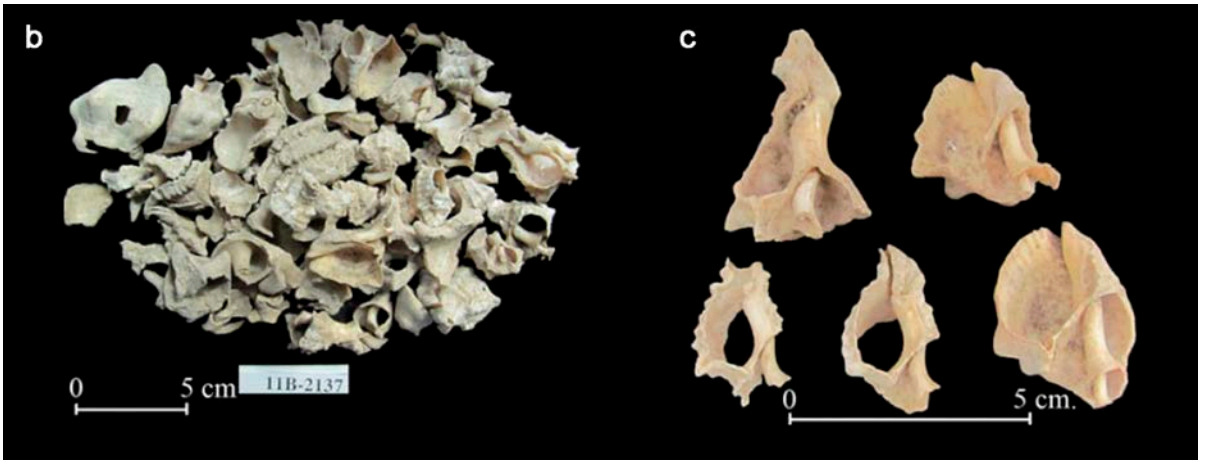

Fig. 9: Tell Shikmona. Crushed shells (Sukenik *et al*. 2017: fig. 1, reproduced with permission).

least two circular pits, approximately 0.90 m in diameter and *ca*. 1 m deep, linked by a mortar-lined channel, inside which remains of calcite were found (Koren 2013: 57). The southern pit (fig. 8) was full of *H. trunculus* shells, and was attached to a small receptacle demarcated by clay slabs, which has been interpreted as the support for an anvil on which the shells were crushed. The pit, which is nearly 1 m deep, has been interpreted as a shell dump, but it is possible that the fill was deposited after the pit was no longer in use. Both the channel that links the pits and the fragments of calcite found within it are stained with purple, and it is therefore possible that the channel was a sort of drain that fed excess leuco base from the southern pit to the other one, where it was collected to be either reused or discarded, for neither pit is lined with hydraulic mortar (Nitschke *et al*. 2011). These structures are dated to the third century BC.

Other than these sites, the evidence for purple extraction in the Eastern Mediterranean is very sporadic. The presence of shells crushed in a regular manner, in association with purple-stained ceramic fragments, is generally admitted as solid evidence for purple extraction fairly close by. This is the case with Tel Shiqmona in Israel (Iron Age II), for example, where heaps of broken shells (80% *B. brandaris*; 11% *H. trunculus*; and 9% S. *haemastoma*) were found in connection with rim and neck fragments of purple-stained ceramic containers (fig. 9; Sukenik *et al*. 2017). Gas chromatography tests performed on these ceramic fragments have revealed a high content of BMI and IND, and a low content of DBI, which agrees with the important proportion of *H. trunculus* in the middens.

Fig. 10: Tell Kabri. Interior of a purple-stained potsherd, part of the upper mouth of a dye vat, dated in the seventh century BC (Koren 2013: fig. 5, reproduced with permission).

Tel Kabri in Israel has yielded similar evidence from the seventh century BC, especially concerning ceramic containers with purple staining on the inside and burn marks on the outside (fig. 10; Koren 2013). The interior marks are located on the upper neck, which indicates that this was the only area exposed to sunlight during the production of the purple, presumably because the lid had to be occasionally removed for stirring the liquid during heating (Koren 2013: 52).

In summary, it appears that much progress has recently been made in the characterisation of purple workshops during the Middle-Late Bronze Age and the Early Iron Age in the Aegean and the Levant, although, paradoxically, more is known about the earliest periods than about later ones (Carannante 2014: 274).

Fig. 11: Teatro Cómico (Cádiz). Kiln structure filled with *H. trunculus* shells (Image courtesy of José Mª Gener).

Fig. 12: Teatro Cómico (Cádiz). Kiln structure filled with *H. trunculus* shells, detail (Image courtesy of José Mª Gener).

The information provided by archaeometry and biochemistry matches the rather scant evidence yielded by the few known workshops. Although this evidence is rarely as eloquent concerning the *chaîne opératoire* as could be wished, it may be said that the process undertaken in order to extract the dyes is now fairly well understood.

PRODUCTION AREAS IN THE WESTERN PHOENICIAN COLONIES AND THE ORIGINS OF PURPLE EXTRACTION IN THE IBERIAN PENINSULA

Evidence for shellfish-based dye production in the west has only started emerging in recent years. This evidence is generally partial and fragmentary, but in some cases it is remarkably early.

The earliest known shell middens in the region were found on the Atlantic coast of the Iberian Peninsula, and are dated to the earliest Phoenician colonisation of the west, a phenomenon that is currently dated to the ninth century BC. Evidence of remains of murex shells crushed in the way consistent with purple dye production have thus far been limited to Phoenician colonial sites, and it is therefore not implausible that the *ars purpuraria* was directly imported from the cities on the Phoenician coast.

The report concerning the presence of possible middens in Huelva's 'pre-colonial' Phoenician levels (Calle Mendez Núñez 11-13 / Plaza de las Monjas 12) is umbiguous (González de Canales *et al*. 2009: 11). These deposits, dated to between 930 and 830 BC, seem to have contained *B. brandaris* and *H. trunculus* (González de Canales *et al*. 2009: 16), but their use for purple production is merely speculative; the report does not clarify whether the shells had been treated in some way or whether they were found forming substantial heaps.

Several Phoenician colonies on the Iberian Mediterranean coast, such as Baria (Villaricos) and Abdera (Cerro de Montecristo, Adra) present a similar case (García Vargas 2004). The identification of purple production at these sites is generally little more than optimistic speculation based on the presence of whole or fractured murex shells, which in itself is insufficient to infer purple production in the vicinity of where they were found.

Similarly, Room XX in Sa Caleta, on Ibiza, has been interpreted as a purple production area, but the number of murex shells is so small (three specimens of *S. haemastoma*; Ramón Torres 2004: 167) that this cannot but be substantiated. The rest of the site has yielded dispersed murex remains found in association with other species which are unrelated to purple production, such as *Patella* sp. and *Monodonta turbinata*, which suggests that all these species were used as food. Although the report for the 1994 excavations (Ramón Torres 2004: 168) has pointed out a substantial number of, sometimes fractured, specimens of *H. trunculus* and *S. haemastoma* in the Phoenician contexts

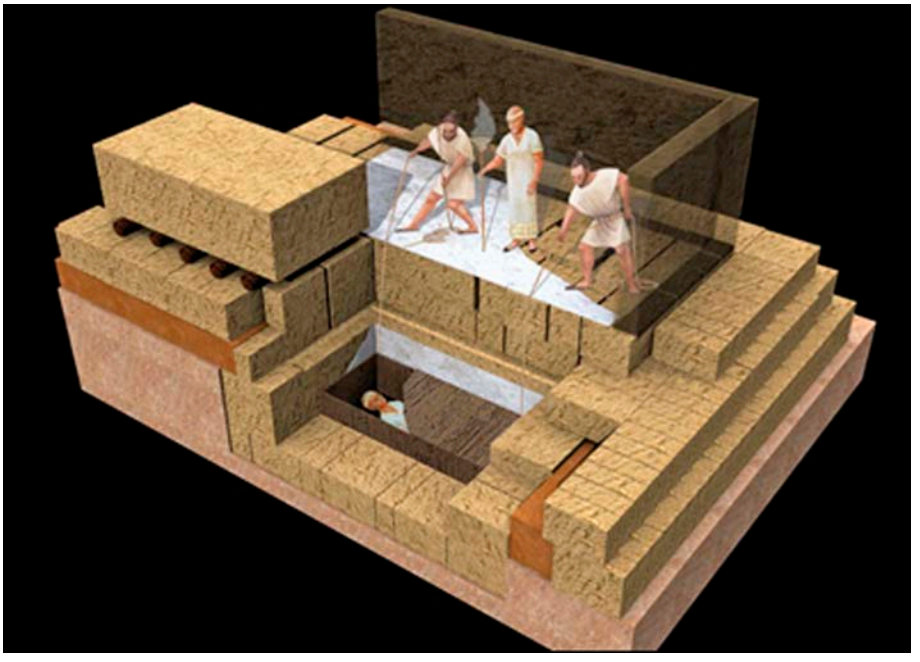

Fig. 13: Reconstruction of the monumental tomb of Casa del Obispo, Cádiz (Image courtesy of José Mª Gener).

of Room XVI, purple-related species amount to a small proportion of all the marine shells in the record; as such, while 97% of marine shell specimens have been identified as *Patella* and *M. turbinata*, *S. haemastoma* represents under half of the remaining 3% (Ramón Torres 2007).

In the Phoenician colony of Cerro del Villar, large quantities of murex were found in association with sixth century BC industrial remains (Aubet Semler 1989: 75), and also in connection with other rooms containing fishing equipment; this, however, does not mean that the molluscs were necessarily being accumulated for the purpose of extracting purple. The report does not clarify if the shells had been broken, but it is to be expected that, had they been, the report would at least mention it.

The contexts at the site of Teatro Cómico in Cadiz present, on the other hand, a different case (Gener *et al*. 2012; see also Estaca *et al*. in this volume). There, a substantial quantity of *H. trunculus* was documented in relation to a kiln, dated to the late ninth century BC and also filled with murex shells (figs. 11-12). The structure is elliptical in shape and 1.60 m long; it was securely dated to phase I (820-800 BC) and was outlined by a course of local shellstone bound together with clay. Inside the structure, a succession of three layers could be distinguished:

- A base of shellstone;

- A very compact layer formed of clay and pulverised *H. trunculus* shells;

- A top layer of red clay, which had clearly been exposed to fire.

Approximately 13.5 m to the south of this structure a sequence of three hearths was identified. The excavators interpreted this structure as a purple-making workshop. The presence of wheel-thrown pottery suggests that the complex must be dated to the colonial period.

The burnt remains correspond to the area where glands were heated after being removed from the broken shells. The shells of *H. trunculus* seem to have been discarded near this structure, as though the whole *chaîne opératoire* took place around this very early structure in Teatro Cómico.

The use of purple as luxury dye is documented in Cadiz in a monumental tomb constructed in local shellstone, dated to the sixth century BC and recently excavated at Casa del Obispo (fig. 13). The analysis of sediment carried out by Salvador Domíguez Bella *et al*. (2011) has demonstrated the presence of purple dye and gold traces in the sediment from the interior of the tomb (that was robbed in Roman times); these traces were interpreted as textile remains.

No secure evidence – according to Alberti's criteria (2008: 75-76) – exists for purple production in the Iberian Peninsula in the first half of the first millennium BC other than the production facilities found in Teatro Cómico in Cadiz. Even these remains are lacking a secure structural

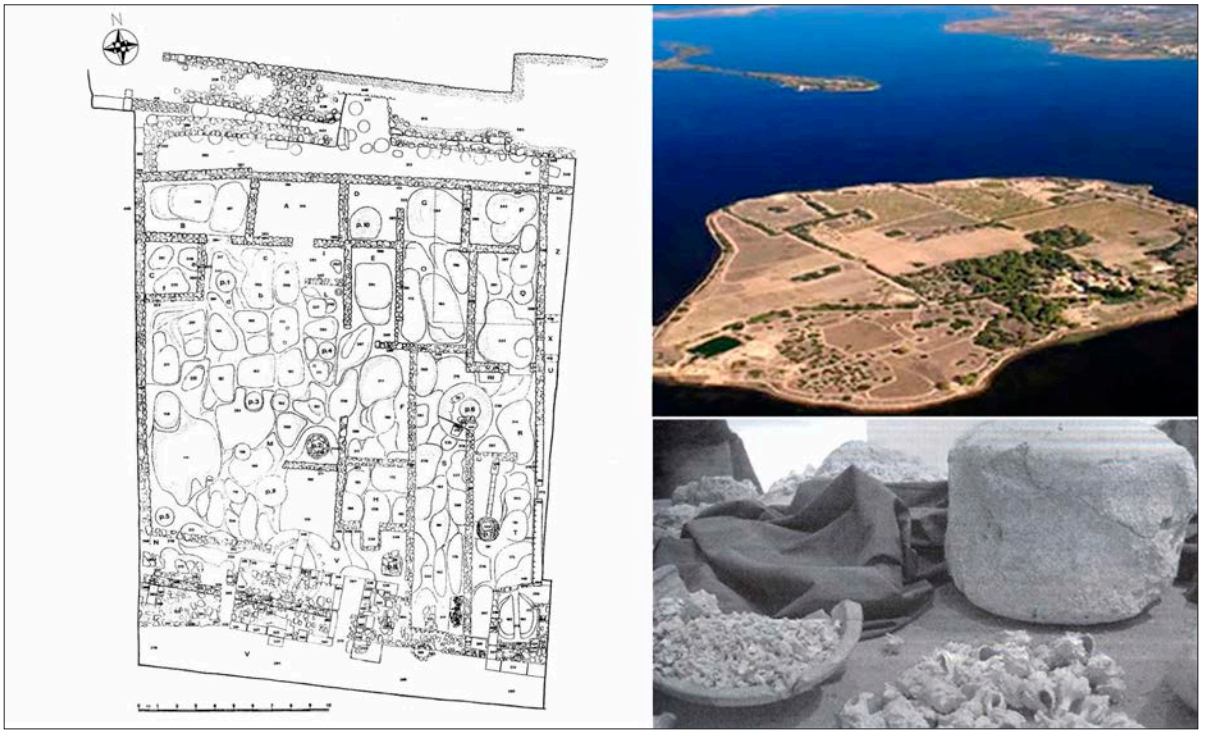

Fig. 14: Motya structures and items. Left: industrial area also known as "Luogo di Arsione". Right up: panoramic view of Mozia island. Right down: crushed shellfishes and an anvil made with a whale vertebra (Tusa 1973).

context, largely owing to the presence of later Phoenician structures on top of them, which has prevented archaeologists from excavating the older levels more extensively.

Other potential production sites, such as Huelva, Ibiza, Adra or Cerro del Villar are merely hypothetical, although the association of purple heaps with fishing-related structures and tools makes Cerro del Villar a relatively strong candidate.

PURPLE IN GREEK AND PUNIC CENTRAL MEDITERRANEAN AND AEGEAN CITIES: THE ARCHAEOLOGICAL EVIDENCE

Archaeological evidence for purple production in the Western and Central Mediterranean in the Punic period (fifth-third century BC) is somewhat more substantial than for earlier historical phases. In the so-called Luogo di Arsione, in Motya off the west coast of Sicily, a complex of approximately 20 ditches cut in the calcareous ground was found to be related to a series of rooms built in stone and sun-dried brick (fig. 14, B-C). Initially, the complex was interpreted as a cremation site related to human sacrifices, the ashes being deposited afterwards in the *Tophet* (Tusa 1972).

Archaemetric work carried out by Ninina Cuomo di Caprio (1981) detected the presence of purple and traces of high temperature inside one of the pits (sample 24). This was linked to *H. trunculus* shell remains in Pit E (Tusa 1973: 19, 39, 40, 47, pls. XIII, XIV; Cuomo di Caprio 1981: 9-10, 13) and elsewhere – frequently beneath the walls (Reese 2005: 110). In Pit E, the *H. trunculus* shells were found in association with four whale vertebrae (*Physeter macrocephalus*), which were interpreted by Reese (2005: 111) as anvils on which the associated specimens of *H. trunculus* were broken (approximately 75-80 individuals), which is plausible given the discovery of stone hammers in the same context (fig 14, A; Reese 2005: 110).

In Euesperides, later known as Berenice or Sidi Khrebish, in Libya, excavations have revealed a purple production area dated to the first half of the third century BC. The workshop could be identified through the presence of heaps of broken *H. trunculus* shells and hearths in the peristyle of a residential structure adapted to house

industrial activities (Wilson *et al*. 2004; Wilson and Tébar 2008). At least two phases, separated by a hiatus, have been identified; both phases present similar features: hearths upon heaps of clay and shell middens, all of which was found covered in ash (Wilson *et al*. 2004: 167). Further accumulations of shells were found nearby, potentially suggesting the presence of other workshops in the vicinity.

In the district of Le Kram in Carthage, Tunisia, the discovery of cisterns, tubs, channels and broken murex shells suggests the presence of a purple workshop in the fourth-third centuries BC in association with a third century BC fullonica (Ben Abdallah *et al*. 1980: 17-18; Annabi 1981: 26-27). These structures were overlaid by houses in the early second century BC.

Excavations on the east coast of Delos in Greece resulted in the discovery of a complex five-room building (although it is not certain that all the rooms correspond to the same complex), within which murex shells were found in association with a hearth; also found were granite hammers and two large rectangular granite tubs, which have been related to the maceration and fermentation of the glands (Brunneau 1969; Monaghan 2001: 164). More shell heaps were found to the north of this facility, which is dated to the early first century BC (Brunneau 1978; Monaghan 2001: 165).

PURPLE AND PUNICS IN IBERIA AND THE BALEARICS ACCORDING TO THE ARCHAEOLOGICAL RECORD

In the Iberian Peninsula, archaeological evidence for shellfish purple production dated to the second half of the first millennium BC is even less explicit than in the first half of the first millennium BC, at least as far as production structures are concerned, although the indirect evidence – essentially shell middens – seems to suggest larger workshops and growing production.

The most substantial site is Calle Luis Milena, in San Fernando (Cadiz), located in the south-central area of the Island of San Fernando. This area is currently densely urbanised, and has often yielded decontextualised archaeological remains. Recent quarrying works have led to the discovery of a tub and a pavement in *opus signinum*, found in association with various walls and very large shell middens (which can be up to 12 m long). Unfortunately, the remains were largely obliterated by recent construction work. A survey carried out in order to map archaeological sites of San Fernando (Bernal *et al*. 2005) documented further heaps of intentionally broken shells, associated with the previously mentioned evidence and Late Punic (T-8.2.1.1, T-12.1.1.1/2 and T-9.1.1.1) and Roman Republican amphorae (imitation of Greco-Italic types, LC 67), as well as Italian black glaze wares and Kouass-type red glaze wares from Cadiz, which suggest a date between the second and first centuries BC. The rescue excavation carried out in 2005 in the southern sector of the site revealed the presence of two tubs of Punic type (for all of this evidence, see Bernal *et al*. 2011: 160-161).

Fig. 15: Late Punic pit filled with shells and fish remains excavated at Luis Milena st. (San Fernando, Cádiz) in 2007 (Image courtesy of D. Bernal and A. Sáez).

A new excavation in 2007 (Bernal *et al*. 2011: 161), occasioned by the construction of new houses in Calle Luis Milena, led to the discovery of an important accumulation of shells, found in association with ceramic remains (fig. 15). The trench was no more than 2 m^2 in size, but it allowed for the collection of 585 kg of marine faunal remains, along with other animal remains and sediment. These remains filled a pit which may have been oval in shape (the small size of the excavation trench precludes greater certainty) and approximately 9 x 4 m in size. This type of pit is common at Late Punic sites in Cadiz, especially in association with pottery workshops, as former clay quarries were reused to dispose of general rubbish or the halieutic waste generated by preserve- and salting factories. On average, the pit was approximately 1 m deep, but in some areas reached 1.2 m.

The total capacity of the pit would therefore have been approximately 60 m^3, 5% of which was taken as a sample. The sample contained 4261 mollusc specimens, suggesting approximately 85,220 specimens for the whole

	N UE 100	N UE 101	N UE 103	D UE 101	D UE 103	D TOTAL
H. trunculus	0	1377	1057	58.25	55.84	57.18
T. aemastoma	2	689	586	29.15	30.96	29.95
B. brandaris	2	58	57	2.45	3.01	2.70
M. Lineata		176	150	7.45	7.92	7.66
N reticulatus		13	16	0.55	0.85	0.68
O. erinacea			3	0.00	0.16	0.07
T. decussatus		13	8	0.55	0.42	0.49
G. Glycymeris		2	0	0.08	0.00	0.05
C. Angulata		4	0	0.17	0.00	0.09
S. Marginatus		29	13	1.23	0.69	0.99
A. Ephippium		3	3	0.13	0.16	0.14

Fig. 16: MNI of mollusc's species of the sample analysed from Calle Luis Milena in San Fernando, Cádiz (Bernal Casasola *et al*. 2011: fig. 20).

pit (Bernal *et al*. 2011: 165). The shells were found in association with diverse ceramic material, especially Late Punic amphorae (T-12.1.1.1/2, T-9.1.1.0 and T-8.2.1.1), Kouass-type table wares, and common and kitchen wares, some of which were subject to residue analysis. These analyses did not detect remains of purple dye, but instead traces of honey and resins.

The pit also contained metal remains of fishing tackle, such as net weights, as well as construction debris and remains of construction materials, including blocks of *signinum*, which were presumably dumped in the pit after the demolition of a nearby building.

The sample contained a high proportion of broken *H. trunculus* and *S. haemastoma*, as well as whole specimens of *B. brandaris*, which suggests that the latter species was not used for dye extraction at Luis Milena. The distribution of marine molluscs by species in the sample is as follows: together, *H. trunculus*, *S. haemastoma* and *B. brandaris* amount to 89.83% of the total (57.18% of which corresponds to *H. trunculus*). The only non-purple-bearing species which is well represented is *Monodonta lineata*, the shells of which are often perforated, which is interpreted as the result of the depredations by the murex molluscs. It is, therefore, likely that the animals were kept alive in the vicinity of each other for a while, before being used (fig. 16).

The pit was formed towards the end of the third century BC, although the area presents earlier evidence of different types of industrial production, including construction debris, which was found mixed with the murex and other mollusc remains. That is, the purple workshop (the fragmentation pattern in the specimens of *H. trunculus* strongly suggests that this activity was indeed performed in the area) was part of an industrial area which included ceramic production and the preparation of fish preserves, as suggested by the salting tubs found nearby, which could have also been used as containers to store molluscs before their processing. Punic salting factories, as well as ceramic workshops which served them, are well known in the Bay of Cadiz from an archaeological point of view. They are very different in size and nature from those dated to Roman times, and their tubs, with rounded angles and bagnerola shape, are easily distinguishable from those used as water tanks for domestic, funerary or cult functions (Sáez Romero and García Vargas 2019).

Similarly 'mixed' deposits (shells, ceramic and other finds, within an industrial complex in which various activities were carried out) were found outside the city of Cádiz's smallest island, in an area called El Olivillo, near the Hospital de Mora, and also, in connection with ceramic waste dumps and Roman Republican tubs, in Calle Gregorio Marañón.

The shells from the El Olivillo site were chiefly found at the bottom of the dump, which was active between the turn of the Common Era and the mid-first century AD, although the most recent levels contain no murex shells. The shell midden of El Olivillo, which seems to be associated with a fairly late date, was discovered only recently, and we are still awaiting its comprehensive publication.

It is also possible to reconsider the second of the shell middens found in relation to the site of Sa Caleta, on Ibiza. This midden was located near the surface, in the area known as Espai XVI, and was excavated by Joan Ramón in 1994. The midden contained eight species, the most abundant of which were *H. trunculus* and *B. brandaris*

(Ramón 2004). Both the archaeological context and radiocarbon dating pointed towards a Late Republican chronology (that is, Late Punic in cultural terms) in the late second or early first century BC, but a recent calibration of the physical data has yielded a chronology around the third or fourth centuries AD, which are outside the purview of the present work (Costa and Alfaro 2010: 176).

Also on Ibiza, Cala Olivera yielded a shell midden excavated in 2005, in which 22 species were represented but in which *H. trunculus* was clearly predominant (Costa and Alfaro 2010). The midden sits above another dump whose activity ceased in the early second century BC. The association of the midden with the remains of a hearth and the presence of fire traces in a different sector of the site make it possible to argue for the production of purple in the site before the Roman imperial period.

In contrast, the association of the basin excavated at Villaricos (Almería) with purple-making activities must be put on hold for the time being, as it is merely based on the presence of dispersed murex shells and the identification of a circular depression in the bottom of a salting vat dated to the late fourth century BC. The excavators suggest that the function of this depression may have been to house the lead containers used in purple extraction (López Castro *et al*. 2007: 16). However, salting vats often present this sort of feature, generally interpreted as drains for the collection of the waste generated during the production of *salsamenta*, making the cleaning of the vats easier between batches.

A recent discovery (Del Arco *et al*. 2017) outside the chronological limits set out for this work, but which should not go unmentioned, given its importance for the analysis of the Atlantic maritime economy and for the scale of the evidence, is a shell midden in the islet of Lobos, off Fuerteventura, which chiefly contains *S. haemastoma* (for Canary Islands and purple dye also see Mederos Martin and Escribano Cobos 2006). Based on the fracture pattern and the presence of remains of dye, in both shells and ceramics, stone hammers and anvils, these shells were used for purple extraction. The ceramic repertoire indicates that the people that worked in the workshop were supplied with food from the Iberian Peninsula. The site produced oil amphorae from the Guadalquivir, wine amphorae from the Tarraconensis and preserved fish from Cadiz. Amphorae and other ceramic wares are dated to the late first century BC and the early first century AD. It seems, therefore, that the workshop was staffed by people from the mainland, in all probability from Cadiz.

CONCLUSIONS

Shellfish purple production in the Western Mediterranean is coetaneous with the Phoenician colonisation, as archaeological evidence from Teatro Cómico (Cádiz) indicates. Here, purple dye was made using primarily *H. trunculus*, in the same way and with the same species of mollusc that was used in the Aegean and Levant from Medium Bronze times onward. These are also the first archaeological remains of purple dye production on the Atlantic littoral of Europe. It is easy to imagine the existence in these early times of similar installations on the Huelva coast, the scene of an even older colonisation episode than those of Cadiz, and also in the Phoenician settlements on the Mediterranean coast of southern Spain. Those would be the oldest purple dye 'workshops' of a long chain of establishments scattered by the end of the first millennium BC from Algarve and Andalucia, in the Iberian Peninsula, to Mogador islands, in the bay of Essaouira, southern Morocco, and, far away, to the Western Canary Islands (Mederos Martin and Escribano Cobos 2006).

Unfortunately, the Cádiz structures could not be related to Phoenician urbanism during its excavation, but evidence of urban development and explicit domestic contexts in the upper levels of the archaeological record of Teatro Cómico show that this was the site of the town of Gdr or Gadir, founded by the Phoenicians in the Far West of the *oecumene*.

The rest of the evidence for the Iron Age I is not so clear. Accumulations of crushed purple shells at Cerro del Villar (Málaga) and Villaricos or Adra (all of them ancient Phoenician sites) are similar to the evidence of Cádiz, in the sense that they can be testimonies of an urban production linked to harbour and fishing areas.

This urban-industrial context of purple production in Far West Punic cities is again the norm (however, there are relatively few contexts) in Punic towns of the southern littoral of Spain. In Cádiz again, the overall impression is that by the end of the first millennium BC the production of purple dye is related to well organised industrial areas that also included halieutic processing installations and amphora manufacture workshops. This is the case of Calle Luis Milena finds, in San Fernando (the *Antipolis* of Strabo, a sort of industrial suburb located in an island in front of the city). A similar context is the heap of crushed shells excavated last year in El Olivillo, in the urban periphery of Punic and Republican

Cádiz. Crushed shells make up the basis of an enormous dump similar to that of Calle Luis Milena and consisting of waste from halieutic workshops and ceramic manufacturing situated in the surrounding areas and dated from the end of first century BC to the middle of the first century AD.

Again, we guess a similar scenario for all the important Punic cities of the period in Spain, like Malaka or Abdera, in Almeria, but we do not have enough data for now to prove it. That is, we do not know if it corresponds to a landscape of large (public) factories or scattered small and medium-size workshops managed by private individuals.

That will be a challenge for the future. Not only to define and to discover new archaeological sites producing purple dye in the towns of Phoenician and Punic coast in the western extreme of the *oecumene*, but also to try and define models of production according to theoretical considerations regarding purple dye uses from protohistoric to Roman times in the western Phoenician-Punic world (see García Vargas 2010).

NOTE

1. Alberti (2008: 75-81) gives a table (Table 2) of six archaeological indicators that characterize production sites and divide these production sites into three groups according with the class of the indicators present at each site:
   - Group A includes sites with purple stained vats, containers with crushed murex shells, burnt organic ashes and traces of burning mixed with crushed murex shells, heaps of crushed murex shells near the installations, and working equipment. These sites are interpreted as «purple industry plants».
   - Group B includes heaps of crushed murex shells on the coast that may indicate «industry plants which were probably located inside or near the settlement».
   - Group C sites show heaps of crushed murex shells in settlement or house strata, crushed or calcined murex shells in plasters, lumps of purple dye stuff and purple pigment in frescoes. This evidence points to «purple-dye processing activities located within the settlement or some other site».

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Technology and Production of Reddish Purple Vegetable Dye in the Bronze and Iron Age: Written Sources and Textile Remains in the Iberian Peninsula

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Abstract:

The knowledge of dyeing techniques dates back to very early times; colour has been an important part of the most ancient cultures. Red hue dyes, such as reddish purple, have played an important role as distinctive marks of social and religious status, especially since these may have been intimately connected to the symbolism and archetype of blood from prehistoric times.
Threads dyed in red shades have been found in some Neolithic settlements in the Middle East, in ancient Mesopotamia and at Charavines, Isère, France (c. 2450 BC). Due to their early date, there are no written sources which describe the exact nature of the colourants used for reddish purple ancient textile remains. It is likely that the inhabitants of the Iberian Peninsula, during the Bronze Age, also dyed their clothes in a reddish purple colour - as found with other Mediterranean cultures. Since no records of the raw material exist, we can only speculate about material used and the methods of extraction required to obtain such dyes. To develop an understanding of this process, this paper reviews the oldest written sources concerning these dyes, together with the information about the dyes obtained through dye analysis of the extant ancient textiles. These considerations leave little doubt that the natural dyes used for reddish purple dye were primarily of local origin and therefore autochthons to the Iberian Peninsula.

Key words: *Colour, Dyes, Bronze Age, Iberian Peninsula, Textiles.*

Resumen:

El conocimiento de las técnicas de teñido se remonta épocas muy tempranas; El color fue un aspecto considerado en las culturas más antiguas. Los tintes de color rojo, como el púrpura rojizo, desempeñaron un importante papel como marcas distintivas de estatus social y religioso, especialmente porque estos colores posiblemente estuvieron íntimamente relacionados con el simbolismo y el arquetipo de la sangre desde tiempos prehistóricos.
Se han encontrado hilos teñidos en tonos rojos en algunos asentamientos neolíticos en el Medio Oriente, en la antigua Mesopotamia y en Charavines, Isère, Francia (c. 2450 a.C.). Debido a su temprana datación, no tenemos fuentes escritas que describan la naturaleza exacta de los colorantes utilizados para estos restos textiles. Es probable que los habitantes de la Península Ibérica, durante la Edad de Bronce, también tiñeran sus ropas en un color púrpura rojizo, como se sabe que se hizo en otras culturas mediterráneas. Dado que no existen registros de las materias primas usadas para este fin, solo podemos especular sobre las materias tintóreas utilizadas y sobre los métodos de extracción requeridos para obtener dichos tintes. Para desarrollar una comprensión de este proceso, este artículo revisa y aúna la información de las fuentes escritas más antiguas al respecto, junto con la información obtenida a través del análisis de colorantes de los restos textiles pertenecientes a este periodo. Estas consideraciones confirman que los tintes naturales utilizados para obtener el color púrpura rojizo fueron, principalmente, de origen local y, por lo tanto, autóctonos de la Península Ibérica.

Palabras clave: *Color, Tintes, Edad del Bronce, Península Ibérica, Textiles.*

INTRODUCTION

The use of natural colouring materials – pigments and dyes – goes back to prehistory in Europe. The abundance of wild plants in Northern Europe and along the Mediterranean coast encouraged the development of textile dyeing with vegetal dyes. Certain colours and plant species were especially favoured in ancient times (Bradley 2009: 189; Martínez García 2013: 151-153). The acquisition of dyestuffs from plants or animals has always been linked to the availability of the local raw materials, easily accessible to the inhabitants of a particular region (Martínez García 2011: 209).

Textiles were at that time, as at present, a necessity of life. They were used daily and satisfied a variety of functions. Basic uses included clothing, sacks, covers, scabbard and sword handles, wall hangings, etc. Textiles also functioned as indicators of status, gender or age. Therefore, the preference of particular colour was also linked to symbolism (Martínez García 2014: 526-549). For example, many cultures, from prehistoric times, considered the colour red to be special, it being the colour of blood, and also associated it with certain magical powers leading to the development of rich ritual and social symbolism (Wunderlich 1925: 1-69).

The ancient Mediterranean world experienced significant social, political and technological changes from the 13th century BC onwards. These were probably a result of an expansion by the Eastern Mediterranean populations. One of the most important indicators of cultural transmission are the luxurious textiles, with multi-coloured geometric decorations and a predominance of dark red colours, along with other special elements. Luxury textiles help to conform the social prestige of a nascent aristocracy (Cáceres 1997: 127-130). Imagery of the new "pro-men" is attested in the *stelae* from the southwestern Iberian Peninsula, and also by the existence of a circulation of prestige goods, from the middle of the 10th century BC (Belén *et al*. 1991: 247-248; Torres 1999: 54-55). In the Iberian Peninsula, the increasing importance of livestock represents a means of accumulating wealth and facilitating the consumption of prestige goods (Cáceres 1997: 135). Archaeological evidence points to an increase in the cattle economy, as can be seen in archaeological sites of Soto de Medinilla (Morales *et al*. 1995: 469-470), Conimbriga (Cardoso 1995) or Peña Negra (González Prats 1983).

Textiles developed as a component of a visual language during the Bronze Age in the Mediterranean world (Sherrat and Sherrat 1993: 364). One of the principal functions of dress, defining group status, requires the use of luxury textiles. Polychrome textiles required expensive dyes and the mordanting process necessary for colourfast colours. Therefore, it seems likely that the first hierarchical societies held a predilection for red and blue as solid colours – evidenced by the large proportion of European textiles in which these two colours are found, belonging to this period. Yellow dye components rarely survive in archaeological samples, although likely they were the most common since a large variety of plants could be used to obtain yellow dyes. Red, purple and blue colours could be obtained by using the dye from marine molluscs, which later would become a symbol of royalty, prestige and social status (Alfaro 2013: 75-99; Martínez García 2013: 151; see also Dionysius of Halicarnassus 3.61.1; Diodorus Siculus 31.15.2; Appian, *Bell*. *Pun*. 8.9.66; Plutarch, *Comp*. *Cim*. *et Luc*. 3.4.). The economic importance of reddish purple textiles goes back to the second and first millennia BC (Reinhold 1969: 300-304; see Marín-Aguilera *et al*. 2019 for the latest evidence on purple-dyed textiles in the Pre-Roman Mediterranean). According to Reinhold, purple already had a high prestige value as early as the first half of the 14th century BC. Red-purple dyes were widely used from 2000 BC in Ugarit, Hattusa, Babylon and Assyria. Likewise, they were also probably used by Minoans and Mycenaeans (Reinhold 1970: 10-12, 17). The excavations at Ugarit (Ras Shamra) revealed that purple was being manufactured there in the middle of the second millennium BC, and Ugaritic documents showed that purple garments were sent as tribute by King Niqmad of Ugarit to King Suppiluliumas, the mighty ruler of the Hittite Empire (Reinhold 1969: 300-304).

TEXTILE REMAINS

Chronologically, the oldest known coloured textile material consists of the black threads found in the Cave of the Warrior in Israel, dated to around the fourth millennium BC. Remains of textiles coloured with ochre of reddish and brown tones were discovered in the pyramid of Seti I and Merenres in Egypt, pertaining to the IV dynasty in the third millennium BC (Barber 1991: 224). Some reddish textiles found in Switzerland and Charavines

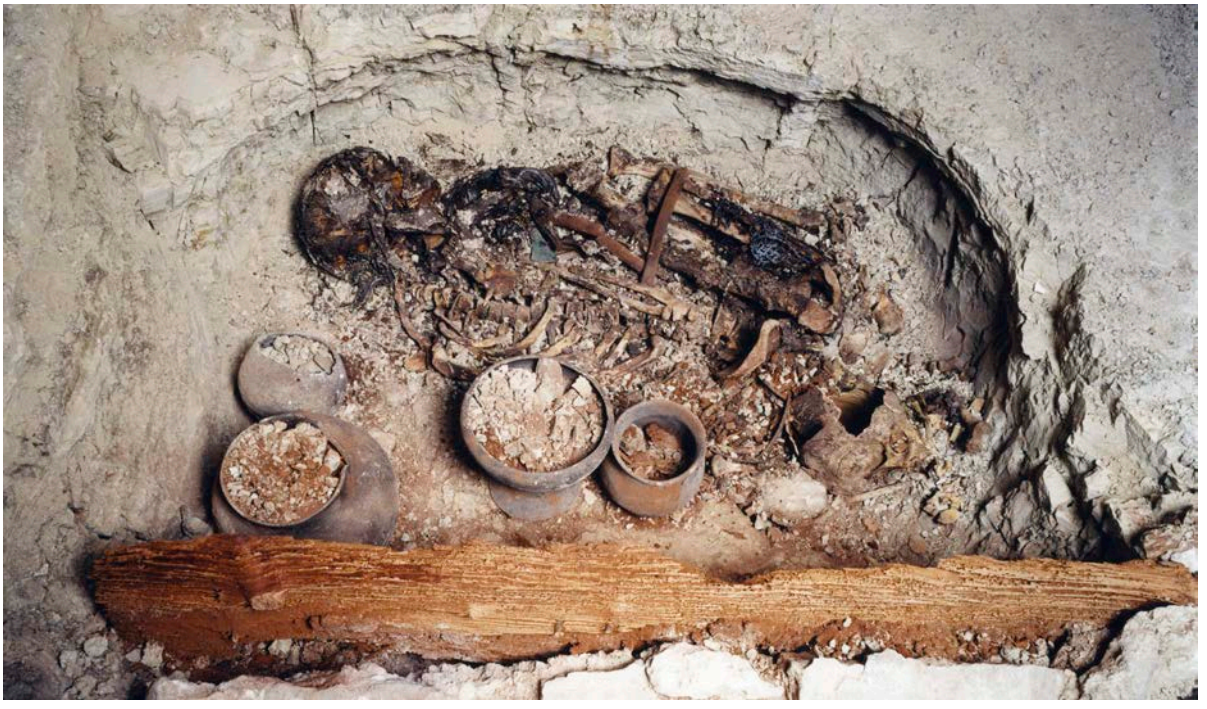

Fig. 1: Grave 121 of Castellón Alto: "The Man of Galera" (image courtesy of Museum of Galera, Granada).

(France) are still preserved today (Barber 1991: 174-175). Only a few textile fragments have been preserved from the Aegean area, dating to the period immediately after 1200 BC. Among these, are the textile remains found at Lefkandi on the Euboea island, dated on the Late Bronze Age and Early Iron Age – where linen textiles with bands decorated with supplementary warp floats in a pattern of zig-zags, chevrons and diamonds, as well as meanders (Barber 1991: 197, 312).

Bronze and Iron Age textiles have been preserved in specific environments, such as the salt mines of Hallstatt, which date between 1500-400 BC and include some of the earliest dyed textiles in Europe (Hofmann-de Keijzer *et al*. 2013: 125-131; 2016: 140-166). The technique of dyeing seems to have been quite developed and widespread in Europe since the Bronze Age, as evidenced by the textile remains found in Hallstatt, and other European Iron Age contexts such as the Villanovan burials of Sasso de Furbara in Italy (Bonfante 2003).

What raw materials were used to obtain the reddish purple colour in the Bronze Age and at the beginning of the Iron Age in the Iberian Peninsula? According to archaeological remains, the evidence of production and use of dyes in these periods is very scarse, and we must proceed with some caution when addressing the use of dyes by Bronze and Iron Age peoples of the Iberian Peninsula. The evidence of textile production found in the Bronze Age contexts of the Iberian Peninsula is mostly limited to plant fibre textiles made of flax, esparto grass and other monocot species. The latter were specifically used for the manufacture of basketry, sacks and ropes, rather than for the making of garments (Alfaro 1984). Possible animal fibre, maybe wool, has been documented in grave 121 of Castellón Alto (fig. 1) (Molina *et al*. 2003: 157; Rodríguez-Ariza *et al*. 2004: 14; Jover *et al*. 2013: 150). However, there are no extant textiles woven in this material until much later in the first millennium BC.

In the Bronze Age archaeological contexts of the south-eastern Iberian Peninsula, over 100 small fragments of linen textiles belonging to clothing, shrouds or covers have been documented in graves and living quarters of 22 settlements. All of them are found in the Argaric contexts – except that of Cabezo Redondo (Villena) near the Terlinque settlement, where some textile imprints were documented (Jover *et al*. 2001: 178-184; Jover *et al*. in this volume). Most fragments have been preserved in contact with copper alloy objects, which sometimes

Fig. 2: Egyptian textile dyed with Ochre. Collection Katoen Natie, Ref. 703, (H. Maertsen) (image courtesy of C. Verhecken Lammens).

resulted in a characteristic green colour of the remains (Badal *et al*. 2005: 235-237). The only textiles found in domestic contexts come from the deposits of El Oficio, house V at Castellón Alto and level IV from department VII of Cabezo Redondo. These are fragments of linen of whitish-brown colour.

The subject of colour in these textiles has been hotly debated since the period of their first discoveries by the Siret brothers. The main evidence of the possible presence of dyed textiles in the Argaric area continue to be the finds referred to by the Siret (Siret and Siret 1890: 200-201). These include the cinnabar bands which appeared on the female skulls from graves 356 and 129 of El Argar, as well as a series of cloth imprints covered with a cinnabar layer, preserved on clay pellets from tomb 797 (López Padilla *et al*. 2013: 274-276). It has been suggested that the bones became stained red as a result of corpse staining, following some kind of funerary ritual; this would imply that the textiles took on a reddish colour by contact transfer (Helbaek 1963: 41, 43; Barber 1991: 223). However, found in domestic contexts were containers and tools linked to the storage, processing and application of inorganic pigments – the oxides of iron, ochre and cinnabar – that could be used to stain the linen textiles, but would not have dyed them as these do not form chemical bonds with the fibre. These were documented at sites such as San Antón de Orihuela, where they are described as: *dying substances with the corresponding mortar of stone to grind*; or at Cerro de El Cuchillo, where a small ceramic vessel was found, containing the remnants of powder of an intense red colour, interpreted as ochre (Lopez Padilla *et al*. 2013). The technique of staining textiles red with ochre dates back to a very early period in Egypt, as can be seen in a linen band coloured pink with ochre, from important collection Katoen Natie (inv. 703-05) (De Moor *et al*. 2008: 65) (fig. 2). It is therefore likely that the knowledge of adding red and brown colours to textiles was present in the Iberian Peninsula at least since the Bronze Age. Mineral dyes are not true dyes since they do not penetrate into the fibre, instead only adhering to the fibre surface, but the technique is the easiest method of colouring a cloth.

Leaving aside pigmentation of red textiles, it is worth noting a spectacular discovery in the Cueva Sagrada at Sierra de la Tercia (Lorca, Murcia) – two complete tunics and some fragments of linen dress that retained traces of reddish-coloured dye (fig. 3). Unlike the tunics, linen textiles found in the sacred cave at Lorca are of a small size (Alfaro 1984; 1992; Ayala 1987). These remains deserve our attention, since chemical dye analysis verified the presence of a vegetal dyestuff derived from madder (*Rubia tinctorum* L). This was one of the plants most commonly used to dye textiles since the prehistoric period, and one of the raw colouring materials used to obtain the reddish purple colour in the Hellenistic and Roman times, the so-called vegetal purple (Steigerwald 1986: 1-57; Martínez García 2011: 207-209; Alfaro and Martínez García 2013: 55-56; Martínez García 2018: 240-244). Although this is the only example in the Iberian Peninsula that validates the hypothesis that the processes of dyeing with plants were already known and practiced in the Bronze Age, numerous research projects, particularly in Central and Northern Europe, have considerably advanced the knowledge of the processes of textile dyeing during prehistoric times (Grömer 2016: 140-166).

Experimental reproduction of dyed textiles from prehistoric Hallstatt has served to increase the knowledge of raw materials involved in the dyeing processes. The use

Fig. 3: Fragment of linen dress. Sacred Cave at Sierra de la Tercia Lorca, Murcia (A. Gueimer).

of Scanning Electron Microscopy (SEM) complemented the knowledge of Bronze Age textiles through analysis of fibres, mordants, and dyes. Furthermore, mordants and dyes were identified by using SEM with Energy Dispersive X-ray analysis (SEM-EDS) and High Performance Liquid Chromatography with Photodiode Detection (HPLC-PDA) (Hofmann-de Keijzer 2010; 2013). Experimental reproduction, together with analysis of dyed textiles and mordants using the techniques mentioned above have not been applied in Spain for the study of dyes in Bronze Age textiles. Therefore, we can only discuss the dyes in this region on the basis of analytical results of linen textiles from Cueva Sagrada at Lorca, mentioned above, and the local plant species with dyeing properties, which would have been typical in the Iberian Peninsula during the Bronze Age (Alonso and Buxó 1995: 21; Buxó 1997: 140, 266, 326).

Dye analyses conducted on the Hallstatt textiles have demonstrated that *Rubiaceae* family plants were used to dye during the European Bronze Age (Hofmann-de Keijzer 2016: 159). The pure reds would be obtained from the roots of *Rubia tinctorum* L., which is rich in alizarin and purpurin colorants. Textile dyes containing only purpurin, which produce a more purple hue, could be made from roots of *Galium* species native to Europe, or wild madder, *Rubia peregrina* L., a plant native to Mediterranean Europe, the Middle East, and the southern British Isles. Based on the Neolithic period remains found in Switzerland, Forbes cited other plant species that could be used to obtain the red colour, such as: *Chenopodium album* L. and *Gallium palustre* L. (Grömer 2016: 156).

The use of *Rubia tinctorum* L. to obtain red dyestuff possibly dates even earlier, to the Neolithic times (*c*. 2700 BC), as evidenced by the remains of madder pollen found in the Charavines (Isère) archaeological site (Cardon 1998: 3-21). There is also evidence for the use of madder in cotton textiles found in Mohenjo Daro, dated to around 3000 BC. According to Forbes it is not known when it was introduced in Mesopotamia, although its use was known, since it is mentioned in recipes for the dyeing of wool dating to the Neo-Babylonian period (seventh century BC) (Forbes 1964: 103-104; Cardon 2003: 97-100; 2007: 119-122). Among the ancient Egyptians its use was frequent. The red dye for their dresses was obtained from the madder. In some purplish-blue textiles found in Amarna, madder was part of a mixture of dyes used to obtain this colour. The dark brown colour of the remains from the tomb of Tutmosis IV was also obtained by mixing madder with other dyes. Some authors identify madder plant with one that appears in heraldic iconography of Upper Egypt and inscriptions of Edfu that mention it in

Fig. 4: *Rubia tinctorum* L., Valencia, Spain (J. Martínez García).

connection with a red dye (Maniche 2006, 154; Hall 2008: 10-11). The use of this plant is thus known from early times and continued till Roman times, as demonstrated by the results of the analyses carried out on Gallo-Roman textiles (Moulherat 2002: 68), textile fragments found at Masada and Cave of Letters in Israel (Granger Taylor 2000: 151-154), Palmyra in Syria (Pfister 1934; 1937; 1940; Böhmer and Karadag 2003), etc. (fig. 4).

Another source of red dye during the European Bronze Age, identified via the analysis of textiles with red motifs, is orchil lichen (*Rocella* sp.), identified by the presence of orcein. In Roman times its colour was valued and used to make a purple dye call Gaetulian purple (Blázquez 2004: 689-704). Orchil lichen grows on Mediterranean coasts, including the Balearic Islands. The most famous red lichen in antiquity grew on Cretan coasts and on Amorgos Island; in the latter case, the dye contributed to the fame of red textiles made on the island (Martínez García 2014: 412-423).

Finally, some more recent finds should be mentioned, such as that of grave 121 from Argaric deposit at Castellón Alto, dated around 1900-1600 BC. Partially mummified remains of an adult and a child associated with various textile remains have been documented at this settlement. The adult was dressed in a type of tunic and linen trousers, of which several fragments are preserved. Found on his right leg was a net of braided esparto, along with possible wool fibres. The child was wearing a cap of woven wool covered with leather, and was dressed in a tunic or linen suit (Molina *et al*. 2003: 157; Rodríguez-Ariza *et al*. 2004: 14; Jover *et al*. 2013: 150). A total of 11 tombs were documented in the archaeological site of Tabayá Argaric settlement. The presence of various textile fragments, possibly of linen, on some ribs, arms and hips, enable the consideration that the deceased were dressed in a tunic or shroud. Fragments of linen were also recovered from a child's burial at Monte Bolón de Elda caves, associated with the settlement of Peñón del Trinitario and dated to 1775 BC (Jover and López 2013: 154). Therefore, for the moment and for Bronze Age of Iberian Peninsula there is only evidence of dying using *Rubia tinctorum* L.

WRITTEN SOURCES

The classical authors are not very explicit when talking about the techniques and the plant materials used to dye within the Iberian Peninsula among the pre-Roman peoples, and do not mention anything regarding the preceding periods.

The Greek and Roman authors, far from offering us a description of dyes, tell us only about the dresses and colours used by the Iberians, highlighting black and purple. For example:

Strabo describes the black veils worn by women (Strab. III, 4, 17).

Livy speaks of the mercenary forces of Hannibal from the Iberian Peninsula and says: «Hispanics were noted for their linen tunics interwoven with purple» (Liv., 22, 46, 5). This could be a vegetal purple or made with kermes.

Polybius also mentions this and points out that: «The Iberians wore thin linen robes, with a purple border according to the use of their regions» (Pol. 1, 17, 4).

Regarding the quality of the dresses, Athenaeus of Naucratis speaks of the *sumptuous dresses* of the Iberians (Athen. Naucr., *The Deinoph*., 1, 33).

With regard to the raw dye materials, Strabo mentions that there are a large number of useful roots for dyes (Strab. III, 4, 16). Pliny the Elder also emphasizes that Roman Hispania beats Italy in terms of the beauty and quality of its dyes (Plin. *NH*, XXXVIII, 13, 203).

We are therefore faced with an absence of reliable data which would attest to the use of other dyeing materials, in addition to *Rubia tinctorum* L., during the Bronze Age. For the study of this subject we only have the dye data, and the technical recipes described in written sources from Bronze Age Mediterranean cultures, such as Mycenaean Linear B archives.

The Akrotiri wall paintings depict youngsters dressed in red, blue and yellow colourful skirts. This indicates that these types of dyed textiles were common in the Aegean Bronze Age. Linear B references provide written testimonies that make reference to sites dedicated to textile production and dyeing. Also, in the Mycenaean evidences referring to textiles, the term *e-ru-ta-ra-pi* appears to connect a red dye to alum for cloth, and *po-ni-ki-ja e-tu- pte-t* refers to red dye for leather (Martínez García 2014: 81- 82). Melena (1974: 187) suggested that it refers to the madder and that it is an appellation of Mycenaean origin that refers to its function (Melena 1974: 187).

The oldest recipe known for dyeing with madder is the above mentioned Neo-Babylonian tablet of the seventh-sixth century BC, currently in the British Museum (fig. 5). This recipe describes basic operations to obtain a bath of madder dye from three different species (Finkel and Taylor 1999): *hat-huritu*, *inza-huritu* and ordinary madder or *huratu*. The Akkadian term *hurratu* refers to the *Rubia tinctorum* L., so it is likely that this is what on the tablet is distinguished as ordinary madder (Cardon 2003: 101). The other varieties could be some autochthonous species in the Middle East such as *Rubia peregrina* L., *Rubia albicaulis Boiss*, or *Rubia dolichophylla Schrenk*.

According to this tablet the first operation prescribed is wool mordanting with alum: «To dye natural wool red, tabarru. You comb the wool. You boil it with alum, an equal weight of each and you boil it in water on a fire» (Cardon 2007: 114). The next phase would be the preparation of a madder bath by adding madder root to boiling water. The recipe specifies root and wool quantities, demanding the same weight of each to obtain a good red colour. This technique for dyeing wool red with madder is the easiest and most traditional Mediterranean recipe, and it is still used today to obtain a dye of pure red (Finkel and Taylor 1999; Cardon 2007: 113-114).

Fig. 5: Neo-Babylonian tablet dated about VII-VI century BC (image courtesy of Dr. J. Taylor, British Museum, © The Trustees of the British Museum).

RECENT ANALYSES

Skeletal remains from some important Bronze Age Argaric burials, such as those of El Argar and Fuente Alamo (Almería), Calle de los Tintes, and Convent of the Mercedarian mothers (Lorca), Cerro de la Encina (Granada), Illeta dels Banyets and San Antón (Alicante), have been subjected to spectroscopic and chromatographic analyses, Scanning Electron Microscopy and X-ray imaging, providing some new data. According to the analytical results conducted on the red stained bones, aluminium (Al), magnesium (Mg), potassium (K) and iron (Fe) ions were detected on the bone surfaces with red stains, while sediment spectrum X-ray diffraction analyses indicate the presence of calcium (Ca) ions and aluminium silicates (López Padilla *et al*. 2012: 281-286). Delibes, as well as other authors, suggested that the bones were not dyed for ornamental purposes; rather, their colour was a result of contact transfer from other coloured material such as textiles (Delibes de Castro 2000). In some of the analysed remains, skeletal areas that have a greater amount of the red colourant, correspond to the zones that could have been in contact with textiles; thus it cannot be confirmed if the dye was transferred from the clothes to the corpse, or vice versa. Therefore, there is still no absolute proof that Argaric textiles were dyed red. There is even less evidence regarding inorganic colourants such as cinnabar, even though this pigment is present in many red linen samples. It should be noted that the red residues on skeletal remains are primarily associated with female burials containing important grave goods, which indicates a distinguished social position, and possibly a relationship

Fig. 6: *Anchusa azurea*, Ibiza, Pou des Lleo (J. Martínez García).

with femininity, the menstrual cycle and motherhood (Wunderlich 1925: 11; Eliade 1975: 54-55; 1999: 44-47; Martínez García 2014: 541-543).

However, another hypothesis can be postulated on the basis of the presence of metal ions associated with iron oxides in the Argaric textiles. Possibly, this may be due to other reasons, such as mordant remains used for dyeing reddish linens utilising some *Rubiaceae* species. The presence of aluminium silicates and potassium provide certain indications about the use of alum as a mordant. Likewise, iron oxides have been widely used in Egypt to dye brown textiles (De Moor *et al*. 2008: 65) There are certain fugitive plant dyes, such as alkanet or orchil lichen, which give rise to red dyes of great beauty and brilliance (Pfister 1935; Martínez García and Martínez 2013: 96). If used, these dyes would have disappeared from textiles and could not be detected by dye analysis. It is only the presence of the metal ions typical for the mordants that may indicate their possible use in the past (Martínez García 2013: 167).

Archaeobotanical studies demonstrate the presence of pollen from wild dye species at a number of important Bronze Age sites. Alkanet pollen has been found at Cabezo Redondo Villena and Rincon de Almendricos (Alonso 2000: 221-238) (fig. 6). The most frequent wild dye plant species in the archaeobotanical record of western Catalonia landscape are *Chenopodium album* L. and *Chenopodium glaucum* L. (present in the Bronze Age Minferri deposit, Cova de Punta Farisa, Masada del Ratón and Iron Age I phase of Els Villars) and *Gallium* species, such as *Gallium aparine* L. found in the Minferri deposit and Els Villars. *Gallium* species of the *Rubiaceae* family produce very bright dyes, which provide textiles with a brilliant purplish red colour. Yellow dye plants such as weld (*Reseda* sp.) are present in Cova Punta Farisa and Els Villars (Alonso 2000: 221-238).

Finally, some considerations regarding alkanet dyestuff should be noted. Alkanet's principal dye component is alkannin. This dyestuff is only partially soluble in organic natural compounds. We can hypothesize, with caution, that the red colour of the human bones from the Argaric burials could come from the red textiles, dyed with *Alkanna tinctoria* (L.) Tausch. The prolonged contact of the dyed clothes with a body in decomposition, together with soil and humidity, would have facilitated the transfer of the dye from the textiles to the human remains. Protein, glycogen, lactic acid and mineral salts such as Na, K, Ca and P, are important chemical components of the human body. The affinity of this dye for organic matter would therefore facilitate the dye fixation. The alkanet is a native plant of Mediterranean regions, and has been used in Egypt since ancient times. According to Greek papyri found at Thebes (Papyrus X Leiden and P. *Graecus Holmiensis*), alkanet was a source for red dye. In pharaonic medicine, it was used in medicinal potions (Maniche 2006: 74). Theophrastus mentions alkanet for dyeing perfume red (Theoph., VI, 31). It is also likely it was used as a textile dye in the Aegean Bronze Age. The lack of analysis, using colorimetric techniques, to detect its presence in the stained bones does not allow us to confirm our hypothesis. Reconstruction of burial conditions, as well as the old alkanet dyeing techniques, would create a reference enabling the application of these colorimetric techniques. This would therefore contribute a new body of data regarding the knowledge and use of vegetal dyes used in the Iberian Bronze Age.

CONCLUSION

To summarize, this paper has demonstrated that the knowledge of dyeing techniques, known from the Greeks and Romans, could have been present as early as the Bronze Age in most of Europe, including the Iberian Peninsula. The data examined included: results of the dye analyses of textile remains from the Iberian Peninsula and Hallstatt, Austria; the description of dyes in Linear B, and madder dyeing recipe described in a Neo-Babylonian tablet. Direct dyeing using tannins and mordants

used for red and yellow colours, was already known in the Bronze Age. Possibly, these techniques only applied to very specific items, such as stripes, bands and other ornaments, that adorned the linen tunics of this period. Based on the presence of inorganic pigments in the Argaric textiles, it is possible that in addition to dyeing with plants, a simpler textile colouring technique, based on using pigments, was used to colour textile surface and give them polychromy.

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Exploitation of Secondary Products at the Phoenician Site of Teatro Cómico, Cádiz (Spain)

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Abstract:

The macrovertebrate zooarchaeological analyses carried out at the Phoenician site of Teatro Cómico (Cádiz) show a predominance of mixed herds of sheep and goat. The patterns derived from the study of the mortality profiles seem to suggest the importance of wool and milk production. In addition to sheep and goat, we have also documented the presence of bovids, suids, equids, dogs, and cats. Animal remains can provide further information about the socio-economic activities taking place at the site. The scarce number of remains from wild species, such as deer, suggests that the exploitation of wild resources was rather limited. Lastly, it is also worth highlighting the presence of Hexaplex trunculus*, used in the production of purple dye. Together, the evidence presented in this paper indicates that secondary products had an important socio-economic role at the Teatro Cómico site, and that both trading and production were important economic dimensions of the Phoenician world.*

Key words: *Teatro Cómico, Phoenicians, Zooarchaeological Analysis, Economy, Textile Production.*

Resumen:

Los análisis zooarqueológicos de los macrovertebrados hallados en los distintos períodos del asentamiento urbano de época fenicia del yacimiento del Teatro Cómico (Cádiz), han mostrado un predominio de rebaños mixtos de ovejas y cabras, los cuales están relacionados según sugieren los patrones de mortandad con la producción de leche y lana. Junto a los ovicápridos en el yacimiento del Teatro Cómico hay otros animales domésticos como bóvidos, suidos, équidos, perro y gato, los cuales también nos han mostrado evidencias de su utilización en diferentes actividades. Junto a ellos han aparecido algunos restos efímeros de especies silvestres, como el ciervo, que demuestran que no fueron recursos muy aprovechados. Junto a estas evidencias destaca la presencia de Hexaplex trunculus *para producir púrpura, lo que hace del Teatro Cómico un lugar singular dedicado a múltiples funciones artesanales y comerciales.*

Palabras clave: *Teatro Cómico, Fenicios, Análisis Zooarqueológicos, Economía, Producción Textil.*

INTRODUCTION

To date, zooarchaeological analyses at Phoenician sites have been rather limited in relation to the large number of excavated sites, even though such studies have been conducted for a long time (Martín Roldán 1959). This situation has already been noted by Riquelme (2001) and other researchers (Uerpmann and Uerpmann 1973; Morales *et al*. 1994; 1995; Montero 1999). We would like to stress that studies focusing on the uses and economic significance of particular animal species are even less common. In this paper, we aim to provide a new perspective for Phoenician zooarchaeology, focusing on the specific economic activities in which animals were involved. We consider primarily the production of secondary products from sheep and goats or bovids.

THE TEATRO CÓMICO SITE

The archaeological site of Teatro Cómico is located in the old town of Cadiz (Andalusia, Spain). Topographically, it corresponds with the highest point of the ancient Erytheia, the smaller island of the former Gadeiras archipelago, and where many researchers have located the early urban settlement of Gadir (Fierro 1979; 1983; 1995: 101-116; Ramírez 1982: 63, 85, 104, 140; Escacena 1985: 43) (fig. 1).

Local archaeological excavations, sponsored since 2002 by the Cadiz municipality, have established ten phases within the occupation sequence, ranging from the ninth century BC to the present day (Gener *et al*. 2012; Zamora *et al*. 2010) (fig. 2). We shall focus on the first four phases, relating to the Phoenician occupation from the ninth to the sixth century BC.

The Period I phase – known as Late Bronze Age/ Phoenician I – dates to the early ninth century to around 820 BC. It is rather poorly known, documented mainly through test pits. Although they have not provided much information about building techniques, they offered some interesting insights into early economic activities, such as craft production. A rounded structure, which yielded a large amount of *Hexaplex trunculus* shells, was found in one of these test pits (fig. 3), which may suggest *in situ* purple dye production, according to Gener *et al*. (2014; see also García Vargas in this volume).

The Period II phase is known as Phoenician A (c. 820/800 – 720 BC). This phase is better known, with a series of buildings arranged into three structural groups, articulated along two streets where eight houses or domestic units can be identified. Their spatial relationship changed throughout the period, with habitat restructurations reflected in changes of the street layout.

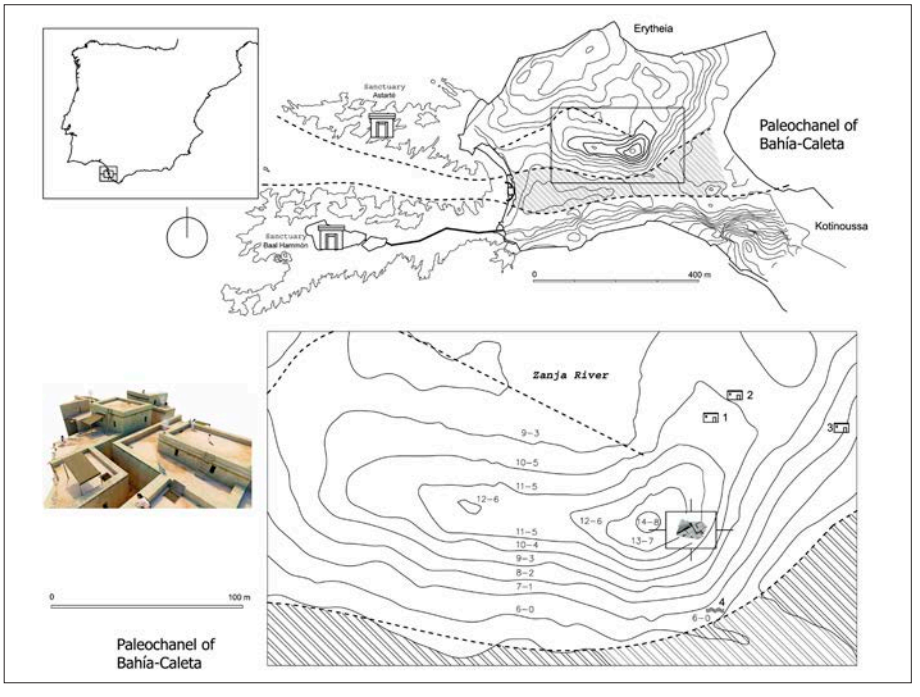

Fig. 1: Above: the location of ancient Cadiz and its topography along the banks of the palaeochannel. Below: Topographical location of the Teatro Cómico site 1 (J. Mª G.).

Ocupation Times			
Phase	Period	c.m.s.n.m.[1]	Chronology
I	Late Bronze / Phoenician	5.50	9th c. BC - 820/800 BC
II	Phoenician A	6.80/5.50	820/800 - 720 BC
III	Phoenician B	7.78	8th - 6th c. BC
IV	Phoenician C	8.09	6th c. BC
V	Roman A	9.29	3rd c. BC - 1st c. AD
VI	Roman B	10.45/8.05	1st c. BC - 2nd c. AD
VII	Roman C	8.16	AD 360 - 6th c. AD
VIII	Middle Ages	11.30	11th - 13th c. AD
IX	Modern / Contemporary	12.20	18th c. AD - AD 1885
X	Contemporary	11.30	1885 - 1995

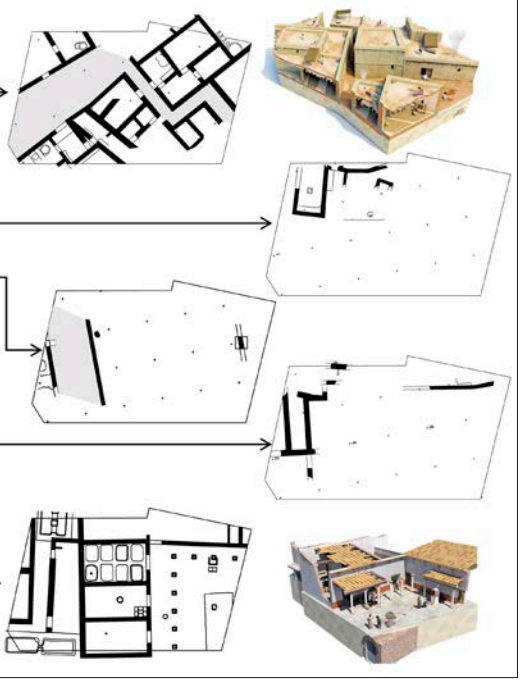

Fig. 2: Occupation periods documented at the site of the ancient Teatro Cómico. C.m.s.n.m.: meters above sea level (J. Mª G.).

During this period, the settlement shows a slight degree of population density, with adjoining and adjacent cuboid buildings, arranged along streets which drive through the complex terrace system established from the citadel down to the shore. It appears likely that this building system followed a social participation model, on the basis of shared construction and organisation parameters. Streets were shared spaces for the circulation of goods and people and they were seen as organizational axes of the urban landscape. Moreover, streets were often preserved and maintained during later building projects. This suggests the existence of

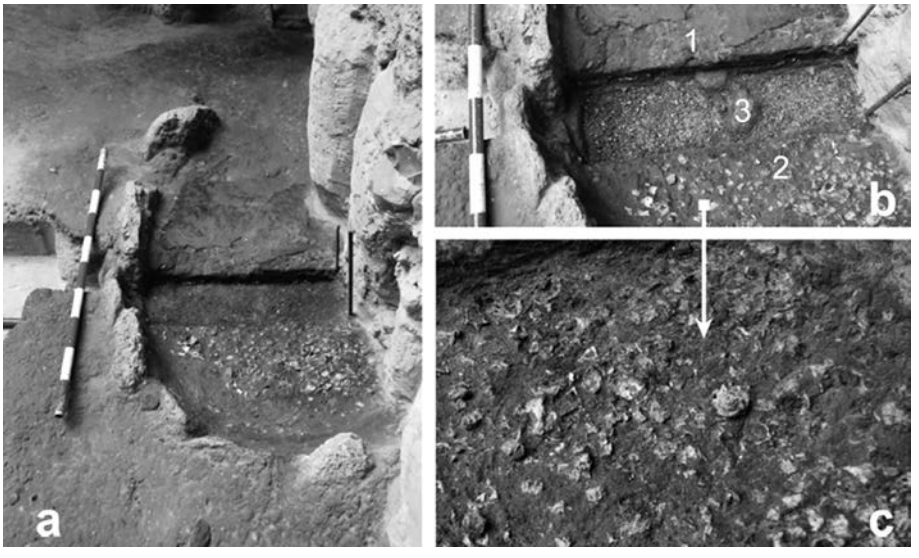

Fig. 3: Structure of the first occupational phase with an abundant accumulation of *Hexaples trunculus* (J. Mª G.).

Fig. 4: Proposed 3D reconstruction of Period II households (Phoenician A) (J. Mª G. y Gesdata, S.L.).

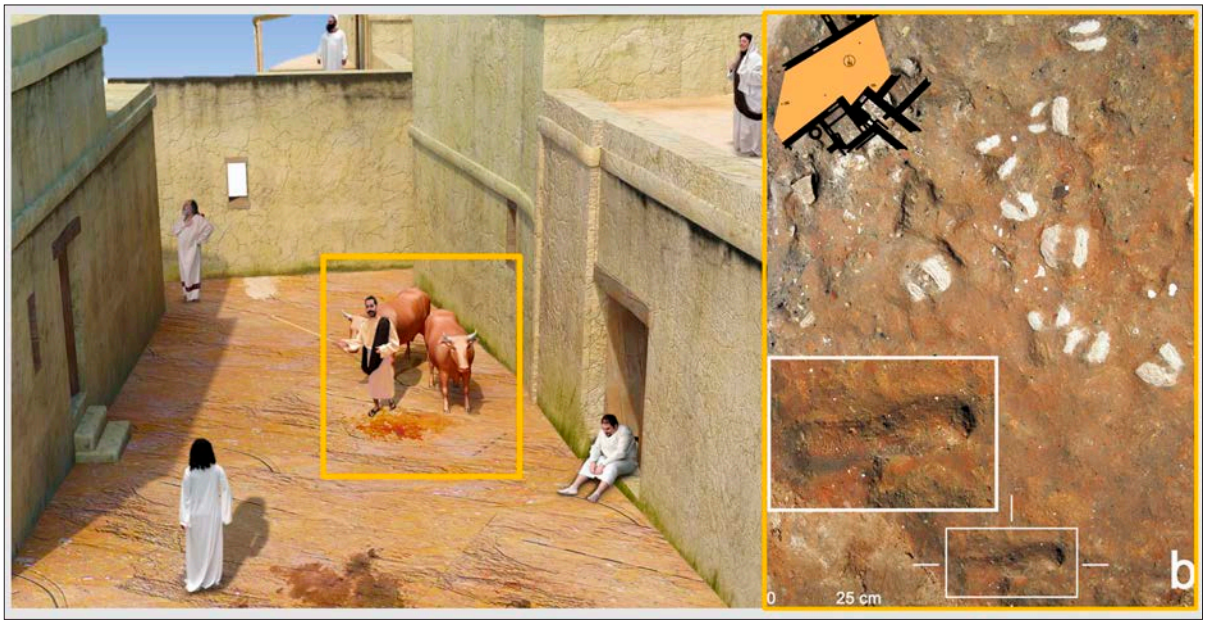

Fig. 5: Left: Detail of the 3D reconstruction of one of the streets. Right: Hoofprints documented on the pavement of Street 1. A possible human footprint can be found on the lower part (J. Mª G. y Gesdata, S.L.).

community-oriented activities in public spaces, which are characteristic of urban settlements, as noted for many Eastern urban sites (Herzog 2007, for Israel; Hellas and Marzoli 2009, for Phoenician urbanism in general; Yasur-Landau *et al*. 2011, for Near Eastern urbanism in general; Fumadó 2013) (figs. 4-5).

Some glimpses of this urban lifestyle can be found in the form of numerous footprints and other traces preserved in the pavement of one of the streets. These traces evidence the crossing and movement of humans and animals, including bovids and ovicaprids, along the streets of Gadir. This evidence suggests *in situ* activities involving livestock on the hoof, complementing the presence of butchery marks on bones found at some of these urban contexts.

Within the urban centre, some buildings had several rooms for different domestic and productive activities. In domestic spaces, it is common to find kitchen facilities and rooms with mills, pestles, and mortars. Among the industrial areas, we find rooms dedicated to pottery production with wheels, shafts, kilns, etc.; spaces for metallurgical production – including slag-filled *tuyères*; and trading areas. Local and imported vessels, amphorae, clay sealings for papyri, Eastern objects – such as alabaster vessels – and a dice-shaped lead weight were found in these industrial areas. Finally, there are also some rooms associated with textile production, with loom weights, spindle whorls, and a bone needle to weave esparto grass (Gener *et al*. 2014).

Period III is a phase of the Phoenician B sequence, dating from the mid-eighth to the early sixth century BC. The building system changes towards the use of conglomerate masonry with limestone and siliceous red clay from Upper Pliocene and Plio-Quaternary deposits (Domínguez-Bella 2011: 62).

Large structures were built by means of pillars, rubble, and stones, developing a well-known Near Eastern technique (pier-and-rubble-masonry). In the Western Mediterranean, this technique experiences the substitution of pillars made from well squared blocks for single stone blocks (orthostates), which are then vertically placed on the walls (Elayi 1990; 1996; Sharon 1987). The only structural group so far excavated dating to this phase comprises at least five rooms made of red clay, each destined to different purposes and activities (Calero *et al*. 2012). The last phases of this period appear to have been rather complex and traumatic.

The Period IV of the sequence, also known as Phoenician C (sixth century BC), shows a change in the urbanisation of the site that involves the partial dismantlement of previous building phases and terrain levelling for new constructions. However, the intense activity at this area during the Roman period has limited the documentation and our understanding of structures dating to this phase.

MATERIALS AND METHODS

MATERIALS

The bone assemblage comprises 1719 remains. They are in good preservation conditions and show a high level of fragmentation. The identified species include *Ovis aries*, *Capra hircus*, *Canis familiaris*, *Equus caballus*, *Bos taurus*, *Sus* sp., and a cat in anatomical connection (Estaca-Gómez *et al*. 2015). We have identified some bird and fish remains that are however not going to be discussed in this paper (Pérez de Ayala 2011a; 2011b). In relation to wild taxa, we note the presence of *Cervus elaphus*, *Erinaceus europaeus*, and *Oryctolagus cuniculus*.

METHODS

The analysis of the bone remains from Teatro Cómico can be divided into three parts: the taxonomic study, mortality patterns, and the interpretation of skeletal profiles.

For a more in-depth discussion of the methods followed in the present zooarchaeological study we recommend Estaca-Gómez *et al*. (2015), where we discuss the use of reference collections together with relevant publications for the purposes of taxonomical identification. We have also arranged species in different categories according to size, which provides useful information about those remains that could not be assigned to specific taxa. Thus, large-sized animals encompass bovids and horses; deer and donkey are considered medium-sized ones, while small-sized animals include sheep, goats, and pigs. Therefore, we have only considered 'unclassifiable' those remains which could not be assigned to either a species or to one of these size-based groups.

In relation to the quantification of bone remains, we have considered the NR (Number of Remains), and the MNI (Minimum Number of Individuals). When constructing age profiles, we have considered five age

Teatro Cómico site			
Taxon	NR	% Total	% classifiable
Bos taurus	341	19.84	35.8
Equus caballus	2	0.12	0.2
Cervus elaphus	3	0.17	0.3
Ovis aries	108	6.28	11.3
Capra hircus	27	1.57	2.8
Ovis / Capra	372	21.64	39.0
Sus sp.	80	4.65	8.4
Canis familiaris	7	0.41	0.7
Oryctolagus cuniculus	7	0.41	0.7
Erinaceus europeus	1	0.06	0.1
Bird sp.	5	0.29	0.5
Large-sized unclass. macromammals	230	13.38	
Small-sized unclass. micromammals	423	24.61	
Unclassifiable	113	6.57	
Total	1719	100	

Fig. 6: Taxonomical profiles on the basis of the NR (Number of Remains).

	MNI						
Taxon	Neonate	Infant	Juvenile	Adult	Senile	Total	%
Bos taurus	0	0	1	4	1	6	15.00
Equus caballus	0	0	0	1	0	1	2.50
Cervus elaphus	0	0	0	1	0	1	2.50
Ovis aries	0	1	1	6	1	9	22.50
Capra hircus	0	1	1	2	0	4	10.00
Ovicaprids	1	1	1	7	0	10	25.00
Sus sp.	0	1	1	2	1	5	12.50
Canis familiaris	0	0	0	1	0	1	2.50
Oryctolagus cuniculus	0	0	0	1	0	1	2.50
Bird sp.	0	0	0	1	0	1	2.50
Erinaceus europeus	0	1	0	0	0	1	2.50
Total						40	100.00

Fig. 7: Pattern of taxonomical representation on the basis of the MNI (Minimum Number of Individuals).

groups: neonates, infants, juveniles, adults, and senile individuals. In order to calculate the age of the remains, we have taken into account the following authors: Pérez Ripoll (1988) in relation to ovicaprids; for deer, we have consulted Mariezkurrena (1983), Klein *et al.* (1983), and Brown and Chapman (1991a; 1991b), and those of Levine (1982) and Guadelli (1998) for equids. To construct the age profiles, we have defined the juvenile cohort as comprising individuals of around 2-3 years of age, assigning those below two years old to the

category of infants, and considering 'neo-nates' the new-born animals. The adult cohort is divided in two groups: prime adult individuals, with an age from sexually mature to around 75% of their expected lifespan, and we have considered senile those with an age greater than 75% of their expected lifespan.

For the quantification of the MNI, we have calculated two types of MNI: a 'global' aspect of the MNI, considering all the stratigraphic units of the same chronology as part of the same assemblage; the second approach was to calculate the MNI of each stratigraphic unit independently and then add them together. This second method tends to yield higher MNI counts, therefore providing a better statistical representation of the faunal assemblage.

Following Yravedra (2006), in our assessment of skeletal part profiles we have grouped bones into four sections: cranial, which comprises the cranium and the mandible; axial parts (vertebrae, ribs, scapula, pelvis), and the appendicular skeleton, further subdivided into upper limb bones (humeri, femora, tibiae, radii-ulnae), and lower limb bones (metapodia, compact bones from ankles and wrists, and phalanges).

ZOOARCHAEOLOGICAL EVIDENCE

We have been able to classify 55.4% of the total faunal assemblage from the site of Teatro Cómico (1719 remains). The assemblage includes a broad spectrum of species, mostly mammals although birds and fish are also present. Domestic species (sheep, goats, bovids, pigs, dogs, and equids) predominate at the site. On the

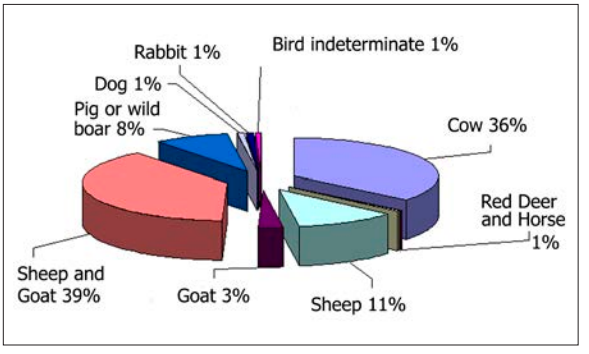

Fig. 8: MNI Percentages for each taxonomical profile, for each stratigraphic unit.

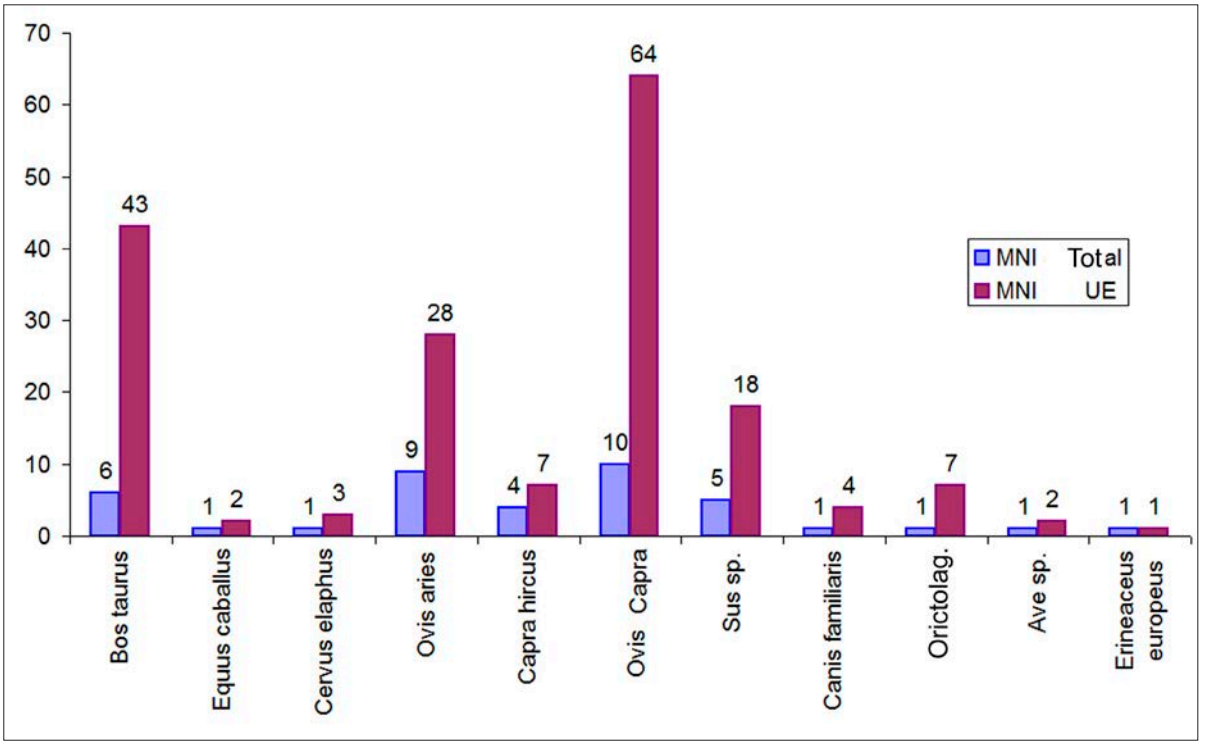

Fig. 9: Comparative assessment of MNI values, both in total and for each stratigraphic unit.

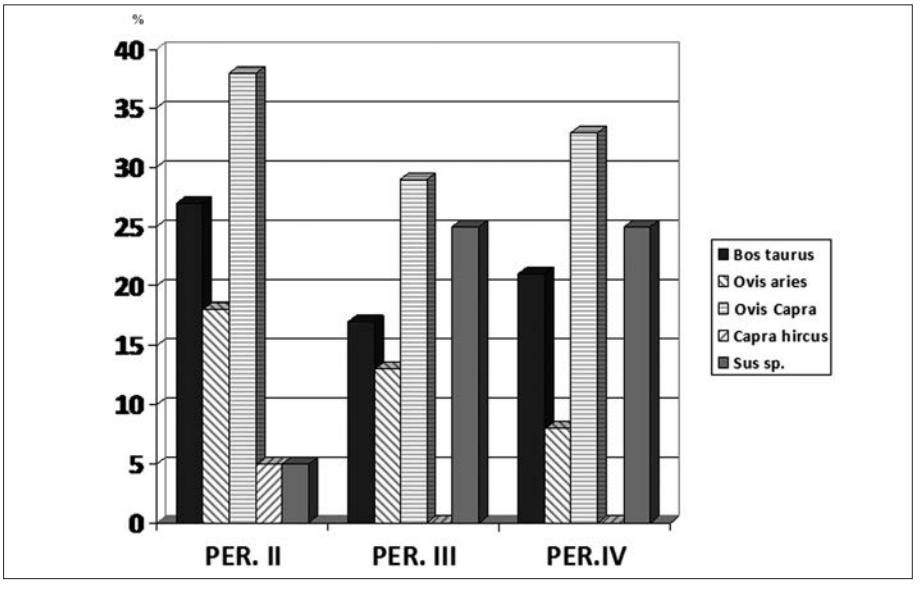

Fig. 10: Percentage-based representation of the NR (Number of Remains) of the main species found at Teatro Cómico, for each of the periods.

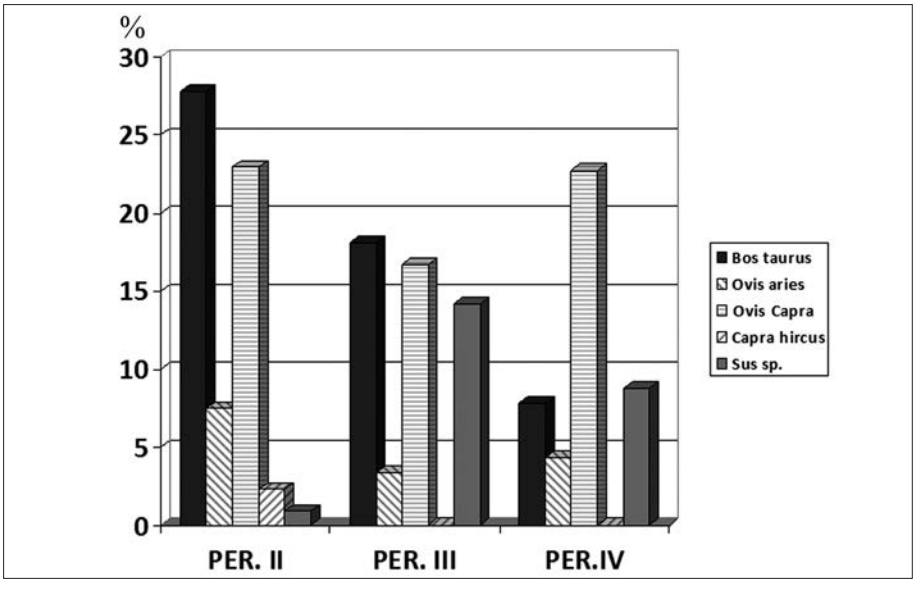

Fig. 11: Percentage-based representation of the MNI (Minimum Number of Individuals) of the main species found at Teatro Cómico, for each of the periods.

other hand, wild taxa only comprise 1% of the classifiable remains, and are represented mainly by deer and rabbit. Among the domestic species, ovicaprids stand out, with 29.5% of the total remains and comprising 53% of all classifiable remains (fig. 6). Second in importance come bovids, with 18.8% of the NR and 35.8% of the classifiable remains. Pigs are the third best represented group, with 4.7% of the NR and 8% of the classifiable remains. Lastly, horse and dog complete the taxonomic profile of domestic species with a rather slim representation in the sample.

With regard to the assessment of the number of remains on the basis of the MNI, we observe a rather similar pattern to the one yielded by the study of the NR mentioned above. Sheep and goat comprise 57% of the MNI, bovids are still the second most represented species with 15% of the MNI, and suids are also the third most frequent species at the site, with a representation of 12% of the MNI (fig. 7).

When considering the MNI percentages of each stratigraphic unit independently (fig. 8), we also note a similar pattern, with sheep and goat reaching over

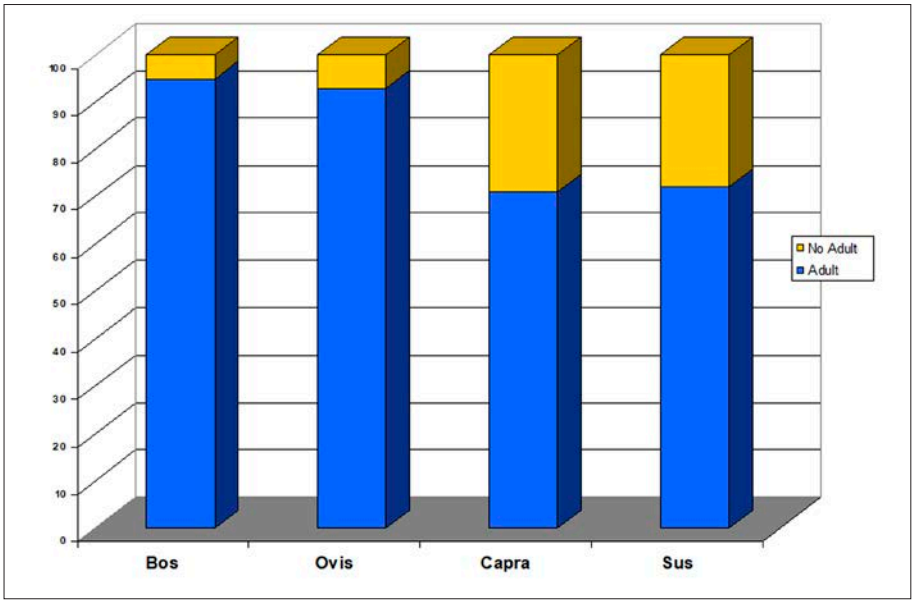

Fig. 12: Representation of adult vs non-adult individuals for the each of the main taxa found at Teatro Cómico.

55% of the sample, even though bovids get a slightly higher percentage (24%), while suids remain relatively relevant with a representation of around 10% of the sample. Several animals consistently yielded low percentages: rabbits comprise 4% and dogs 2% of the MNI per stratigraphic unit. The remaining species combined represent only the 4.5% of the total MNI per stratigraphic unit (fig. 8).

Therefore, we can confirm that the MNI increases when considering each stratigraphic unit on its own (fig. 9). Bovids show the greater variation, with an MNI of 6 when considering the assemblage as a whole, and 43 when adding together all stratigraphically-based MNIs, an increase of 700%; similarly, sheep and goat have an original MNI value of 23, reaching 99 when considering this more contextual approach. Pigs and rabbits also experience a similar statistical boost, although the variance is smaller for those species with the lowest number of remains. This suggests that the contextual approach of considering the MNI for each stratigraphic unit on its own does provide a more statistically representative sample for the purposes of zooarchaeological analysis and interpretation.

There is some variability in terms of taxonomical representation throughout the sequence. Notably, Period II has yielded the largest number of remains and individuals (figs. 10-11). Sheep and goat are the best represented species, both in terms of the NR and the MNI; bovids come second, in line with the global taxonomic profiles described for the site as a whole (figs. 6-7). Other species are scarcely represented, with suids just barely reaching 1% of the sample.

Period III has a smaller quantity of remains, just over 350. Taxonomically, ovicaprids are still predominant, followed by bovids and suids. Pigs in particular experience a significant increase in relation to the previous period, reaching 14.16% of the NR and 25% of the MNI (figs. 10-11). Besides, they become the second most represented species during Period IV, even if their MNI count does not increase accordingly. This is due to the progressive decrease in the number of *Bos taurus* remains throughout the sequence. The drop is particularly significant during Period IV, on the basis of the NR (fig. 10), although the decline is less marked if only the MNI is considered. We stress again that sheep and goat are the most represented species throughout all the periods under study.

When looking at the mortality profiles, it can be noted that most of the individuals are adults (fig. 12). For example, the mortality profiles for sheep and goat show that mature adults comprise over half of the sample. This pattern suggests that animal exploitation was not predominantly oriented towards meat production; instead, we argue that the interest in keeping adult individuals alive appears to indicate a greater interest in secondary products, such as wool and milk. This interpretation is further supported by the presence at the site of items of material culture oriented to textile production, such as needles and spindle whorls, and others used for processing

dairy products. Adult animals, particularly bovids, may have also been used as beasts of burden for pulling carts. This aspect might have been particularly relevant in the context of harbour activity, as bovids would have played an important role in loading and transporting ship cargo, as well as to pulling nets and fishing boats onto the beach shore (Delgado 2008). The use of pulling force from oxen for fishing wels catfish (*Silurus glanis*) has been documented among the Moesi (Thrace) in the second and third centuries AD (Claudio Eliano, *De Natura Animalium*, XIV, 25). The earliest references regarding the use of oxen for fishing purposes in southern Iberia come from the 18th century, when their force was deployed in the fishing technique known as trawling (Mirabent 1850; Delgado 2008), although their origin presumably derives from earlier cultural practices.

TAPHONOMICAL ANALYSES

Concerning the study of bone surface modifications, we have identified cut-marks on bone remains from all age groups. This pattern suggests that all animals, regardless of age, were exploited for meat consumption, including those primarily kept for their secondary products, once they reached an age when they were no longer able to provide those products.

In the study of the *Suidae* assemblage, we have documented the presence of infant and juvenile individuals, most likely slaughtered for meat procurement. This aspect is relevant, given the potential implications of pig consumption in Phoenician settlements (Morales *et al*. 1995: 526-527). However, determining who was responsible for pig consumption at a site that was perhaps inhabited by both Phoenicians and local people is not an easy task. Similarly, it is not known to what extent such food taboo would be followed or enforced. Therefore, we argue that pig consumption ought not to be straightforwardly considered a meaningful cultural marker for determining whether a site was Phoenician or indigenous.

In relation to bovids, adult individuals predominate. This pattern seems to suggest the relevance of dairy products, further stressed by the discovery of associated ceramic remains. The possible presence of oxen could be linked with pulling and loading; nonetheless, we are yet to undertake the required biometric analyses on the Teatro Cómico assemblage that would confirm their presence. The analysis of bone surface modifications indicates that all bovid age groups were being slaughtered for meat consumption, in addition to being exploited for other functional purposes.

The analysis of the skeletal profiles shows that all skeletal sections are represented for the main animal species (sheep/goat, bovids, *Suidae*), thus indicating that they came to the site as dressed carcasses or on the hoof. Nevertheless, as we can see in Figure 13, some elements are better represented than others, with cranial elements being the most abundant. This pattern can be due to two factors: firstly, the greater degree of fragmentation experienced by cranial elements, and secondly the abundance of teeth in relation to other anatomical elements. Axial elements for animals other than sheep/goat are less common (fig 13). Regarding appendicular elements, upper limb bones are the best represented for sheep/goat and bovids. On the other hand, the upper limb bones and the axial elements of pigs are poorly represented in the bone assemblage. This pattern seems to be a consequence of their intense exploitation in the process of meat preparation and consumption, as suggested by the presence of cut-marks on most pig bone surfaces.

IMPLICATIONS OF THE FAUNAL ANALYSIS FOR UNDERSTANDING THE EXPLOITATION OF SECONDARY PRODUCTS AT THE TEATRO CÓMICO SITE

In comparison to other contemporary sites, Teatro Cómico has yielded a less numerous bone assemblage than those found at Castillo de Doña Blanca or Toscanos (Morales *et al*. 1994; 1995). Nevertheless, their taxonomic profiles do not differ significantly from these other sites: sheep and goats are the most represented, followed by bovids and pigs, whereas equids, dogs, and wild animals, such as deer, are rare.

The zooarchaeological study of the Teatro Cómico bone assemblage has yielded several lines of evidence supporting the exploitation of secondary animal products at the site. For example, age profiles show a high proportion of adult individuals across all taxa (fig. 12). These mortality patterns seem to suggest long-term engagements with animals for purposes other than meat consumption.

Moreover, sheep and goat are the most frequent species throughout the sequence, whereas the relative representation of other species (such as bovids or pigs) changes over time. Sheep and goats can both provide milk and wool. The predominance of sheep can be linked with the

Anatomical part	*Bos taurus*	*Equus caballus*	*Cervus elaphus*	*Ovis aries*	*Capra hircus*	*Ovis /Capra*	*Sus* sp.	*Canis familiaris*	*Oryctolagus cuniculus*
Horn	13								
Cranium	105					20			
Maxilla	4			5		4	2		
Mandible	28			12	5	22	7	1	
Teeth						5	2		1
Incisor	1								
Canine							3	1	
Premolar	5			19	11	14	7		
Molar	29			30	8	11	14		
Vertebra	20					48			
Rib	14					19	2		
Scapula	7			1		11	2		
Humerus	7	1		10	1	23	3	1	2
Radius	5			4		20	2		1
Radio-Ulna	2					7			
Ulna	2					7	2		
Metacarpus	14			7	1	27			
Astragalus	2			5		8	1		
Patella				1					
Superior	4					2			
Pelvis	3			1		6	2		
Femur	7			1		27			1
Tibia	8			7		30	5	2	2
Fibula							2		
Metatarsal	9		1	3	1	18			
Tarsal	1								
Metapodium	5	1				9	16	2	
Calcaneus	1			2		5	1		
Sesamoid						1			
Phalanx	38		2			28	7		
Unclassifiable	7								
Total	341	2	3	108	27	372	80	7	7
Cranial	185	0	0	66	24	76	35	2	1
Axial	44	0	0	2	0	84	6	0	0
Upper Limbs	31	1	0	22	1	114	14	3	6
Lower Limbs	74	1	3	18	2	98	25	2	0

Fig. 13: Skeletal profiles for the main taxa documented in the Teatro Cómico bone assemblage.

requirements of the textile industry, given that sheep produce more wool; the existence and relevance of textile production is further confirmed by the presence of specialised items of material culture, such as needles, spindle whorls, and loom weights. Moreover, the extraction of purple dye from *Hexaplex trunculus* can also be linked with efforts to meet the demands of the textile market. Furthermore, as mentioned above, the presence of a rounded structure from the Phase I period (fig. 3), which yielded a large amount of *Hexaplex trunculus* shells,

could suggest *in situ* purple dye production (Gener *et al*. 2014). The production of purple dye has already been documented at other Phoenician sites in the Mediterranean, such as Motya and Carthage. At Motya, in levels dated to the sixth to fifth centuries BC, murex shells were crushed with stone hammers on whale vertebrae used as anvils (Reese 2005); at Carthage, a deposit with *Murex trunculus* shells was found on a layer dating to the eighth century BC (*cf*. Gener *et al*. 2014).

The study of bovid remains has not confirmed yet whether oxen are also represented in the assemblage. However, these remains have yielded valuable information regarding the intensity of labour demanded from the animals. It is worth noting that the soil surrounding the site is not particularly conducive to cereal agriculture, so the involvement of cattle as beasts of burden on other demanding tasks beyond or in addition to agricultural labour is quite likely. The presence of hoofprints and raceway traces on street surfaces, together with the maritime vocation of the inhabitants of the site in the context of active trading, might indicate the use of these animals for pulling and transporting ship cargo and/or fishing implements, such as nets.

Pigs would usually seem to have been only relevant for their meat. However, the Teatro Cómico assemblage shows a predominance of adult individuals, and the relative frequency of the species changes over time, becoming the second most abundant animal during Period IV (figs. 10-11). This situation is at odds with the pattern seen at most Phoenician sites, where this species never appeared to have reached over 12% of the faunal assemblage – in contrast with Tartessian sites, where pigs are generally more common. Nonetheless, it is worth noting how limbs, the most meat-rich parts of the skeleton, are rather poorly represented. Perhaps, pig hindlimbs and forelimbs were relevant also for their potential role as currency in economic transactions, although they may have been directly traded to other sites for consumption.

In relation to meat procurement, the presence of cut-marks confirms a meat-oriented exploitation of animal remains at the site. In general, the remains from species which provide less utility in terms of secondary products tend to yield more butchery marks: for example, goat bones tend to show cut-marks more frequently than those of sheep. Nonetheless, it is worth noting that the slaughter of mature adult individuals tends to occur at an age when they are no longer able to continue providing secondary products or they are too old for demanding physical tasks. In other words, butchery patterns suggest that their consumption aimed to maximise their overall productivity and usefulness after their primary function was exhausted. It is relevant to note that this pattern of meat procurement being subordinated to the production of secondary products is in stark contrast with the evidence from sites such as the ceremonial centre of Montemolín, where most sheep, goats, pigs, and bovids were slaughtered before they were two years old (De la Bandera *et al*. 1995; Chaves *et al*. 2000).

In conclusion, the mortality patterns and skeletal part profiles of the faunal assemblage of Teatro Cómico indicates a complex system of herd management. The presence of hoofprints in public contexts and the discovery of specialised items of material culture related to the processing of dairy products and textile production indicates that animals were relevant beyond meat provision. In fact, we argue that the zooarchaeological study of the Teatro Cómico bone assemblage supports the notion that secondary products, such as wool, milk, leather but also animal traction, could have represented a significant socio-economic dimension for inhabitants of this Phoenician site.

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Functionality and Economic Uses of Animals in Early Iron Age Central Iberia

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Abstract:

Discussions about herding economy during the Early Iron Age in central Iberia are still rather limited in historiographic research due to the reduced number and low representation of the faunal samples available. The use of zooarchaeological and taphonomic methodology to analyse a series of samples from recently studied sites resulted in a comprehensive summary of the use of fauna in these societies. Conclusions led to a contrasted interpretation of the functionality and use of domestic animals during the Early Iron Age in the Tajo middle valley, presenting them as more than mere food supplies.

Key words: *Animal Exploitation, Tajo Middle Valley, Zooarchaeology, Taphonomy.*

Resumen:

En este trabajo se aborda una cuestión poco documentada historiográficamente debido a que los datos sobre economía ganadera, para este momento y lugar, son escasos como consecuencia de que la mayor parte de las muestras faunísticas estudiadas son poco representativas y muy exiguas. Con nuestra investigación tratamos a través de metodologías zooarqueológicas y tafonómicas integrar sus resultados con el registro arqueológico, en relación a varios yacimientos estudiados recientemente y ponerlos en relación con los datos existentes, con el fin de ofrecer una interpretación contrastada sobre la funcionalidad y los usos de la ganadería en la Primera Edad del Hierro en el valle medio del Tajo.

Palabras clave: *Economía, Ganadería, Valle Medio del Tajo, Primera Edad del Hierro, Zooarqueología, Tafonomía.*

INTRODUCTION

Iron Age societies, particularly during the earlier period, have not been considered in the Tajo middle valley area until recently, when a larger *corpus* of bibliography has started growing regarding different social aspects (Morín *et al*. 2005; Dávila 2007; Torres 2013; Baquedano 2014).

However, these works have not enlarged on the economic strategies developed by these peoples, especially regarding animal exploitation (Yravedra and Estaca-Gómez 2014). Exceptions were the papers by Morales (1980); Miguel (1985); Chaves *et al*. (1991); Cerdeño *et al*. (1992); Miguel and Morales (1994); Liesau (1998a; 1998b); Urbina *et al*. (2005); Yravedra (2007a; 2007b; 2012); Consuegra and Díaz del Río (2007), and López and Morales (2012). These references set the basis for a discourse which stated that local populations consumed mainly ovicaprids, followed by bovids and suids. However, the data derived from a faunal study may go beyond establishing animal consumption patterns and attempt to illustrate the economic lifeways during the Iron Age in the area (Yravedra and Estaca-Gómez 2014; Estaca-Gómez 2017).

MATERIALS AND METHODS

Two kinds of data are presented and compared in this analysis. On the one hand, our revision of the faunal record from the site La Guirnalda de Quer, in Guadalajara province (Agustí 2007; Agustí *et al*. 2012) is introduced, as well as of three other sites in the Madrid area: Humanejos (Flores 2011), La Cuesta (Flores and Sanabria 2012; 2014) and Torrejón de Velasco (Morín 2008). The last two sites are in fact the same settlement but received different names during excavation; so, they are considered here as a unit identified as La Cuesta. The sample is completed with the Cerrocuquillo site (Baquedano *et al*. 2010; Torija *et al*. 2010) in Toledo (fig. 1). In total, the faunal sample studied comprises 10850 remains, 2301 coming from La Guirnalda, just 135 from Humanejos, 669 from La Cuesta and 7745 from Cerrocuquillo.

The second group of data originated in published records from the sites of Las Camas (Yravedra 2007a), Cerro San Antonio (Chaves *et al*. 1991), Ecce Homo (Morales 1980), La Capellana (Liesau 1998a), Puente Largo del Jarama (Liesau 1998a), Arroyo Culebro A (Orri and Nadal 2002) and Arroyo Culebro UAM (Liesau 1998b).

In terms of the methodology applied, the Number of Remains (NR) and the Minimal Number of Individuals (MNI) were calculated. Age discrimination allowed a more precise definition of the taxonomic profiles, which were later supplemented by skeletal profiles.

The taxonomic identification followed Lavocat (1966), Pales and Lambert (1971), Schmid (1972), Martín and Blázquez (1983) and Hilson (1992). More specifically, Boessneck (1969), Payne (1985), Prummel and Frisch (1986) and Fernández (2001) were used to differentiate between *Ovis aries* and *Capra hircus*, whereas *Bos taurus* bones were classified according to Prummel (1988). Finally, Payne (1988) paper facilitated the distinction between boar and domestic pig. Bibliography was consulted for comparison with the reference collection. It should be noted that the NR included the complete sample, both identified and indeterminate remains. In the case of MNI, fragments were ascribed to the most frequent anatomical remain, discriminating between left and right elements (Brain 1969). The MNI was estimated in two ways: each stratigraphic unit was regarded independently and later integrated in the total MNI of the whole assemblage.

Age patters were established by teeth characterisation, considering tooth wear and the eruption of permanent pieces as well as the presence of deciduous ones. Bone ossification levels and epiphysis fusion were also considered. The different age groups were divided into infant, juvenile and adult. Age estimations considered the data by Pérez Ripoll (1988) and Couturier (1962) for ovicaprids; and Mariezkurrena (1983), Brown and Chapman (1991a; 1991b) and Guadelli (1998) for equids.

Regarding the sexing of the animals, the fragmentation of the remains and the absence of complete pelvises has not allowed us to make a direct determination of the sex or the species, only in the case of deer antlers it was possible to make some direct identification. However, through the biometrics of the epiphyses of long bones following (Driesch 1976) some assumptions have been made, as in the case of the discrimination between ox and cow in some sites such as La Guirnalda de Quer (Estaca-Gómez 2017).

Lastly, the anatomical representation of remains was analysed, describing the skeletal part of the bone fragment. Indeterminate bones were ascribed to the axial category, either as spongy (if they were spongy tissues from an epiphysis or other compact bone) or diaphysis fragments. The methodology used aimed to identify the elements most severely affected by fracture. Furthermore,

bones were grouped in three different sections: cranial (including lower jaw); axial (vertebrae, ribs, scapulae and pelvis, following Yravedra 2006); and appendicular, subdivided into upper (humeri, femora, tibiae and radii, ulnae) and lower elements (metapodials and compact bones).

FAUNAL CHARACTERISATION IN THE EARLY IRON AGE

It has been traditionally assumed that Early Iron Age societies in the area had a mixed economy based on agriculture and cattle herding. Although broad descriptions of the local economic development have been published, specific faunal studies were limited to the presentation of a small number of samples. Compared to the total amount of known sites, only 24% of the locations with Early Iron Age chronology have incorporated some heterogeneous information about faunal remains (Estaca-Gómez 2017).

Consequently, there is a large variability in the data provided. Virtually all sites specify the NR while other variables are proportionally reduced. For instance, information regarding MNI and age patterns is rather frequent except for Ecce Homo, Puente Largo del Jarama and La Capellana; but aspects such as skeletal profiles are present in a dramatically reduced number of sites and taxonomic information to define seasonality is almost non-existent (fig. 2).

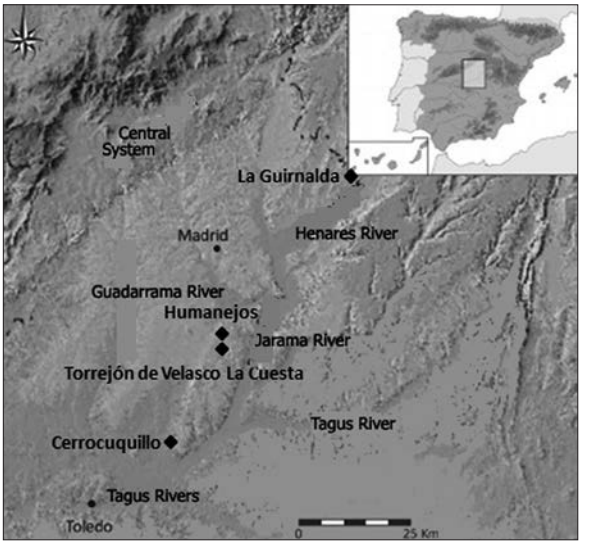

Fig. 1: Geographical location of the sites studied (Author).

In taxonomic terms, NR estimations in available databases indicate that ovicaprids were the main species, except in the case of Las Camas. They were followed by bovids and pigs. The fourth most important species were equids, with generalised frequencies lower than 10%. Dogs were scarcely represented. The same scheme is reproduced in MNI calculations, where ovicaprids represented about 40% of the individuals documented in each site, bovids were below 20% of MNI except for Las Camas,

SITE	NR	MNI-Age	Skeletal profiles	Seasonality	Taphonomy
Ecce Homo	X				
Cerro San Antonio	X	X			
La Capellana	X				
Puente Largo del Jarama	X				
Arroyo Culebro UAM	X	X			
Arroyo Culebro A	X	X	X		x
Las Camas	X	X	X	X	x
La Guirnalda	X	X	X	X	x
Torrejón de Velasco	X	X	X	X	x
La Cuesta	X	X	X	X	x
Cerrocuquillo	X	X	X	X	x
Humanejos	X	X	X	X	x

Fig. 2: Sites analysed in this paper.

	Las Camas A		Las Camas B		Cerro San Antonio		Ecce Homo		La Capellana		Puente Largo Jarama	
Species	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**
Bos taurus	938	40.0	269	44.6	38	17.2	11	19	31	16	5	36
Equus caballus	259	11.1	32	5.3	3	1.3	1	2	5	3	1	7.1
Equus asinus												
Equus sp.												
Cervus elaphus	57	2.4	35	5.8	10	4.5	9	15.3	1	0.4		
Ovis aries	176	7.5	24	4.0	7	3.1	3	5.1				
Capra hircus	117	5.0	25	4.1	3	1.3						
Ovis / Capra	494	21.1	182	30.2	117	53.1	25	42.4	129	66	7	50
C. capreolus	1											
Sus domesticus	85	3.6	23	3.8	24	11			25	13		
Sus scrofa	17	0.7	3	0.5								
Sus sp.	179	7.6					7	11.9				
Canis familiaris	13	0.6	4	0.7	1	0.4	3	5.1	1	0.4		
Canis lupus	1											
	Arroyo Culebro A		**Arroyo Culebro UAM**		**La Guirnalda**		**Humanejos**		**La Cuesta**		**Cerrocuquillo**	
Species	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**	**NR**	**%**
Bos taurus	43	28.7	35	23	***437***	***30.6***	***30***	***23.3***	***177***	***41.4***	***367***	***14.1***
Equus caballus	15	10.0	5	3.3	***110***	***7.7***	***32***	***24.8***	***37***	***8.6***	***25***	***1.0***
Equus asinus					***40***	***2.8***			***1***	***0.2***	***5***	***0.2***
Equus sp.												
Cervus elaphus	1	0.7	2	1.3	***100***	***7.0***			***3***	***0.7***	***30***	***1.2***
Ovis aries			7	4.5	***98***	***6.9***	***8***	***6.2***	***29***	***6.8***	***617***	***23.7***
Capra hircus	2	1.3	5	3.3	***84***	***5.9***			***16***	***3.7***	***37***	***1.4***
Ovis / Capra	64	42.7	83	54.2	***404***	***28.3***	***27***	***20.9***	***100***	***23.4***	***1298***	***49.9***
C. capreolus			1	0.7	***2***	***0.1***			***2***	***0.5***		
Sus domesticus	25	16.7	12	8								
Sus scrofa					***4***	***0.3***					***3***	***0.1***
Sus sp.					***123***	***8.6***	***10***	***7.8***	***52***	***12.1***	***187***	***7.2***
Canis familiaris			2	1.3	***21***	***1.5***			***10***	***2.3***	***32***	***1.2***

Fig. 3: Number of remains (NR) in published sites and the ones presented here (italic bold) for the Early Iron Age.

suids did not reach 15% and horses constitute less than 10%. On the other hand, wild animals were better represented in MNI than in NR (figs. 3-4).

Consequently, it could be argued that during the Early Iron Age an animal herding economy developed, focusing on sheep flocks. It may reflect more intensive mobility patterns than in the Late Iron Age, when taxa diversified and included bovids and suids.

FUNCTIONALITY AND USES OF DOCUMENTED FAUNA

FOOD CONSUMPTION

Faunal remains reflect the many roles played by animals in daily life during the Early Iron Age. It has traditionally been assumed that in food-producing societies

	Las Camas A		Las Camas B		Cerro San Antonio		Ecce Homo		La Capellana		Puente Largo Jarama	
Species	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**
Bos taurus	17	19.1	**5**	14.3	2	8.7						
Equus caballus	7	7.9	2	5.7	1	4.3						
Equus asinus												
Equus sp.												
Cervus elaphus	4	4.5	1	2.9	1	4.3						
Ovis aries	15	16.9	4	11.4	3	13.0						
Capra hircus	11	12.4	3	8.6	2	8.7						
Ovis / Capra	15	16.9	14	40.0	7	30.4						
C. capreolus	1	1.1				0.0						
Sus domesticus	7	7.9	2	5.7	3	13.0						
Sus scrofa	3	3.4	1	2.9								
Sus sp.	4	4.5										
	Arroyo Culebro A		**Arroyo Culebro UAM**		**La Guirnalda**		**Humanejos**		**La Cuesta**		**Cerrocuquillo**	
Species	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**	**MNI**	**%**
Bos taurus	21	26.3	2	11.8	***15***	***21.7***	***1***	***16.7***	***6***	***18.2***	*7*	***11.9***
Equus caballus	10	12.5	1	5.9	***3***	***4.3***	***1***	***16.7***	***2***	***6.1***	***1***	***1.7***
Equus asinus					***5***	***7.2***			***1***	***3.0***	***1***	***1.7***
Equus sp.												
Cervus elaphus	1	1.3	1	5.9	***2***	***2.9***	***1***	***16.7***	***2***	***6.1***	***1***	***1.7***
Ovis aries			1	5.9	***9***	***13.0***	***1***	***16.7***	***5***	***15.2***	***20***	***33.9***
Capra hircus	2	2.5	3	17.6	***10***	***14.5***			***4***	***12.1***	***6***	***10.2***
Ovis / Capra	31	38.8	1	5.9	***11***	***15.9***	***1***	***16.7***	***5***	***15.2***	***16***	***27.1***
C. capreolus			1	5.9	***2***	***2.9***			***1***	***3.0***		
Sus domesticus	15	18.8										
Sus scrofa					***2***	***2.9***					***1***	***1.7***
Sus sp.			2	11.8	***4***	***5.8***	***1***	***16.7***	***5***	***15.2***	***5***	***8.5***

Fig. 4: Minimal number of individuals (MNI) in published sites and the ones presented here (italic bold) for the Early Iron Age.

domestic animals were mainly regarded as foodstuff (Iborra 1999). However, revisions by Liesau and Blasco (1999), Collard *et al*. (2010), and Vidal and Maicas (2010), among others, indicated that animals were not just used as a food resource, as evidenced in a varied archaeological record since prehistoric times.

Even if the nutritious value of animals is the focus, some considerations should be made. Firstly, it is quite different to consume an adult than a juvenile or infant specimen, as their meat may have had different economic, social or even ritual-religious connotations.

A high percentage of the individuals were slaughtered when adult or senile, probably after exploiting the products they could offered in their lifetime. In fact, during this period 30% of ovicaprids remains were from infant and juvenile individuals. In the case of cows, they yielded values lower than 20% for these two age groups. Suid non-adults represented more than 40% of the sample in the five sites with MNI values. According to these data, herding practices can be seen as diversified: animals were not just kept for meat production; they were also important for other products

(Sherratt 1981) such as wool or milk, in a similar way to modern cattle management (Cambero 1999). Moreover, most of the young individuals documented were slaughtered in the autumn.

An analysis of the anatomical representation of animal parts was proposed to evaluate meat processing for human consumption. Although the results were not definitive, the skeletal profiles of the sites where this variable was considered broadly indicated that all the anatomical parts were present. It suggests that in most cases both slaughtering and consumption took place inside the settlement or in the nearby area. In addition, the classification of fauna according to activity areas (i.e. industrial, domestic, disposal area) in the sites studied may be indicating the differential consumption of species and parts. A particularly relevant detail was detected in the way bones were disposed of, because not all remains seemed to have ended up in garbage areas. During the Early Iron Age there was an equilibrated distribution of remains in the three areas mentioned (fig. 5), indicating that not all the remains consumed were dropped in the disposal area, but they were also discarded in the domestic and industrial sections. It should be noted that some of the activity areas were not identified in all the sites considered, resulting in variations in the percentages; however, the existence of bone remains in domestic and productive areas was unquestionable.

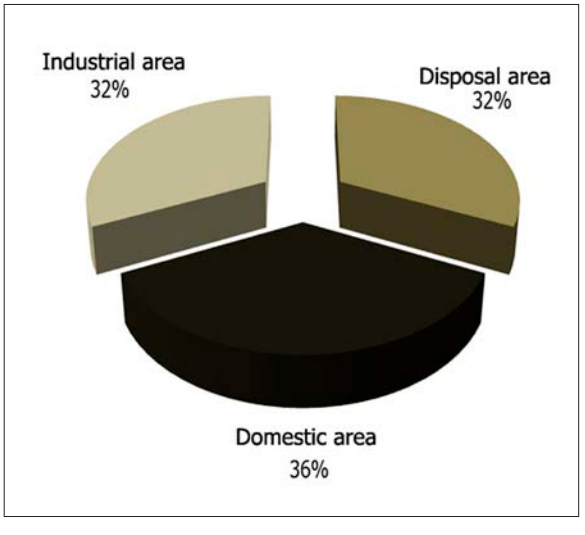

Fig. 5: Comparison of the three areas documented in the Early Iron Age sites considered.

Taphonomic studies provided information about processing marks on typical domestic animals – ovicaprids, bovids and suids – as well as less frequent taxa such as horse and dog (Yravedra 2007a, b, c, d; 2009a, b; Estaca-Gómez and Yravedra 2010; 2011a, b). Processing marks were found among specimens of all ages.

This fact reinforces the idea that all the species present were processed for meat once they were no longer useful for wool, milk, workforce, etc. It was clearly indicated in the marks related to meat extraction: skinning, disarticulation, evisceration and butchering.

Cut marks were identified in most of the sites where these data were available and they appeared on the same anatomical parts, particularly long bone epiphyses. Furthermore, bone breaking marks indicative of legs butchering were recorded. Evisceration and disarticulation marks indicated that Early Iron Age populations did not only butcher animals for immediate consumption and cooking – a practice evidenced in the cream-coloured dehydrated bones in the sample – but also for their short- and medium-time preservation. Although it is not possible to prove this treatment from the faunal remains, basic preservation methods could have been rather frequent at the time, such as meat drying to prevent the action of microorganisms.

Meat could have been treated by the combination of either heat and smoke or dry and cold air, as well as by the use of antiseptic products such as firewood smoke or salt (Torres 2007: 51). Salt would have been also fundamental for other kinds of animal product treatments, such as cheese-making or skin processing (Valiente *et al*. 2014). A further meat preservation method used at the time was embedding it in fat or lard, attested in a Late Iron Age deposit found at Las Ruedas necropolis in Pintia (Sanz *et al*. 2003: 152; Juan and Matalama 2003: 314-316).

CRAFTING ACTIVITIES

Iron Age populations did not just resort to meat preservation processes; they must have also spent some time in crafting activities in which living animals were actively involved, such as textile production using their wool or hair. Female mammals would be frequently milked to obtain dairy products as well. In some other activities, animals had to be butchered, their skin was tanned and the bones, horns and antlers used to make bone instruments.

In these sedentary populations, milk must have been an important product consumed either raw or processed in dairy products, an aspect not usually mentioned in contemporaneous research (Sherrat 1981). We agree with other authors (Liesau and Blasco 1999; Torres and Sagardoy 2004; Torres 2007) that this absence could be due to the organic nature of many of the tools probably used for dairy processing, frequently made of wood, leather and similar materials which rarely survive in the archaeological record.

Similarly, it is well-known that the identification of casein in pottery containers is still ambiguous even in vessels which are known to have contained milk (i.e. the so-called cheese strainers). Milk from cows, sheep and goats should have been quickly processed due to its short lifespan when raw. Once fermented, however, it is a medium-lasting foodstuff in the case of yogurt, curd, ricotta-cheese, etc., and long-lasting product in the form of hard cheese and butter. These by-products could have been stored and transported rather easily, resulting in a useful protein source while preserving the animal alive.

Another fundamental activity at the time must have been textile production, traditionally considered a female task (Torres 2005; 2011; Bonet and Vives-Ferrándiz 2011). Textiles could have been made from plant fibres, mainly flax and cotton, as found in Early Iron Age levels at Cerrocuquillo (Baquedano *et al*. 2010). However, the most common raw material for fabrics was probably the wool from adult sheep. This use of the wool could justify the mortality patterns identified, where a high percentage of slaughtered sheep were adults, indicating the importance of the living animal.

In order to obtain the fibre, sheep first had to be sheared, probably using lithic flakes or knives in early times (Mallía-Guest 2012), a time-demanding activity. The use of shears during the Late Iron Age, present at Llano de la Horca (Ruiz Zapatero *et. al*. 2012: 340) and Dehesa de la Oliva (Cuadrado 1991), would have significantly improved shearing conditions.

This raw material would have been later cleaned by combing and carding. Natural teazles could have been initially used, such as a dry thistle, to later incorporate a metal comb like the one found at Llano de la Horca (Ruiz Zapatero *et al*. 2012).

The process would produce fibre to be spun using a spindle, a light wood, bone or cane rod some 20 to 30 cm long. The best example documented so far dates from the Late Iron Age, a spindle found at Cerro Redondo which still had a string of wool attached (Blasco and Alonso 1985). At one end of the rod, a truncated or bitroncoconical spindle whorl normally made of pottery, bone or wood was positioned. In the sites considered in this analysis, only one bitroncoconical spindle whorl from Cerrocuquillo was documented in the Early Iron Age levels. Furthermore, a bone spindle whorl was found at La Guirnalda in Late Iron Age levels. Spindle whorls facilitated the rotation of the fibre and reduced oscillation in quick rotations. In addition to their weight, they favoured skein production to be used in the loom (Castro 1980: 144; see also Marín-Aguilera in this volume).

It is rather common to find spindle whorl assemblages in domestic contexts. Although the sites considered here did not yield these objects for earlier times, the situation changed during the Late Iron Age, where they were found both in domestic locations (i.e. the collapse of a dwelling at La Guirnalda) or spread around many areas, such as Sector II at La Gavia III. They were also located in crafting sectors at La Cuesta, a situation closely similar to the significant concentration reported for Fuente de la Mora (Leganés, Madrid) and identified as a specialised working area (Vega *et al*. 2009).

Other elements to be considered in this activity are the truncated conical and rectangular loom weights used to stretched the threads in vertical warp-weighted looms. Due to their wood composition, looms are not frequent in archaeological records but can be deduced from the holes in some habitation floors, or the concentration of loom weights in certain domestic areas, as in the case of La Guirnalda, area 1 (UE 23018). In this UE, loom weights were found *in situ*, as also happened at La Gavia III, Sector II for the later period. Loom weights were also found in the Early Iron Age industrial area at Cerrocuquillo. Therefore, textile-related activities and, by extension, wool production seem to have been a frequent activity in faunal management in the sites studied.

Although wool was probably the main raw material for clothing, the use of animal skin and leather, either domestic or wild, cannot be discounted. They could have been transformed or manufactured and included the original hairy coat or not. They may have been tanned and used not only for clothing and shoes but also for furniture, containers, belts, cuirasses, helmets, horse harnesses, etc. (Cuadrado 1991; Liesau and Blasco 1999; Torres 2005: 108).

Fig. 6: Cow phalange with skinning marks from Las Camas (Photograph by José Yravedra).

It should be considered that, when an animal is hunted or slaughtered, both its meat and skin should be immediately processed to avoid rotting and keep the leather flexible and strong. Hence, it is necessary to skin the animal, as evidenced in all the sites analysed. Skinning marks were frequently found on bones such as cow and horse phalanges at La Guirnalda, Cerrocuquillo and Las Camas (fig. 6).

The skin has to be later cleaned by using scrapers and abrasive materials such as ashes to eliminate all fat and lard. It must later be introduced in a solution with tannin, a treatment which could last for about six months (Torres 2005: 109). A treatment with animal urine can be incorporated to obtain greater flexibility. Last, the skin is ready to be decorated applying either mineral and plant pigments or blood, either as colorant or thickener (Vidal and Maicas 2010).

The extraction of both tendons and viscera were clearly evidenced on the bones, either by disarticulation marks for tendon extraction – particularly on long bones (fig. 7) – or by the evisceration marks in the inner part of ribs. Examples of tendon extraction were found in all the sites analysed. They could have been used as a strong and flexible string for clothing, tool tying, etc. Marks typical of viscera extraction were also documented in some of the sites studied. During evisceration, both the stomach

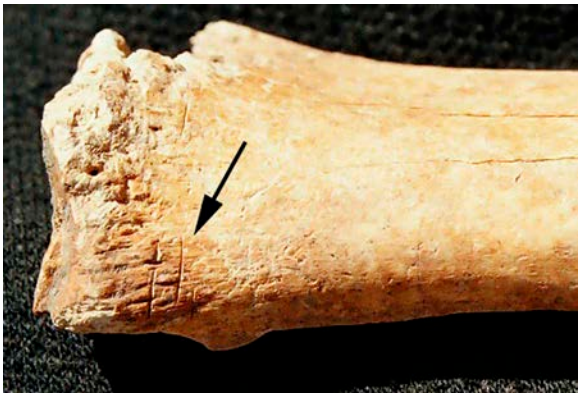

Fig. 7: Cow radius with dismemberment marks from Las Camas (Photograph by José Yravedra).

and the bowels were extracted – as well as other edible parts such as the liver, the kidney, etc. – which may be used as containers for liquids. The meat would have been cured or dried (Stewart 1984).

Bone tools have usually been regarded as the main non-edible animal remains. We have not focused on this material here, but some notes may be included. In the sites studied, bone material culture was mainly limited to pointed and bevel elements as well as spatulae. As noted by Vidal and Maicas (2010), many of the bones broken for marrow extraction could have been later used to manufacture bone tools, particularly in the case of long specimens.

Horns and antlers were also used as raw material. As with bone industry, this material is not analysed here. In short, their use is evidenced in the cut marks on a bovid horn at La Cuesta, and a similar alteration at La Guirnalda, which also presented two marked deer antlers.

Lastly, the identification of bone as fuel should be mentioned, as bone flakes could have compensated for scarcity of firewood in hearths (Yravedra *et al*. 2005; Vidal and Estaca-Gómez 2014). However, evidence of this use was not clear, since the cases studied yielded just a few charred bones which were not suficient to draw any conclusions; however, this possibility should not be discounted. Dung may have been used as fuel as well, due to its low combustion and constant temperature, a clear advantage for time-demanding cooking such as soups or stews (Vidal and Maicas 2010). Marrow grease has been widely used throughout history as an element for lighting, foodstuff and medicine, and could be traced by the fracture patterns of long bones typical of marrow extraction.

CONCLUSIONS

This paper was intended to provide a broad analysis of Early Iron Age fauna in a little known area. It has not only focused on zooarchaeology but also on the implications animals had in contemporaneous populations in the Tajo middle valley. The analysis indicates that the dominant taxa in the area in terms of NR and MNI for this chronological period were ovicaprids, followed by bovids, suids and equids. Furthermore, the distribution of faunal remains in the different activity *loci* (i.e. industrial, domestic and disposal areas) does not differ.

The intention here was to set a correlation between faunal remains and the material record recovered in each settlement to define the uses and functionality of animals in social activities. It showed that the abundance of adult individuals could have been associated to the exploitation of living animals for the production of dairy products, wool, hair and other secondary products, reflected in the material evidence such as teazles, loom weights, spindle whorls, etc. Furthermore, the presence of a few infantile and juvenile individuals may be related to the necessary reduction of offspring for sheep and cow milk exploitation. According to this evidence, it can be interpreted that the sites were interested in the production of wool, milk, workforce and secondary products as main resources.

Further studies are needed in the future to define the spatial distribution of bone accumulations at different sites such as settlements and necropoleis, among others. Furthermore, they should consider in-site distributional analysis to define, for instance, animal pens or possible symbolic-religious deposition of fauna. This broader picture would allow a better understanding of the use and functionality of animals in the Early Iron Age.

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Significance of Textile Production in the Argaric Culture (Spain)

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Abstract:

In recent decades, research on the Bronze Age in the south-east of the Iberian Peninsula has focused mainly on analysis of the processes of hierarchy and social development. The valued archaeological indicators have been very diverse: from the ceramic and metallurgical specialization, to the normalization of funeral practices or the settlement pattern. However, only in recent years the importance of textile production in these processes has begun to be considered. With the present work we intend to evaluate the importance of this basic and fundamental craft, assessing the set of labour processes involved, the degree of specialization achieved, and the social value granted to textile products in the Bronze Age culture of El Argar.

Key words: *Textile Production, Bronze Age, Argaric Culture, Specialization, Social Development.*

Resumen:

En las últimas décadas, las investigaciones sobre la Edad del Bronce en el Sudeste de la península ibérica se han centrado preferentemente en análisis de los procesos de jerarquización y desarrollo social. Los indicadores arqueológicos valorados han sido muy diversos: desde la especialización cerámica y metalúrgica, a la normalización de las prácticas funerarias o el patrón de asentamiento. Sin embargo, sólo en los últimos años comienza a ser considerada la importancia de la producción textil en dichos procesos. Con el presente trabajo pretendemos evaluar la importancia de esta artesanía básica y fundamental, valorando el conjunto de procesos laborales implicados, el grado de especialización alcanzado y el valor social otorgado a los productos textiles en la cultura de El Argar.

Palabras clave: *Producción Textil, Edad del Bronce, Cultura de El Argar, Especialización, Desarrollo Social.*

INTRODUCTION

Research on the Bronze Age in the south-eastern Iberian Peninsula is almost a century and a half old. After a long period of establishing the bases for the sequencing and seriation of material necessary for recognizing and characterizing the Argaric culture (Siret and Siret 1890; Cuadrado 1950; Tarradell 1965; Lull 1983), in recent decades the studies have been orientated towards analysing social hierarchization and development (Arteaga 2000; Lull *et al*. 2009; 2011; Cámara and Molina 2011). Diverse aspects have been evaluated: from the containers and grave items (Lull and Estévez 1986; Lull *et al*. 2011), specialization of metallurgy, and ceramics (Lull *et al*. 2011; Aranda 2004), to the centralization of production of subsistence goods (Risch 2002; Lull *et al*. 2011). However, only in the last few years has textile production come to be considered another archaeological indicator within the framework of these processes (Risch 2002; Jover and López 2013).

Textile production became notable in the second millennium BC in much of the Mediterranean area (among others, Lucas and Harris 1962; Killen 1984; Barber 1992; Gilis and Nosch 2007; Gleba 2008; Andersson Strand and Nosch 2015). Not surprisingly, some of the final processes of textile activity – especially weaving and garment making – demand great skill as well as many hours of work in conditions often linked to labour specialization; and a division of labour which, by extension, can be related to the emergence of class-structured societies.

The objective of this work is to assess, based on archaeological evidence, the implications of textile production in the Argaric culture. In this sense, it should be borne in mind that this Bronze Age society, which developed from the end of the third to middle of the second millennium BC in the south-eastern Iberian Peninsula, has been categorized by some researchers as a chieftainship and by others as a state (Arteaga 2000; Camara and Molina 2011; Lull *et al*. 2009; 2011).

THEORETICAL APPROACH AND HYPOTHESIS

Overall, textile production is interrelated with a broad variety of production activities: agriculture, animal husbandry, harvesting, the treatment of wild resources, and various handicrafts (Gleba 2008; Gleba and Mannering 2012; Andersson Strand and Nosch 2015). Depending on the degree of labour specialization, it can also involve the need for specific spaces for the storage of raw materials, as well as their treatment and manufacture (Costin 2005; Jover and López 2013).

In short, textile production involves a complex chain of processes connected spatially, temporally, and technically. This requires careful planning and organization, from production and management of the raw materials, to the production of thread, to the final processes of preparing fabrics and the fashioning and sewing of garments (Costin 2013). Textile products could therefore be used as goods of high social value, especially considering the time invested in their preparation. These could furthermore acquire an exchange value, given their social role, in addition to their durability, quality, and ease of storing and transporting (Harris 2017).

In the case of the Argaric culture, one question is to what extent the preparation, exchange, and distribution of textiles could be controlled by its emerging elite class. Our starting hypothesis is that El Argar could be characterized as an early class society (Jover 1999: 165-181). In this type of social order, the community as a whole maintains ownership over objects and means of labour, but the elite has the power to appropriate a part of the product by developing tribute mechanisms without the need to exercise direct control over the herds or the land of the dominated groups, or over the processes related to the acquisition of primary raw materials or manufacturing of goods, which in general did not need full-time specialists (Bate 1984).

With regard to textile production, the elite appropriated a portion of the goods generated, either in the form of raw material or in the form of thread, cloth, fabric, or garments. Thus, together with other crafts, textile production must have played a prominent role in the creation of demand, as well as intragroup and intergroup identities, as reinforcement of social inequality.

The validation of these considerations requires empirical information, but most of the labour processes involved in textile production have left no material traces in the archaeological record. However, certain tools related to spinning and weaving have been preserved, as well as a relatively large set of textile remains. Via the analysis of observation units, such as the activity areas and their spatial distribution at the settlements and in the territory (Flores 2007), we can infer significant aspects of the labour processes involved and of the distribution – and in some cases exchange – of raw materials as well as textile products within the society as well as between societies.

OBSERVATION: EVIDENCE OF TEXTILE ACTIVITY

The documentation of archaeological remains related to textile production in Argaric settlements dates to the pioneering works of the brothers Henri and Louis Siret in the late 19th and early 20th century. In their excavations, they found many work tools, such as loom weights or spindle whorls, and even stems and seeds of burnt flax. They also found considerable amounts of metal objects, wrapped in fragments of linen, which were deposited inside the tombs as a part of the grave goods (Alfaro 1984; Hundt 1991).

More than a century later, the archaeological record has grown considerably. Currently, we have nearly 100 sources of evidences, documented in both domestic and funerary contexts, including remains of garments, shrouds, cloth, and, specially, concentrations of loom weights, interpreted mostly as the evidence of warp-weighted looms (Jover and López 2013: Table 1).

FIBRES

In the archaeological record few animal or plant fibres have survived. Notably wool, flax and other plant species such as esparto grass (*Stipa tenacissima*) and bulrush (*Scirpus Holoschoenus* and *Typha* sp.) have been found. At the moment, wool has been possibly identified only at the site of Castellón Alto, inside Grave 121 (Molina *et al*. 2003; Rodríguez-Ariza *et al*. 2004; Rodríguez-Ariza and Guillén 2007) and at the settlement itself, from a mass of carbonized material similar to foam. On the other hand, almost 100 archaeological contexts have provided evidence of flax and esparto (Jover and López 2013: 166-167, fig 20). In the case of flax, its presence is recorded in the form of seeds at many sites (fig. 1) (Buxó and Piqué 2008; Lull *et al*. 2015a; 2015b) and also, although in lower numbers, as fibres and fabrics of linen. The same can be said for esparto, used not only in rope making, basket weaving, and as material for construction, but also in making garments, in the same way as other fibre plants such as bulrush (Jover *et al*. 2001; Jover and López 2013: 154).

TOOLS

Tools that may be connected to some of the processes involved in textile production include needles, bone and metal awls, copper knives and daggers, spacers and spools. Use-wear analyses made in recent times indicate the great variety of work processes in which bone awls were used, particularly the perforation of leather and basketry (Le Moine 1994; Buc and Loponte 2007). On the other hand, knives and daggers could be involved in cutting and making garments.

With respect to needles, what appears beyond doubt is their involvement in sewing. There must have been wooden needles, but only those made of bone have survived. A particularly common type of bone needle was made using pig fibula. It had a perforation in the proximal epiphysis, through which the thread was passed (López Padilla 2011: 388).

Thread spacers, made of antler and used to facilitate the interweaving of warp and weft, are also found in settlements near the Argaric area, such as Cabezo Redondo (López Padilla 2011: 430). Probably most of them were made of wood, given the small number of documented pieces. Such is the case of the four-hole wooden thread separator which was found in the dwelling VIII of the Bronze Age site of Cerro de El Cuchillo, in Castilla-La Mancha. A small piece of charred thread was preserved inside one of the perforations. In addition, next to this singular piece, a large number of storage containers with charred grain, several silos and a significant concentration of loom weights of oblong shape with four perforations were recorded in this room (Hernández and Simón 1993: 53, fig. 3.9), which was destroyed by fire around 1800 cal BC.

Other objects that have been linked to textile activities are the clay spools, found until recently only at certain sites: Peñalosa (Contreras and Cámara 2000: 133), El Argar (Siret and Siret, 1890: 157, Lam 24), El Picacho de Oria (Hernández and Dug 1975) and Cuesta del Negro (Contreras and Cámara 2000: 133). These objects are the only ones that could be interpreted as bobbins or spools to store thread on the Argaric territory, since for the moment, no wooden bobbins or spindles with thread wound on them – such as those found at the Motilla of Santa María del Retamar (Galán and Sánchez 1994: 99) and at Terlinques (Jover *et al*. 2001) – have been recorded. If we consider that the wooden rods of these bobbins could have had prior use as spindle shafts, they would be a rare direct evidence of these types of objects in the archaeological record of the Iberian Peninsula. Finally, we should mention the wooden shaft of a possible spindle (in this case without yarn) found in Cueva Sagrada I, dating to the end of the third millennium BC, immediately preceding the Argaric period (Eiroa 2005).

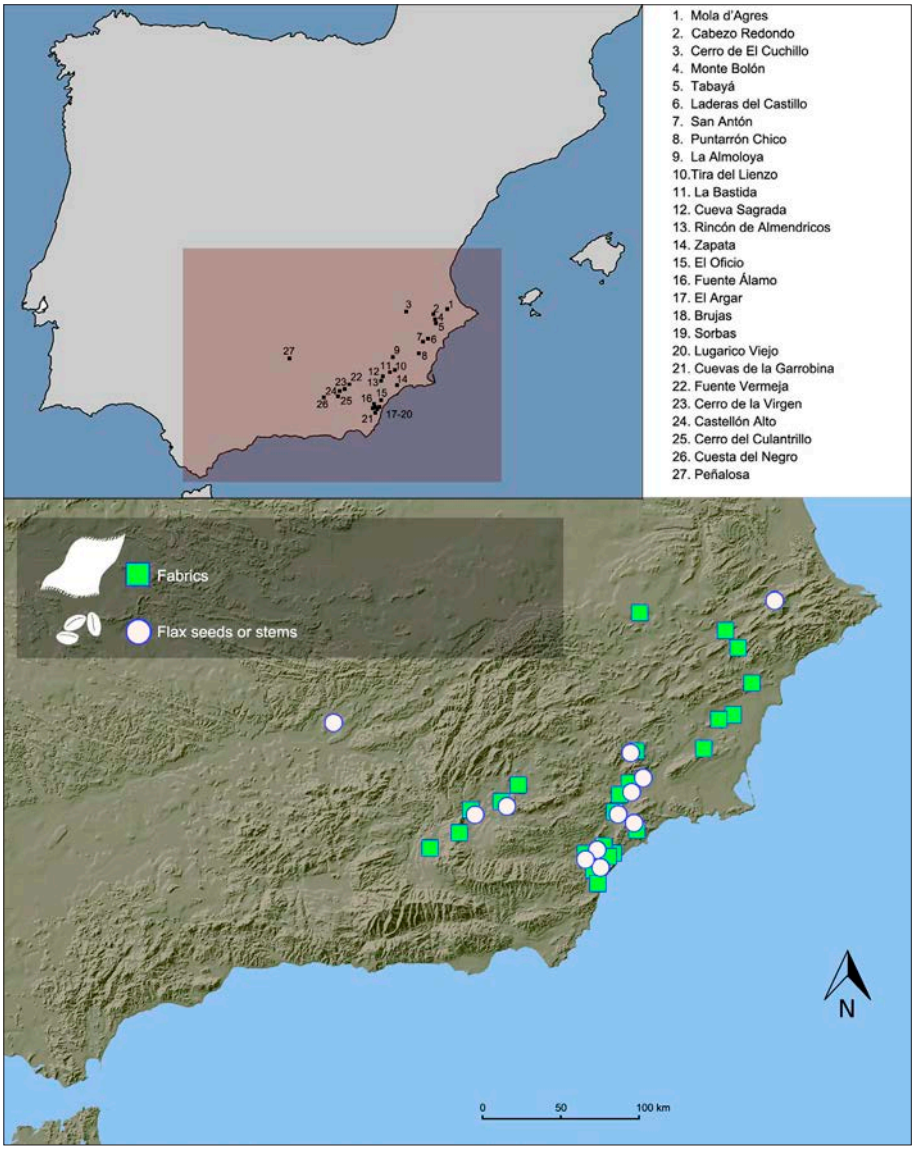

Fig. 1: Distribution of archaeological sites with presence of flax seeds or stems and fabrics (Authors).

The tools most directly linked to the spinning and weaving processes preserved in the archaeological record are, respectively, the spindle whorls and loom weights. The spindle whorls, documented already in the late Neolithic period (López Mira 2004), began to spread through the south-eastern Iberian Peninsula from the third millennium BC onwards. Their presence indicates an increase in the productivity, compared with preceding periods, as these whorls enable the production of a greater amount of thread in less time. Considerable diversity of the forms of the spindle whorls has been recorded, both in terms of morphology and weight as well as material used: clay, stone, antler, and bone. They are usually circular, with a central perforation, where the shaft of the spindle would have been inserted. The most common shapes in the second millennium BC are discoid and biconical; most whorls are made of fired clay. The discoid shape, the most common type from the Copper Age to the middle of the second millennium BC, has been documented at Argaric sites such as Zapata, El Argar and Fuente Álamo (Siret and Siret 1890), and also at other sites of the Argaric periphery, such as Cabezo Redondo (Soler 1987: 112). We could also include in this group spindle whorls made from deer antler, widely documented

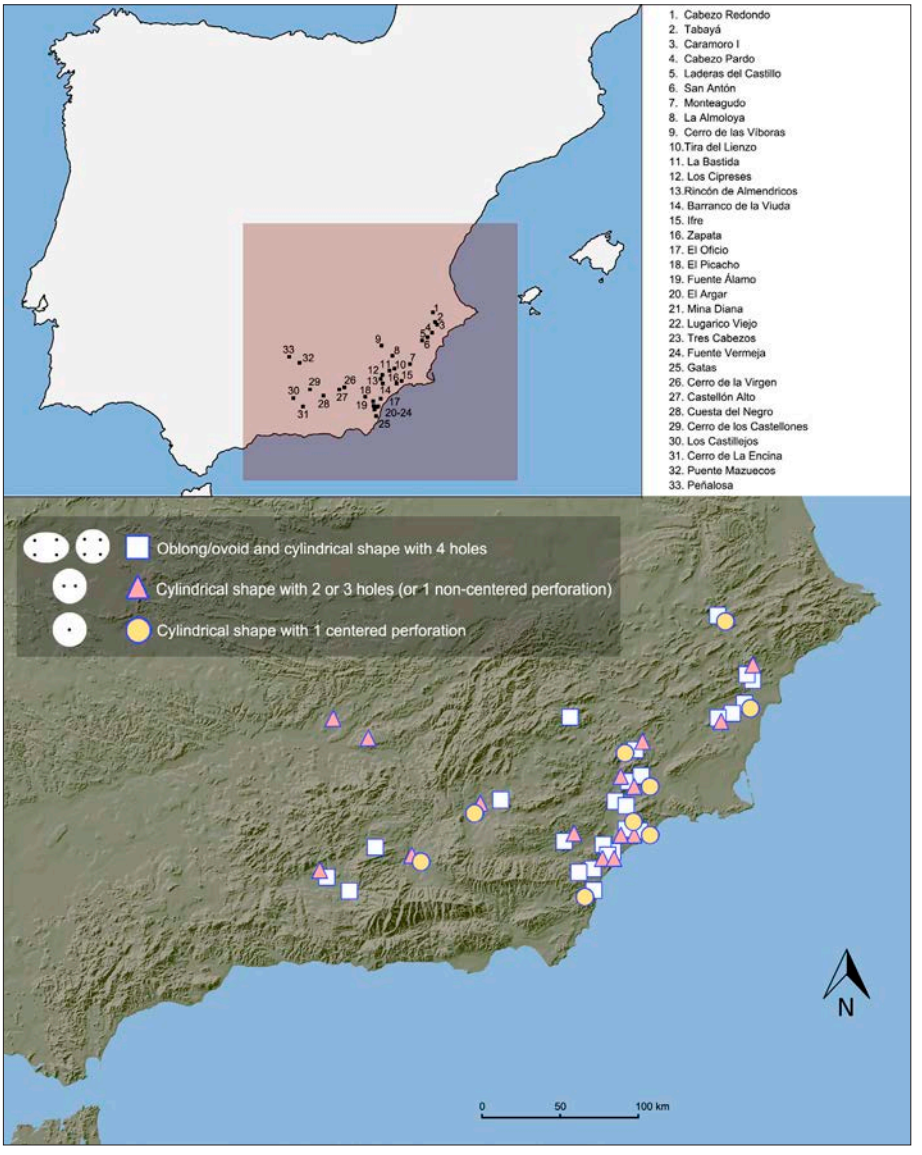

Fig. 2: Distribution map of the different types of loom weights in the Argaric culture (Authors).

from the middle of the second millennium cal BC (Basso 2018b), at sites such as Cabezo Redondo (López Padilla 2011) or La Almoloya (Lull *et al*. 2015b: 102). Biconical whorls, all made of clay, are found at El Argar (Siret and Siret 1890: 158, lam. 24), Cabezo Redondo (Soler García 1987: 112, fig. 39. 4, 6, 7 y 8), Laderas del Castillo, San Antón de Orihuela (López Mira 2004: 88), and Tabayá (López Mira 1995: 789, fig. 3.1). Rare pieces with an irregular cross-section, somewhat like a bitruncated cone, have been documented at sites on the Argaric periphery, such as Terlinques (Jover *et al*. 2001) and Cabezo Redondo (Soler 1987: fig. 39. 2 y 5).

With respect to the weight, we found a wide variation, ranging from less than 20 g to more than 100 g, with most weighing between 30 and 65 g (López Mira 1995: 790). Perhaps the most remarkable aspect is the growth in predominance of biconical whorls as the second millennium BC progresses, in a clear trend towards the standardization in ceramics of a type of tool that generally presents lack thereof.

Spindle whorls at excavated Bronze Age sites are relatively scarce. This could be explained by the fact that some of them were made from wood or some other perishable material. In any event, this aspect substantially changed

with the advance of the Late Bronze Age, and especially in the Iron Age, when whorls even started to appear as typical grave goods in female burials (Rafel 2007; see also Prados Torreira and Sánchez Moral in this volume).

The loom weights, on the contrary, are far more common. These objects are usually made of clay, although some examples of stone have been found in Argaric settlements such as Rincón de Almendricos (Ayala 1991: 174) or Peñalosa (Carrión 2000: 147, fig. 7.4,1). Loom weights vary in shape (oblong, ovoid, or cylindrical), size, weight, and number of perforations (between one and four). Often, they are found concentrated, isolated or grouped in sets of a several pieces inside domestic areas or in open spaces of the settlements.

In the Argaric context, the loom weights can be grouped into two general types, with some slight morphological variables. One general shape is ovoid, with some objects approaching spherical with an irregular rectangular cross-section, with one to four perforations, and of markedly different weights. One variant of this type comprises oblong/rectangular loom weights with slightly rounded sides and a rectangular or oval front, with four aligned perforations, and of considerable size – reaching more than 20 cm in length and 5 cm in thickness, and weighing up to 3 kg. All these variants have been recorded at different Argaric sites (fig. 2). The second general type includes cylindrical loom weights with two and in some cases one or three off-centred perforations. This is the only type recorded at the sites of Peñalosa (Contreras *et al*. 2000) and Castellón Alto (Contreras *et al*. 2000: 90). A variant of this second type of loom weight is cylindrical with a single central perforation. Its appearance in the archaeological record seems to be somewhat later, but prior to 1550 cal BC (López and Martínez 2014: 193) and it persists at least to the end of the second millennium BC. Its presence is attested, above all, in the northern and eastern areas of El Argar.

PRODUCTS

Practically all the garments and fabric fragments documented in the south-eastern Iberian Peninsula are made of linen. Exceptional remains were found of a possible wool cap and a legging of woven esparto in Grave 121 of Castellón Alto, a site at which a foamy carbonized material was found, this being interpreted as residues of the burning of a skein of wool (Molina *et al*. 2003; Contreras *et al*. 2000: 89; Rodríguez-Ariza and Guillén 2007: 67). In contrast, the number of fragments of garments, shrouds, or sheets of linen reaches more than 100 fragments (Siret and Siret 1890; Alfaro 1984; Hundt 1991). Currently, 98 examples are known at 22 settlements, almost all Argaric (Jover and López 2013). The only exceptions outside the Argaric area include fragments found in a burial in Cave No. 9 of Monte Bolón (Soler Díaz *et al*. 2008; Herráez and Acuña 2011; Jover and López 2013; Basso 2019) and a small fragment of fabric documented in Stratum IV of dwelling VII of Cabezo Redondo (Soler García 1987: 46).

The great majority of the extant linen fragments come from burials where they were preserved in direct contact with the metal objects (fig. 3). Only two cases are known in which the remains appeared in domestic contexts of Argaric settlements: Hut "V" of El Oficio (Alfaro 1984: 123) and Castellón Alto (Rodríguez-Ariza and Guillén 2007: 63).

Evidence for dyeing fibres or clothes continues to be extremely scarce. In fact, for the Argaric culture the most relevant are still the findings of more than a century ago by the Siret brothers (1890). They discovered pigment traces in the form of stripes going round the craniums from graves 356 (Siret and Siret 1890: 198; lam. xx.1 and 2) and 129 of El Argar (Jacques 1890: 397; tab. xxvi), while a thin layer of cinnabar covered some imprints of cloth preserved over a lump of clay in grave 797 (Siret and Siret 1890: 201). A similar imprint, though without traces of pigment, has been recorded in grave 111 of Fuente Álamo. In this case, it was possible to recognize part of a piece of fine linen, which in Hagg's opinion, could have covered part of the food among the grave goods outside the tomb (Schubart *et al*. 2004: 142). The debate concerning the possible origin of these and other pigment traces located on some skeletons continues (Delibes 2000; see also Martínez García in this volume). Although analyses confirm the presence of cinnabar on the bones and other elements of the interior of the burials, none have come from textile samples (Juan Tresserras 2004; López Padilla *et al*. 2012).

To date, the only known case of coloured fabrics that has been analysed are the fragments from Cueva Sagrada I (Lorca, Murcia). These present reddish colour from intentional dyeing of the fabric with madder (*Rubia tinctorum* L.), a plant native to Southern Europe and that grows wild around the Mediterranean region (Alfaro 2005: 237). The presence of iron and aluminium in the sample analysed suggests that the mordant used to fix the colour could have been alum.

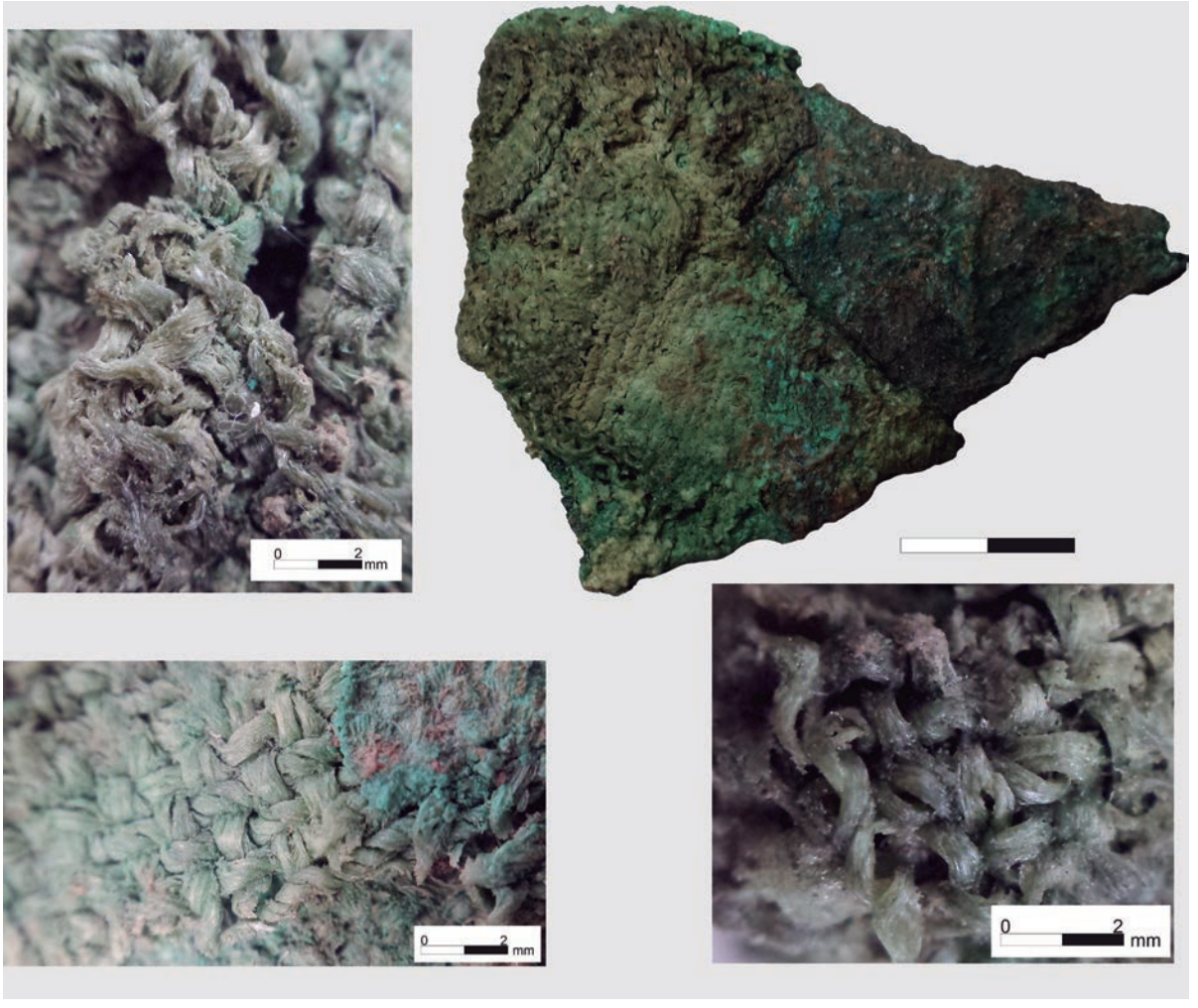

Fig. 3: Knife with mineralised textile remains of San Antón (Orihuela, Alicante). Piece deposited in Museo Arqueológico Provincial de Alicante, MARQ. J. Furgús Collection (MARQ).

The evidence reviewed above suggests that the use of linen (and possibly wool) garments was typical in the south-eastern Iberian Peninsula, but only their preservation in funerary contexts has enabled the recognition of their ubiquity.

INFERENCE: TEXTILE PRODUCTION AREAS

There are a considerable number of procedures for making textiles that could have been used and some that we have no record of, simply because all the tools used for this activity were made of perishable materials. If we look strictly at the archaeological record, the type of loom most commonly used was the warp-weighted loom (Alfaro 1984: 94-106; Contreras *et al*. 2000). The discovery of groups of weights at various settlements, in some cases aligned and associated with burnt rectilinear wooden beams – and even with spindle whorls or remains of yarn nearby – lead to the inference of their use and the existence of textile production areas in numerous contexts. However, we should not overlook that the presence of a set of weights does not necessarily imply the existence of a loom (Basso 2018a). In some cases, they may simply be stored, while in others, they may have been reused to construct ovens or other structures, as happened, for example, at Monteagudo (Medina 2003: 151, lám. 15). In any event, the presence of such concentrations of loom weights appears, in general, to be direct proof of the existence of looms.

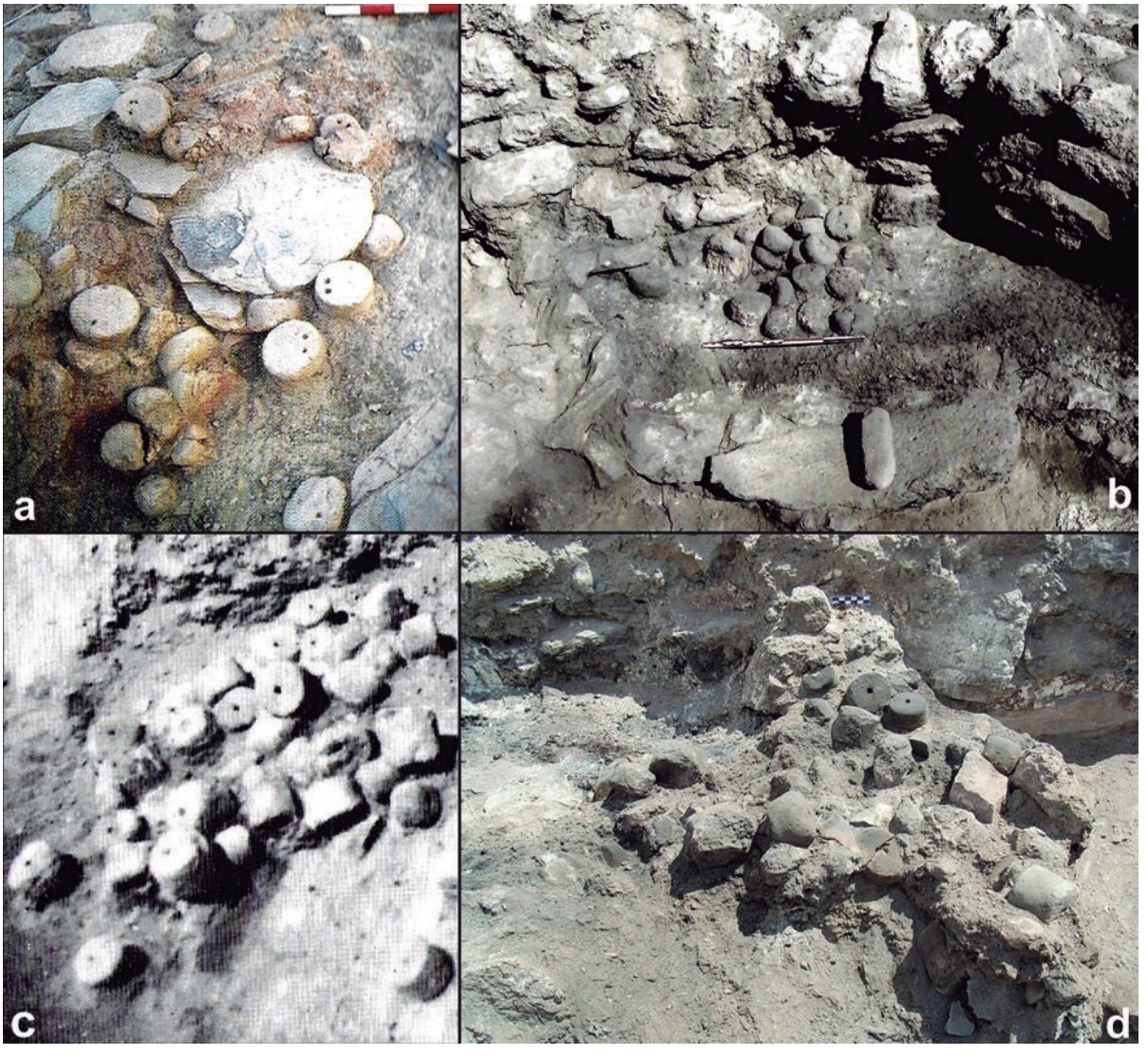

Fig. 4: Different findings of groups of loom weights in occupational contexts. a) CEIVa at Peñalosa (Baños de la Encina, Jaén) (Contreras 2000: 90); b) H55 at La Almoloya (Pliego, Murcia) (Lull *et al*. 2015b: 104); c) Department XVIII at Cabezo Redondo (Villena, Alicante) (Soler 1987: 302, Lam. 31); d) Upper circulation space at Cabezo Redondo (Courtesy of Hernández) (figures published with permission).

The number of settlements where isolated loom weights have been recorded is very large. Here we refer only to the instances where of a number of weights were found grouped in archaeological contexts. To date, groups of loom weights have been found in at least a dozen Argaric villages. In some of these, such as Fuente Álamo, Tira del Lienzo, Caramoro I or Los Cipreses, concentrations appear in a single building; at other sites, such as La Almoloya and Peñalosa (fig. 4), the largest concentrations were found in two of the housing units documented, although in other spaces – up to ten in the case of Peñalosa – isolated weights also appeared in varying numbers.

One of the sites with the greatest volume of information in this respect is Cabezo Redondo. During the excavations of J. M. Soler García (1987: 111-112), 128 loom weights with central perforations were documented at the site, found in 9 of the 18 dwellings identified. This number has grown over recent years thanks to the excavations at the site from 1987 to the present (Hernández *et al*.

2009; 2016). In Stratum V of Sector E of dwelling XVIII, a group of 52 weights were found resting on a piece of spirally-woven esparto mat. The weights were piled in a rectangular space in two groups and, on them, two charred wooden beams of some 10 cm in diameter were found (Soler García 1987: 87; 91), indicating the existence of a vertical warp-weighted loom. The weights differed in size and weight, but the measurements made by Soler for the most complete specimens gave mean values of 72 mm in diameter, 53 mm in thickness, and 387 g in weight (Soler García 1987: 112). Another 18 weights, probably stored, were located in the same dwelling. A second large concentration, with a total of 36 weights, appeared in dwelling XV (Soler García 1987: 77). Nevertheless, weights were also documented in dwellings I, II, IV, VI, VII, XIII, and XVII. Also, in recent excavations at Cabezo Redondo, both isolated and grouped loom weights have been documented in a many dwellings (Hérnández *et al*. 2016). Particularly notable is a new concentration of another group of about fifty cylindrical weights with central perforation, with the remains of thread, associated with a burnt wooden beam located in what is considered to be a passage way in the upper part of dwelling XXVII (Hernández *et al*. 2009). This loom was situated in this space in its final moments of use. Groups of weights associated with charred beams have also been recorded at Castellón Alto (Contreras and Cámara 2000: 129) and Rincón de Almendricos (Ayala 1991: 174).

It should be noted that all these textile production areas were located inside buildings and dwellings, with the exception of the above-mentioned concentration in the passage way of Cabezo Redondo. There, a great quantity of stone, ceramic, bone, and metal objects, and even a spindle whorl were also found (Hernández *et al*. 2009), however we cannot be sure of their contemporaneity with the loom. On the other hand, it is also common for the concentrations of loom weights to appear next to access doors, as in Peñalosa, where the loom weights of house IV and house VI were found next to the entrance door. The entrance of this last house is directly connected to the yard of the CEVIg, where activities related to metallurgical production took place (Contreras and Cámara 2000: 132, note 2).

This association of loom weight accumulations with passageways or open spaces, or with some of the larger buildings of the settlements, where many other productive activities occurred, is quite common. Another good example is Building H1 of Tira del Lienzo (Lull *et al*. 2015a: 194), where, apart from the weights, grinding tools were documented together with various vessels and silverwork (Lull *et al*. 2014).

DISCUSSION

Despite the perishable nature of textiles, the special preservation conditions in a considerable number of Bronze Age sites of the south-eastern Iberian Peninsula have made it possible to recognize basic aspects of the production and use of textile products. The presence of spindle whorls, loom weights, looms, and graves with the remains of garments or linen cloth in many of the excavated settlements – regardless of their size, location, or economic orientation – suggests that the processes related to spinning, weaving, and preparing cloth and garments constituted usual daily tasks.

Therefore, although we cannot firmly validate this due to the lack of more specific analyses, all findings appear to indicate that the acquisition and production of a good part of the textile goods and their consumption were only mediated by distribution processes. To date, we have no proof to confirm the existence of exchange processes, although it is presumed that these occurred. Nor is it possible to hypothesise about the organisation of production, for example: whether each domestic group was self-sufficient and produced its own cloth and garments; or whether some crafts activities, including textile making, were managed collectively by multiple domestic groups within each settlement joined together; or whether, on the contrary, textile production, distribution, and exchange were largely controlled by the Argaric elite, due to their high economic and social value.

Firstly, it bears pointing out that in the extensively excavated settlements only few areas – generally no more than two or three – show clear evidence of activities linked to textile production. This is inconsistent with the trend towards self-sufficiency of each domestic group, since it indicates spatial concentration of textile production only in certain areas of each settlement. However, it is no less certain that it is relatively common to find loom weights, isolated or in very low numbers, inside other buildings of the settlements analysed, as documented at Peñalosa, Castellón Alto or Cabezo Redondo. It is thus possible that textile production was carried out in the settlements more broadly than the concentrations of tools

in certain spaces might lead us to believe at first. We suggest that, in fact, the archaeological record is providing us with indices of differences, in relative terms, associated to the productive capacity of different domestic groups in each settlement rather than differences, in absolute terms, within those groups. Nevertheless, it is evident that, in order to develop and formulate this hypothesis more precisely, it would be necessary to have a greater quantity and better quality of information on the depositional and post-depositional history of the contexts excavated.

Other evidence points in the same direction. Zooarchaeological studies at small as well as large settlements indicate an intensive use of the secondary products derived from domestic livestock, including wool (Andúgar and Saña 2004; Rizo 2009), although without evidence of an exclusively wool-oriented flock management. This suggests that the composition and management of herds was probably controlled by each domestic group and/or lineage, with the aim of efficiently covering the broad range of their needs.

Similarly, the presence of flax stems and seeds in most of the extensively excavated settlements, enable us to infer that the cultivation of this plant was probably widespread, taking advantage of the favourable conditions for its growth in the south-eastern Iberian Peninsula. We have more evidence to assume a common use of other plant fibres, such as esparto, reeds, and rushes, for basketry, ropes, construction material, and also clothes. These plant species are abundant and easily accessible in many areas of the south-eastern Iberian Peninsula and were therefore likely available to every domestic group, lineage, or community. We conclude, therefore, that the access to the raw materials involved in textile production could be quite wide-spread.

Hence, it should not be surprising that looms or other evidence of textile production have been found in almost all types of settlements: farms or villages situated on the plane, such as Rincón de Almendricos or Los Cipreses; small fortified settlements, such as Caramoro I; settlements of diverse sizes and clearly diverse production orientations, such as Castellón Alto and Peñalosa; and in large

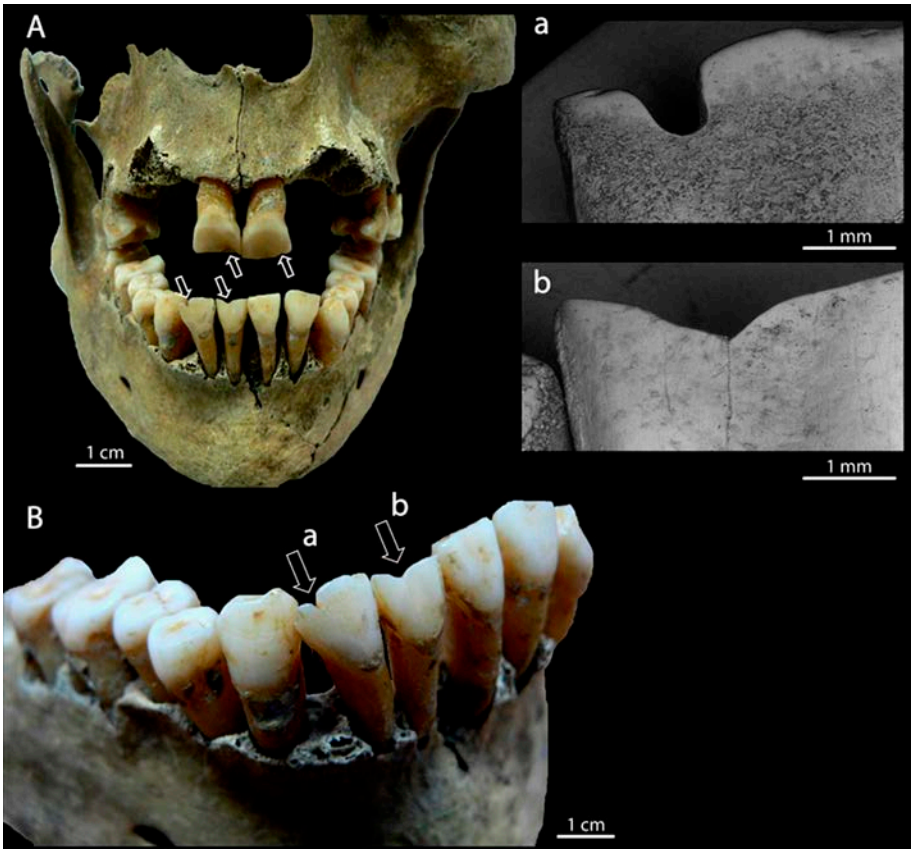

Fig. 5: Incisors with grooves in the shape of a "U" or "V" of a young woman buried at Cabezo Redondo (Romero 2016: 86, published with permission).

central settlements such as El Argar. It is also notable that at several well-excavated sites textile production areas shared the same space as other craft activities of major social interest, such as metallurgy and jewellery production. Cases in point include Peñalosa (Contreras and Cámara 2000: 129) and Tira del Lienzo (Lull *et al*. 2015a: 191-197).

The presence of warp-weighted looms together with metallurgical activities in particular buildings is documented from the middle to late Argaric period, in all cases after 1800-1750 cal BC, if we consider the dates available for the above-mentioned sites. These developments, which appear to be directed towards greater control of textile production processes, coincide temporally and spatially with notable shifts in the management of space in the settlements, characterized by the presence of buildings – in some cases quite large – in which diverse craft activities were concentrated (López and Jover 2014).

At the same time, there was a progressive standardization of certain textile tools, such as spindle whorls and loom weights. Towards 1800/1750 cal BC, biconical ceramic spindle whorls became common, while oblong loom weights disappeared as new types emerged. The cylindrical loom weight type began to dominate in the archaeological record, first with two, and occasionally with three, perforations, finally giving way to the ones with a single central perforation. All these technological changes indicate not only a major standardization in the work implements but, above all, the introduction of improvements in textile production and, possibly, a higher degree of craft specialization.

Finally, hypothesis proposed some years ago by Risch (2002: 75) regarding the association of women with textile activity based on the analysis of grave goods deserves a comment. While the social roles and position in political decision-making processes of some men was emphasised through their association with arms, women's importance in the social productive processes, specifically in connection with garment production, was demonstrated through their association with metal awls and knives or daggers in their tombs. Women would have been fundamental in the economy in relation to the textile activities. In this sense, evidence of wear in the teeth – incisors with in the U- or V- shaped grooves – of some women buried at Cabezo Redondo (fig. 5) (Romero 2016: 85-86), could have been related to the continued to spinning or processing of fibres, and as such would be a useful indicator of the possible link of women with textile production.

CONCLUSION

As opposed to what occurred with other crafts or basic production activities, textile production has not, according to our results, been adequately assessed in relation to the processes of social development during the second millennium BC in the south-eastern Iberian Peninsula. In general, we conclude that, quite to the contrary, it has been underestimated for several reasons, two of which bear highlighting:

1. Firstly, because due to the scarcity of textile evidence preserved in the archaeological record, the positivist and verificationist standpoints, still dominant in archaeological research, hold that what cannot be seen does not constitute proof and therefore cannot be used to formulate a hypothesis.

2. Secondly, because, in the light of comparative ethnography and ancient iconographic evidence, textile production (particularly spinning and weaving) has been considered an activity of women, and thereby (although not explicitly) seen as a domestic, and therefore secondary, activity of little relevance in the study of social development processes.

However, the development of textile activities necessarily implies the participation of a large number of people in multiple work processes related to obtaining wool, flax, and other plant fibres, in their processing and treatment, and in the production of a wide variety of products: clothes, bags, caps, bedlinen, sacks, and blankets, among many others. Equally so, this is an activity that also required varied and numerous tools, from awls and bone or metal needles to spindle whorls and loom weights of clay and wooden warp-weighted looms, whose manufacture in turn would have required the participation of numerous craftspeople. All this, in short, represents an enormous volume of work dedicated to producing a type of consumer goods common in the core of the social group.

Textile production thus does not appear to be an activity of scant relevance in the Argaric Culture. On the contrary, it unites a series of processes, sequentially linked, with those that cover basic needs such as clothing and protection for the body, among other necessities. The participation and labour cooperation of the entire group in these processes would require effective planning and coordination on the part of some members of the group. In the case of this work being undertaken within the extended family group or lineage, the production would have the aim of covering the needs of all the members of

the group, and a surplus could be used to exchange for other goods. In the case of an early class society, both the raw materials, whether processed or not, as well as the textiles or even the finished garments, could have served as tribute. We still do not have the means to answer the question as to whether or not the elite that began to gain power during the development of the Argaric society succeeded in controlling certain processes of textile production (Lull *et al*. 2011; López and Jover 2014), and if so, to what extent. Such control would point to the localisation of weaving in specific buildings of Argaric settlements, in the same space where other activities of special social relevance were undertaken, such as manufacturing of metal products, jewerly or even ivory work (López Padilla 2011). Further study is needed to clarify these and other questions.

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Among Threads and Looms. Maintenance Activities in the Iberian Societies: the Case of El Cerro de la Plaza de Armas in Puente Tablas (Jaén)

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Abstract:

In this paper we revise and re-interpret some of the areas in the oppidum *of Puente Tablas (Jaén) for the Iberian phase (late fifth-third century BC), focusing on the evidence of textile weaving. In this case, we aim to analyse this activity as a productive function, endowing it with the value it merits as part of the so-called maintenance activities, linking it not only to the social sphere, but also to those of the economy and culture. In particular, this article focuses on the analysis of hitherto unpublished complexes and contexts associated with this Iberian* oppidum. *This analysis is crucial since the empirical base is fundamental for inferring interpretations associated with these activities. The analysis of the various selected archaeological contexts provides information about the wide-ranging economic and social dimensions this activity acquired during this period.*

Key words: *Iberian Societies,* Oppidum *of Puente Tablas, Maintenance Activities, Textile Production.*

Resumen:

Abordamos en este trabajo la revisión y relectura de algunos espacios en el oppidum *del Cerro de la Plaza de Armas, (Puente Tablas, Jaén) para la fase del ibérico pleno (fines del s. V - III a.C.), centradas en los indicadores de actividad textil. En este caso, pretendemos analizarla como una función productiva, dándole el valor que le corresponde dentro de las llamadas actividades de mantenimiento, relacionándola no solo con la esfera social sino también con la económica y la cultural. De manera particular, centramos este artículo en el análisis, de conjuntos y contextos inéditos hasta el momento, asociados a este* oppidum *ibero. El análisis de los distintos contextos arqueológicos seleccionados nos proporciona información acerca de las amplias dimensiones económicas y sociales que esta actividad va a adquirir en esta etapa.*

Palabras clave: *Sociedades Iberas, Trabajo Textil, Actividades de Mantenimiento,* Oppidum *de Puente Tablas.*

INTRODUCTION

The material analysed here comes from the Iberian *oppidum* of Puente Tablas (Jaén, Spain). The Iberians are known as one of the most prominent cultures in the Iberian Peninsula during the Iron Age. The Iberian world developed from the sixth century BC and reached its zenith during the fifth to the third century BC. Geographically, the Iberian culture spread over the south, east and north of the Iberian Peninsula, as well as over the southeast of present-day France, and represented a clearly Mediterranean culture (Ruiz and Molinos 1998; Aranegui 2012).

As with other ancient Mediterranean cultures, for example the Greeks or the Etruscans, in the Iberian societies spinning and weaving have traditionally been associated with women. A large number of studies, focusing on different contexts (settlements, sanctuaries and burial sites), have revealed the importance of the material culture linked to these activities, demonstrating without doubt that they were an integral part of life. Nevertheless, the work related to textile production has not enjoyed explicit recognition in the economic sphere of these societies, probably because it was found in the domestic sphere and not considered an important technology as it was linked to women.

It has, therefore, been necessary to recognise the importance of these tasks, at the same time as studying, in greater depth, the daily life they were part of, and how they were related to the other spheres of action (social, political, economic, religious, etc.). This, in our opinion, is what has been done by focusing on the so-called *maintenance activities* (Bardavío and González Marcén 1996; González Marcén and Picazo 1997; Colomer *et al*. 1998), which have now been consolidated in the theoretical and conceptual panorama of gender studies. Their application as an analytical category has allowed not only a detailed analysis of the different activities, such as weaving, but also an examination of how, based on the changes undergone and the transformations involved, they may have had an impact on the social dynamic (Masvidal *et al*. 2000).

In chronological terms, we will focus our investigation on the period defined as 'Iberian,' essentially from the end of the fifth and through the fourth-third centuries BC. Spatially, we will deal primarily with the Alto Guadalquivir area, focusing on the *oppidum* of Puente Tablas (Jaén). We propose a revision and a re-interpretation of some of the houses documented in that settlement, while approaching activities that have not been dealt with before, such as those related to textile production. We look at different unpublished archaeological contexts that include material evidence of a heterogeneous nature. These provide us with information about the raw materials and end products, as well as the processes and technology used and the socio-economic and symbolic dimensions of this activity. The analysis of these findings and processes is crucial as an empirical base, without which it would be impossible to make interpretations associated with these activities. This will allow us not only to give visibility to and render an account of the active agency of Iberian women, but also to approach a more wide-ranging analysis of the domestic groups, reflecting on the implication of this activity in the community and its bearing on society.

THE *OPPIDUM* OF PUENTE TABLAS: AN INITIAL REVIEW OF TEXTILE PRODUCTION ON VARIOUS SCALES

This enclave of a little more than 5 ha is a medium-sized *oppidum* in the settlement scheme of the Alto Guadalquivir. It is situated in a privileged location, both for the control of the surrounding territory and for the economic potential of the area it would have benefited from (fig. 1). The investigations carried out since the 1980s under the direction of Arturo Ruiz Rodríguez and Manuel Molinos have provided abundant and important information (Ruiz and Molinos 2015). Born as a result of the concentration of several villages that took place in the ninth century BC, during the Late Bronze Age, it was occupied for a long period until the third century BC, with a brief period of interruption at the end of the fourth century BC. The site underwent one of its major changes with the construction of a strong fortification in the seventh century BC (which would be rebuilt over time). At the same time, an urban structure was developed in the middle of the plateau, with regularly laid out streets and a palatial zone in the south. Completed by the sixth century BC, these developments were the keystones in the history of its occupation (Ruiz *et al*. 2015). In the mid-fifth century BC, we see one of the most important reorganisations of the settlement, which involved the interior space of the *oppidum*. It is around that time that the so-called Puerta del Sol (Sun Gate) was built, a space charged with symbolism and with a sanctuary next to it (Ruiz *et al*. 2015). During the same period, the palace was extended

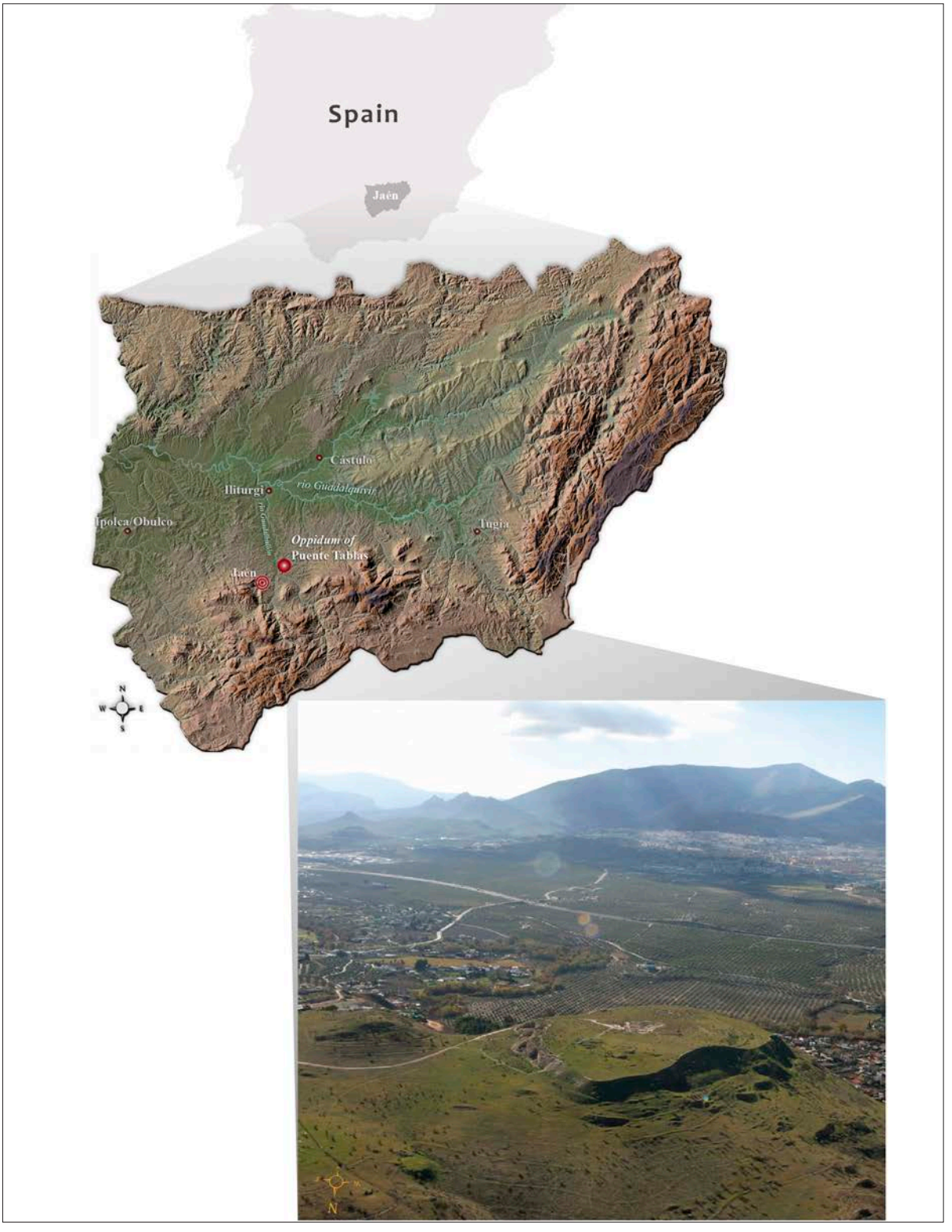

Fig. 1: Location of the *oppidum* of Puente Tablas (IAI-UJA Archive).

and took on the form we see today. The rest of the interior space was organised into a residential area for relatives and clients of the lineage, which we see throughout the fourth century BC and during the third century BC. It is this later phase that we focus on in this paper.

INDICATORS OF TEXTILE PRODUCTION: RAW MATERIALS AND TOOLS

The evidence of textile production in this settlement is mainly indirect, although this allows us to approach it from diverse perspectives and contexts, as well as utilising heterogeneous records. In terms of the raw materials used, it is the archaeofaunal and the archaeobotanical analyses that allow us to draw conclusions regarding the use of the different types of fibres of animal and plant origin.

RAW MATERIALS

The use of fibres of animal origin is attested, albeit indirectly, as stated above, by a significant presence of ovicaprid bones at the site. The faunal analyses in the settlement show the importance of livestock, especially sheep, the numbers of which increased significantly at the end of the fifth century and beginning of the fourth century BC. The observations reveal, for example, dental wear that indicates the presence of adult sheep, mainly females (Ruiz *et al*. 1985), which is indicative of a strategy of use aimed primarily at the production of secondary resources, among which would have been wool. The high quality of wool from this area is mentioned by some of the classical authors. For example, in his *Natural History*, Pliny the Elder describes the wools of Baetica and Lusitania and notes in particular the black-fleeced sheep of Hispania (Plin. *NH* XIX.2, XIX.7 ff., VIII.73).

On the other hand, a systematic sampling of post-2005 archaeological studies, which carried out palaeoenvironmental analyses, revealed the presence of textile fibre plants (Montes 2014; 2015). These analyses were carried out in diverse contexts, both in the Block 1 area of houses, as well as in the palatial and Puerta del Sol sanctuary areas. The analyses show that plants used to make textiles were the second most abundant after the cereals, making up 36.7% of the plant remains. Two species were identified: flax (*Linum usitatissimum*), albeit with a low frequency of only 2%, and esparto (*Stipa tenacissima*), which is more common at 61% and represents the second most important species identified in the settlement. Esparto is part of the natural vegetation that grows around the *oppidum*, and the large number of rhizomes from this plant found and their abundance in the analysed samples show that it was an important resource used by the inhabitants of the site (Montes 2015: 128-129).

The written sources also indicate that the main fibres used in the area were – in addition to wool – flax and esparto. Pliny the Elder tells us of the excellent quality of the linen of Hispania (Plin. *NH* XIX.2, XIX.7 ff.). He also comments on the marvellous and extremely useful plant that is the esparto of the Carthaginensis, which was used to make shepherds' shoes and clothes, among other things (Rísquez 2016: 55).

Another type of record refers to the artefacts linked to some of the textile production stages, primarily spinning and weaving. The archaeological record contains a large number of spindle whorls and loom weights, as well as other tools that have gone almost unnoticed, such as the bone spacers used in tablet weaving, spindle hooks, and possible bone pin beaters. These items show us the different stages of thread preparation, the manufacture of fabrics and other elements or objects, such as ropes, mats and baskets. They also allow technological-functional analysis arising from their detailed study, as has been carried out in other Mediterranean areas (Gleba 2008).

SPINNING

Spindle whorls, being the tools that were placed at the bottom of the spindle to make it turn faster and facilitate the spinning of the resulting thread, constitute the most commonly found evidence of spinning activities (fig. 2). Of the 36 spindle whorls documented for the end of the fifth century and beginning of the fourth century BC, all were handmade and had been fired, primarily in reducing atmosphere (66% of the total). With regard to the paste, there is a clear predominance of fine and well-levigated fabrics (79.2%), with those that present clearly visible coarse or average-sized inclusions (8.3% and 12.5% respectively) being in the minority. The surfaces of most items have been smoothed, and in some cases it is possible to see the finger marks. Only two spindle whorls are decorated. One has a decoration of vertical zig-zag lines of dots, while the other – associated with

Number	Heigh cm	Ø max. cm	Ø orifice cm	Weight gr	Number	Heigh cm	Ø max. cm	Ø orifice cm	Weight gr
0002	1.7	2.0	0.5	6.02	**0198**	3.4	2.5	0.5	21.1*
0005	2.3	2.9	0.7	17.4	**0200**	-	2.8	0.5	-
0007	2.4	3.9	0.7	18.0*	**0221**	2.1	3.0	0.6	18.5
0009	1.5	1.9	0.5	4.9	**0230**	2.0	2.7	0.6	11.8
0019	2.6	3.2	0.6	21.3	**0296**	1.9	3.0	0.6	18.4
0020	2.5	2.7	0.5	20.4	**0442**	-	-	-	-
0033	1.7	2.7	0.5	14.5	**0511**	1.8	2.5	0.5	9.1
0036	1.9	3.8	0.6	30.7	**1072**	1.6	2.7	0.4	9.1
0053	2.5	4.2	0.9	41.2	**1393**	-	-	-	-
0053 (b)	2.0	4.0	0.7	32.2	**1973**	1.4	4.0	0.9	22.7
0064	1.9	3.1	0.6	17.2	**2042**	2.2	3.2	0.6	20.9
0065	1.7	4.5	0.9	41.3	**2127**	2.1	2.9	0.6	14.8
0087 (a)	2.1	3.0	0.6	21.3	**2194**	2.9	3.8	0.6	37.8
0087 (b)	2.1	2.5	0.5	6.9*	**2276**	2.1	3.2	0.6	20.4
0093	2.8	4.1	0.5	25.0	**2486**	2.2	3.2	0.6	20.3
0111 (a)	2.0	3.3	0.7	23.2	**3013**	2.6	2.2	0.5	10.6
0111 (b)	1.7	2.6	0.5	10.2	**3018**	1.9	2.7	0.6	13.2
0150	1.9	2.4	0.4	7.5	**6116 (b)**	1.9	2.9	0.6	13.12
0176	1.8	2.5	0.4	8.9	**7157**	-	-	-	-

Fig. 2: Tipology and physical parameters of spindle whorls in the *oppidum* of Puente Tablas. *Weight of half spindle whorl conserved (Image: Authors).

a ritual – has a more complex decoration of incised sun-motifs and opposing circles. In this case, we hypothesise that the decoration can be explained by the specific symbolic and ritual functionality of the spindle whorl. In terms of their shapes, the troncoconical and bitroncoconical forms predominate (44.4% and 27.7% respectively); the rest – discoidal, spherical and star-shaped – range between 5% and 11%.

As previously demonstrated by other studies, one of the important functional characteristics of these tools is their size, as the thickness and strength of the yarn depended on the weight of the spindle whorl (Castro 1980: 142; Chazelles 2000: 116). Thus, the larger, heavier whorls, which were also associated with longer spindles, were likely used to obtain thicker, stronger threads. The smaller, lighter ones were used to produce finer threads (Alfaro 1984: 77). The variety in thread diameter would have allowed to produce various qualities of fabric. At the same time, the lighter spindle whorls could have been used to increase and speed up production, which would also have been linked to the larger number of bitroncoconical and troncoconical forms (66% of the total), as these shapes at the end of the spindle increase the speed, reduce the oscillation and maintain the spinning balance for longer (Castro 1980: 144).

In addition to their weight, it is important to consider a series of measurements for these artefacts, such as the height and diameter or the size of the central perforation. In the sample we are studying, although the height of the pieces ranges from 1.4 cm to 2.9 cm, most are in the 1.5 cm to 2.5 cm range (72.2%). Their diameters are between 1.9 and 4.5 cm and the central perforations are very homogeneous with 75% between 0.5 and 0.6 cm, although we identify two groups with similar percentages near 50%. One group includes those that have a diameter greater than 3 cm, in which a large number is between 3 cm and 3.2 cm and the rest are between 3.8 cm and 4.2 cm; only one example is larger (4.5 cm). In the second group, the pieces range from 2 cm to 3 cm, although most are in the higher values of the range, above 2.5 cm. With respect to the weight, taking into account solely the objects that are complete (29), various groups can be distinguished. The first (five pieces) is between 6-9.1 g, the second (five) between 10.2-14.5 g, the third (four) between 17.2-18.4 g, and the fourth and largest group (seven) between 20-25 g. There are pieces that do not fall within these ranges, either because they are lighter (4.1 g) (fig. 2, No. 9) or heavier (32.2 g). The latter differs from the rest also in its shape, as it is star-shaped and was found in one of the houses, as we will analyse below (fig. 2, No. 53b). It is interesting to note that heavier spindle whorls (>42 g), have been documented in the earlier phases of the settlement, in the fortification (fig. 2, Nos. 53 and 198), but we do not find these values in the middle Iberian phase, which could point to an evolution over time towards lighter weights, as has been indicated in other studies (Castro 1980).

Considering these data, it can be pointed out that the diversity of shapes and weights of the documented spindle whorls refer to a thread production with heterogeneous thickness, length and resistance.

Another aspect to highlight would be the microwear observable on most of the spindle whorls, which indicates continued use.

Also linked to spinning, we should point out one of the more unusual items we were able to document. This is a bronze rod ending in a hook, which could have been part of a spindle (fig. 2, No. 19b). A spindle either had a groove or a small hook through which to thread or fix the yarn, allowing the spinner to begin working with the next length of half-twisted fibres between the hook and their hand. It can also be used to fix the yarn when plying two single threads into one (Alfaro 1984: 74). Spindle hooks have been documented in other European settlements (Alfaro 1984: fig. 34) and in other periods (Gostencnik 2011a: fig. 8; Gostencnik 2011b: fig. 3, 7-8).

WEAVING

The evidence of fabric weaving is based mainly on the finds of loom weights, as well as other minor objects, including part of a bone spacer that still has six perforations and some possible bone pin beaters.

A total of 19 loom weights has been documented for the end of the fifth century and beginning of the fourth century BC. We have classified them into five types, based on a combination of different parameters (fig. 3): shape (trapezoidal, rounded or prismatic), weight (between 100 g and 580 g), height (between 8.2 and 12.7 cm), thickness (ranging from 4.2 to 10.5 cm), the number of suspension holes (one or two), and the location of the find. All these are important indicators, if we bear in mind that the function for which they would have been used was the production of fabrics and they would have

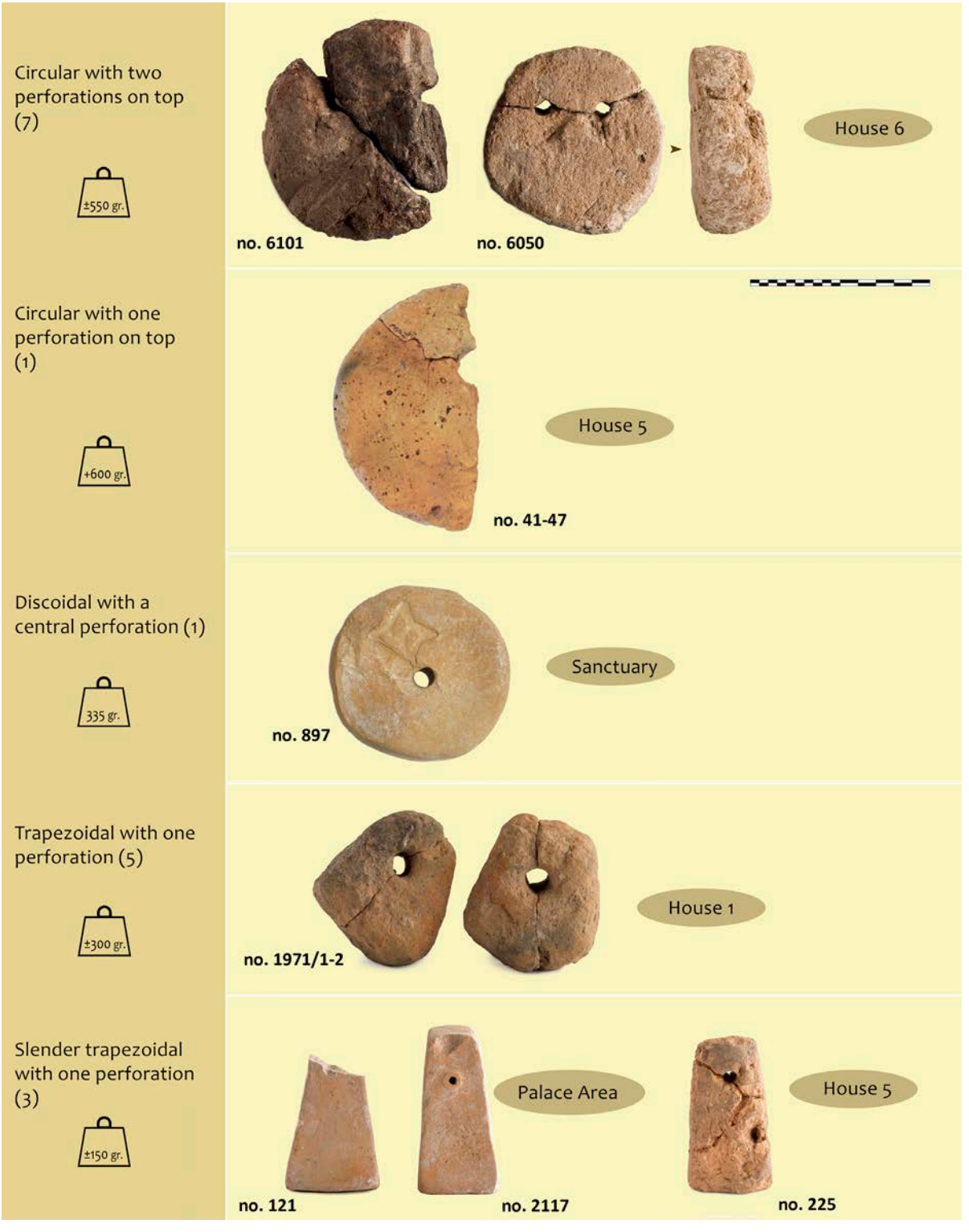

Fig. 3: Typology of loom weights in the *oppidum* of Puente Tablas (Image: Authors).

determined the number of threads attached to each loom weight. They can also give us information about the strength, flexibility and rigidity of the thread used. We do, however, have to point out (this will be dealt with below) that some of them were not intended for this function or were used for different purposes, with a symbolic connotation.

If we consider the technical aspects of their manufacture, the first differentiation would be whether the pieces were fired or not. The largest group corresponds to the fired weights, which were subjected to an oxidising atmosphere. Within this group, we can also observe two fabric types: on the one hand that which contains coarse inclusions and has virtually no surface finish, and on the other, that with fine inclusions. There are very few examples of the latter; they are well-fired pieces with well-levigated pastes and smoothed surfaces, and are also decorated. The sun-dried weights are made with very coarse pastes and well-visible inclusions. Some of them are fractured, possibly due to use or because the area of the hole is the most fragile. It is therefore an unintentional fragmentation, likely due to the production processes, together with post-depositional factors.

If we link the technical and the formal aspects, we also observe notable differences. The different production techniques we have described correspond to different shapes, weights and heights.

Among those that have been fired, three have a fine matrix, of which two have a trapezoidal prism shape (height 8.75 cm) with a hole at the top and a weight of 184 g, while one is discoidal (maximum diameter 9.7 cm) with a central hole and a weight of 335 g. The first was found in the palatial area and the second in the sanctuary area. Loom weights with the coarser matrix are trapezoidal and circular, with a single hole. By groups, those of trapezoidal shape weigh *ca*. 300 g and are 8.2 cm and 8.4 cm high, while circular ones must have been heavier, since fragmentary finds weigh almost 400 g. Circular weights are also larger than the previous ones (12.7 cm in height). Finally, we must mention the presence of some whole pieces with a lower weight of around 150 g and a height of 8.8 cm.

All the weights that have not been fired have coarse tempers and are essentially round with two holes. They weigh more, between 500 and 580 g, and are between 10 and 11.7 cm high. Without doubt, all this evidence points to the production of diverse types of fabric. They varied in terms of the number of warp threads used. It is important to emphasise that some of these weights were found as sets, leading us to hypothesise the presence of looms. They present size and morphological diversity, as we will detail below.

Another type of find related to textile production is a bone spacer. It is a rectangular piece of bone with 4.5 cm of its length preserved and a thickness of 1 cm, and with six visible perforations of 0.2 cm in diameter (fig. 2, No. 195). This type of object is linked to other weaving techniques associated with the so-called tablet looms (Di Fraia 2010: 62-63). These looms consisted of small tablets of different shapes, although the square ones were the most common. They were made of hard materials, mainly bone or wood, and had small holes in the corners through which the threads of the warp passed. There is abundant evidence of this type of tablet loom from prehistory to Roman times (Cardito 1996), and it has also been documented in Iberian contexts dating to the period of our interest, such as in the necropolis of El Cigarralejo (Cuadrado 1987) and in Baza (Ruiz de Haro 2014), as well as in settlement contexts such as La Bastida de les Alcusses (Bonet *et al*. 2011: 166-171). The use of this type of loom has been dealt with extensively (Alfaro 1984: 85-89), however of most relevance to our paper is that the spacers/tensors with multiple holes were indispensable for the functioning of this system. Their purpose was to prevent the groups of threads from various tablets becoming entangled as they were rotated. This type of loom would have been used to make the borders of the larger pieces of fabric, bands for different garments (tunics, cloaks, etc.) as well as belts or ribbons. One of the best-known representations, in which we can see how our piece would have been inserted in this type of loom, in this case to make the edge of a cloak, was found in the Lippi Tomb 89/1972 in the Etruscan necropolis of Verucchio in Italy. This example has been used for the proposed reconstruction of the procedure followed and the tools used, indicating the function of these pieces (Raeder Knudsen 2002: 229-230, fig. 103, fig. 104). Three bone spacers with a sub-rectangular section, similar to that we present here, were documented at Fonte Tasca di Archi in Italy (Di Fraia 2010: 62-63, figs. 3-5).

Finally, although very fragmented, we have identified possible bone pin beaters; they are not very elaborate and are associated with some of the areas which are discussed in greater depth below.

Fig. 4: An spatial distribution: spinning and weaving in the *oppidum* (Image: Authors).

AN INITIAL APPROACH TO SPATIAL DISTRIBUTION: SPINNING AND WEAVING IN THE *OPPIDUM*

Spindle whorls are involved in one of the earlier steps in textile making, i.e. spinning. The spatial distribution of spindle whorls in the areas of Puente Tablas that have been excavated to date indicates that spinning was carried out across virtually the entire settlement, suggesting that no specific space was dedicated for it (fig. 4).

In this sense, differences in the distinct areas of the *oppidum* are evidenced based on the technical-functional parameters that we have described in the previous section. Almost all the pieces found in the palatial zone, which amount to 23.6% of the sample, are more than 3 cm in diameter (3-4.5 cm). Only one is slightly smaller (2.9 cm). However, among the shapes, the largest percentage corresponds to those that are troncoconical and bitroncoconical, as in the rest of the settlement; two are discoidal and correspond to those with the largest diameters (3.8 cm and 4.5 cm). It is also noteworthy that of the only two decorated troncoconical pieces, one was found here and the other in an equally symbolic and important place – the Puerta del Sol sanctuary. It is the only example found there and perhaps it had a different use – a metaphoric allusion – given the context.

In the middle of the *oppidum*, where some of the excavated domestic units or houses are located, 42% of the pieces have a greater variability in diameter (1.9-4 cm) and weight. Two distinct groups (with more than one item) can be differentiated. One between 9.1 g and 14.5 g and another between 20.3 g and 23.2 g; we will evaluate the rest of the pieces individually. One of them corresponds to the smallest example found in the settlement (4.9 g), another to an intermediate value between the two differentiated groups (17.2 g), and the third is much heavier (32.2 g). The uniformity of shapes should be emphasised, with an almost absolute predominance of troncoconical and bitroncoconical forms. The heaviest piece identified also differs in that it is the only one with a star shape.

Spindle whorls found in the surroundings of the fortification (22%) present a greater variety of shapes (spherical, bitroncoconical and star-shaped), with two groups in terms of weight (6.02-10 g and 20.4-23 g) and one piece weighing 17.4 g. This would indicate a group with a lighter weight, lower than that documented in the houses, which could have been used to make finer threads, and another in which the pieces have similar weights to the other zone.

The remaining 12% were documented in different test trenches excavated on the plateau, mainly between the houses and the palatial zone. They are all troncoconical

or bitroncoconical and not very heavy (10.6-18.5 g) and, once again, could have been used to manufacture different types of thread.

As far as the loom weights are concerned, the greatest concentration is found in the middle of the plateau, specifically the excavated houses, as indicated by their spatial analysis. The differences in shape (trapezoidal with a single hole and rounded with two orifices), all made using coarse pastes, together with the weights (150 g, 300 g, 500 g - 580 g and more) and firings, allow us to undertake a more detailed study, hypothesising the presence of different types of looms.

Also of major significance is the location of the two well-fired weights, which were made using finely levigated clay. One, which was found in the palatial zone, is in the shape of a trapezoidal prism with a hole at the top. It has an oxidation-type firing, with a smooth, highly polished surface and an incised line on the base. Its markedly smaller size and weight (184 g), as well as the context in which it was found – a foundation ritual – leads us to believe that it was used in worship.

Much clearer is the symbolic value of the piece found at the Puerta del Sol sanctuary – a discoidal weight with a hole in the middle, weighing 335 g, with an oxidation firing, and a finely levigated clay with a smoothed surface. In this case, it is decorated on one side with a lotus flower motif – associated with divinity in Iberian societies. Both will be dealt with below.

THE HOUSES AS A STUDY CONTEXT

The urban layout in the centre of the *oppidum* has been well documented by the excavations carried out in recent years, which have revealed its domestic architecture. As we have already indicated, we know that square and rectangular plots were laid out from the mid-fifth century BC in the centre of the settlement. These corresponded to houses that went on to form blocks situated between streets. These blocks appear to have the same design: an approximate width of 28 m with two rows of houses separated by a common wall that distributes them on both sides, opening onto two different streets of some 3 m in width.

In Block Number 1 (fig. 4), the open-area excavation of various houses revealed a variability in the size and distribution of their spaces, with some opening onto Street 3 and one onto Street 2. They all have a length of some 14 m, although their widths vary between 6 and 9 m, manifesting the diversity of these domestic units. The smaller ones would have covered some 60 m^2 and the largest (so far documented), House 2, is 120 m^2. We also know that in some cases they had an upper floor. Some, such as Houses 3-4, are highly complex and likely exceeded the scope of a domestic space and may have been a large warehouse (Ruiz *et al*. 2015).

In all these houses, the courtyard plays an essential role because is the main area for consumption and for the production activities. It was the largest space in the house and only the half was roofed. Likewise, we see a greater trend towards privacy based on the arrangement of the doors and the existence of this type of courtyards around which the house is structured. There was also an increase in complexity, whereby the different spaces appear to reveal a greater functional specialisation.

Thus, the house becomes an exceptional context for analysing aspects related to the maintenance activities and in the following sections we focus on one of these activities – textile production.

AMONG THREADS AND LOOMS: A MICROSPATIAL ANALYSIS OF THE TEXTILE ACTIVITIES

House 1 is the simplest of those excavated in Street 3, with a courtyard at the entrance and two rooms at the back (fig. 5). The room on the left has a continuous bench that acted as a cupboard onto which various receptacles were placed. The room on the right, like the other, has part of the floor paved, with the rest possibly having been occupied by an item of furniture or a bed, which is why it has been interpreted as a store-bedroom (Ruiz *et al*. 2015: 116).

Items linked to textile production were found in the courtyard of this dwelling. They include a spindle whorl and a set of five loom weights found together, three of which are complete. Here it is necessary to highlight not only their shape (all trapezoidal with a single hole), which is different to those documented in other spaces, but also their weight (all around 300 g) and height (8.2-8.4 cm). The most spacious room, which is interpreted as having multifunctional purpose (Rísquez *et al*. 1991), also contained a loom weight. Although it is also trapezoidal in shape, its appearance is much more stylised, as it is slightly higher (9 cm) and significantly narrower, with smaller distance between the hole and the top. Its weight of 150 g is half that of those found in the courtyard, and could possibly link it to the production of a different kind of fabric.

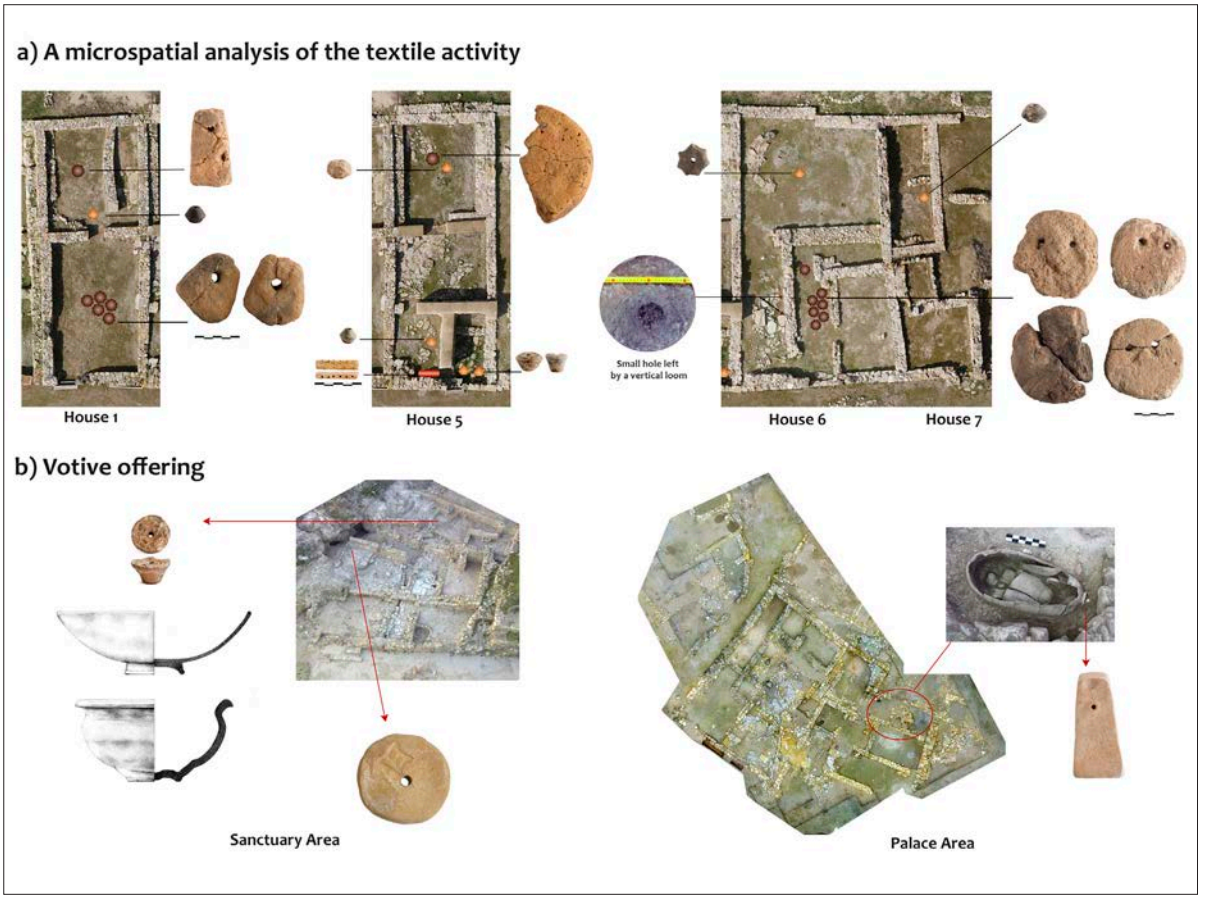

Fig. 5: A microspatial analysis of the textile activity and the ritual dimension of weaving (Image: Authors / IAI-UJA Archive).

House 5 is the same width and length as House 1. At the entrance it has several rooms, including a stable. The courtyard is on the opposite side, i.e. at the back, where the remains of an oven have been documented. This house contained the largest number of spindle whorls (4). In terms of the weight, two groups – 4.9 g and 14.5-17.2 g – indicate that the threads produced here were relatively fine. It is also significant that it was in this house that the bone spacer associated with a possible tablet loom was discovered. It is also significant that it was in this house that the bone spacer associated with a possible tablet loom was discovered. Also in the courtyard of this house two pieces of a circular loom weight were located. It is the largest one documented in this settlement based to its preserved weight and size.

The last of the houses analysed here, House 6, shares its western wall with the previous house and is identical in size, 14 m long and 9 m wide. During the phase we are studying, it was divided into five spaces, four of them covered and with a semi-covered courtyard at the back, where a star-shaped spindle whorl was found, as well as an oven, probably for baking bread. In this case, the rooms are on each side of a passageway that starts at the entrance. In terms of textile activity indicators, here we were able to document a set of weights that differ from those already described. They correspond to the group that has not been subjected to firing. They are round with two holes, weighting between 500-580 g and with heights between 10-11.7 cm. What is significant in this case is the presence next to one of the walls, also near the entrance, of two small post holes in the floor, with a distance between them of some 70 cm, that could correspond to the width of a vertical loom. This is an important fact as, with those measurements, we can estimate the width of the loom and even the width of the pieces of fabric made on it.

THE RITUAL DIMENSIONS OF WEAVING

For a comprehensive view of the implications of the archaeological record associated with the textile activities in this *oppidum*, we need to include some aspects linked to ritual practices. The ritualisation of domestic items with diverse uses was common in the Iberian societies. Thus, spindle whorls and loom weights are attested in numerous places of worship, sometimes in large numbers. Examples of this include the territorial sanctuaries of Collado de los Jardines (Santa Elena, Jaén), La Cueva de la Lobera (Castellar, Jaén) and El Cerro de los Santos (Montealegre, Albacete) (Sánchez Gómez 2002; Rueda 2011). In these cases, a very extensive record of the loom weights is related to the offering of the artefact itself, and what it could represent symbolically. We also find infrastructure related to fabric weaving as a sacred activity in the sanctuaries themselves. In the case of spindle whorls, their extensive documentation in places of worship, within which coming of age rites played an important role, links them to the symbolisation of the transformation from childhood to adulthood, which involves leaving behind the characteristics and activities of youth (Rueda 2013a). In the specific case of textile production, it would also have symbolised the adoption of a different role in the control of specific activities, such as weaving. Occasionally, the iconography provides us with exceptional testimonies of this activity, which is linked to the female sphere, for example, in Sant Miquel de Llíria (Valencia). In fact, this image is one of few iconographic testimonies of Iberian period that shows a feminine scene revolving around textile activity. There are two protagonists. To the right, a woman in profile view is depicted seated in an highly decorated chair. She is located opposite to a loom from which a set of threads hangs. The woman holds in the hand what has been interpreted as a flower. On the other side of the loom, a young woman (characterized by the braided hairdo finished off in a ring) is spinning, holding a spindle and a ball in each of her hands (Izquierdo and Pérez Ballester 2005: 94-95; see also Prados Torreira and Sánchez Moral in this volume).

However, the map of symbolic manifestations with which these finds are associated is much richer and the recent discoveries in Puente Tablas contribute to our understanding of the specific processes linked to diverse contexts and meanings. One of them is related to the palace, specifically to the production area that served the palace, in which of particular relevance is a large oven with preserved semicircular stone base. It would have been infrastructurally important for this area because its dimensions are unusually large and, instead of being located in a public space as in other Iberian sites, it was located in a private one, i.e. the palace. Its construction was preceded by a very particular ritual: the deposition of an amphora sealed with a plaster stopper, next to which a loom weight was placed. The physical-chemical analyses to determine the amphora contents indicate the presence of vegetable fats, which would suggest that it contained some type of vegetable oil – without doubt, a product of considerable value in the productive context of the third century BC. We may, therefore, be looking at the foundation ritual of an important and recognisable feature of the palace.

Another of the contexts takes us to the Puerta del Sol sanctuary, a place of worship organised around a complex mythology of a female divinity. This area would have been used for a series of rites that defined the aristocratic cult of an Iberian lineage for the late fifth century and the first half of the fourth century BC (Ruiz *et al*. 2015). The sanctuary covers an area of 300 m^2 and is divided into three terraces, two of them with a clear ritual function. The middle terrace, which has been defined as the main ritual area, included an exceptional find: a unique loom weight with a lotus flower stamped on it not found in any other Iberian context. At its western end, there are four small caves and a paved platform with three small libation altars that correspond to three of the four caves facing the complex. The caves, as a liminal space in the symbolic sense, are differentiated and physically separated from the built area with a small stone wall. It is a boundary, a *témenos*, that cannot be crossed. Indeed, no offerings have been documented inside the caves. This contrasts with the votive record of the platform and courtyard of this terrace, in which there is the noteworthy presence of pottery storage vessels – amphorae, together with small cups. Also worthy of mention is the discovery in the same area of a two Attic black-figure cups and a red-figure krater. The latter depicts an initiation rite in the presence of a statue of a goddess, probably Aphrodite or Artemis. This piece is therefore linked to the rite carried out in this area, although we are still unable to specify its exact function. Nevertheless, its intriguing iconography, which integrates perfectly into the symbolic context of this sanctuary, indicates its possible importance in the celebration of rituals. Another indication is its deposition in the worship context, together with the ceramic votive offering mentioned above (possibly foundational),

as the sanctuary was intentionally dismantled at the beginning of the fourth century BC and subjected to a major restructuring that included sealing off the caves and this terrace. The commemoration of aspects and artefacts (liturgical or not) must have been intentional, sealing them in their final place of use and deposition.

In fact, remembrance rituals are often integrated into the Iberian religious space in diverse ways. The last context to be discussed at Puente Tablas must have been part of this area of commemoration, linked to this sanctuary. In the third century BC, a small underground deposit was documented directly in the sediment that seals and covers the area of the sanctuary, specifically on its upper terrace. It is a small assemblage made up of two pottery cups and a decorated spindle whorl. This context is linked to the aforementioned reoccupation phase of the third century of the *oppidum*. In this phase the occupants continued to use key areas, such as the palace and the same houses that were inhabited in the fourth century BC, but not the sanctuary, that continued abandoned. Nevertheless, in different areas we document re-founding and commemoration rituals (House 7), with areas that still survived in the collective memory, half a century after the town had been abandoned.

CONCLUSIONS

Regarding the textile activity, we are witnessing an increase in the production of fabrics in the Middle Iberian Period for Iberian Area. Considering the increase of sheep cattle and the presence of traces of vegetable fibers and textile manufacturing tools, this process is also visible on a smaller scale in Puente Tablas. This suggests that there would have been a major demand for cloth. Nevertheless, understanding how textile production was organised in the settlement is complicated, particularly since much of the site is still unexcavated. However, in the light of the information we have obtained, we can offer hypotheses that will go some way towards reaching this objective.

The first inference concerns the diversity of fabrics that were likely produced. This, as we have indicated, can be inferred from the raw materials used (wool and flax) and the types of thread that the inhabitants appear to have been making (of diverse thicknesses and strengths), in accordance with the different groups of spindle whorls we have found. Likewise, we can point out that the textile production took place in domestic spaces, where other activities of the group inhabiting them were carried out. In light of the data referred to in the previous sections, we could hypothesise a certain specialisation in the work, at least as far as textile production in these houses is concerned. The different shapes and weights of the loom weights, as well as the find connected to tablet weaving, with clear differences between the analysed contexts, suggest differentiated types of production. If we consider the fact that these houses are in the same block, we could infer the social relations of those who inhabited those spaces. It is entirely possible that they could have worked together on the production of different types of textile goods, especially considering that such fabrics were not just for clothing but also for domestic textiles, such as bed linen, furnishings, hangings, etc.

On the other hand, in some houses, possibly corresponding to certain social levels (e.g. House 2), no elements linked to this production were documented. If such production was carried out in a differentiated manner in other units it could indicate a certain level of organisation and control.

Other aspects that would be worth researching in depth through specific studies are those linked to the learning and initiation practises in textiles activities. Images like the one mentioned above, from Sant Miquel de Llíria, show the use of spinning elements associated with young girls (Izquierdo y Pérez Ballester 2005), which refer us to aspects related to education and transmission of knowledge linked to different weaving processes. Another matter is to assess the role that miniatures can play in the transfer of knowledge and of symbolic aspects related to textile activity and the female gender in Iberian societies (López-Bertrán 2015). As has been analysed for other Iberian sites, such as La Bastida de les Alcusses, the miniatures that allude to domestic items and contexts contribute to the transmission of values related to diverse aspects (the resources of the land, the use of arms, banqueting, etc.), among which we find those linked to behaviours fixed in the «'ideals of gender', fundamental for building social persons» (López-Beltrán and Vives-Ferrándiz 2015: 11-12). Closely related to this sphere would be the ritual and symbolic area that, as we have previously indicated, is introduced in a very personal and active manner in the space of the *oppidum*. Once again, the religious space, which essentially alludes to these activities, is constructed heterogeneously and is rich in nuances.

Within this space, these finds (primarily spindle whorls and loom weights) are incorporated and sometimes do not correspond strictly to their function, but are symbolic, alluding to the house, the family, the initiation or prosperity. On the other hand, we should not lose sight of the direct relationship attested in these Iberian societies between the attire, status and social identity. For example, in the iconographic language of the Cástulo sanctuaries (Collado de los Jardines and La Cueva de la Lobera), the form of dress, as a social and ritual mark full of symbolism, was an active element in the ceremonies (Rueda 2013b). These contexts highlight the importance, formally and informally, of the composition of the attire, which is involved in the configuration of the body as a social construction and space of memory, and helps us to deduce aspects related to religious and social identities. In summary, and related to the subject of this article, these aspects allow us to evaluate the transference of the textile production and uses to other spheres, jolting us out of our theoretical positioning and traditional preconceptions that restricted this activity to the sphere of the house and a strictly domestic reading.

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Textiles and Rituality in the Late Tartessian Culture of the Guadiana Valley

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Abstract:

After the downfall of the Guadalquivir's Tartessian Culture at the end of the sixth century BC, the Tartessian core located along the Middle Guadiana Valley continued its cultural and economic development as a type of hybrid response, having a unique, prosperous period throughout the fifth century BC. The archaeology of this complex society is represented in Tartessic lowland buildings covered by tumuli, like the well-known examples at Cancho Roano (Zalamea de la Serena, Badajoz) and La Mata (Campanario, Badajoz). In the case of the former, remnants of textile activities such as spinning and weaving are plentiful, including loom weights, spindle whorls, metal and bone needles, as well as pins. Textile fibres were not recovered; however, recent finds provide insight into the technical and ritual meanings of textiles in these unique contexts. An example of this are the discoveries at the Casas del Turuñuelo site (Guareña, Badajoz), a newly-excavated building under a tumulus that produced fabrics and textile tools. These new discoveries are presented herein, along with a review of prior finds to permit us new interpretations.

Key words: *Tartessian Culture, Guadiana Valley, Loom Weights, Spindle Whorls, Flax, Basketwork.*

Resumen:

Tras el final de la Cultura tartésica en el Guadalquivir, a finales del s. VI a.C., el núcleo tartésico localizado a lo largo del Valle medio del Guadiana continuó su desarrollo cultural y económico como una respuesta híbrida con una prosperidad singular a lo largo de todo el s. V a.C. La Arqueología de este ámbito cultural está representada por los conocidos edificios tartésicos en llano, posteriormente cubiertos por túmulos como los conocidos de Cancho Roano (Zalamea de la Serena, Badajoz) y La Mata (Campanario, Badajoz). En el primer caso, los restos de actividades textiles como el hilado y el tejido fueron abundantes, incluyendo pesos de telar, fusayolas y agujas de metal y de hueso, e incluso alfileres. No se recuperaron fibras textiles, pero recientes hallazgos han incrementado nuestros conocimientos sobre el significado técnico y ritual de los textiles en estos contextos tan singulares, como aquellos procedentes de Casas del Turuñuelo (Guareña, Badajoz), un edificio bajo túmulo recién excavado, lleno de restos de tejidos y de herramientas textiles. Estos nuevos hallazgos se presentan en esta publicación junto a una revisión de los antiguos para permitirnos nuevas interpretaciones.

Palabras clave: *Cultura Tartésica, Valle del Guadiana, Pesas de Telar, Fusayolas, Lino, Cestería.*

INTRODUCTION

During the last thirty years, the Early Iron Age in the Guadiana Valley has gradually been revealed as a period in which the inhabitants of the central river basin developed a flourishing and prosperous culture, linked to the presence of Phoenician and Greek colonies on the shores of the Spanish Mediterranean and, especially, in the Gulf of Cadiz. This development, until a few years ago, was interpreted as a consequence of the peripheral effects of a single, main core, located on the coasts of Huelva and identified with the mythical *Tartessos* (Rodríguez Díaz and Enriquez 2001; Celestino 2014 with references) – a phenomenon that was discovered to be much more complex than the "Orientalizing" process that had been proposed previously (Almagro-Gorbea 1977). However, recent research undertaken at important Portuguese sites has allowed us to not only re-evaluate the supposed hinterland of the Guadiana but also recognize, in fair measure, a process of Phoenician colonization along Portugal's Atlantic coast (Arruda 1999-2000). It is for this reason that the authors of the present article defend the existence of an *Atlantic Tartessos*, which allows us to understand the endurance over more than a century (the fifth century BC) of the traditional *Tartessos* (Pellicer 2000; Celestino 2005; Álvarez Martí-Aguilar 2005).

The settlement structure of those interior populations seems to have revolved around certain 'central' sites located at strategic heights for territorial control, such as El Tamborrío-Entrerríos and Mértola (Labarthe *et al*. 2003; Rodríguez Díaz *et al*. 2011; Rodríguez González 2018). As has been suggested for Medellín, Lobón, and Badajoz (Almagro-Gorbea *et al*. 2008), the most important aspect of settlement in these contexts has been revealed to be a certain type of flat construction, which is monumental in character and has complex features (Jiménez Ávila 1997; Almagro-Gorbea *et al*. 2008: 159 ff; Rodríguez Díaz 2009) (fig. 1).

The paradigmatic excavations at Cancho Roano have demonstrated that the origin of these buildings can be dated to the beginning of the Iron Age in the region, and this has been confirmed by subsequent excavations at La Mata (Rodríguez Díaz 2004; Celestino 2014: 228 ff). However, the more complete view of these sites focuses on their last phase of use, typically developed throughout the fifth century BC with material parameters that were essentially similar.

For this reason, the archaeological remains attributed to this *Late Tartessian Phase* are particularly rich and abundant and this includes those remains which relate to the textile industry. Textile production activities were previously documented, in the case of Cancho Roano, by the authors in a work of synthesis and interpretation (Berrocal-Rangel 2003), in which they assessed the methodological difficulties that the excavation of this exceptional site involved – a work from which numerous interpretations of the site's specific function stem.

CANCHO ROANO: THE IMPORTANCE OF AN "ONLY PARADIGM"

Cancho Roano A, dated throughout the fifth century BC, is a site consisting of a set of bipartite structures, each considered to be part of a single building. Its organization is centripetal in nature, with a central, compact rectangular module whose sides are projected in the form of wings to cover a square area. This area acts as an access courtyard, with a peripheral module composed of a series of small, rectangular rooms which surround the central area on all sides, with an eastern door that provides access to the aforementioned courtyard (Celestino 2001: 30-31).

Leaving aside the highly debated issue of the building's interpretation, we wish to make it clear that all of the textile tools studied can be considered contemporary, in terms of use or possible use, at the time of Building A's decline (Celestino *et al*. 1996: 341). However, the occupation of this building and those that preceded it was consecutive in nature and of a short duration, perhaps little more than a century – a period that is not longer than the traditional service life of textile tools (fig. 2). The following conclusions concern the various types of tools present at the site (Berrocal-Rangel 2003).

SPINDLE WHORLS

Spindle whorls are the most numerous textile tools at the site. In all the rooms and northern and western areas, nearly 500 items were found, although only in the latter area there were groups or associations that allow for them to be connected with closed contexts. These sets seem to correspond with the use traditionally accepted for spindle whorls throughout time: real whorls as well as stoppers of a manual distaff. Therefore, as

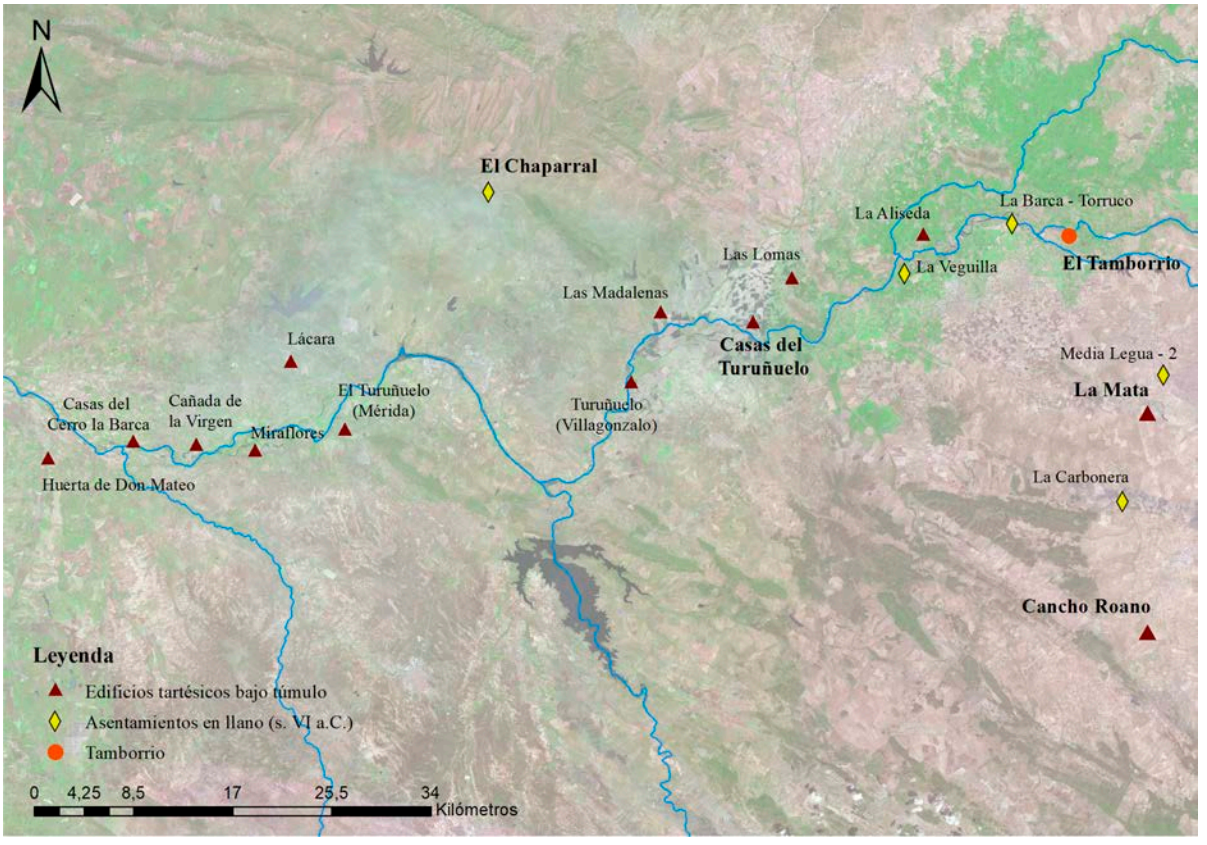

Fig. 1: Territory map of the middle valley of the Guadiana river (Image: E. Rodríguez González).

hypotheses, there would be two possible uses for a whorl, one in the botton of a drop spindle and, another, on the upper top of a distaff, acording to Spanish ethnographical modern testimonies (González-Hontoria and Timon 1983: 39-41).

Detailed morphological analysis of the spindle whorls confirmed that they are homogeneous in nature, both in shape and external appearance, as well as in terms of manufacturing techniques and the ceramic pastes used. They reflect standardized production – a response to widespread, controlled demand – designed to meet the needs of the local and regional market. These conclusions are based on an exhaustive analysis of a set of 343 complete items: 98% were made of ceramics, with a variety of shapes encompassing five major groups: three with a simple shape (conical, cylindrical, spherical) and two with combined shapes (biconical and biconical truncated). 54 % of all the whorls are strictly of the bitroncoconical shape, with that number increasing to 70.81 % if variations of this shape are factored in. Therefore, the study of these pieces demonstrates the success of the bitroncoconical shape, which may be explained by the ease with which it maintained inertia from rotary propulsion, yielding better results when compared with simpler shapes, such as conical or cylindrical. Another interesting aspect was the fact that the decorated pieces only accounted for 4.7 % of the total, something that markedly contrasts with the 45.7 % of decorated spindle whorls amongst the 127 found at the Sanctuary of Capote, dated between the fourth and second century BC and part of a clearly sacred context (Berrocal-Rangel 2003: 225). That fact, and some secondary evidence, allows one to defend the theory that most spindle whorls were meant for simple manufacturing use. They had weights ranging between 1 and 34 g and, therefore, they must have been used for spinning flexible fibres of varying consistency and size – within the limited repertoire available at the time: wool, flax and, possibly, some other fibre that was probably like what Pliny referred to as *carbusus* (*NH*, XIX, 1, 2, and 10)[1].

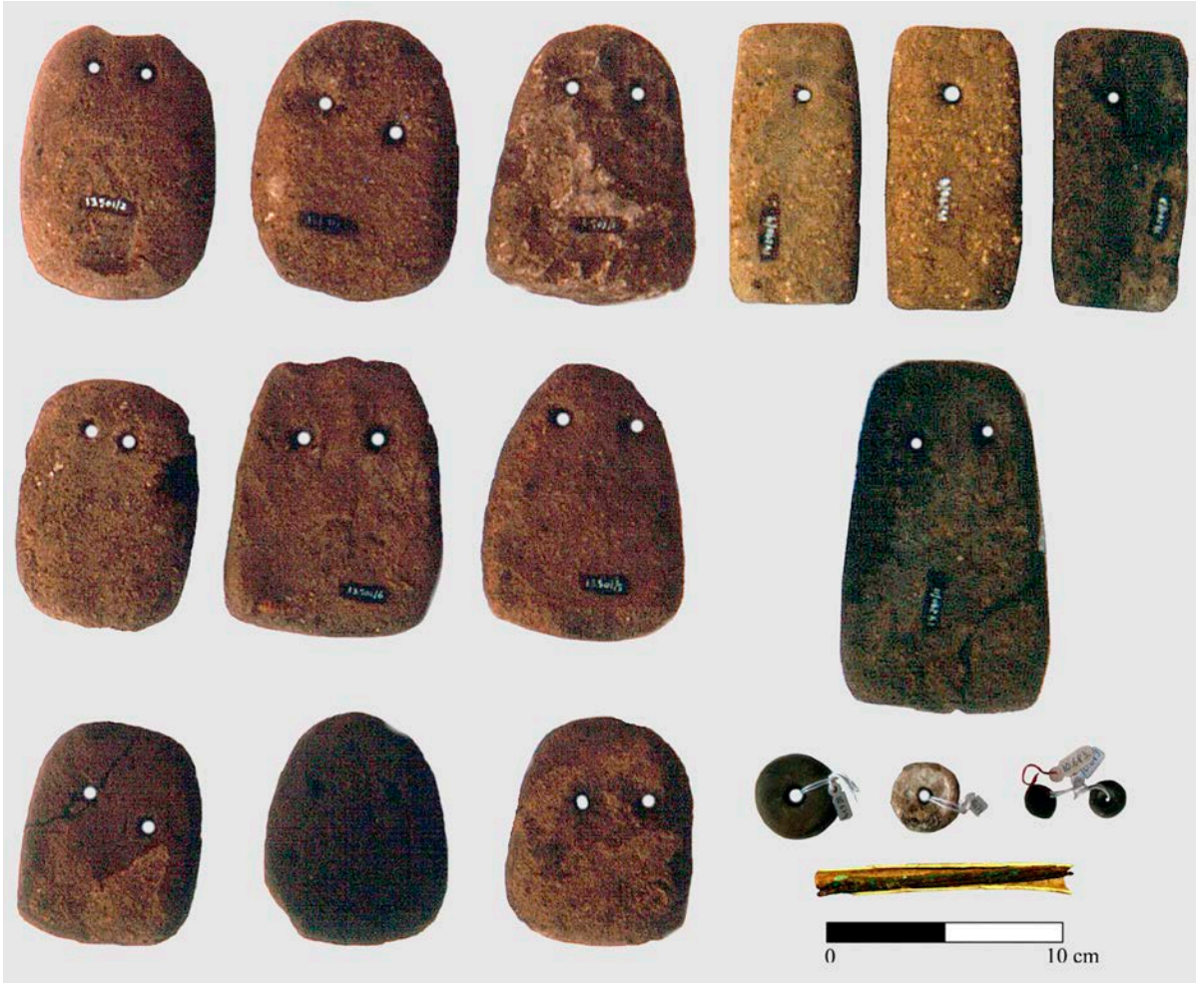

Fig. 2: Loom weights, whorls and bronze needles in a bone box, from Cancho Roano A site (Image: Authors).

The idea of a standardized set of tools gains force when observing the clustering of the spindle whorl weights around four values: 3.5 g, 7.5 g, 12.5 g, and 17 g. These values are common at prehistoric Peninsular sites, but the set at Cancho Roano has the particularity of having 48 % of its weights under 12 g, and even 10 g, and this is a peculiarity that we consider remarkable as the weight of the spindle whorl played an important role in the manufacturing of thread, influencing its thickness (Castro 1980: 142; Olofsson *et al*. 2015). Values and attributes so regularly distributed bring us to propose the production of spindle whorls with the use of moulds and templates. The analysis of the relationship between the maximum diameters and maximum heights allowed this possibility to be verified, and to be reinforced through comparison of the visual appearance and regularity of the shapes, profiles, and surface treatments (Berrocal-Rangel 2003: fig. 10). Thus, we were able to distinguish three groups of spindle whorls: irregular items; items with a regular circular shape when viewed from the side, and regular pieces.

The first group, at first sight, were probably hand-made pieces, while the third would most likely originate from the use of moulds for their manufacturing and the second group could have been the result of the use of rigid templates to standardize the size and circular shape. Of the 336 objects analyzed, the distribution between the first and the third group is almost identical: 43.4 % and 41.7 %, respectively. These two groups, which are at first sight surprising when considering the uniqueness of the weights, may reflect two types of manufacturing or spinning tradition: one which was regulated and standardized, and another which

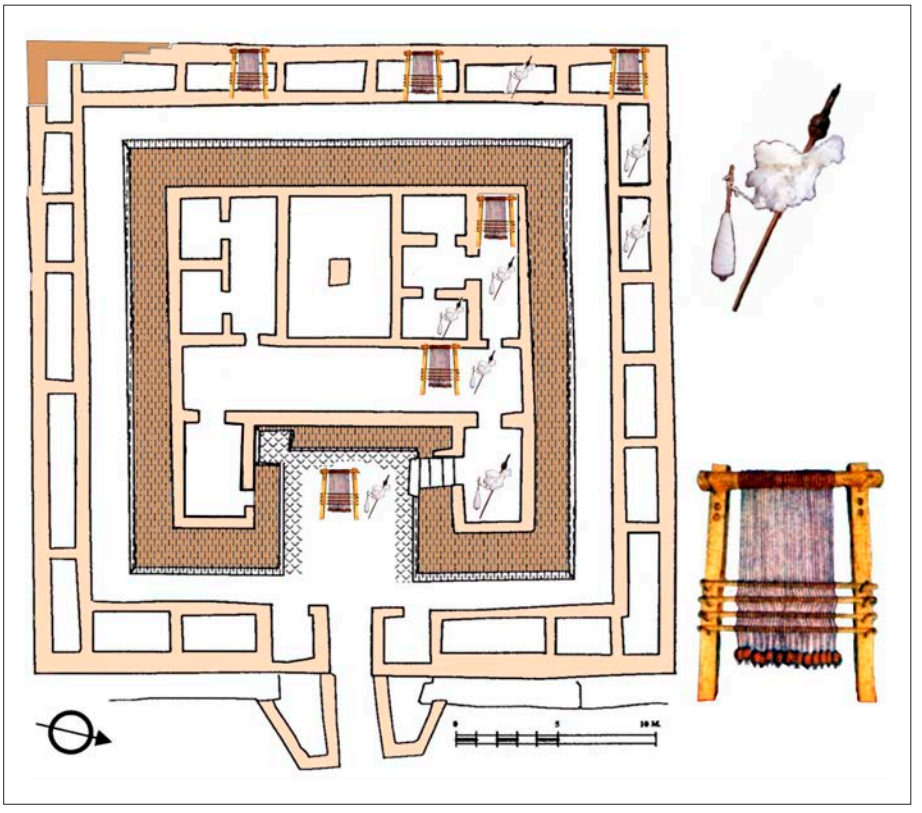

Fig. 3: Proposed location of vertical looms and hand distaffs in the floor plan of Cancho Roano according to Berrocal-Rangel (2003).

was more open to improvisation. Regarding the first group, the regularity in terms of the diameter is surprising (54.6 % of the pieces in this group measure between 20 and 32 mm), something that brings us to believe that we are faced with specific types of spindle whorls manufactured with moulds or templates, using reduction firing, well-levigated pastes and careful surface finish – being polished and even burnished, with very scarce decoration. The analysis of the diameter/height variables presented a regression in the form of uniform linear development, which allows us to draw out an equation of correlation whose coefficient, "r," is 0.80 (Berrocal-Rangel 2003: 240 and figs 10.1, 10.2). Additionally, it is a good idea to observe the accumulation of pieces with identical diameters that are distributed in the form of continuous ranges along consecutive heights: pieces measuring 16 mm; and measuring from 20 to 37 mm. As height/diameter regression does not just provide a higher concentration of points, approximating a clear "cloud" silhouette, the diameter variable's operation as independent with respect to the height is clearly demonstrated.

These diameter/weight/diameter regressions yielded, additionally, a novelty in the performance of the lower values. In terms of the predominance of diameters, those that are below 20 mm are dependent upon the weights. In this sense, we believe that it is more difficult to control the weight of such small pieces than their diameters, unless we are talking about very precise production that is monitored with a very well-defined technical interest.

With regard to the spatial distribution of spindle whorls, we observe a series of clusters. Thus, five sets can be selected from the exterior module, in the northern wings (rooms N3 and N6) and western wings (rooms O1, O2, and O3), associated or not with looms: 14, 6, 14, 24, and 8 spindle whorls. All are, as can be seen, even numbers, which may reflect, therefore, a certain duality for each spindle (fig. 3; Berrocal-Rangel 2003).

LOOM WEIGHTS

The second set of textile tools consists of loom weights – the weights of vertical warp-weighted looms with a single warp beam (Hoffmann 1974: 297ff; Alfaro 1984: 124; Wild 1988: 31-33; Gleba 2008; Andersson *et al*. 2015). Many loom weights were found at Cancho Roano forming sets, which has allowed us to propose the

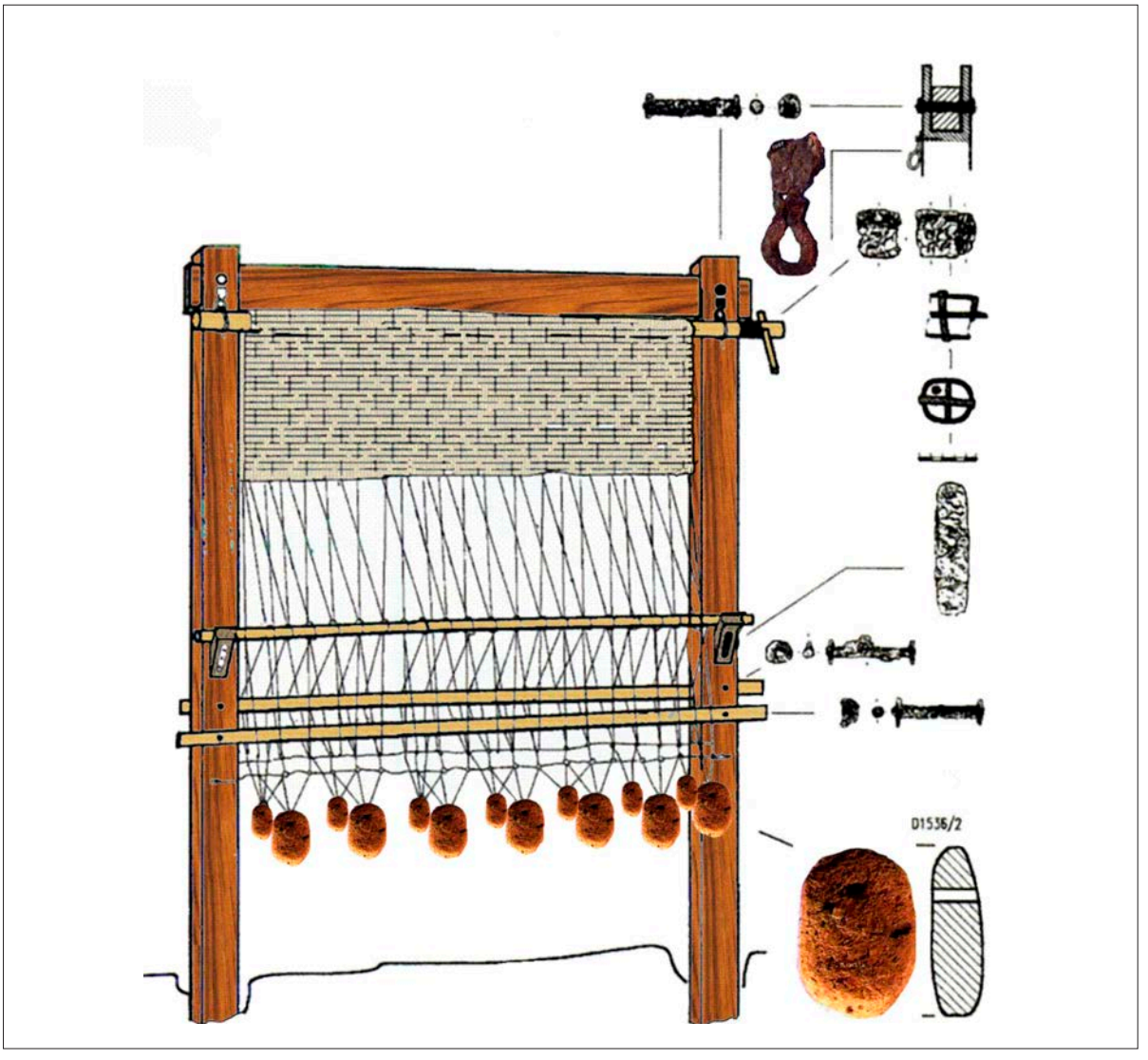

Fig. 4: Proposed construction of a vertical warp-weighted loom at Cancho Roano that includes the various iron and ceramic elements found at the site (L. Berrocal).

presence of looms (Maluquer de Motes 1983: pl. XXX; Celestino and Jiménez Ávila 1996: 134-135). Nonetheless, we must keep in mind that alternative explanations of the function of these objects have been proposed (Castro Curel 1984: 150; 1986).

Ignoring isolated cases that are easily ruled out due to their specific features, we studied these weights by following the morphological guidelines used by other researchers. The number of complete pieces, 128 units, was enough to come to important conclusions, especially if we take into account that, since the first archaeological campaigns, concentrations of numerous pieces were located in high-traffic or access areas, leading the excavator Juan Maluquer to consider the existence of looms. The fragile nature of these pieces, due to low firing they were subjected to, allows us to explain the fact that many of these objects broke after their excavation – if they were not already clearly in pieces (Celestino 1996: 110).

In more recent archaeological campaigns, however, more careful recovery allowed for the identification of complete sets which, nevertheless, also included many damaged weights. Such differences allow us to understand

the difficulties of identifying possible looms. Fortunately, in rooms O1, O3, and O5 we were able to document a significant amount of wood fragments and pieces of iron that have allowed us to identify the presence of looms with certainty and to subsequently reconstruct them with a high degree of fidelity (Celestino 1996: 345-346; Berrocal-Rangel 2003) (fig. 4). A similar conclusion could be reached for the concentrations of weights found in rooms N1 and H3. Lastly, the clusters of weights in the building's central module, in H5 and H11, could correspond to looms, but also to post-depositional accumulations, as Maluquer himself also considered.

The analysis of this material yielded interesting conclusions, such as the poor material quality of the pastes used, scarcely levigated, and the firing at such a low temperature that the weights can hardly be considered ceramic. Their shapes are of simple types: prismatic, ovoid/pyriform, and rounded-rectangles. That is to say, basic shapes, spread in a similar layout, from which seven truncated pyramidal weights stand out. In terms of the dimensions and weights, the most interesting results are inferred from the study of the latter weights. In this case, we were able to observe that, although there are some pieces of up to 2000 g, a smaller weight of 1000 g is more common, with regular staggering of values around 300, 450, 600, 700, 800, and 1075 g. These must have corresponded to the different fibres and qualities of thread used.

The most interesting aspect of this study is the homogeneity of certain concentrations, such as the case of room O1, with seven similar weights, all of which were prismatic. Similarly, in H2, we could speak of two possible looms judging by the concentration of many loom weights of around 140 and 680 g respectively. These two categories, with low and medium weight values, are repeated in the other full sets: in the case of O1, the seven weights studied are all prismatic, with weights of around 270 g and measuring 85 mm in height, like in H12 (H3-H5), and with stelliform weights of 325 g and measuring 90 mm in height. In contrast, in H2 and O3, we find medium-size weight concentrations, with prismatic and stelliform shapes in the former, averaging 680 g and 140 mm in height, and ovoid shapes in the latter, weighing around 780 g and measuring 145 mm in height. These groups seem to reflect different sets of loom weights, while the appearance of some individual weights that are heavier could correspond to specific, unknown functions, such as acting as a counterweight for the thread guide or a reed for a two-beam loom (Gil 1990: 252).

In summary, it can be argued that these weights functioned as loom weights for warp-weighted looms, to provide regular tension for the warp threads, with similar weights and shapes (Castro Curel 1984: 105). The number of weights per loom could range between 13 and 21, possibly odd numbers to facilitate the dual separation of the warp threads. Likewise, we cannot rule out looms of larger or smaller size, such as those made up of nine weights found in Biskupin (Grossmann 1991: 29).

OTHER TEXTILE TOOLS

The third set of textile instruments is made up of other tools and possible remains of looms: needles, threaders, shuttles, etc. Although some tools are missing, such as combs, spacers, shears, there is a good collection of needles and threaders, especially the spectacular group of four identical bronze needles found inside their case in room O2 (Celestino and Jiménez Ávila 1996: 113: fig. 29.2), a space which would have had distaffs and spindles (fig. 3). The needles correspond to one of the two basic types found at Cancho Roano: they are made of bronze or copper, with a circular cross-section and single eye that is oval in shape, ranging 6-10 cm in length. They were likely used for sewing and joining different pieces of fabric (Wild 1988: 53 ff). The other type of needle is made of bone, spindle-shaped, with a flattened oval cross-section, and with one to three holes and 8-12 cm in length. This type is appropriate for stitching thick fibres, as esparto, or for non-woven techniques, such as looping or netting.

Another documented tool is an elongated piece of iron with a forked end that has been identified as a bobbin or shuttle and was found on the floor of room O4, a room in which there were no loom weights or spindle weights. However, this is not the case for a set of iron bolts that was found in room O5, where the greatest number of loom weights were found. These bolts, as well as a rolling drum, grommets, and platens provide some idea as to why the presence of one or more looms was considered (Celestino and Jiménez Ávila 1996: 84 and 148, figs. 21-22; Kurtz 2003: 308-309). This interpretation is based on the identification of items like six double flat-head bolts whose length is 10 cm, inherent to a fastening system made up of an upper beam and two bars to separate the warp threads, at the right foot of a vertical loom; and the identification of items like two rolling drums, with nails crossing inside their interior to hold a piece of

wood, of which parts remain intact. We identify this as an end of the warp beam, which most likely would have worked as a barrier, preventing the movement of the loom from interfering with the beam. As we are proposing a complex vertical loom model, basically intended for serial production, the warp beam must be independent from the frame's lintel or top. This is a solution in which the loom runs the risk of coming undone each time the freshly-woven fabric is removed.

In summary, based upon the definition of homogeneous sets of similar weights and their association with other material remains, the existence of vertical looms in perimeter rooms O1, O3, and O5 is proposed. They were also very probably in existence in rooms H3 and H2 of the central building, but we cannot say how many there were nor the number of weights that each one had. By way of approximation, based on the best-preserved sets, we propose sets of 13 to 21 weights, with the most representative values being around 14 units. The homogeneity of weights, shapes, and measurements allows us to differentiate between these sets: some with higher weights, around 700 g, and others that are lighter, under 400 g. These differences could be due to the use of different types of fibres, like wool and flax. However, we know that in H12, both types were together and perhaps placed on the same loom as needed. The pieces of iron with associated remains of wood from room O5 allowed us to reconstruct a basic type of vertical loom that we think had a single warp beam (fig. 4), along the lines of the traditional vertical looms known as "high-warp" looms (González-Hontoria and Timón 1983: 47, fig. 38). A loom of this type is capable of generating fabrics of 1 m in width, and it would reach 3 m in height (Castro 1984:109). In terms of the thread production, distaffs and spindles are also located in the northwestern half of the center and perimeter modules of the building, like the looms. Regarding the spindles, they seemed to occupy rooms interspersed with the rooms that housed the looms, as if the two activities, spinning and weaving, had separate spaces – at least in terms of their storage. In O1, nevertheless, stoppers and spindle whorls were next to a set of light loom weights (250 g).

This diversity of looms and distaffs confirms the importance of the textile industry in this privileged context, acting as proof of products that surely stood out because of their nature and variety and due to their exquisite nature – in line with the degree of social and technical development demonstrated by these late Tartessian societies. The different areas, whether they are open like H12 and H2 or closed like the perimeter rooms, have enabled us to differentiate between the presence of workshops and storerooms. Workshops seem to have been located in high-traffic areas that were open and communal in nature, as is to be expected for settlements of the Bronze Age and Early Iron Age in the Iberian Peninsula and Europe, and as can be seen in Peñalosa de Baños de la Encina (Jaén), Lloma del Betxí (Paterna, Valencia) (Contreras *et al*. 1992; De Pedro 1998: 75 and 181) or even Biskupin (Grossman 1991: 29; Grossman and Woiciech 2011). In terms of the storerooms, we consider these perimeter rooms to be like warehouses, too small and seemingly too dark to allow for tasks that require visual precision and space. This interpretation is reinforced by the confirmation that distaffs and looms were kept in neighboring rooms, yet interspersed amongst each other – indicating a particular storage pattern.

LA MATA AND OTHER SITES

Cancho Roano's *paradigm status* developed during its publication as preliminary results of excavations undertaken at similar sites also began to come to light, especially at La Mata de Campanario (Rodríguez Díaz 2004). Although the stratigraphical contexts of this archaeological site support functional interpretations that are different, there is no doubt about the similarities between both complexes, which are contemporaneous and spatially close to each other. This is true, at least, in terms of the construction similarities and of the common materials. Thus, La Mata is a single building with a plan that closely resembles Cancho Roano A and B, as well as being occupied from the end of the sixth to the end of the fifth century BC (Rodríguez Díaz and Ortiz 2004: 297-301). The materials found at the time of La Mata building's demise can be considered contemporary to Cancho Roano A. However, delving deeper into the two contexts, the differences between the two sites become apparent. At La Mata, the household functional nature is much more prominent in the interpretations undertaken by the researchers studying the site. This is, without a doubt, based on the presence of elements such as the coterminous and central hearths of rooms 1, 2, and 3, and on the nature of the majority of the materials found therein, especially spindle whorls and loom weights (Rodríguez Díaz and Ortiz 2004: 265-266). Still, to this

end, the consideration of textile tools as being inherent to the domestic production environment of the building (rooms E1 and E2) (Rodríguez Díaz and Ortiz 2004: 265) does not stray that far away from our conclusions in connection with Cancho Roano. Rather, they reinforce these findings, as we insist on the manufacturing functions of the materials from the site (Berrocal-Rangel 2003: 237, 255, 268).

Nevertheless, the similarities between both sets of materials do not go much further: neither in terms of the wealth of artefacts, nor in terms of the degree of conservation thereof does La Mata yield data comparable to that of Cancho Roano. The number of spindle whorls and, especially, the number of loom weights are significantly lower. The poor quality of the textile tools, particularly loom weights, is apparent, as is the poor state of conservation of the later (Rodríguez Díaz and Ortiz 2004: 263). The 89 spindle whorls found do not appear to reflect the careful production and serial nature that is recognized over a large part of the Cancho Roano site. Furthermore, complete sets are not recognized beyond what is deduced from the weights and spindle whorls found in Area C, which is located on the upper floor of the building. The excavators note: «In fact, we believe that if there was a loom somewhere in the building, it was precisely in this area» (Rodríguez Díaz and Ortiz 2004: 265). Indeed, the nine loom weights and 28 spindle whorls found in the Area C supports this interpretation. Likewise, the fact that 28 spindle whorls were recovered from the lower floor (especially from Room 2, scattered over the entire surface of the room), compared with three loom weights, makes the possibility of the existence of a second loom in this space unlikely.

The presence of bolts similar to those found at Cancho Roano – both in the above-mentioned Room E2 and in Area C of both floors of La Mata – would support the existence of a second loom, along with nails (3), spindle whorls (9), and loom weights (2) at the northern end of Corridor E4 of the bottom floor, around the wine press identified there. The excavators specify: *We do not rule out the fact that some of these pieces could come from the upper floor* (Rodríguez Díaz and Ortiz 2003: 265). To this end, it is possible that Area E of the floor was the location of looms. From the available clues, one could argue the presence of two vertical looms similar to those of Cancho Roano located on the upper floor of the building, in the better-lit areas: Areas C (central) and E (hall-corridor). In addition, the spinning work could have also been undertaken in Rooms E1 and E2, where household life was carried out.

La Mata did provide some exceptional evidence related to basketwork, in the form of esparto grass fibres (Rodríguez Díaz and Ortiz 2003: 295-296), a generic term unless dealing with imports, as esparto grass (*Stipa tenacissima*) is not found in the southwest Iberian Peninsula (Rivera and Obón 1997: 1071ff; García Hotal 2007; Watson *et al*. 2008)[2]. Using fibres of similar grass species, at least two vessels were braided whose bases were found more or less well preserved in Room E8 and on the threshold between Room E2 and Corridor E4. In the first case, it was a vessel of a considerable size, as its base measures 35 cm in diameter, while the second artefact was probably similar. Remains of cereal grains were found near both vessels, as well as the remains of legumes and grape seeds – foods that clearly should not have been mixed. Archaeologists were not able to reconstruct the contours of these vessels, but they proposed, with a good degree of certainty on the basis of the preserved braids, that they were probably something like bassinets without handles, similar to what we know as *escriña*, manufactured in Las Hurdes with woven or bundled rye straw and stitched with tender stems of briers (*Rubus idaeus*) (Rodríguez Díaz and Ortiz 2004: 124, 296, fig. 122). Judging from the photograph published of the base of E8 (Rodríguez Díaz and Ortiz 2004: fig. 122), the object was likely made using coiled basketry technique – as mats, baskets, and chests were traditionally made – usually with rush or galingale (*Cyperus longus*).

The rest of the contemporary sites, including those occupied throughout the sixth century BC, are certainly sparing with textile artefacts. This is what is understood in the so-called Caserío de Cerro Manzanillo (Villar de Rena, Badajoz), a rural settlement abandoned in the middle of the sixth century BC. The textile-related material is limited to an incomplete loom weight of a prismatic shape and five spindle whorls (Rodríguez Díaz *et al*. 2009: 38; 115-117). The spindle whorls have spherical and biconical shapes, and they are very irregular, like their firing (Rodríguez Díaz *et al*. 2009: fig. 48), standing in stark contrast with the regular shapes found at Cancho Roano and, even, with some of those found at La Mata.

A similar picture is obtained from the publication of El Chaparral (Aljucén, Badajoz), where three spindle whorls were recovered, one being spherical and two bitroncoconical, all being plain and having irregular firing. They were found not in primary context (Sanabria 2008: 93, 102; Jiménez Ávila and Ortega 2008: 274). Likewise, in the lands of Alentejo in Portugal, contemporary archaeological sites

offer the same picture: a single spindle whorl with a spherical profile and bitroncoconical trends was found at Herdade da Sapatoa (Redondo, Alto Alentejo) – a site dated to the first half of the fifth century BC that could be compared with Cerro Manzanillo (Mataloto 2004: 98, fig. XXXVII, 88). Two spindle whorls found at Mingens 10, more to the southeast (Calado and Mataloto 2008: 193, fig. 4), seem to be a bit older and their profiles reflect greater irregularity in comparison with the aforementioned finds. That is why the regular profile of a spindle whorl found in Abul A1 (Phase II, second half of the seventh century BC; Silva 2005: 759) has a dual significance: it is a piece that is not only more ancient than any of those mentioned previously, but it also presents a bitroncoconical profile that moves the regularity of Cancho Roano back by two centuries.

THE MOST RECENT EVIDENCE: THE CASAS DEL TURUÑUELO BUILDING

The Casas del Turuñuelo site (Guareña, Badajoz) site is located in the Vegas Altas, Guadiana Valley – the region where a large part of the archaeological sites discussed above are located. This site was known for some of the incidental finds, which enabled its identification as a *Tartessic building hidden under a tumulus* like Cancho Roano, La Mata, and Turuñuelo in Mérida (Jiménez Ávila 1997: 146; Rodríguez Díaz and Ortiz 1998: 243-244, Rodríguez González 2018). In 2013, two of the present authors (S. C. and E. R.) began a prospection project, which resulted in the excavation of the site. After three archaeological campaigns, the existence of a huge building, contemporary to those of Cancho Roano and La Mata, was dated to the end of the fifth century BC (Rodríguez González and Celestino 2017a). Inside, a large room has been documented (called Room 100), with a surface area of more than 60 m^2 and in a state of preservation that can only be qualified as exceptional (Rodríguez González and Celestino 2017b) (fig. 5). It is a rectangular room, with an entrance from the east, and the rest of the building probably likewise facing east, according to the common custom of contemporary buildings. Beautifully preserved, the door has a 1.7 m span and is located in the centre of the eastern wall, at the end of a room with walls that were plastered with lime and decorated with raised motifs. In its interior, the furniture highlights its uniqueness: a semicircular basin is open in the floor and finished off with the same lime plaster as the walls. The basin is located at the other end of the room, facing the door. An extensive bench runs along the northern wall and, opposite this, a tiered pedestal made of adobe coated with thin slate slabs emphasizes the southern wall. This pedestal serves as the base for a large vessel – perhaps a bath, sarcophagus, or basin – sculpted or constructed with the same lime plaster as the walls. Finally, in the centre of the room, a great low-lying altar clearly sets the ritual tone inherent to this construction, an *eschára*, similar to others found in Tartessian sanctuaries (Escacena and Coto 2010; Gómez Peña 2010). Formed by a series of small slate slabs that provide it with its basic shape, and filled with an adobe base,

Fig. 5: Aerial view of the main room of Casas del Turuñuelo (Image: Building Tartessos Project).

Fig. 6: Textile preserved on ceramic fragments / Detail photography (Image: Building Tartessos Project).

Fig. 7: Remains of textile fibres located in the UE 108. The fibres are carbonized (Image: Building Tartessos Project).

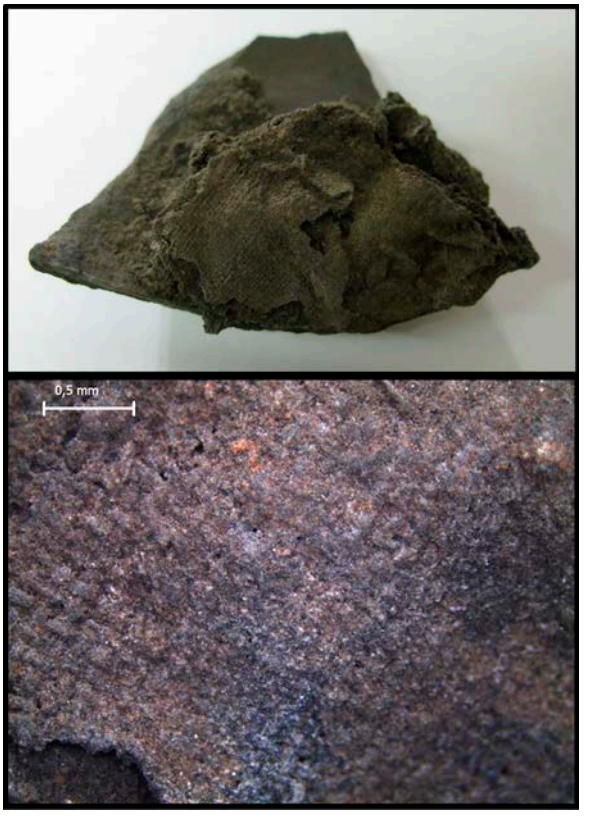

Fig. 8: Fragment of cloth adhered to a grey ceramic urn located in the vestibule from the archeological site of Casas del Turuñuelo (Guareña, Badajoz, Spain) / Detail photography (Image: Building Tartessos Project).

combustion residues are not present but instead there is the skin of an animal. Room 100 has provided a set of extraordinary materials consistent with the exceptional nature of its construction techniques and furnishings. Most importantly, the constant humidity provided by the massive adobe construction, as well as its location next to the banks of the Guadiana River, allowed for the excellent conservation of fabrics, seeds, and charcoal.

Opposite the door, in the interior of the room, remains of woven plant fibres were found whose location and method of construction allowed to identify them as mats (Marín-Aguilera *et al*. 2019). These fibres are similar to many others found on the paving slabs made of fired adobe that were located at the opposite end on the western side of the room – clear remains of mats. Thanks to a fossilization process, part of these fibres were preserved on ceramic fragments, enabling the recognition and recovery of part of the braid used in the manufacturing of mats (fig. 6). Flax, esparto grass and the earliest remains of wool in the Iberian Peninsula have been identified so far (Marín-Aguilera *et al*. 2019). The same mat, or another one if there were several, was located under UE108, a stratum of coal that, near the

Fig. 9: Loom weight set from the archaeological site of Casas del Turuñuelo (Guareña, Badajoz, Spain) (Image: Building Tartessos Project).

centre of the northern wall, charred these fibres, allowing, in this case, for the type of plaiting to be identified (fig. 7). In this case, the mat's knotting appears to have a perpendicular nature and to have a checkerboard pattern (Alfaro 1980: 112).

Lastly, outside Room 100, in its entrance hall, a grey vessel was found containing a fragment of cloth made of fine, compact fibres identified as flax, and woven in a balanced plain weave or tabby (fig. 8). The presence of seeds at its side lead us to suggest that the cloth could be from a small sack, which most likely contained these seeds, perhaps inside the ceramic vessel. In addition, this area also yielded another spectacular find during the archaeological campaign of the summer of 2016. Next to the south wall of this space, numerous small pieces of charcoal and charred wood were documented in an elongated arrangement, parallel to the wall, in between numerous (43) loom weights. This association led us to suppose that these remains corresponded to a textile device, possibly one or more looms, judging by the large number of loom weights and by the variety of their shapes. In this case, the fire that brought about the end of the building also preserved the loom weights, which were lightly fired (fig. 9).

In terms of their shape, loom weights are similar to those of Cancho Roano, the majority of them being pyramidal in shape, although at Casas del Turuñuelo they have a clear truncated pyramidal trend (with nine complete examples). In contrast, ovoid and rectangular shapes are present in much smaller numbers, with 3 intact examples. Considering the precariousness in the manufacturing of these pieces, we do not believe that a relevant conclusion can be drawn from any of those differences. Conclusions cannot be drawn from their weights, which have a wide range like the examples found at Cancho Roano, ranging between 250 g and 1200 g (compared to 300-1075 g at Cancho Roano). This wide range, however, confirms that they may correspond to different loom sets.

Along with these loom weights and remains of charred wood, another very interesting set of weights was documented: of discoid shape and measuring more than 10 cm in diameter. Judging by their size and weight, somewhat less than 900 g (with some specimens close to 600 g),

Fig. 10: Discoid weights from the archaeological site of Casas del Turuñuelo (Guareña, Badajoz, Spain) (Image: Building Tartessos Project).

they could be considered loom weights. However, their shape, unusual for loom weights and similar to spindle whorls and distaff stoppers, suggest they could be anything from weights for hand nets (the discoid shape could have helped with their throwing; Mayoral *et al*. 2000: 188-189) to weights for thatched roofs. Similar discoid weights are known from the Late Bronze Age Spanish South-eastern Levante coast (Jover and López 2013: 160-161; Hernández Pérez *et al*. 2014). They are cylindrical rather than discoid, have diameter under 10 and thickness between 7 and 8 cm, and have a central hole (Barciela *et al*. 2014: 125). The weights found at Casas de Turuñuelo have a diameter of 12 cm or greater, thickness of 5 cm and a central hole. The pieces numbered 30 and 31, the best preserved of all, additionally present various shallow cavities on one of the flat faces of these disks (fig. 10), perhaps an indication of their use as a different type of tool, such as weights for braces and lathes that belonged to goldsmiths and those who worked with ivory (Ambruster 1993: 274: 11).

CONCLUSIONS

The textile technology based on a hand spindle with a spindle whorl and a warp-weighted loom is not documented archaeologically in the southwest of the Iberian Peninsula until relatively late in comparison with the southeast. The first spindle whorls do not appear in the archaeological record until the beginning of the Iron Age, in contexts that are clearly Oriental or Orientalizing. In the interior of the Guadiana Valley, the materialisation of this technology cannot be extended earlier than the sixth century BC, and its evidence is quite scarce (Almagro-Gorbea 2008: 947; Jiménez Ávila and Ortega 2008: 274). Amongst these materials, spindle whorls present shapes that tend to be spherical, highly irregular, in contrast with the later types and the isolated biconical specimen from Abul. Only at the archaeological sites of the fifth century BC, are spindle whorls and loom weights represent sufficiently to indicate that this textile technology was fully developed. Likewise, in the case of Cancho Roano, this development manifests traits of complex, standardized production.

The archaeological contexts in which textiles tools have been found indicate that textile technology was used in all contexts, from the domestic to the ritual or ceremonial levels. However, clear differences are observed in the specimens from the fifth century BC. Thus, in La Mata, the most feasible locations for spinning activities were Rooms E1 and E2 – of a clearly domestic character. Likewise, the only possible looms were probably located on the upper floor of the building, Area C (central) and E (hall-corridor), locations that were supposedly well lit and appropriate for textile manufacturing. A very different situation is the one deduced from the textile tools at Cancho Roano, a site whose materials indicate a special end purpose. Although not necessarily implying a religious nature, the looms in operation in the central building of Cancho Roano, or those stored in the perimeter rooms, appear to have been used for the manufacturing of fine, delicate fabrics. This production could have been aimed at supplying clothing for the Tartessian elite or for rituals. The ritual nature seems much clearer at Casas del Turuñuelo, both due to the low-lying altar and the exceptional ergology of the furnishings in Room 100.

The combination of a large number of loom weights and remains of wood and iron anchoring elements seem to indicate the existence of looms at Cancho Roano and La Mata. From the study of the loom weight concentrations, one can observe the variety of weights and shapes, always recurring, and the poor quality of their manufacturing. This variety of loom weights would most likely suggest the existence of different sets – sets varying in number and type of loom weights that could have been used on the same loom frame depending on the cloth type to be woven (Olofsson *et al*. 2015).

Loom weights were not fired, except for brief *baking* by sunlight. This seems plausible since weights were usually at risk when changing the shed or warp beams. They could be hit, or broken, changing their original weights; thus, it was opted to use raw, *recyclable* weights.

NOTES

1. From Sansk. *Karpâsa*, was an Eastern product… superior in beauty and quality to the wool of sheep, according to *Herodotus*, 3.106" (Smith *et al*. eds. 1890: Word CARBASUS): http://www.perseus.tufts.edu/ consulted on January 2, 2017.
2. To this end, the *Spanish Plant Information System* (Anthos, 2017. Real Jardín Botánico – CSIC, www.anthos.es, consulted 09-01-2017) includes, amongst a dozen species of *Stipa*, two with presence in the Iberian southwest, *S. bromoides* and *S. capensis*.

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Textiles and Rituality in Iberian Culture

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Abstract:

The aim of this article is to examine archaeological finds related to textile production in the Iberian Culture, particularly between the fifth and third centuries BC. We focus especially on ritual activities and consider both their presence in Iberian funerary contexts and sanctuaries and their links to activities carried out by women. We also highlight the presence and strong symbolic implications of objects related to the world of yarn making and weaving. On the one hand, the presence of these objects reveals the distinct intention of representing productive activities which, as in other Mediterranean contexts, are intimately linked to the female gender. On the other hand, and through certain images and the prominence of grave goods, these objects also envisage ideas about status, as they always appear associated with women of the aristocracy. As well as gender and social hierarchy, these symbols also represent a high level of skill in the practice of certain activities, which only a few women – all members of the most privileged groups – would be qualified to perform.

Key words: *Iberian Culture, Textile Production, Funerary Contexts, Sanctuaries, Gender Archaeology.*

Resumen:

En este artículo vamos a tratar de examinar brevemente, las evidencias arqueológicas que encontramos relacionadas con el ámbito de la producción textil en la Cultura Ibérica, sobre todo durante los ss. V-III a.n.e., y su papel, en las actividades rituales, especialmente a partir de su presencia en los contextos funerarios y en los santuarios de la Cultura Ibérica, así como su clara relación con las actividades de las mujeres. La presencia de objetos relacionados con el mundo del hilado y el tejido, posee también una importante carga simbólica. Por un lado muestra la intención de representar unas actividades productivas vinculadas, como en otros contextos mediterráneos, claramente con el género femenino. Pero al mismo tiempo, y a través de determinadas imágenes o destacados ajuares, proyectan asimismo una idea de estatus, ya que son las mujeres aristocráticas las que se muestran con estos símbolos que, además de género y jerarquía social, representan también la destreza a la hora de realizar una actividad, para cuya alta cualificación solo estarían capacitadas unas determinadas mujeres, pertenecientes todas ellas a las esferas más elevadas de la sociedad.

Palabras clave: *Cultura Ibérica, Producción Textil, Contextos Funerarios, Santuarios, Arqueología de Género.*

INTRODUCTION

In the first part of this article we will briefly analyse several archaeological finds related to textile production, and examine their significance in the funerary contexts and sanctuaries of Iberian culture between the fifth and third centuries BC. In order to adequately frame the importance of their presence in these contexts, we will refer first to textile tools – such as spindle whorls, loom weights, and, to a lesser extent, needles – which are most frequently found at various settlement, funerary or sanctuary sites. Following this, we will review the less frequently-found tools such as tablets, tensioners, weaving reels, etc. The presence of textile remains preserved in both funerary and votive contexts will also be examined. Next, we will highlight the significance of iconographic representations on painted ceramic vessels, stone sculptures and small bronze figurines, which can provide valuable insights into understanding textile production through the images of spindles and looms, and textile products, through the depictions of luxurious garments such mantles, tunics, etc. Finally, we will examine the productive value and strong symbolic character of these materials. Both aspects are closely linked to the construction of gender and, in some cases, to the status and social prestige attached to women's mastery in textile production skills. The emerging picture suggests the great symbolic importance of a number of tools and images related to textile production in a wide range of Iberian contexts, from settlement to funerary contexts and sanctuaries.

TEXTILES AND SETTLEMENTS

Textile tools in settlement contexts often pose the challenge of reduced visibility for archaeologists. Spindle whorls and loom weights tend to have a greater size and are made of more durable materials, like terracotta, which make them more noticeable. However, many other tools have often gone unnoticed, either due to their size – as in the case of needles – or due to being made of organic materials, although the presence of spindles and spindle whorls, for example, has been widely documented in other Mediterranean contexts (Gleba 2008; 2009). In other cases, where textile tools have been recorded, their importance has often been overlooked by archaeologists. In settlement contexts where such finds have occurred, a lack of attention prevents a deeper understanding of their possible significance: beyond merely the production and self-supply of each domestic unit. Yet their presence, especially in some *distinct buildings* featuring prominently in several large settlements, could also denote symbolic links with home-protecting cults. A good example of this is Department 1 of El Tossal de Sant Miquel de Llíria, where spindle whorls and loom weights have been found among other notable materials, such as oil lamps and fragments of red-figure *skyphoi* (Bonet and Mata 1997: 133, fig. 6). Equally remarkable is the iconography recorded on a ceramic plaque recovered at what is known as the *sacred room* at the La Serreta settlement in Alcoy (Alicante). The plaque's surface features a scene whose protagonist, a lady, is holding a spindle in her hand (Tortosa Rocamora 2007: 243; Grau *et al*. 2008).

Another frequent find at settlement sites are shears, such as those found at La Bastida de Les Alcusses (Mogente, Valencia) (Bonet *et al*. 1994). As demonstrated below, such objects have also been found deposited at burial sites. Still, it is highly likely that in those Iberian sites where textile production was of some importance – such as the Castellet de Bernabé (Guérin 1999), a divine entity may have protected its practitioners, as seems to be the case in many other Mediterranean contexts of that time (Gleba 2009: 70).

In any case, Iberian textile products must have been of high quality. Among the few references available, a truly striking example is a dismissive remark by Athenaeus of Naucratis regarding the Massaliots, who he calls effeminate for importing and wearing Iberian tunics (as mentioned in Garcia Cardiel 2015: 198, note 514; Ate. XII, 25). This provides one more piece of evidence for the potential of Iberian textile production to reach beyond the domestic realm and, in some cases, become an important commercial item. A workshop for linen production was found at Coll del Moro in Gandesa, dated to 250-200 BC. Its 107 loom wights and imprint of a vertical loom imply the existence of a possibly supra-domestic work structure, which would require specialization (Rafel *et al*. 1994: 134; Rafel 2007: 118).

The presence of objects related to textile activities also raises important questions about recent interpretations of their symbolic significance as votive elements in the foundation rituals of certain domestic spaces. An example of this is the site of El Puig d'Alcoi (Grau *et al*. 2015: 67-84), where rituals carried out in what is known as Space 7000 involved the deposition of three ovicaprids, a falcata-shaped knife, loom weights and the remains of a perinatal

individual. The finds have led archaeologists to propose the existence of foundation ritual reflecting both the internal importance of textile activities for groups, and the unique mastery of this particular craft, over the craftspeople of other settlements, by members of one specific group.

Images of women weaving or spinning are widespread in the Mediterranean, especially among aristocratic groups. Thread making and cloth production were important domestic tasks. Iberian iconographic representations, especially stone funerary images, but also painted ceramics, also illustrate the ideas of aristocratic women devoted to textile activities. As we have presented, textile production was of great importance in the domestic economic sphere. The need and demand for this type of product related to everything from personal use as garments to other economic activities and their likely role in pacts, gifts, presents, certain civic ceremonies, exchange of goods, etc. Spinning and weaving required good lighting, so vertical looms were probably transported to better-lit areas, such as yards or the entries to dwellings. We have already mentioned how, in certain occasions, domestic production extended beyond the domestic sphere, becoming a commercially-oriented and specialized activity. In fact, Iberian women's cloth-making skills have also been highlighted by many ancient written texts. Ephorus of Cyme underlined the importance of these activities by noting that every year Iberian women made public displays of the cloths they had woven and an appointed group of men would evaluate these by vote, and honour the woman who had worked the hardest (Nicol. Dam. frag. 102, *Fragmenta Historicorum Graecorum*, III, 456). This suggests the importance of yearly public displays of a characteristically domestic type of work.

Iberian women wore multi-layered garments of different colours and shapes, decorated with folds. The raw materials they used – wool and linen – were coloured with natural dying materials, which we can reconstruct mainly through iconographic representations. The famous Dama de Baza is a remarkably well-preserved example of the skilful use of polychromy (Chapa and Izquierdo 2010: 35; Gómez *et al*. 2010: 113) (fig. 1).

Another important source of Iberian iconography is pottery, which provides various representations of women at work. Ceramic pots found at La Serreta (Alcoy, Alicante) (Tortosa Rocamora 2007: 243; Grau *et al*. 2008: 5-29) depict women working on vertical looms, and an interesting fragment found at the Tossal de Sant Miquel de Llíria depicts two women spinning and weaving (Izquierdo and Pérez Ballester 2005: 85-103) (fig. 2).

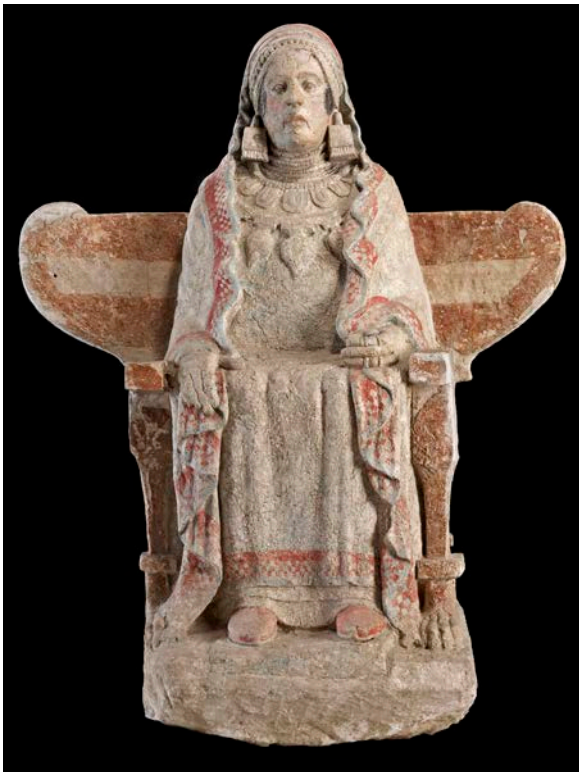

Fig. 1: Dama de Baza (Museo Arqueológico Nacional).

Thus, images in a variety of different media, whether stone or ceramics, reflect the intention of representing certain production activities. As in other Mediterranean contexts, these are closely linked to the female gender. At the same time, certain sculptures or grave goods also project ideas about status and gender, as suggested by the fact that it is women of the aristocracy who chose to represent themselves through these symbols. The sculptures and grave goods also display the level of skill required to carry out certain activities, which only certain women – all of them from highly privileged sectors of society – would possess (Rafel 2007; Gleba 2008; Prados 2016).

THE FUNERARY WORLD

One of the best-known funerary scenes is the so-called Albufereta couple, which is sadly now missing from the Alicante museum (Llobregat 1972: fig. VII). This sculpture is closely linked to the funerary world and has been interpreted as a farewell scene where each character

Fig. 2: Women working on vertical looms: a. La Serreta (Alcoy, Alicante) (Museo Arqueológico de Alcoy); b. Edeta, Tossal de Sant Miquel de Lliria (Museo de Prehistoria de Valencia).

Fig. 3: Albufereta (Alicante), a funerary couple (MARC).

is carrying elements suited to their gender roles and status: weapons for the man, textile tools for the woman (Guerin 2005: 2) (fig. 3).

Many Iberian female burials contain elements related to textile activities, such as spindle whorls, loom weights, or small perforated tablets, as in the case of tomb 200 at El Cigarralejo (Cuadrado 1987; Rafel 2007; García Luque and Rísquez 2008). Their frequent recurrence in female burials also marks the gender-symbolic value attached to these tools of textile activity. As we will present below, these objects were also present at sanctuaries, where they were deposited as offerings to a female divinity. Other equally remarkable finds include shears, such as those found in tomb 161 at El Cigarralejo, and a skin-tanning scraper (Cuadrado 1987), similar to those documented at several Italic sites (Gleba 2008a: 123). Their presence at these sites could either indicate the trade of the person buried there or could be symbolic of local sheep owners.

Conversely, one of the precautions to be taken when analyzing the connection between textile production and funerary contexts is the need to avoid direct identifications between funerary grave goods and gender. Although direct associations of weapons with male individuals and spindle whorls with female individuals usually tend to match, there are also exceptions. The most representative and significant example is the one found inside Tomb 155 at the Baza necropolis in Granada (Presedo 1973; 1982), the original context of the Dama de Baza (the Baza Lady) mentioned above (fig. 1). This is a funerary context with the greatest number of panoplies in Iberian culture found to date. Despite being a female burial, as attested by analyses of the bone remains (Díaz-Andreu and Tortosa 1998; Chapa and Izquierdo 2010; Trancho and Robledo 2010; Prados 2010; 2016; Quesada 2010; 2012), no objects related to the world of textile production were deposited

as grave goods. The textile world is still clearly present at this burial, although not in the form of the tools – spindle whorls, loom weights, etc. – but through the female sculpture's dress, which in itself is a funerary urn, and, in our view, through the decoration of some ceramic vases among her grave goods, which seem to imitate textile motifs, at the expense of imported – e.g. Greek – pottery.

Thus, as Gleba (2008) has noted with respect to the various necropoleis on the Italian Peninsula, the highly elaborate hems of certain cloth materials were a tribute to the great skill of those who had made them. Not only were such skills restricted to women of the elite, but, at the same time, by being buried wearing such garments women indicated both their gender identity and their belonging to these elites. On the other hand, it is highly likely that such elaborate garments suggest the existence of grades within the different categories of women involved in textile activities. These would range from those women – possibly including children – in charge of more basic tasks to more specialised responsibilities, probably undertaken by women of higher status and of a certain age – who were capable of working at a level of technical skill only attainable by a small minority. We should also contemplate the possibility, put forth by Masvidal *et al*. (2000), that the productive needs of Iberian culture in its most developed phases may have required the growth of certain activities, including textile work. Thus, the often-recorded coupling of luxury ware and textile elements within these communities would reflect the importance of textile activities within them, as has been documented in the *distinctive rooms* mentioned above (Grau *et al*. 2008; 2015).

The presence of spindle whorls in male burials – although in many examples there is no conclusive osteological analysis – has been explained in a number of different ways, from suggestions that they might have been offerings made by female members of the families of the deceased, to assertions that individuals buried there might have been textile traders or the owners of textile workshops (Cabrera and Griñó 1986: 194, note 3). The possibility has even been contemplated that these spindle whorls might have been used as closing devices for no longer preserved bags of clothing. In any case, it seems evident that since a large proportion of textile tools and their components were made of organic materials, it would be difficult, except in rare cases, to record such components as spindle whorls, loom weights, thread tensioners and, in some cases, punches. As for wool combs, they would probably be made of wood or bone.

Still, to fully tackle the topic of textile-related finds in Iberian contexts, we must mention the necropolis of El Cigarralejo, excavated by Cuadrado (1987) in Mula (Murcia). As already noted, one of the most interesting burials at this necropolis is Tomb 200. Although a lengthier interpretation of this complex topic lies beyond the scope of this article, this tomb seems to contain a rich set of instruments linked to the textile world, including 56 spindle whorls, four or five tablets and two loom thread tensioners. This burial site also yielded a carved piece of boxwood which Cuadrado (1987) interpreted as a turned wooden leg, whereas Alfaro (1984:77) states that this and other pieces of wood could have been thread reels, as is also supported by Rafel (2007: 127). Finally, based on their similarity to Roman spindles, Rísquez and García Luque (2008: fig. 2) proposed that these objects could also be the remains of spindles.

Another remarkable aspect of this burial is the existence of small loom pieces whose size would, in Alfaro's (1984: 89) view, require that the user should necessarily be an expert. We must also mention the presence of large bone needles, some of which could have been used as awls (Rísquez and García Luque 2007: 159). Another remarkable aspect of Tomb 200 is the presence of cloth remains – linen and wool – preserved through charring in the funeral pyre, indicating the existence of fabrics of varying degrees of thickness and different qualities.

For all the reasons stated above, the textile work at this site cannot possibly be reduced to a single element symbolised by a spindle whorl. On the contrary, we would like to highlight the way in which specialized textile production becomes a symbol of both high status and the highly-skilled work deployed in cloth making. Similarly, the presence of loom weights may also be connected to the commercialisation of these materials. In this sense, Rísquez and García Luque (2007) emphasise a highly interesting aspect, already suggested by Cuadrado (1987) – the possibility that a truly great number of the articulated bone-pieces, knucklebones, found among grave goods (some 300), could reflect a specific form of accounting for textile activities (Rísquez and García Luque 2007: 162). In our own view the presence of these bone pieces allows other interpretations with closer links to the technical aspects of cloth making. These could have been used as reels for thread storage, as separators – markers – for different types of threads, or even as an auxiliary element to spindles to prevent them from unreeling during spinning. The latter function seems confirmed at the

Roman necropolis of Almenara de Adaja (Valladolid), where a perforated piece of bone was found which perfectly fitted the spindle present in the same grave (García Merino and Sánchez Simón 2011: 239-255). Whether or not one accepts this particular interpretation, these remains emphasise the productive importance of textile activities along with aspects such as gender, status and possibly age.

In turn, studies about Pre-Roman textile production in the Italian Peninsula carried out by Gleba (2008; 2009) highlight that the symbolic importance of some textile tools present in graves becomes manifest when these are made in precious materials. When spindles or spindle whorls are made of ivory or amber, loss of these tools' practical qualities would render their symbolic character even more prominent. Since spindles and spindle whorls are the most visible textile tools and can be easily transported, they would have eventually come to make these activities visible, as well as the women in charge of them.

PLACES OF WORSHIP

A detailed analysis of the various spaces that could be considered sacred in the Iberian world – a complex issue which also raises questions about the regional and chronological spectrum of such sacred spaces – lies beyond the scope of this article. In this brief review about the ritual character of textile production we will only mention the presence of some of the more typical textile tools – spindle whorls, loom weights, and needles – at several worship places, such as votive wells, sanctuary caves, territorial sanctuaries, etc. We will also consider the presence of different types of *fibulae* – sometimes in truly striking numbers – which are undoubtedly to be considered in relation to the offerings of articles of clothing at sanctuaries on the occasion of certain festivities.

If there is something clearly distinguishable about the iconographic representations of the various *ex-voto* figurines – whether made in stone, terracotta or bronze – it is the importance of clothing for the followers who were present at the sanctuaries. A strict dress code appears to emerge, which the entire community would be familiar with and willing to replicate, also with respect to haircuts, gestures, etc. An entire body language was used, which would contribute to constructing and defining gender, age and social status.

An important aspect regarding textile tools at places of worship is the age of the excavations that yielded them. This makes it hard to tell, for example, whether spindle whorls and loom weights were found together or not – possibly indicating the *in situ* production of these articles of clothing – or whether other objects such as plaques, thread tensioners, spindles, spindle whorls, etc. – were recorded too, which might indicate the development of specialised textile activities at the sanctuary. Those present at the first (early 20th century) stages of the excavation of Collado de los Jardines (Santa Elena, Jaén) describe up to 50 spindle whorls. However, the proportion of these finds in comparison with the rest of the offerings is difficult to determine, as the early archaeologists were likely to have overlooked them, in their greater concern to find more valued objects such as bronze votive figurines and better-preserved pieces (Calvo and Cabré 1918). Similarly, it is reasonable to assume that needles, spindles, spindle whorls, etc. might have been found on site but were neglected in the inventories and records written up to the first quarter of the 20th century (Calvo and Cabré 1918-1919; Casañas and Del Nido 1959).

Also remarkable is the presence of spindle whorl and *fibula* offerings at various sanctuary caves in the Spanish Mediterranean area. The cave at Cerro Hueco, Valencia, has yielded a truly remarkable number of spindle whorls (González-Alcalde 2002-2003: fig. 6). The cave Cueva de la Nariz, Moratalla (Murcia), is also yielding interesting results (Alfaro and Ocharán 2014: 35-53), which we will review below.

We would also like to mention the votive well at El Amarejo which, according to archaeologists in charge of the excavation, was active between the late fourth and third centuries BC (Broncano 1989). It should be noted that other authors, such as Uroz Rodríguez, date it a century later in the final stages of the settlement's history. Among other finds, the well has yielded numerous materials related to textile activities, including four loom weights, 14 spindle whorls, 25 sewing needles, four punches, various remains of string and 17 fragments of fibre materials, such as esparto grass and wool. A comb and a wooden spindle whorl were also found (Broncano 1989: 63).

The votive deposit of Libisosa (Lezuza, Albacete) was in proximity to the El Almarejo site and its rich materials deserve due attention. This very deep trench – possibly a water well originally – was later used for votive offering deposition. Excavated and dated to the last third

of the first century BC (Uroz Rodríguez 2012: 442), the votive deposit yielded, among other objects, several needles, loom weights, and spindle whorls. The team in charge of the excavation have proposed that the latter might have been used to close bags, a hypothesis we do not share. Finds at this site also included remains of a bone needle and various ankle-bone fragments. Finally, an *oinochoe* has been found, with a depiction of a small female figure emerging among birds holding a spindle (Uroz Rodríguez 2012: 325; Uroz Rodríguez and Uroz Sáez 2016).

The sanctuary at the cave of La Lobera, in Castellar (Jaén), yielded needles, which, in combination with the great number of votive bronze figurines, could indicate greater female devotion for the – possibly female – divinity represented there (Nicolini *et al*. 2004; Prados 2007; 2014; Rueda 2013). One of the most remarkable results of the excavations carried out by Nicolini and the team from the University of Jaén at this site is the presence of pins and many *fibulae* (Nicolini *et al*. 2004). While most of these *fibulae* are ring-shaped, there are also some La Téne types. Both Lantier (1917) and Calvo and Cabré (1917-1918) had already described great numbers of *fibulae* of this type from this sanctuary at the start of the last century. The team excavating in the last years of the 20th century, on the other hand, highlighted that all the *fibulae* they had found were small and, in many cases, could even be considered miniatures – being less than 30 mm in diameter (Nicolini *et al*. 2004).

Finally, we will analyse some *ex-voto* from the most prominent Iberian sanctuaries in detail. A well-known example are the stone figurines from the Cerro de los Santos site in Albacete where both male and, especially, female figures wear mantles, veils, tunics, skirts, shoes, hairpieces and jewellery in an attempt to affirm their status (Chapa 1984; Ruano 1987; Ruiz Bremón 1989; Brotons *et al*. 1998; Sánchez Gómez 2002; García Cardiel 2015) (fig. 4).

As mentioned above, the body language of bronze *ex-voto* figurines is highly expressive, as shown by their appearance at different rituals, or at different points in the course of these. Both male and female figures appear in dress or nude. The males are often depicted bearing weapons and are often shown nude, while female figures sometimes wear a belt. The *ex-voto* figurines which are represented in dress wear specific clothes which could possibly indicate their participation in different rites of passage or coming-of-age ceremonies, possibly prior to marriage. Such could be the case with votive figurines of young women wearing a long, narrow-waisted tunic and other symbols of age such as braided hair. Other women who have already been through the ritual offer their own images as women covered with a certain type of veil (Nicolini 1968; 1969; Prados 1992; 1997; 2018; Rueda 2011; 2013; 2015; 2018). Similarly, those offerers who place *ex-voto* figurines of babies wrapped up in sheets, bundled up for divinities to protect them – as happens in other Mediterranean sanctuaries – also show the importance of textiles (Prados 2013). However, gender and status – as expressed through dress and personal adornment – are also made manifest through a wide range of textile materials, as we have seen for funerary sculptures or the various textile items preserved at the necropolis at El Cigarralejo. These materials include mantles and tunics made in wool, but also very fine – almost transparent – pieces in linen, possibly used for veils and certain types of tunics, as appears to be the case in the sanctuaries of

Fig. 4: Stone *ex-voto*, Cerro de los Santos (Albacete) (MAN).

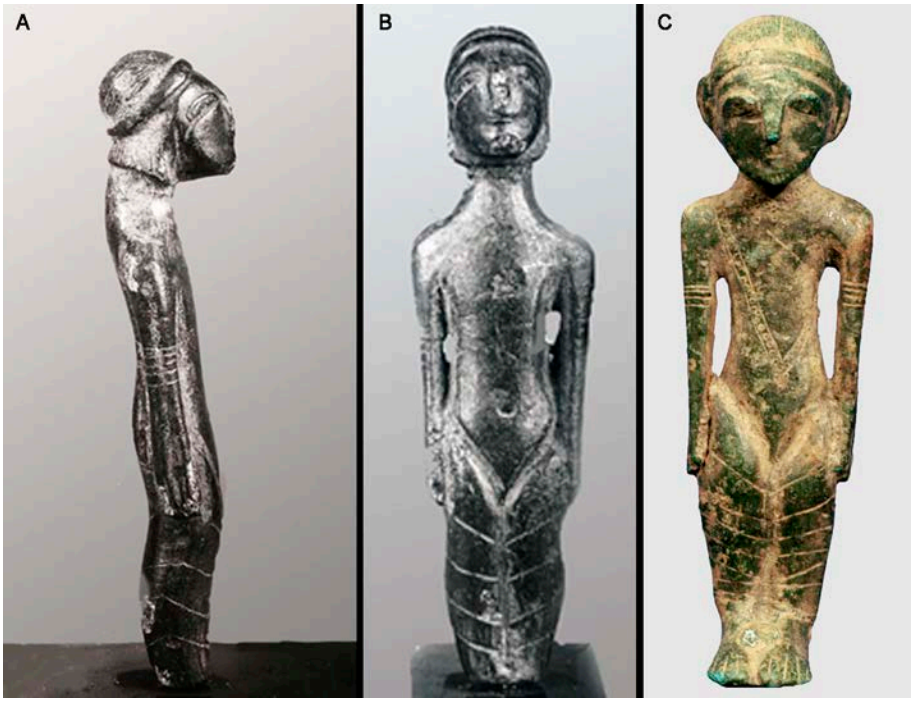

Fig. 5: Bronze figurines wearing fine tunics, Jaén (Archive Nicolini).

Fig. 6: Bronze figurine, Collado de los Jardines (Santa Elena, Jaén): a. female; b. male (MAN).

Collado de los Jardines and Castellar, in Jaén, where both male and female votive figurines are wearing such fine tunics that they outline the figures' nipples and belly-buttons (fig. 5a-c). These tunics were probably ordered to be made specially for certain festivities, and are likely to have been subjected to precise rules, both with regards to dress and attitude and to hairstyle, as some male *ex-voto* votive figurines wearing these clothes have shaved hair. Some of these tunics also show decorated hems which would require extreme textile skill on the part of those in charge of making them. In any case, the presence of this type of textile material would mean that both those wearing them and those making them would show their prestige through these public displays of textile production (fig. 6). The same type of decorated hem is also present in various textiles and garments, worn by both men and women, as shown by the short kilt-like *shendyt* worn by some votive figurines representing men (fig. 6). We have already mentioned that the fact that offerers presented themselves nude or in dress would probably be prescribed and depend on ritual regulations, as can be seen in a number of different examples of votive figurines. In fact, when either men or women appear dressed they are wearing different types of garments: short tunics and *shendyts*, covered or not in different *sagum*-type clothes, fine linen tunics, long tunics sometimes covered in veils, etc.

Some of the most characteristic clothes, especially those of warriors, can be most clearly appreciated in the stone sculptures represented by individual funerary

sculptures, and especially through the great stone monuments from Pozo Moro, Albacete (Almagro-Gorbea 1983; López Pardo 2006), Cerrillo Blanco, Porcuna (Navarrete 1987; Negueruela 1990; Ruiz and Molinos 2015), and El Pajarillo, Huelma (Molinos *et al*. 1998; 2015), the last two in the province of Jaén. Social organisation would probably condition these monuments to be arranged in such a way that their presence at the sanctuaries sanctioned each communities' regulations – as attested through the depositing of *ex-voto* figurines (Prados 2014). In this sense, it is highly likely that the significant numbers of *fibulae* at sanctuaries could indicate offerings made to this end by either individual women or groups of women, as in other Mediterranean contexts. As well as displaying their delicate work, these women thus highlighted the importance of textile production and possibly different levels of social participation in community rituals (Prados 2016; 2018).

Finally, we would also like to mention the presence of bronze *ex-voto* figurines found wrapped in cloth, for example at the sanctuaries of la Cueva de la Nariz (Alfaro and Ocharán 2014) and at La Luz (Comino 2016; Tortosa and Comino 2018).

FINAL REFLECTIONS

To summarise, we would like to highlight that Iberian culture presents textile-related tools in habitation contexts, in necropoleis and in sanctuaries. Although we lack sufficient data from habitation contexts to fully explain the connection between textile production and the cult of domestic entities, or to any specific divinities that might protect this activity, the presence of textile materials at so-called *distinctive buildings* has to be noted – perhaps as offerings as part of foundation rituals. Also, the proportion of objects deposited as part of female grave goods is evidently greater than their presence at sanctuaries, as is also the case in other Mediterranean Iron-Age contexts. On the other hand, we should not lose sight of problems of preservation, both with respect to the funerary ritual of cremation and concerning the very dynamics of excavation. These processes may have caused data loss from the archaeological record, either because tools are made with organic raw materials – especially wood and bone – or because their small size, as in the case of needles, may have caused them to be overlooked in recording. Few remains of textile materials are present in either sanctuaries or burials. Among the examples preserved, Tomb 200 at El Cigarralejo (Mula, Murcia) is remarkable for both the quantity and variety of its textile tools. Both elements would encourage us to suggest a visible desire to perpetuate the importance of the person buried through the funerary ritual. However, most Iberian necropoleis only feature spindle whorls or the occasional loom weight as part of the grave goods assemblage, primarily found in female burials – although these have also been occasionally recorded in male burials. It is also quite clear that textile tools deposited in burials are broadly connected to the symbolic character of gender construction but also, in some cases, with a fundamental display of a woman's status, both on the part of the rich person occupying the burial, and on that of the skilled maker of textile materials. Such technical craft skills were far beyond the reach of most women and were only possessed by those in the highest social sectors. Similarly, the appearance of tablets and thread tensioners indicates the high quality of some garments, which were comparable to those made elsewhere in the Mediterranean. Such borders can be observed in extraordinary funeral sculptures such as the Dama de Baza, or some stone and bronze votive figurines.

In some cases, similar to finding women buried with weapons – as is the case with the Dama de Baza – spindle whorls may occur at male burials. This makes it difficult to tell whether their symbolic character is lost, or if the construction of their gender is somewhat blurred. The finds could also indicate that the individuals buried there were textile traders; or could constitute an offering on the part of a female member of the buried person's family. These objects could even point to the possibility that spindle whorls might have been used as clasps for bags made of clothing containing food, flowers, etc.

Regarding their importance as offerings at sanctuaries, we believe that their scarce presence in older excavations may have been due to their durability and size – wool combs for example could have been made of wood or bone and thus did not survive, while other small tools, such as needles, may not have been recorded as systematically as the more artistically valuable objects, such as the *ex-voto* figurines. Neither spindle whorls nor loom weights are often recorded in groups, which precludes the possibility of looms being present at sanctuaries to make clothes for the divinity, as might be suggested by the significant quantities of *fibulae* recorded at them.

Some of the higher-quality garments, which some votive figurines appear to be wearing, may have been deposited as offerings at these sacred spaces. The use of objects linked to textile production in rites of passage and coming-of-age rituals should also be taken into consideration. Rather than marking the fact that someone might have reached an adequate age to spin or weave – a task that young girls were probably taught with the guidance of an older woman – these rituals may have marked an aristocratic women's role in maintenance activities. These items could therefore symbolise age and status, both within the family group and the community. Thus, the presence of textile tools and the iconographic representation of high-quality garments in Iberian culture burials and sanctuaries reveal the economic and symbolic importance of textile activities, both in the construction of gender and in defining status and social prestige.

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Spinning the World: A Final Comment

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Abstract:

The paper provides a short discussion on textile archaeology, including historiographical notes and the explanation of the latest textile tools' methodology, and charts new research venues for the study of textile production in Portugal and Spain. The numerous and varied research themes within textile archaeology should make archaeologists rethink the central role of textiles in the ancient Mediterranean, and the wide range of new perspectives that their analysis can bring to the study of cultural, socioeconomic, and political aspects of ancient societies in Portugal and Spain.

Key words: *Textile Archaeology, Textile Tool Methodology, Socioeconomic Aspects, Creativity.*

Resumen:

Este artículo ofrece una breve discusión sobre la arqueología del tejido, incluyendo notas historiográficas y la explicación de la última metodología en el estudio de herramientas textiles, así como expone nuevas vías de investigación para el estudio de la producción textil en Portugal y España. Los numerosos y variados temas de investigación dentro de la arqueología del tejido deberían inspirar una reconsideración del papel central que tuvieron los tejidos en el antiguo Mediterráneo, y la amplia gama de nuevas perspectivas que su análisis puede aportar al estudio de los aspectos culturales, socioeconómicos y políticos de las sociedades antiguas en Portugal y España.

Palabras clave: *Arqueología del Tejido, Metodología de Útiles Textiles, Aspectos Socioeconómicos, Creatividad.*

INTRODUCTION

The publication of Carmen Alfaro's *Tejido y cestería en la Península Ibérica. Historia de su técnica e industrias desde la Prehistoria hasta la Romanización* in 1984 marked the beginning of a field of expertise that was, however, not fully explored by archaeologists until recently. In fact, it was only in the 2000s that scholars got more interested in textiles and therefore new projects opened new windows into textile research (see Alfaro in this volume, and Gleba in this volume), both from archaeological perspectives and, more recently, from historical ones looking at clothing as material culture (e.g. Riello and Parthasarathi 2009; Rublack 2010; Welch 2017; Hanß 2019).

Still, compared to the numerous publications in the field of textile archaeology in Europe (Gleba 2008; Gleba and Pásztókai-Szeöke 2013; Andersson Strand and Nosch 2015; Grömer 2016; Brøns and Nosch 2017), and in the US (Brumfiel 1991; Asturias de Barrios and García 1992; Arnold *et al*. 2007; Halperin 2011; Dransart *et al*. 2012; Costin 2013), textile research in Portugal and Spain remains quite unmapped. The collection of papers gathered in this volume demonstrates, however, the potential of textile archaeology in the Late Bronze – Early Iron Age Iberia. This volume encompasses both new and not-so-new case studies and facilitates access for the researchers interested in Bronze and Iron Age textiles in Iberia to the latest evidence from different regions – Extremadura, Andalusia, Alicante, Balearic Islands, Madrid-Toledo. It is also accessible to an English audience, which was one of our major goals since most articles on textiles from Iberia are written mostly in Spanish (Alfaro *et al*. 2004; Alfaro and Karali 2008; Alfaro *et al*. 2011; Vilches Suárez 2015; Gomes 2017).

Carmen Alfaro (in this volume) has already pointed out some of the contributions' highlights and Margarita Gleba (in this volume) has focused on the scientific methodology of textile analysis and textile *chaîne opératoire*, so I will focus here instead on the potential future research on textiles in Spain and Portugal. The aim is charting new research perspectives that would contribute to the study of past societies and enormously enrich our understanding of Bronze and Iron Age societies in this cross-cultural region between the Atlantic Ocean and the Mediterranean Sea.

TEXTILE ARCHAEOLOGY

The study of metals, lithics, and pottery from archaeometric perspectives is well developed in Portugal and Spain (e.g. Capel Martínez 1999; García Rosselló and Calvo Trias 2013; Pereira *et al*. 2017; Armada *et al*. 2019). However, the scientific methodology for the analysis of archaeological textiles and tools is still largely disregarded, despite the vast literature on the topic (Barber 1991; Emery 1994; Gleba 2008; Andersson Strand and Nosch 2015; Grömer 2016). Usually associated with women and domestic activities, the study of textiles has been traditionally neglected by a predominantly male scholarship (Harlow and Nosch 2014: 3, 11; Brøns 2017: 11; Marín-Aguilera 2019: 230-231). Even today, most textile researchers are women (e.g. Arnold *et al*. 2007; Rublack 2010; Gleba and Pásztókai-Szeöke 2013; Peck 2013; Brøns and Nosch 2017).

Fig. 1: 19th-century Mapuche spindle from the Museo de Historia Natural de Concepción, Chile (Author).

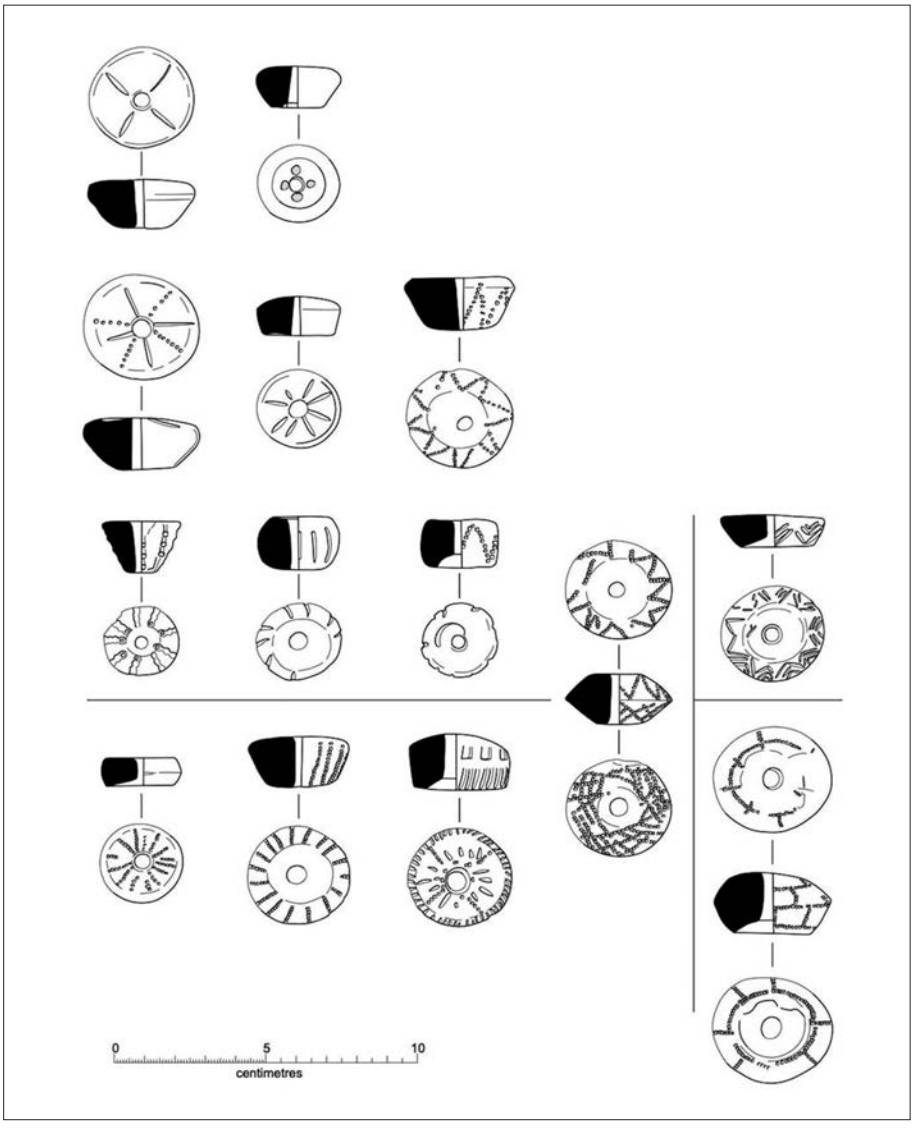

Fig. 2: Spindle whorls from Cancho Roano with incised decoration (Image: Vicki Herring, after Berrocal 2003: 236, fig. 9).

Textiles and textile technologies are known even before societies started to produce ceramic and metals (Harlow and Nosch 2014: 3), and they have been a basic need from the Neolithic onwards in Europe and many other world regions (Barber 1991; Kriger 2006; Riello and Parthasarathi 2009). Yet, to identify different chronologies we use stone technology (Palaeolithic and Neolithic), metals (Bronze and Iron Ages), 'in-betweeners' (Chalcolithic), pottery (Pre-ceramic and Ceramic period), writing (Prehistory, Protohistory, and History), colonialism (Prehispanic/Precolumbian vs. Hispanic/Colonial period), and Eurocentric approaches (Formative/Pre-Classic, Classic and Postclassic periods in Mexico and Central America, analogous to those of the 'Classical civilisations' in Europe). Textile technologies have never been thought as chronological markers, even though many of them are clearly associated with particular historical periods and regions (Pacey 1991; Petersen and Wolford 2000; Riello and Parthasarathi 2009; Dransart *et al*. 2012; Marín-Aguilera *et al*. 2018; González Vergara 2019).

Beyond chronological indicators, Bronze and Iron Age textile technologies are far from rudimentary. In fact, textile technology has barely changed since its conception (Albers 2017: 4-5). Since weaving needs a minimum of equipment but is time-consuming, innovations

Fig. 3: Spindle whorls (above) and loom weights (below) from El Turuñuelo de Guareña (Image: Esther Rodríguez González, as published in Marín-Aguilera *et al*. 2019).

have mostly accelerated the weaving process by developing time-saving devices, but have not changed the basic principle of weaving (Albers 2017: 1).

There are different ways of preparing the thread (see Gleba in this volume) as well as different looms identified for the Bronze and Iron Ages in the Mediterranean and, more generally, in Europe (Alfaro 1984; Barber 1991; Gleba 2008; Grömer 2016). For spinning, the most common archaeological objects are spindles (fig. 1) – a straight rod, designed to twist and spin fibre into yarn, and whorl or flywheel – small object fastened near the bottom or near the upper end of the spindle, used to increase and maintain the speed of the spin (fig. 2). For weaving, the usual finds in archaeological sites are loom weights, associated with the warp-weighted loom (fig. 3); but there are other types of looms used in the Bronze and Iron Ages that do not need weights and, therefore, are more difficult to identity in the archaeological record (fig. 4).

Spindles are usually made of wood or bone and are rarely preserved in the archaeological record of Spain and Portugal, whereas spindle whorls can be made of wood, bone, metal, coral, stone or clay – the last two materials survive better archaeologically. Loom weights are usually made of stone or clay; in the latter case, if the loom weight was not fired, it might be more difficult to recover archaeologically. Thus, as the traditional aphorism reads, *absence of evidence is not evidence of absence*: the fact that we do not find archaeological evidence for spindle whorls or loom weights does not mean that they did not exist or that they were not used. Similarly, the fact that we do not find loom weights does not necessarily mean that people were not weaving, as they could have used another type of loom (e.g. horizontal ground loom or the vertical two-beam loom).

Looms are likewise rarely preserved archaeologically, for they are made of (perishable) wood and easily portable. Even in the 19th century, the accommodation of a loom necessitated only a tiny transformation within a room or the seasonal conversion of a house area into a textile workshop when there were no agricultural tasks (Mohanty 2006: 107-115; Nevell 2008). These arrangements leave unfortunately few archaeological traces, making it very difficult to identify textile production areas and indeed looms. The evidence of loom weights points to the existence of a warp-weighted loom; but unless the loom was not destroyed *in situ*, i.e. leaving loom weights roughly in place, it is difficult to identify its specific location (Barber 1991: 102). In fact, without this evidence, it is not possible to know how many looms existed or were being used contemporaneously on site. Further, loom weights could be stored and thus not in use, or could have fallen from the upper floor where they were either in use or in storage.

TEXTILE TOOL METHODOLOGY

Spindle whorls are used by archaeologists to determine the thickness of the thread spun. The weight, diameter, and shape of the whorls are the most important parameters for calculating the type of yarn. They are used to estimate the diameter of the thread as well as the moment of inertia and rotational speed – and thus approximate

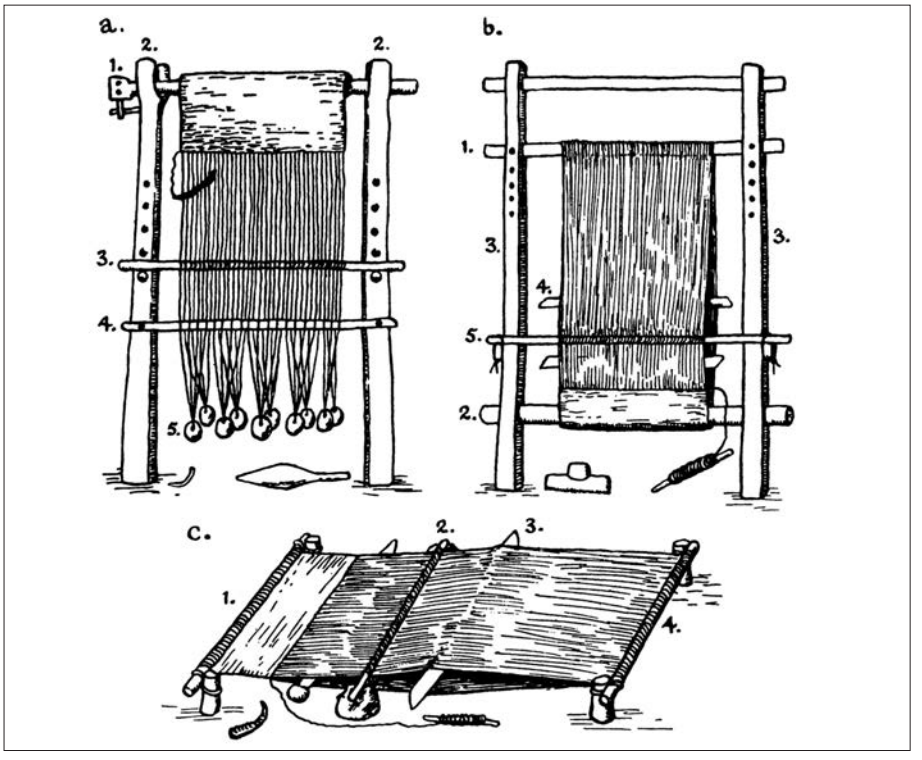

Fig. 4: Types of looms in the Mediterranean Bronze and Iron Ages – warp-weighted loom, two beam, and ground floor (after Crowfoot 1937: 37, fig. 1).

spinning time (Grömer 2005; 2016: 86-87; Martial and Médard 2007; Mårtensson *et al*. 2009; Chmielewski and Gardyński 2010).

Smaller whorls cause more and faster rotation, whereas larger spindle whorls give the spinner more time to feed the yarn onto the spindle and facilitate better control over the technique. Small and light spindle whorls are thus not the evidence of infants' learning how to spin thread, but rather indicate the existence of highly skilled spinners (Baitzel and Goldstein 2018), and most likely the use of the supported technique that allows a greater control over the quality of the thread (Grömer 2005; Ibarra *et al*. 2018).

The fibre used will define the more suitable spindle whorl to use. Experiments have shown that smaller whorls work better for shorter fibres, such as cotton but also wool, and the resulting thread would be finer – the tiny moulded and burnished whorls at Cancho Roano are a great example here (Marín-Aguilera 2019: 239). Spindle whorls weighing around 20-35 g are more suitable for spinning flax, whose fibres are longer and with more overlap, longer wool staple or for plying (Grömer 2016: 88-89). The latter was the case, for instance, for the whorls found at La Mata (Marín-Aguilera 2019: 237).

Archaeological experiments have produced insightful information regarding the functional properties of loom weights (Cutler *et al*. 2013; Andersson Strand and Nosch 2015). For optimal weaving, between 5 and 50 warp threads should be attached to each loom weight (Mårtensson *et al*. 2009: 392; L. Hammarlund, personal communication, June 11, 2018). The thread diameter determines the necessary tension on the loom, but the degree of twist and fibre quality also play a crucial role (Andersson Strand 2010: 18; Grömer 2016: 112). Thick and thin threads usually need different tension in the loom, which is obtained by using lighter or heavier weights and/or by varying the number of threads per loom weight. This is important, because if the weaver attaches heavy loom weights to very thin thread, the latter will most likely break.

The shape and thickness of the loom weight is also a significant factor, for it would determine a higher or lower density of warp threads, as well as the loom set-up, e.g. loom weights hanging more or less closely together (Mårtensson *et al*. 2009). Depending on this, the fabric would be denser or looser in its composition, and this affects its visual and physical properties, e.g. a denser fabric would protect better from the cold.

The type of weaving technique is likewise an important factor when estimating the results of the calculations. A plain weave or tabby (*tafetán* in Spanish) is a basic weaving technique in which one warp thread passes over and under a single weft thread forming a simple criss-cross pattern. In a 2/2 twill weave (*sarga* in Spanish) each warp thread passes over two weft threads, then under two, making a diagonal pattern, e.g. chevron, diamond, etc. Tabbies are known as early as the Neolithic and have been documented in the Chalcolithic of Iberia at Los Millares (see Gleba in this volume; Jover Maestre *et al*. in this volume), and twills have been attested at Casas del Turuñuelo for the first time in the Iberian Peninsula (Marín-Aguilera *et al*. 2019).

The weaving technique affects the number of loom weights for the loom set-up. The number of loom weights will vary depending on the size of the textile the weaver wants to make, as well as on the technique (s)he will use for making it. In a warp-weighted loom, a square metre of 2/2 twill can be made by using either two or four rows of loom weights, the latter requiring double the number of loom weights, and consequently more metres of yarn; whilst a square metre of tabby would require two rows and the same number of loom weights as a two-rows made 2/2 twill (see Marín-Aguilera 2019; Marín-Aguilera *et al*. 2019). The number of loom weights is therefore never indicative of the number of looms in a given site, but might be indicative of household or workshop production. At Poggio Civitate in Italy, archaeologists have found more than 1,000 textile implements, identifying a workshop on site (Gleba 2007; Cutler *et al*. 2020); and the same is the case for Gordion in Turkey (Burke 2005). The workshop excavated at Coll del Moro is the first (and only one until now) evidencing flax processing (Rafel i Fontanals *et al*. 1994), yet the 107 loom weights recovered are not enough to identify a textile workshop.

Mathematical calculations form thus the core of textile technologies (Brezine 2009; Andersson Strand and Nosch 2015; Albers 2017), but the type of selected fibre is also crucial, as it would determine the type of spindle whorl used, as well as the warp tension and therefore the number of loom weights and the ratio of threads/loom weight on the loom (Grömer 2016; Marín-Aguilera *et al*. 2019; Cutler *et al*. 2020). Fibre assumptions have been proven wrong in many occasions, as many fibres are very similar and only SEM analysis can discriminate between them. For instance, Viking fine cloth was traditionally thought to be made out of flax, but a recent study has demonstrated that fine textiles were also made of hemp (Skoglund *et al*. 2013).

To conclude, it is very important to study the technical specifications of textile tools and fibres (and their archaeological evidence/absence) to determine the type of textiles that different groups were manufacturing, as this brief section (with references) has demonstrated.

WHAT TEXTILE ARCHAEOLOGY CAN TELL US

From raw materials to product, the study of textiles contributes to a more comprehensive understanding of different societal and economic aspects. An encompassed approach to the study of textiles has recently showed the development of different Mediterranean textile cultures by looking at specific spinning and weaving techniques (Gleba 2017; Gleba *et al*. 2018), and the range of textile products and possibilities by functionally analysing textile tools (Cutler *et al*. 2013; 2020; Luberto and Meo 2017; Marín-Aguilera 2019; Marín-Aguilera *et al*. 2019).

Evidence of the use of plant fibres for baskets, shoes, cords, and textiles is well-known in the Iberian Peninsula (Gleba in this volume; Jover Maestre *et al*. in this volume); less so are animal fibres (but see Alfaro and Ocharán 2014; Marín-Aguilera *et al*. 2019). Yet, archaeobotany, and especially zooarchaeology, can provide insightful data on textile raw materials and thus on mobility, different livestock and land strategies that would further enrich our knowledge of ancient Mediterranean societies.

Sheep bone analysis indicates whether animals were kept for wool or meat (see Estaca-Gómez in this volume; Estaca-Gómez *et al*. in this volume), as well as transhumance (Heitz 2015; Valenzuela-Lamas *et al*. 2016). Sheep management and mobility have recently been identified by using isotopic analysis ($^{87}Sr/^{86}Sr$, $\delta^{18}O$, $\delta^{13}C$, and $\delta^{15}N$) in central Italy. This study has demonstrated divergent livestock strategies among Etruscan sites, and the association of urban centres with increasing control over their territories and the mobilisation of animal resources, which correlates well with textile production (Trentacoste *et al*. 2020). Understanding different managerial responses to livestock control and agricultural production in Spain and Portugal could help us get a better understanding of the development of

urbanisation in the Iberian period, as well as the impact of the Phoenician, Greek, and Roman colonisation from the ninth century BC onwards.

Mobility of products, communities, and craftspeople is indeed becoming a fashionable topic in Bronze and Iron Age studies. The spread of purple-dyed textiles followed the Phoenician arrival in the central and western Mediterranean (Marín-Aguilera *et al*. 2018; see also García Vargas in this volume); transhumance might have been behind mixed textile practices and cultures in southern Italy (Gleba *et al*. 2018); and the movement of weavers might have brought innovations in textile techniques during the so-called 'Minoanisation' of the Bronze Age Aegean (Cutler 2012), and mobile specialised textile production in the Iron Age (Foxhall 2011; Marín-Aguilera 2019). Using geospatial patterning in carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), and non-exchangeable hydrogen ($\delta^{2}H$) composition of modern and ancient sheep proteins, researchers have recently proved how wool used in medieval Iceland in reality originated in Britain or northern Germany and acquired as traded good via trade networks (von Holstein *et al*. 2016). Provenance analysis of both textiles and sheep bones like the latter one would be extremely valuable for deepening our knowledge on trade routes in the Western Mediterranean Bronze and Iron Ages.

The analysis of faunal remains using biometric comparisons has recently shed light on selective sheep breeding practices in the Roman period, the impact of which can be seen earlier in southern Italy where the increase in size of livestock was concomitant of the Greek colonisation of Magna Graecia (Gaastra 2014). This type of studies, combined with ancient DNA, would be useful to determine whether there were different sheep varieties in Iberia (and the Western Mediterranean for that matter); and more importantly, if communities practised selective breeding aimed at getting diverse fleece qualities. That would point to a highly specialised manufacture of textiles before the arrival of the Romans in the region, and would help us get a clearer picture of sheep exploitation and use (see, for instance, Brandt *et al*. 2011).

Context is everything in archaeology, and a contextual study of textile production has already demonstrated the significance of textiles as ritual offerings in Iberia (see Berrocal-Rangel *et al*.; Rísquez Cuenca *et al*.; Prados and Sánchez Moral in this volume; see also Marín-Aguilera *et al*. 2019; Brøns & Nosch 2017; Vilches Suárez 2015), as well as its symbolism when deposited as grave goods (Gleba 2009; Gomes 2017). A more comprehensive contextual study would shed light on how visual textile production activities were, e.g. wether spinners and weavers were confined to private, almost invisible spaces at home. The evidence of Cancho Roano seems to suggest quite the opposite (Marín-Aguilera 2019: 246). If textile production was still difficult to disentangle from household production in the 18th-19th century even if it was specialised (Li 2009; Tsurumi 1990; Hafter 1995), there is a need to re-open the debate on maintenance activities and craft specialisation in the Bronze and Iron Age Mediterranean.

The archaeology of maintenance activities is well-developed in Spain, particularly in Barcelona, Jaén and Granada, and has greatly contributed to the study of household and gender activities (González Marcén *et al*. 2007; Montón Subías and Sánchez Romero 2008; Sánchez Romero and Cid López 2018). Textile production in the ancient Mediterranean is one of the economic activities traditionally associated with women (see Rafel i Fontanals 2007 for a discussion on the Iberian culture), deeply influenced by the image of Penelope weaving and waiting for the return of Odysseus. Weaving and spinning seem to be indeed identified as female activities in the Iberian world, where there is also iconography (see Prados and Sánchez Moral in this volume), but textile production was carried out also by men in the Near East (Garcia-Ventura 2014). Did the Phoenicians, for instance, have male textile workers? And if they did, how did they adapt that practice to their new colonial settings? How was textile production organised in other Iberian and island regions?

Besides rethinking gender roles in textile production, there are many textile topics traditionally disregarded by scholars whose study would bring insightful perspectives to the study of the Bronze and Iron Ages in Portugal and Spain. I will highlight here only two of them: the manufacture of sails and textile creativity. There is a striking lack of studies (not of evidence) for the production of functional textiles such as sails in the Bronze and Iron Ages in Spain and Portugal, even though the Iberian Peninsula is always interpreted as the cultural crossroads between the Atlantic and the Mediterranean (Celestino Pérez *et al*. 2008), and was colonised by Phoenician, Greek, and Roman seafarers. Indeed, underwater archaeologists have excavated several Phoenician shipwrecks off the coast of Murcia in Spain (Martínez Alcalde *et al*. 2017; see also Gambin

et al. 2018; Pomey and Poveda 2015), some with remains of rigs and cords. Yet, there are no studies to date on sail production – the lack of preserved textiles should not prevent archaeologists to study them, as it does not the interpretation of many other archaeological absences.

Another neglected yet fascinating theme in Bronze and Iron Age Spain and Portugal is craft ingenuity (Bender Jørgensen *et al*. 2018; Romankiewicz 2018). Creativity in textiles served (and continues to do so today) visual and sensory purposes besides the practical ones. In Europe, creativity was boosted especially from the (Late) Bronze Age when most textile tools likely took form and wool was introduced as a fibre (Bender Jørgensen 2018a: 27; 2018b: 69). Spinners and weavers played with textures and the sense of touch, colour, reflections and lighting, glittering, shape and patterns (Fossøy 2018; Grömer 2016; 2018; Rösel-Mautendorfer 2018), including the decoration of their tools (Bergerbrant 2018; Berrocal-Rangel 2003: fig. 9; Gomes 2017: 49). Wool is particularly good for dyeing, and the process of dyeing has been in fact the most explored among archaeologists, especially for the production of shellfish-purple dye upon the arrival of the Phoenicians in Iberia, the Balearics and the Canary Islands (Aleixandre and Pastor 2008; Bernal Casasola *et al*. 2011; Marín-Aguilera *et al*. 2018; Mederos Martín and Escribano Cobo 2015; see also García Vargas in this volume). Nonetheless, mollusc-dye was not the most common one in the ancient Mediterranean, but rather plant dyes, which were easier and 'cheaper' to produce, as explained by Martínez García in this volume. Not surprisingly, shellfish-purple dye was imitated and widely consumed by the masses by the Hellenistic period, making it very difficult to tell the difference between the 'real' purple dye and the plant-based dye (Gleba *et al*. 2017).

CONCLUSION

Textile remains are scarcely preserved in Portugal and Spain, but textile tools are ubiquitous. Yet, textile studies continue to be overlooked by scholars. Future research lines to explore are varied. We need more scientific and methodological analyses to approach the study of Bronze and Iron Age archaeological textiles and tools, their production and consumption; but also, fresh and renewed insights into functionality, context, economic and trade impact, and creativity.

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