Mycenaean Textiles:

Production and Maritime Trade

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Abstract

Extensive archaeological evidence suggests that the Mycenaean textile industry was a primary maritime export for the Mycenaean palaces. Linear B texts notate centrally administered production of textiles, but do not explicitly record the trade or sale of finished products. This paper explores the archaeological evidence associated with the widescale textile manufacture under Mycenaean palace administrations, and the supporting evidence to propose that textiles were produced on a scale which is indicative of a primary export commodity. These locally produced commodities were traded through maritime routes with neighbouring cultures for a range of exotic goods. Mycenaean textiles were composed of organic matter which rarely results in archaeological preservation, so this trade with surrounding cultures is instead mapped through ceramic artefacts, iconographic sources, and evidence of Mycenaean contact from other cultural contexts. Alternative means of textile consumption within the Mycenaean world will be weighed against the evidence for the argument of primary textile production for maritime export. This will support the assertion that the Mycenaean textile economy existed for maritime trade.

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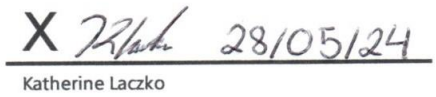
Declaration of Authorship

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text



Katherine Laczko

Dedication

I dedicate this thesis to my parents, who regrettably both passed from fatal heart attacks during the research and writing of this paper. I love you both with my (genetically questionable) heart.

Introduction

Summary

Mycenaean textiles were a central commodity for many of the Mycenaean kingdoms due to the scale of bulk textiles recorded in extant palatial records. Discussions in the field of Mycenaean textiles have focused on the form and creation of these items, but little has been written on the destination for the finished pieces (Andersson Strand & Nosch 2003, Burke 2010, Droβ-Krüpe & Nosch 2016, Rougemont 2014). This thesis seeks to examine the literature focused on the production of these textiles and the destination of finished goods. This will be demonstrated through the evidence of Mycenaean textile manufacture, Bronze Age Aegean trade and analysing maritime trade routes which enabled contact with international buyers.

Thesis Overview

This first chapter addresses the significance of textile archaeology and the ethnographic development of human adaption and utilisation of clothing. It will refer to the evidence of textiles within the archaeological record, and the sources determining our understanding of ancient textile manufacture. The second chapter focuses on the Mycenaean textile industry by addressing surviving primary sources including Linear B Mycenaean textile terminology, and how the written record impacts our understanding of textile creation. The third chapter discusses the size, breadth, and economic significance of Mycenaean palatial complexes and their management of textile manufacture as a predominant trade commodity. After establishing the available evidence of the Mycenaean textile trade, and its relevance to the Mycenaean economy, the fourth chapter will review Mycenaean trade within the Aegean, and how these textiles may have been traded with foreign entities. Evidence for the trade of textiles will be investigated in Chapter Five, as will the possibility of alternative uses for palatially-manufactured textiles outside of trade for equivalently valued goods. The conclusion of this thesis will discuss the gaps in research within the field, and the possibilities of further archaeological discoveries due to the rise in technological advancements, and the remaining holes within the archaeological record.

The Current Discourse within Mycenaean Textile Archaeology

Literature relating to Mycenaean textile manufacture has taken a range of different forms to date: the study of surviving Linear B tablets, the archaeological evidence of textile tools, and the representation of textiles in seals, motifs, and impressions within clay. Emerging study in the field focuses on reverse engineering the scale of this industry by reviewing the surviving extant sources, and using experimental archaeology to calculate the specificities of these finished textiles. Using this evidence, the predominant theory amongst textile archaeologists is that these textiles were created by the Mycenaean kingdoms to be used as a trade commodity for exchange with other cultures, primarily through maritime trade (Barber 2016, Breniquet & Michel 2014, Burke 2010, Droβ-Krüpe & Nosch 2016, Gleba 2014). While this theory is widely accepted, the destination for these textiles has little primary evidence, such as definitively uncovering in situ finished textiles along known maritime trade routes, or instances of surviving Mycenaean fabrics preserved by a trade partner (Sabatini 2016:217). This is due to the fragile organic material of the fabrics, combined with the exceptional circumstances required to enable such matter to be preserved. Likewise, the nature of Linear B tablets was only intended for temporary internal records by palace officials, well outside the scope of recording the destination of traded shipments.

Limitations and Scope

The evidence presented in this thesis is by no means an exhaustive analysis of all textile archaeology within the Bronze Age Aegean. Some limiting factors include the inability to fully discuss the cultural impact of the gradual decline of the Minoan civilisation and its role in the rise of the Mycenaean kingdoms, in particular the period in which both civilisations coexisted within a narrow geographic area. This includes the shift in some sites' usage from Minoan to Mycenaean, the elements of Minoan textile culture adapted into Mycenaean styles, and the exploitation of established Minoan trade routes (Burke 1997, Burke 1999, Nosch 2016, Papadimitriou & Demetra 2013:10, Perivoliotis 2005:8, Shaw 2010). Likewise, it would be impossible to comprehensively include all the influences from other cultures in the creation of the Mycenaean administrative systems, the formation, and inner workings of those

systems, and how these factors impacted the widescale textile industry. This thesis will also not discuss the watercraft used to move these items throughout the Aegean and the development of ever-advancing maritime technologies, as this would be impossible to discuss at any length (Shaw & Chapin 2016).

This thesis was begun during widespread COVID lockdowns and as a result travel to access sites in person and primary sources was not possible. Thereby the decision was made to conduct a desk-based study of the available material, but this created understandable limitations in the research material.

Research Questions

How is our understanding of the Mycenaean textile industry integral to the wider discourse on Mycenaean culture and economics? What evidence is available to study the economies of maritime trade and local consumption of these textiles?

Methodology

The methodological processes used to answer these questions primarily relate to reviewing the available research on the archaeological evidence of textile manufacture within the Mycenaean Bronze Age. This will include a review of relevant academic literature concerning Mycenaean textiles by exploring extant Mycenaean sources associated with the textile trade. This focus will justify consideration of the Mycenaean textile industry as a primary export of the Mycenaean palaces, and as a foundational aspect of the wider Mycenaean economy.

Chapter One: Introduction to Textile Archaeology

1.1 Defining textiles

Textiles were a primary export of the Mycenaean palatial economy, but these textiles did not exist without prehistoric context. The creation of these textiles and the culture in which they were crafted form an important background to the study of textile archaeology in the Mycenaean age. Similarly, it is important to recognise biases that exist around the study of textiles, particularly clothing, from historic and modern perspectives and how these biases may affect associated research.

A textile is a material of any fibrous construction, which may include fabric for clothing, sails, nets, bags, braided or felted materials (Andersson Strand 2012a: 22, Gleba 2020:3330, Nosch 2012:45). The raw materials for creating textiles in antiquity were restricted to plant fibres such as flax, hemp or nettle, or alternatively animal fibres predominantly wool from sheep but also camel or goat hair (Gleba 2020:3330, Nosch 2012:43). Research on ancient textiles commonly focuses on the creation of a woven fabric for clothing which can be interpreted as an important indicator of social stratification, cultural beliefs or simply as a physical barrier between the skin and the environment. Textiles may also be adopted for other utilitarian functions, such as sheets or blankets for bedding at the domestic level, or as sails for ships which facilitated trade with neighbouring cultures (Gleba 2020:3330). Textiles may also be restricted to certain groups or individuals, such as the use of ritual garb associated with ceremonial duties, or by the ability to afford luxury materials which were exclusive to the wealthy elite. The following chapters will primarily be focusing on textiles used in clothing, with the understanding that textiles are also used in a multitude of other applications in both antiquity and modernity.

1.2 Human adaption of clothing

Humans wear clothing for numerous reasons: thermoregulation, decoration, camouflage, protection, and modesty (Buckner 2021:706). While it is outside the scope of this paper to fully explore each of these reasons, a brief history of the

development of clothing and textile culture is necessary to understand the manufacture and use of Mycenaean textiles.

As hominins evolved and began to occupy wider areas, several adaptive changes allowed them to utilize climates they previously were unable to comfortable inhabit. *Homo sapiens* began to use clothing to access these areas but this advancement was likely not limited to only that branch of the *homo* genus (Gillian 2023:12, Toups et al. 2011:29). As samples of intact animal hides from the period of expansion c. 100,000 years ago are unlikely to be preserved, research into host-led parasitic evolution of lice has been used to map a tangible chronology of early hominins' loss of body hair, and the beginning of the use of clothing (Collard et al. 2016, Kittler et al. 2003, Toups et al. 2011: 235). The human louse (*Pediculus humanus*) has two primary variants, head lice (*P. h. capitis*) and clothing lice (*P. h. corporis*) which have developed several defining features specific to their targeted habitat (Kittler et al. 2003:1414, Toups et al. 2011:30). As evolutionary changes lessened body hair on hominins, these lice were restricted to hair solely on the head, which subsequently led to the divergence of lice which specifically focused on inhabiting clothing (Kittler et al. 2003:1414, Toups et al. 2011:30). Using a Bayesian coalescent modelling approach, Toups (et al. 2011:29) estimates the date of the divergence to separate types of lice occurred at least c. 83,000 to as early as c. 170,000 years ago. Prior to the appearance of these lice, it is improbable that the parasite could have evolved without the host-led adaption of clothing (Toups et al. 2011:30). Early hominins primarily wore animal skins and plant fibres, which varied based on the region and the heating or cooling requirements of the clothing, the materials available, and the emerging 'cloth culture' (Harris 2012:62, Buckner 2021:707). A predominant factor on the regional development of clothing is due to the climate, with Egyptian styles tending to prefer light, flax-derived linens versus the Mycenaean-preferred insulation of wool (Harris 2012:83).

Humans continue to wear clothing for protection or warmth, but if the only function of clothing was to keep our bodies warm, then people in warmer climates could foreseeably abandon the use of clothing altogether. However, this would negate other ways in which clothing is utilized (Buckner 2021:707, Fowles 1974:343). A more modern argument for clothing is for the sake of modesty, which is either

justified through mainstream religious doctrine, or as a societal norm upheld by many modern cultures (Bohn 2004:4, Bliss 1916: 219, Pilcher 2010:468).

1.3 The use of clothing in social cues

Within social constructs, clothing enables people to express subtle messages to the viewer, which may include their occupation, gender, or social status. This informs anthropologists and archaeologists about the society in which the clothing was created, and the subtexts which were conveyed by the textiles worn.

Clothing has been used in both ancient and modern contexts to be decorative. Decorative elements are used to communicate a range of subtle messages which are indicative of the wearer. These innate communications define the wearer in a greater societal context and enables this wearer to determine where they wish to be viewed within the social strata (Adams 2007:201, Daters 1990:49, Fowles 1974:345, Gleba 2020:3329, Holman 1980: 372). The most obvious distinction is the definition of gender using socially normative trends in attire (Blakemore 2003:417, Crane 2000:16, Fowles 1974:345). These norms tend to begin during infancy where the standard assignment of gender has been defined through colour co-ordination, in the modern context of gender trends, blue for males and pink for females (Bohn 2004:5, Fowles 1974:345). Types of clothing also reinforce gender stereotypes, such as women wearing skirts or dresses, while men would be viewed as acting against the standard social discourse to wear the same items (Blakemore 2003:417, Fowles 1974:345, Pilcher 2010). This trend is slowly changing with an emphasis in social discourse to normalise the those operating outside a binary gender dichotomy, but this has been a historical standard for clothing.

The use of clothing in a modern context tends to communicate an individual's wealth or status. This can be achieved in several ways, from the use of expensive materials to show an outright display of the quality of materials an individual can afford, or by the style of dress being indicative of a high social class (Barber 2007:178, Crane 2000:3, Fowles 1974:346, Murray 2016:90, Solomon 1982:509, Trnka 2007:128). This is often reflected in work attire with modern examples such as, businessmen wearing formal suits which indicate a lack of physical labouring in their profession, whereas the tradesman in standard high visibility workwear who have a lower social

standing when directly compared with corporate fashions (Bohn 2004:8, Fowles 1974:346, Holman 1980: 372, Solomon 1982:509). Of course, this is based on a social hierarchy which values certain professionals above others and is most easily identified through the style of dress required by the individual. A pertinent example of this is the phrase, “Blue-collar jobs” which imply the wearer engages in a field requiring manual labour and are regarded to be a more physically taxing, male-dominated job (Kundel 1976:233, Min 2015, Torlina 2011:43). In contrast, “White-collar workers” tend to be perceived to have less physically demanding work, are often office based and of a low physical nature (Rosenfeld & Plax 1977:24, Torlina 2011:66).

Wealth is also evident through wearing branded goods, which is most identified by the notoriety of the specific brand rather than the materials used to construct the garment (Barber 2007:178, Fowles 1964:346). For example, the fibre content between a modern branded shirt and a shirt from an unnamed brand may be identical, but the mark-up on the branded shirt may be significantly more, purely due to the notoriety of the label as a luxury brand. From a utilitarian view, this is a seemingly absurd purchase however, within our social constructs this elevates the wearer into a higher social status due to their ability to afford items which do not necessarily provide value for money.

The ancient world, in particular our targeted era of the Mycenaean age of c.1750 to 1050 BCE, clothing mirrored many of the modern ideals previously discussed. However, the expression of wealth tended to be demonstrated through the quality of the materials instead of through the influence of marketing. This trend of conspicuous consumption helped to outwardly distinguish members of the wealthy elite and visually separate them from the lower classes (Barber 2007:177, Droβ-Krüpe & Nosch 2016:315, Sabatini 2006:218, Voutsaki 2001:206). However, the allure of imported textiles also influenced desirability through the novelty and fetishization of other cultural styles (Stears 2010:229). Aside from the novelty of exotic goods, the Mycenaean textiles were of a high quality, many either finished or dyed elaborately which would have been outside the abilities of a homemade textile due to the cost of materials, and time it would take a lone person to craft (Killen 2007:57, Marin-Aguilera et al. 2019:127). However, it is worthwhile to acknowledge

how important dyes were to differentiate between a homemade textile, and the calibre of the textiles created by the Mycenaean palatial system. The use of dyes created a textile which was highly valuable, and in many cases, restricted to elite use by its value (Gleba 2011:4).

1.4 The importance of textiles in the archaeological record

Textiles provide significant archaeological evidence for the daily lives of ancient people, the cultural contexts which influenced the styles of their clothing and wider social stratification in which differing clothing styles existed. Textile manufacture was one of the most labour-intensive occupations in the ancient world and was practiced in all levels of society which enabled the textile manufacturing industry to be one of the largest and most economically profitable (Burke & Chapin 2016:17, Droβ-Krüpe & Nosch 2016:296, Gleba 2011:4, Gleba 2020:3329). Predominantly, the creation of textiles has historically been 'women's work' which illuminates the economic role of women- led industry by the selling of finished textiles either within the home, or through a wider economic system (Barber 2007:173). Therefore, the creation of textiles can be compared across a multitude of social strata, and thereby communicates subtle differences in how this task was treated by various social groups. The textiles themselves also identify an expression of age, gender, social class, religion, ethnicity, or occupation (Adams 2007:201, Gleba 2020:3329, Nosch 2012:49). By unravelling the distinguishing aspects of how people identified themselves, we can gain a clearer picture of how the society operated and how members of the society viewed themselves through material expression. How textiles were made also gives us a great deal of information about the societies in which they were created. The different techniques used when creating these textiles hint at subtle differences in their production across different chronological and geographical frameworks, which can be indicative of subtle changes in technological or cultural shifts (Ciszuk 2007:14). These shifts may be as innocuous as the influence of another culture manipulating a change in fashion (Gleba 2020:3335). A great example of the spread of fashion can be seen through Classical Greek clothing styles appearing in Etruria, and then from Etruria dispersing into central Europe (Gleba 2020:3335). This not only demonstrates the active trade routes at the time, but also the impact of cross-cultural adoption and diffusion.

Extant samples of textiles from the Bronze Age Aegean are extremely rare, but there is a myriad of ways that archaeologists can draw conclusions about the textiles produced and worn in the Mycenaean world without necessarily having access to surviving textiles (Burke & Chapin 2016:17, Droβ-Krüpe & Nosch 2016:294, Harris 2021:88, Nosch 2014a:271, Sabatini 2016:217, Wild 2007:3). To begin, impressions of textiles have been found on metal and pottery (Nosch et al. 2021:37 – 39, Trnka 2007:127). Other evidence on the forms of dress can be discerned from a range of items associated with the culture, such as attire represented in wall paintings, pottery, seals, stone, metal, or ceramic items (Burke & Chapin 2016:19, Gleba 2019:10, Murray 2016:43, Nosch et al. 2021:39 – 40, Shaw 2010:315, Trnka 2007:127). Subtleties in the use of costumes are also clear in these examples, ritual dress depicted in frescos are clearly differentiated as religious attire rather than normal female dress as represented in other sources (Barber 1990:104, Boloti 2017 :9, Trnka 2007:128). Motifs found represented on vases and frescos were likely also replicated in real garments (Barbier 1990:104, Perivoliotis 2005:8, Trnka 2007:128). Commonly used motifs in Mycenaean designs were symbols such as stars, squares, circles, rosettes, dots or stripes, and intricate banding, often horizontal with vertical bars (Perivoliotis 2005:8, Trnka 2007:128). These colourful motifs were often geometric, suggesting that they would have been easily incorporated into a woven design, and likely this influence of geometric patterning may have begun through loom-woven banded designs (Barbier 1990:104, Nosch 2012:45, Perivoliotis 2005:7 – 8). Linear B documents kept by Mycenaean palatial administration also attests to the decorative elements such as the fringes and edges of a finished textile (Nosch 2014a: 571). Specific ingredients of the dyes are not explicitly named in the Linear B records, but the colour of the finished textiles are mentioned, such as the specialised use of purple dyes extracted from molluscs in the *Muricidae* family (Marin-Aguilera et al. 2019:128, Rougemont 2014:355). This also indicates a wide range of dyeing and decoration in luxury textiles, which may not have been preserved but are traced through the written or iconographical record.

1.5 Textile tools

Tools associated with textile production tend to be only partially preserved due to the biodegradation of wood used to produce spindles and looms. Spindles (Figure 1)

were used to spin raw fibre into yarn, while looms (and loom weights (Figure 2)) were used to weave the individual strands of yarn into cloth (Sabatini 2016:219). While other tools were used for the shearing of sheep, or the processing of flax, spindle whorls and loom weights are the most commonly found artefacts of textile production (Burke & Chapin 2016:18, Martensson et al. 2009:373, Nosch 2012:47, Nosch 2014b:6, Sabatini 2016:217). The development of tools can give us some idea about how the technology of producing textiles changed over time. An example of this change is how spindle whorls from the Neolithic age tend to be larger and heavier but become smaller towards the Late Bronze Age (Laurito et al. 2009:12, Nosch 2014b:6). From this evidence, it appears that there was a marked increase in the use of wool fibres due to the change in spindle whorls. This led to more complex techniques beginning to be used to produce finer textiles, although this evolution was by no means a linear progression (Nosch 2014b:6). During the Bronze Age, multiple types of looms would have been used including a tubular loom, the two-beam (or horizontal) loom, and the warp-weighted loom (Nosch 2014b:7). In the research, there is a general emphasis placed on researching the specificities of the warp-weighted loom, which is an unfortunate bias created by the number of loom weights in the archaeological record, whereas the organic materials of the looms themselves are generally not preserved (Martensson et al. 2009:373). Loom weights are the most prevalent archaeological resource found from the weaving process and are found in an assortment of different shapes, weights, and contexts (Martensson et al. 2009:373).

Figure 1. Clay and stone conuli spindle whorls, Mycenae c. 1400 - 1050 BCE, Archaeological Museum of Mycenae (Photograph: Katherine Laczko).

Figure 2. Clay loom weights, Mixed Mycenaean sites c. 1600 - 1450BCE, Heraklion Museum (Photograph: Katherine Laczko).

Within textile archaeology, experimental archaeology enables researchers to further understand artefacts such as loom weights or spindle whorls by identifying the limitations of these tools through practical application (Andersson Strand et al. 2010:161, Burke & Chapin 2016:29 – 38, Ciszuk 2007:4). This enables archaeologists to gain further insights into the few surviving elements of textile manufacture, such as the methods of construction, how long items would have taken to be made, and how much raw material was required to produce for each product (Andersson et al. 2008, Andersson Strand et al. 2010:163, Andersson Strand 2012a:21, Ciszuk 2011:14, Gleba 2011:4, Martensson et al. 2009:379-82, Peacock 2001:181). The Danish National Research Foundation's Centre for Textile Research at Copenhagen University (CTR) has been at the forefront of much of this research and has funded a number of experiments which pair skilled craftspeople with recreated supplies modelled after those found in archaeological contexts (Andersson Strand 2012a:23, Martensson et al. 2009:379, Nosch 2012:47). Looking at the Cretan yield of 40 tons of clean wool, it would have likely taken 480,000 days for a single person to spin the 240,000km of finished thread, or the equivalent of a single person working for 1300 years which implies that Crete must have required at least 1000 spinners to fulfil their annual wool production (Nosch 2014a:395). This suggests that the textile industry was profitable enough to fund such a large workforce and therefore was a cornerstone of the Mycenaean palatial economies.

1.6 Fibres for textile construction in Mycenaean Greece

Fibres used for ancient textiles fall into one of two categories, plant fibres or animal fibres (Andersson Strand 2012a:23, Burke & Chapin 2016:21, Gleba 2020:3330). In the Mycenaean context, the primary material used for exported textiles was wool from sheep, because rearing sheep was preferable for the Mycenaean landscape, which was steep, rocky, and unsuitable for many agricultural uses (Gleba 2014:123, Nosch et al. 2021:35, Perivoliotis 2005:6). In addition to the wool that sheep produced during their lifetime, they could also be a source of secondary products such meat and materials created from the carcass (Nosch 2014a:371, Nosch et al. 2021:35) However, plant fibres were still commonly used for textiles alongside wool, especially by the lower classes who may not have been able to afford the asset of sheep (Perivoliotis 2005:6). Most plant fibres are interchangeably called bast fibres,

as the fibre is extracted from the inner bark, or bast, of the plant, unlike cotton, which uses the cotton 'boll', and was not introduced until after the Mycenaean era (Gleba & Harris 2019:2329, Gleba 2020:333, Haugan & Holst 2014:951). Plant fibres used by the Mycenaeans included flax for linen (*Linum usitatissimum*), hemp (*Cannabis sativa*) and nettle (*Urtica diocia*) but they also utilised Spanish broom and various trees (Andersson Strand 2012a:23, Gleba 2011:15, Gleba 2020:3330, Harris 2012:73,81, Haugan & Holst 2014:952).

Flax was one of the earliest species of domesticated plants for fibre in the Ancient Near East, with evidence of seeds and linen textiles found in Palestine from the end of the eighth millennium BCE (Burke & Chapin 2016:21, Rougemont 2007:46, Wild 1988:21). Two syllabograms represent flax/linen in the Linear B documents, the first, *SA* appears at both Pylos and Knossos, representing the flax stems in either their raw state, or just after retting (Freo et al. 2010:344, Rougemont 2007:46). The second syllabogram, *RI* is used to describe the fibres at a later stage of processing, such as prior to spinning or as already spun into linen thread (Rougemont 2007:46). Alternatively, *ri-ta* or *ri-no* refers to finished linen textile directly (Freo et al. 2010:344, Gasbarra 2016:259, Rougemont 2007:47). At Knossos, *ri-ta* is mentioned five or six times within the Linear B records (Freo et al. 2010:344). Flax has many beneficial properties, first as a bast fibre, but also able to be used for oil and medicinal applications (Andersson Strand 2012a:24, Burke & Chapin 2016:22). The benefit of linen is that it is a light and breathable textile, it absorbs well, and the fibres dry easily (Andersson Strand 2012a:24). However, flax can be difficult to cultivate as the plant requires regular access to water, the plant depletes the soil of nutrients and is susceptible to fungal diseases (Andersson Strand 2012a:25, Burke & Chapin 2016:22). Processing the flax into a usable bast fibre is very labour intensive and creates a large amount of wasted vegetation (Andersson Strand 2012a:27, Nosch 2014a:388, Wild 1988:22). Rougemont (2007:46) proposes that flax was likely cultivated in Messina and Crete, but the required conditions vastly limited the available arable land suitable for its agriculture. The Pylian administration was also known to receive flax as a form of taxation in return for landholding, with PY Na 520 recording the receipt of this flax by referring to the material as, *pu2- te-re ki-ti-je-se* or 'the planters cultivate' (Freo et al. 2010:344, Hruby 2013:425, Nosch 2014a:396). The evidence seems to suggest that Pylos was the primary producer of Mycenaean

linen by the fragmentary Pylian tablets recording flax and linen production, whereas Knossos was known as the primary wool producer (Burke & Chapin 2016:38, Nosch 2014a:396).

Hemp and nettle fibres were also processed in a similar method to flax but produced a coarser yarn which was used to make rope, sails, or nets (Andersson Strand 2012a:24). Due to the difficulty of differentiating between flax, hemp and nettle, archaeologists have often misidentified discoveries made of bast fibres, by assuming the items to be made from flax (Andersson Strand 2012a:24, Bergfjord et al. 2012). In the case of the Mycenaean Linear B records, the only bast fibre attested to was flax, which indicates it was the only specialised, and controlled plant material used for textile manufacture by the Mycenaean palatial administration (Nosch 2012:51).

The predominant fibre used by the Mycenaeans was wool, which had been sourced from domesticated sheep and selectively bred since the Neolithic era, to develop a uniform fleece with a longer staple length, which was more suited for textiles than pre-domesticated species (Nosch 2014b:4). Wool remains one of the dominant fibres for textiles, even into our modern age due to its ability to stretch, which allows for a more elastic finished textile, than possible with most plant fibres (Andersson Strand 2012a: 23, Gleba 2014:1). Wool is a lightweight material and can provide excellent insulation due to the small air pockets within the twisted fibres, which makes wool fabrics comfortable to wear both in hot and cold climates (Gleba 2014:1). Furthermore, raw fleece comes in a range of colours, with plain white or cream fleeces able to absorb and hold dyes far more easily, (and efficiently) than equivalent plant fibres (Gleba 2014:1).

Textiles have been an integral part of human material culture for at least the last c. 83,000 years. This lineage for the adaption of textiles has developed a practical need for clothing as temperature regulation, alongside the innate social markers of those wearing clothing. Thereby the study of Mycenaean textiles serves the dual purpose of enlightening researchers about the function of the Mycenaean palatial economies, but also the social stratification existing within the creation and use of these textiles.

Chapter Two: Mycenaean Textile Terminology

2.1 Available written sources

Extant textiles from Mycenaean Greece rarely survive due to the organic materials they are composed of biodegrading over time. Instead of the textiles themselves, Linear B records created by the Mycenaean palatial administration document the textile industry from individual sheep, their fleeces, textile workers and the finished products (Figure 3). Using this alternative source of archaeological evidence, these terms can be analysed to understand the textiles created by the palace for maritime export and the workforce involved in their production.

Modern knowledge of the production of textiles in Mycenaean Greece tends to be based on Linear B records which include both archival (tablets, nodules, labels) and non-archival (inscriptions on items) script (Judson 2000b:148, Rougemont 2014:340 Tisdell & Szizzero 2023:196). Linear B is syllabic system comprised by syllabograms, most of which represent a single vowel, or a single consonant followed by another vowel, along with ideograms which designates items or commodities (Judson 2000b: 524, Karagianni 2015:25). These Linear B tablets were inscribed with a sharp stylus onto clay, which was left to air dry and then stored in baskets within the palace archives (Judson 2000a:13). Tablets were primarily used by scribes to record animals, people, or goods which fell under palatial control. These tablets tend to only note the current or prior year which suggests they were replaced annually (Judson 2000a:13, Karagianni 2015:30, Killen 1984:243). Due to the rarity of archival documents and the limited survival of these sources, much of Linear B is undeciphered purely due to the low reoccurrence of certain symbols (Freo et al. 2010:338, Judson 2000a: 6). Many of these documents are highly fragmented and are unable to be deciphered due to poor preservation. So, while Linear B records are a rich resource for archaeological study, they must be viewed through the lens of the potential for missing information, and the lack of available data to conclusively map economic trends (Killen 1984:243). Luckily, textiles are well accounted for in palatial Linear B records and provide an expansive textual baseline for archaeologists, but these records do not mention the locations of exported textiles (Tartaron 2013:24).

Linear B archival tablets have been unearthed from at least ten different sites spanning the modern Greek mainland and Crete (Figure 3.) (Freo et al. 2010:338, Killen 2007:50, Nosch 2012:45, Rougemont 2014:340). Of these sites, Knossos has the most extensive records regarding the palatial management for the manufacture of textiles. Of these records attributed to Scribe 103 at Knossos, the Lc(1) and Od(1) sets are the some of the best preserved, and contain an astonishing amount of detail about the management of animals, workers and their expected production (Burke 1997:414, Burke & Chapin 2016:37, Firth and Nosch 2002:122, Gasbarra 2016:251, Nosch 2012;45, Tisdell & Szizzero 2023:196). The system qualifying sets Lc(1) and Od(1) has come under some debate as the original classification was to group sets of tablets together based on repeating logograms, and then by the known scribe (Firth & Nosch 2002:123). Therefore, the Od(1) set became a group of miscellaneous tablets with logograms relating to wool grouped together, rather than identifying an intended in situ filing system by its author (Firth and Nosch 2002:123). The resulting debate has been as to whether archival tablets have been mixed into other incorrect sets, and conversely if tablets that did not hold logograms relating to wool, were also intended to relate to a single, complete archive (Firth & Nosch 2002:123). Meanwhile at Pylos, the administration of textiles appears to have occurred within the second story of the palace, within the megaron (Judson 2000b:150, Schon 2011:222). This placement suggests that the palatial authorities were involved in the entire process from the management of sheep, all the way to the finishing of luxury textiles (Schon 2011:223).

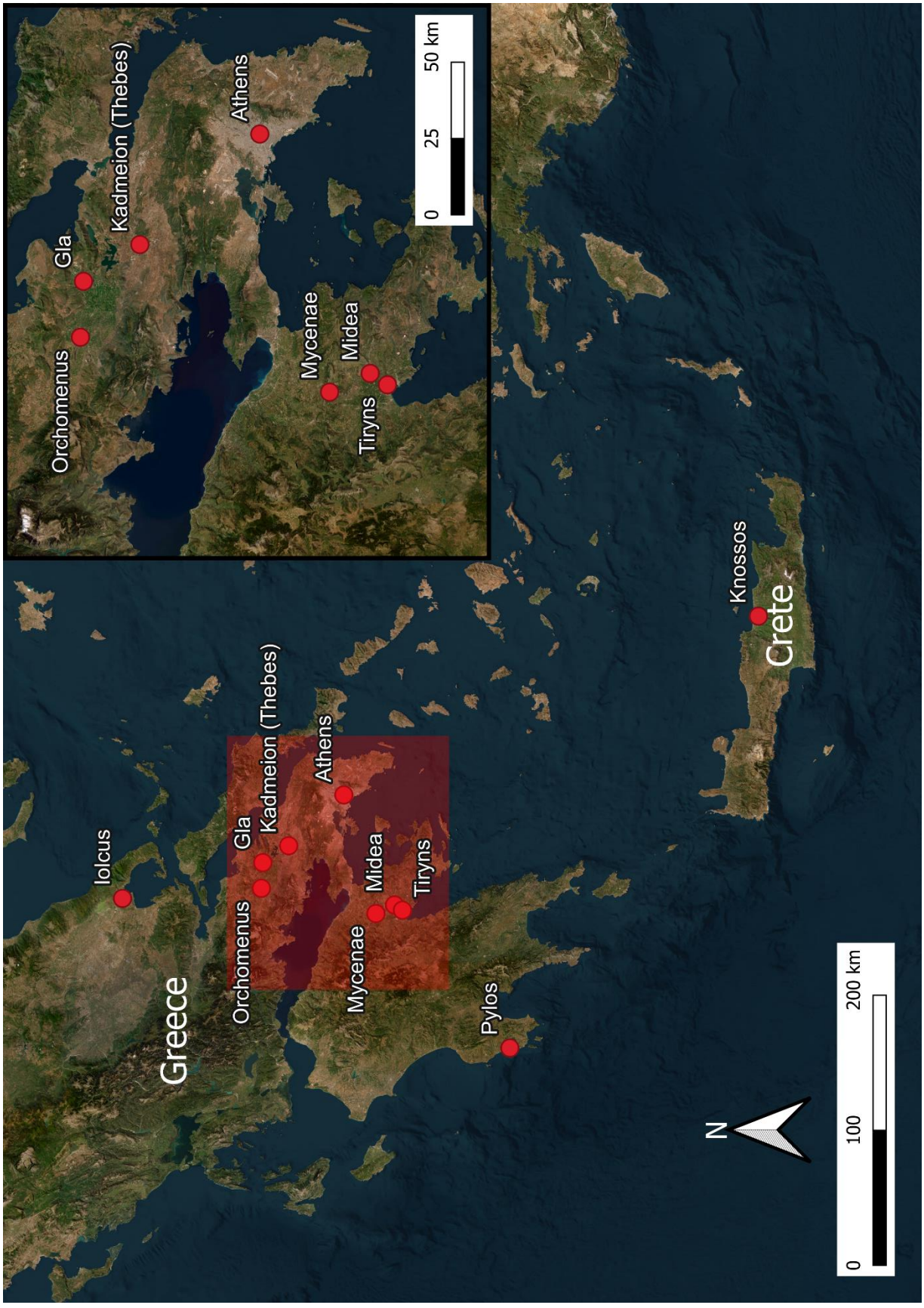


Figure 3. Map of known Mycenaean palaces (Map: Katherine Laczko, QGIS 2024).

2.2 Linear B Textile Terminology

One of the primary sources for our modern understanding of the Mycenaean textile industry are the Linear B tablets used by the palatial administration to account for supplies, workers, and their expected production. This chapter deals with the Linear B terminology for wool, textiles, and their manufacture.

LANA is the Linear B logogram for wool, transcribed from the Latin for modern use, otherwise designated by Linear B logogram number *145 (Freo et al. 2010: 340, Nosch 2014a:372). Wool is never referred to as a noun, either by the type of fleece or the finished textile, the adjective *we-we-e-a* instead relates to something designated as ‘woollen’ (Freo et al. 2010:340, Nosch 2014a:372). LANA is also used as unit of weight, which is approximately three kilograms of wool, or the expected total wool from four male adult castrated sheep, otherwise known as wethers (Burke 2010:83, Freo et al. 2010:341, Nosch 2014a:373) Wool targets do seem to change from breeding flocks using separate words for wool from sheep and lambs (Nosch 2014a:373). Wool from an adult sheep is written *as o-u-ka*, as opposed to the wool from lambs which is *wo-ro-ne-ja* (Nosch 2014a:373).

Textiles are generally recorded by the logogram transcribed from the Latin as TELA (Nosch 2014a:377). TELA is used as a generic sign for textiles but endograms were created out of the standard logogram for TELA, by adding a syllable inside the TELA logogram, which indicates an abbreviation of the specific type of textile the symbol is denoting (Nosch 2014a:377). There are three primary textiles which Mycenaean palatial systems produced and were recorded in several palace archives (Nosch 2014a:378). These varieties of textiles are, *te-pa*, *pu-ka-ta-ri-ja* and *pa-we-a* (Burke 2010:78, Nosch 2014a:378).

TELA-TE or *Te-pa* has been recorded in archival documents from Knossos, Pylos, Mycenae and Thebes (Kadmeion) and is made from the wool of adult sheep (Nosch 2014a:377,378). *Te-pa* is a large, heavy woollen textile which has no indication of any ornate finishing, such dye or decoration (Killen 2015:363, Nosch 2011:496, Nosch 2014a:378). Each *te-pa* requires seven units of LANA which totals approximately twenty-one kilos, however the variant *te-pa pe-to-ko* instead requires

ten units of LANA which works out to be approximately thirty kilograms per finished textile (Firth & Nosch 2002:126, Nosch 2014a:378).

TELA-PU or *Pu-ka-ta-ri-ja* is another textile made from wool, but unlike *te-pa*, the name suggests the textile was twice as thick (Nosch 2014a:378). This textile has been recorded at Pylos and Mycenae, but this is the most prevalent form of textile documented within the Knossos records (Nosch 2014a:378). While there are no evident references to decorative finishing of the textile, the *pu-ku-ta-ri-ja* and *pu-ru-wa/purwa*i may have been coloured red either through natural colour of the wool used in this textile, or by un-recorded dyeing of the finished textile (Nosch 2014a:379). The level of detail in the Mycenaean palatial records regarding the production and finishing of these textiles makes it quite unlikely that dyeing these products on such a large-scale would be otherwise unrecorded. This suggests that if there was a reddish hue to *pu-ka-ta-ri-ja*, it would be something naturally occurring in the raw wool.

TELA-PA or *pa-we-a* is the final of the three most abundant textiles from Mycenaean palaces with references to *pa-we-a* found in Knossos, Pylos and Mycenae (Nosch 2014a:379). When compared to the production of *te-pa* and *pu-ka-ta-ri-ja, pa-we-a* requires far less wool to manufacture, 1.67 LANA units which is equivalent to about five kilograms of raw wool (Nosch 2012:50, Nosch 2014:379). The finished size is also on a much smaller scale, with it being approximately a ‘wearable size’ or about two meters squared (Nosch 2014a:379). *Pa-we-a* has a couple of important differences from the previous two examples, the first is that *pa-we-a* can be made of either wool or linen, instead of *te-pa* and *pu-ka-ta-ri-ja* which were only recorded to be made from wool (Nosch 2014a:379). The second difference is that *pa-we-a* were often decorated, either by dyeing or other ways of finishing the textile such as fringes or banding (Nosch 2014a:379, Nosch 2011:502). As decorative work requires specialised skills and further materials to dye, this textile would have likely been an expensive commodity.

2.3 Collectors

Administration of materials, workers and final products also has its own specific terminology within the Linear B records. Reference is made to ‘collectors’ in these

documents (Figure 3.) which suggests that regional organisation was done by an administrator who may have held a position of power in one or multiple production centres (Firth & Nosch 2002:127, Nosch 2011:495, Nosch 2014a:382, Schon 2011:224). Collectors also appear to have occupied a role associated with supervising shepherding practices and accounting for large flocks (Nosch 2021:43). The exact power and influence of these collectors is unknown, but records attest to their role in administrating the textile production as integral within the Mycenaean palatial systems (Killen 1985, Nosch 2014a:382, Rougemont 2001:133, Tisdell & Szizzero 2023:196). Even the term 'Collectors' is not a designation from the Mycenaean era, but the best equivalent translation from the Linear B script. Collector groups account for approximately 30% of the texts relating to major industries overseen by the Mycenaean palatial economies (Nosch 2011:496). Some collectors are recognised in the documents by their personal names, in the Linear B this is distinguished by the suffix *–jo* which is a signifier that the proceeding text relates to a personal male name (Figure 4.) (Killen 2015:196, Nosch 2014a:382). The use of personal names suggests that collectors were either members of the royal family, or part of the palatial aristocracy (Rougemont 2001:133, Tisdell & Szizzero 2023:196). Of these personal names, only 900 are known at Knossos and any kind of familial link is exceedingly rare (Killen 2015:196, Rougemont 2001:135).

Further evidence of their role is apparent within records they kept, especially the expected targets and any shortcomings by the workers. Within the L(3) set from Knossos, the collector named *I-se-we-ri-jo* records that the textile *pu-ka-ta-ri-ja* was missing from the previous year's expected production by using the term, *o-pe-ro pe-ru-si-nwa* or by the shortened form, *o-pe-ro pe* (Nosch 2014a:382). However, groups were not always assigned a collector, with non-collector groups operating with similar targets and comprised approximately 70% of the total *ta-ra-si-ja* workers (Nosch 2000:45).

Figure 4. Π-N1338 Palm-leaf tablet recording the quantity of wool distributed to workshops under collector sa-mu-ta-jo, Knossos c.1375 - 1300 BCE, Heraklion Museum (Photograph: Katherine Laczko).

2.4 *Ta-ri-si-ja*

Ta-ri-si-ja refers to the Mycenaean organisational system which enabled decentralised production by a large workforce, while still controlled by central palace administration (Burke & Chapin 2016:37, Firth & Nosch 2002:121, Killen 2001:175, Schon 2011:223). This system provides raw materials and rations in exchange for the labour to produce finished products, facilitated the exchange of materials in different stages of production, and eventually distributed finished products for later use and/or sale (Hruby 2013:423, Killen 2001:175, Nosch 2000, Nosch 2014a:395, Tisdell & Szizzero 2023:197). Hruby (2013:425), argues that it can be directly related to modern taxation, but with a form of labour in place of a percentage of earnings and multiple tiers of taxed groups occurring within this system (Figure 4.) (de Fido 2001:16). Production targets could either be set for individuals or collective groups, but it is believed that the administration in Knossos and Pylos primarily assigned group targets, while at Mycenae, administration set targets for individual households

(Nosch 2000:54, Schon 2011:221). The individuals associated with the *ta-ri-si-ja* system were likely palace dependents, such as slaves, orphans, or widows which were compensated by rations and housing (Burke & Chapin 2016:37, Hruby 2013:425, Killen 2001:172, Killen 2015:944, Nosch 2012:46, Nosch 2014a:395). The number of groups themselves were limited, as evident by the repetition of the same groups within tablets recovered from the Ak set (Firth & Nosch 2002:126). By calculating the attested workforce at Knossos in the Ak records, we can deduce that the number of workers was extremely large within those limited groups, and therefore the individual workers were likely only required to meet a small target such as three months' worth of work for the annual allotment of rations (Killen 2001:174, Killen 2015:942). Interestingly, when calculating the wool required to construct a *pa-wo* textile, far more wool was provided than required to construct the textile alone, which suggests that workers may have also been compensated for their labour with excess supplies for their own personal use (Nosch 2012:51).

Figure 5. Π-N Palm- leaf tablet 693, Knossos c. 1275 - 1250BCE, Heraklion Museum (Photograph: Katherine Laczko).

This system does not only apply to the manufacture of textiles, but also other specialised crafts which also operated under the same *ta-ri-si-ja* structure, such as bronzeworking (Killen 2001a:161, Nosch 2000:43). Further similarities can be found in the interchangeable terminology between the crafts, with *o-pa* pertaining to both the refurbishment of armour and finishing or fulling of textiles (Killen 2001a:161). There are few Linear B records attesting to *ta-ri-si-ja* directly in association with the textile industry (Nosch 2000:46). *Ta-ri-si-ja* is directly referenced on two tablets containing total targets from central Crete which suggests that other tablets in this series also operated under the *ta-ri-si-ja* system without explicitly stating so (Nosch 2000:46).

Ta-ri-si-ja was not the only mode of textile production, and only appears as a system for acquiring certain types of textiles which may suggest that different types of these textiles operated under different methods of compensation for specialised labour (Nosch 2000:46). While it can be suggested that *ta-ri-si-ja* was an important part of the administrative system for textile production in the Mycenaean world, it was no means the only arrangement to produce textiles for the Mycenaean palaces (Nosch 2000:46, Nosch et al. 2013:474).

2.5 Decoration and finishing

The decoration of textiles raised them from a common, everyday necessity to a prestige item that only the wealthy could afford. Decoration is attested to in the Linear B records as, *o-nu-ka* which is generally translated as ‘fringes’; while true fringes tend to describe intertwined ends from the warp thread on a woven garment, sometimes these fringes were multicoloured, as noted in the Linear B as, *po-ki-ro-nu-ka* (Nosch 2014a:387, Rougemont 2014:356). Unfortunately, ‘finishing’ is not well defined in the Linear B translations, so it becomes a blanket term to apply to any of the decorative processes otherwise associated with finishing a textile (Firth & Nosch 2002:134).

In the tablets themselves, the archives concerned with the finishing of textiles were found adjacent to tablets involved with setting targets for cloth production (Firth & Nosch 2002:134). This is particularly interesting because it suggests that finishing was not directly correlated to the number of textiles produced. This indicates that not

all exported products were dyed or decorated, and much of the exported textiles were likely plain-woven.

Of the language of finishing itself, *o-nu-kelo-nu-ka* is suggested to be an all-encompassing term for decorative items which is linked to the later Ancient Greek for ‘nail’, likely referring to techniques of woven bandings (Firth & Nosch 2002:134). *A-ze-ti-ri-jala-ke-ti-rr-ja* therefore, are the women who worked as the makers of the decorative elements (Firth & Nosch 2002:134, Killen 2015:364). An example of these decorative elements is the manufacture of heading bands which were woven separately to the main textile and then attached to form a decorative band at either warp end (Firth & Nosch 2002:135). By looking at Mycenaean frescoes’ contemporary with the manufacture of these textiles, it is quite likely to surmise that these bands would have been manufactured with contrasting colours (Firth & Nosch 2002:135).

Dyes linked to evidence found in Mycenaean workshops include a range of colours, with a particular emphasis placed on the ability to manufacture purple dye which was incredibly difficult to produce and therefore more valuable (Burke 1999:78, Burke 2010:78, Harris 2012:74, Marin-Aguilera et al. 2018:127, Soutiropoulou et al. 2021:171). This purple dye was made from three species of molluscs belonging to the *Muricidae* family, which was difficult to extract due to the colour only being expressed when a specific chemical reaction is created during the death of the mollusc (Burke 1999:80, Marin-Aguilera et al. 2018:129). The signifier for colour is *pa-ra-ku* and the wool chosen to be coloured needed to first be either bleached or dyed. This added labour would have required the wool to have been of the highest quality due to value of the extra work and specialist materials (Firth & Nosch 2002:137). In the Linear B, we have reference to different dyes that were used, *e-ru-ta-ra-pi* was a textile with red or orange finishing, *po-ni-ke-ja* were a completely red textile, *pa-ra-ku* were textiles of blue or green, *po-pu-re-ja* were purple textiles, *pu-ru-wa* were brown textiles and *po-ri-wa w*ere grey textiles (Becker 2022:17,Freo et al. 2010:348, Nosch 2014a: 387, Nosch 2014b :8, Perivoliotis 2005:7, Rougemont 2014:355). Tablets from Pylos register payment made to the supplier of alum, which is the setting agent for dyes, but there is no record of the amount of alum that was purchased (Rougemont 2014:356, Nosch 2014b:8).

2.6 Titles of workers

Workers associated with the manufacture of textiles had their own specific designations within the Linear B records, some which differentiated between female and male roles. Examples of professional roles recorded are: *pe-ki-ti-ra (*combers), *a-ra-ka-te-ja* (spinners), *a-ke-ti-ri-ja & e-ta-wo-ne-we* (finishers or decorators) and *ka-na-pe-we* (fullers) (Freo et al. 2010:354, Killen 2007: 50, Mazow 2013:215, Nosch 2012:28, Rougemont 2014:357). Also, individual specialists are occasionally mentioned such as the *i pe-ki-ta* who is also described as *ka-na-pe-u wa-na-ka-te-ro* 'royal fuller' and thereby deemed as an official directly responsible for finishing textiles for the palace (Killen 1984:245, Nosch 2014b:8, Palaima 1997:410). Many of the roles associated with processing the raw wool into a finished textile are believed to have been dominated by women, with approximately 1000 women and children employed in the textile industry of Knossos (Nosch 2014b:1). Instead, men tend to be associated with roles as shepherds, with 700 shepherds tending the flocks of central and western Crete but otherwise generally excluded from defined gender roles within textile workers (Nosch 2014a:391, Nosch 2014b:1). Differences do occur within the designations for weaving with *i-te-ja-o* 'of female weavers' and *i-te-we* 'of male weavers' (Nosch 2012:49). However, one of the designations for weavers, *pe-re-ke-we* is associated with both genders, which may suggest it held a specialist role which was not based on gender (Rougemont 2014:356). Most of these terms are believed to have been primarily associated with wool, but some professional titles specify the use of flax, such as *ri-ne-ja* which were linen workers (Freo et al. 2010:345). Also, at Pylos there is mention of a collector specialising in linen, *ri-na-ko-ro,* although there is little specification about whether the collector is receiving finished textiles, or merely the materials at various stages of production (Freo et al. 2010:345). Ethnic groups are also highlighted within the sets of workers, to define regional ethnicities' production targets (Firth & Nosch 2002:127 – 128, Nosch 2000:46). However, these roles do not necessarily cover all the workers associated with the movement of textiles, and the records are fragmentary, especially outside Knossos. Thereby we cannot assume that this evidence gives a conclusive list of roles within textile production, or within the wider world of textile-related trade.

2.7 Tools in Written Sources

Tools are rarely attested to within the Linear B, through evidence in the use of language, (and the few tool remnants remaining) we may draw inferences about the tools used, and the contexts in which they were utilised. As discussed in the previous chapter, loom weights and spindle whorls are some of the most abundant forms of evidence in the archaeological record relating to textiles, due to their relative durability by being created out of clay or stone (Freo et al.2010:358, Martensson et al 2009:373, Sabatini 2016:219, Sabatini & Bergerbrant 2019:3). These weights indicate that during this period, a primary means of textile construction was through use of a warp-weighted loom (Burke & Chapin 2016:32). Evidence of the use of these warp-weighted looms are evidenced by loom weight deposits which occur as early as the Middle Neolithic period and continued to be used throughout the entire Mycenaean era (Burke & Chapin 2016:32). These were standing looms with loom weights directly providing tension to the warp threads from a horizonal bar at the top of the loom, allowing weavers to move the weft threads horizontally to create a woven fabric (Burke & Chapin 2016:32). Loom weights are not mentioned in the Linear B, and any written reference to them comes later from the Ancient Greek texts (Freo et al. 2010:358).

2.8 Discussing the Gaps in Translation

The *ta-ri-si-ja* system is difficult to cross-reference with iterations in other professions, as it appears in reference to the textile industry only twice in within all the Linear B evidence from Crete (Nosch 2000:46 – 47). Of these two references, they contain different terminology, *ke-ri-mi-ja* and another word which is undecipherable, likely containing two syllables, but currently transcribed to ‘vest’ (Nosch 2000:52). Nosch (2000:52) suggests that *ke-ri-mi-ja* and *vestiga* may be alternatives to the *ta-ri-si-ja* system using different social groups, different target values, differences in the work or, a new term of a developing, decentralized system. This example could radically change the way we view the palatially operated textile industries, as we may only have a small understanding of its scale due to the surviving documents, and of those documents, some aspects of these texts are fragmentary. It appears highly unlikely that the textile manufacture systems could

only be managed by the *ta-ri-si-ja* system alone, but that is still debated due to the relative lack of evidence in the records (Nosch 2014a:383).

The translations are commonly duplicated within the Linear B, as in the case of red coloured textiles with p*o-pu-re-ja, e-ru-ta-ra, pu-ru-wa* and *po-ni-ki-jo* all denoting some variation of red dye (Nosch 2004:32). Similarly, the colour *purwai i*s believed to refer to a red-brown colour of finished textile that was not dyed but came from the natural shade of the wool (Nosch 2004:32). This may indicate a nuance amongst the dyes or final product that is unable to be deciphered from the records alone (Nosch 2004:32). Furthermore, the descriptions of coloured textiles can be highly variable, with certain hues potentially resulting from the same dyes. Also, the texts do not define textiles of mixed colours, or with a primary colour but alternate fringing (Nosch 2004:32 – 33). Nosch (2004:37) suggests that the differences in terminology relate to the material used to dye the fabrics, rather than the hue. But again, we are trying to draw relations through our present knowledge of how wool responds to dye, rather than direct correlations through records denoting these specificities or the species producing the wool during this era.

The Linear B evidence gives an extensive account of the roles associated with the production of textiles under the Mycenaean palaces. Using these terms, the types of textiles produced, and attributes of those textiles enable researchers to account for the types of textiles supplied by the Mycenaean palaces for maritime trade.

Chapter Three: Scale and Palatial Targets

3.1 Scale of the Mycenaean textile industry

As the Linear B records have demonstrated, the Mycenaean palaces had a wide range of workers and types of textiles produced under their administration. The administration itself is also documented within the Linear B records, and the scale in which it operated within scope of the palace complexes. By calculating the animals, workforce and the textiles required to fulfil documented quotas, it can be reasonably argued that the textile industry operated primarily as a trade commodity.

When considering the number of farmers and craftspeople inherently associated with Mycenaean textile production, it is apparent that it was a complex and well-funded industry (Burke & Chapin 2016:37, Killen 1984:242, Rougemont 2014). Burke (1997) asserts that the nature of the textile industry intrinsically lent itself to being managed by palatial control and therefore supported the continued growth of centrally-managed textile production (Burke 1997:423). Best estimates by Nosch (2014b:1) state that Mycenaean flocks produced c. 50 – 76 tons of raw wool, resulting in c. 25 – 40 tons of cleaned wool for creating between 2500 and 25,000 textiles per annum. Luxury materials were used to increase the desirability of these products among the elite, as did the complex patterns, dyes and fringes used to finish these textiles. The revenue generated by this industry indicates that textile manufacture was a primary export from the Mycenaean palaces, which enables an archaeological insight into both the political control and the financial power of the Mycenaean kingdoms. Tracking the flow of materials inherent with producing large numbers of textiles also enables modern researchers to track how the Mycenaean palatial administration operated locally, within Mycenaean Greece and Crete, and also as an interregional trading entity (Alberti 2012:25, Harris 2012:73, Killen 1984:241). Considering the limited available sources associated with tangible evidence of extant textiles, an emphasis must be placed on other primary sources. Extensive detail of the textile operations preserved through Linear B tablets provides an insight into the raw numbers of sheep, workers and material recorded by these administrative centres, and the parameters in which these palaces operated. In these tablets we have detailed records of the whole textile manufacture process from the birthing ratio of

new lambs, the number of palace-controlled flocks, the amount of fleece harvested from the individual sheep, the production of yarn, and finally, the textiles produced and received by the palaces (Nosch 2012:46, Nosch 2014b:1).

3.2 Sheep and expected wool production

The Linear B logogram for sheep is transcribed to the Latin name of domestic sheep, Ovis and the logogram also defines the sex of the animal with vertical markings (Nosch 2014b: 3, Rougemont 2014:346). Linear B records show that distinguishing animals by sex was not only applied to only ovine records, indicating that this was a general practice among all livestock. Consequently, it is also likely that the sex of an animal defined their specific purpose within the flock (Nosch 2014b: 3, Rougemont 2014:34). Male sheep were castrated to ensure better wool production, suggesting breeding was closely planned and recorded, including which individuals could continue breeding within the flock (Nosch 2014b:1, Rougemont 2014:346). Wethers held in a flock also appear to have lived an average of five to six years longer than rams, which suggests rams had an earlier decrease in wool quality, or were intended to be used for their mutton, horns, sinew, skin and other secondary products as the animal aged (Killen 2015:73, Nosch 2014b:2 Nosch et al. 2021:47).

By utilising Linear B records to calculate how many individual animals were in a flock, and how much wool these animals were expected to produce. A unit of wool, represented by the logogram LANA, equates to approximately three kilograms of fleece, or the expected production of four adult wethers (Burke 2010:83, Freo et al. 2010:341, Nosch 2014a:373, Rougemont 2014:349). However, these numbers relate to wethers only (the castrated male sheep) which are kept solely for producing wool. The wool production ratio for breeding flocks, namely those made up of ewes and lambs, is more difficult to determine, with Rougemont (2014:350) referencing KN Dl(1) tablets, which seem to approximate five sheep for one LANA of wool.

3.3 Administration of palatial production

Textile manufacture was administered from the Mycenaean palaces through multiple channels of procurement, and redistribution for materials and labour (Alberti 2012:23, Burke & Chapin 2016:37, Droβ-Krüpe & Nosch 2016: 300, Killen 1984:252,

Lupack 2011:207, Nosch 2012:43, Voutsaki 2001:207). However, it is important to remember that the Mycenaean palatial administration was not a uniform system and there appears to be a certain amount of collaboration between the palaces throughout their use (Burke & Chapin 2016:37, Kelder 2020:40, Palaima 1991:275, Sherratt 2001: 232, Tisdell & Szizzero 2023:195). Each palace centre operated independently within its own region and while there may have been trade between palace centres, each palace was separately managed. This continued until c. 1400 BCE when Kelder (2020:39) suggests that the king of Mycenae became a great king, and exerted power to some degree over the other Mycenaean palaces. The evidence for this claim is robust, as interregional trade does seem to favour resources being funnelled to Mycenae at this time. The head of each palace was known as the *wanax*, this figure is often believed to be synonymous with the rank and title of king, as the head of the religious, military, and judicial systems (Haskell 2004:152, Tisdell & Szizzero 2023:195). Aside from this role, the *wanax* was directly involved in the production of textiles, and in particular, certain textiles such as those dyed purple (Haskell 2004:152, Nosch, 2004:37, Palaima 1995:157, Palaima 1997:407). This further implies the importance of his position as the head of the royal household, and directly oversaw the production of textiles designed for the elite. Mycenaean culture is often generalised, however these palace centres were not homogenous, and did not necessarily cooperate to produce a ‘Mycenaean’ product, instead producing items from Knossos, Pylos, or Tiryns, for example. Nevertheless, Kelder (2020) has argued that due to the scale of c.1400 BCE Mycenaean expansion, and its close trade with Egypt, that Mycenae's ‘great king’ may have held varying levels of control over other Mycenaean kingdoms and been instrumental in advancing the reach of Mycenaean goods. While it is possible that Mycenae may have had influence over a range of products from other kingdoms for international trade, it certainly does not mean they had a homogenous scheme for production and administration. This theory also does not account for the domino effect of trade links with Mycenae enabling subsequent access to smaller kingdoms through indirect contact.

Sources for the scale of textile manufacture in Mycenaean Greece are limited by several factors. The first limiting factor is that Linear B records only come from contexts of palatial administration, and as previously mentioned, were not created to

be durable or long-term (Gasbarra 2016:260, Killen 1984:243, Palaima 2011:274 Palaima 2014:439). Instead, the preservation of many of these Linear B tablets was due to an uncontrolled fire which inadvertently baked the clay allowing for their survival (Palaima 2014: 439, Tisdell & Szizzero 2023:197). These administrative records were only required to last a single year, and then would be replaced with an updated version (Bennet 2001:29, Judson 2000:13, Killen 1984: 243, Killen 2015:397). This means that the records we have access to are only from a limited perspective, and in many cases, from a single year prior to the collapse of these administrative centres. The time associated with the collapse of each of the Mycenaean palaces also influenced the number of records preserved, the relative size of the associated territory, and the time of year, which may imply variability in the number records kept, or the restocking of flocks which had not yet been tallied (Rougemont 2014:342). An example of this is the discrepancy between the number of sheep recorded at Pylos, as opposed to the number recorded at Knossos. Records from Pylos total approximately 10,000 sheep, whereas Knossos records the same 10,000 sheep on a single tablet of a larger collection (Nosch 2014b:1, Rougemont 2014:341). Rougemont (2014:342) suggests that this may be due to the palace at Pylos being destroyed at the beginning of Spring, before shearing records would have been created, whereas Knossos was burnt at the end of summer when shearing records would have already been catalogued.

The second limiting factor is that Linear B accounts tend to be from the larger palace centres, with fewer sources from smaller secondary sites, and none from private textile merchants which operated outside the palatial system (Killen 1984:243, Killen 2015:397, Rougemont 2014:340). So, we only get fragments concerning the wider world of textiles in the Mycenaean period and are unable to fully construct a comprehensive understanding of the differences between palatial systems, non-palace-owned operations, and domestic textiles produced for the household (Rougemont 2014:340). As such, when looking at the primary records relating to the creation of textiles, the scale only accounts for textiles produced through the palatial administration of large centres, but not the wide range of other entities also producing textiles commercially and privately.

Mycenaean Knossos tends to be used as the preferred case study due to the inadvertent preservation of the Linear B records, the number of records recovered from the site, the size of the region Knossos controlled, and the long history of site occupation. There is the threat of doubling up in the numbers from Knossos, as both separate shearing records and flock records were maintained, which indicates that an aggregate number of sheep across all the references would likely not be accurate to the total sheep accounted for (Rougemont 2014:343). Focusing on the records attesting to the number of sheep spread amongst numerous flocks, Knossos is noted to have controlled approximately 100,000 sheep (Figure 6) (Killen 2015: 73, Nosch 2014a: 393, Nosch 2014b:1, Rougemont 2014:343). Only two tablets recovered from Knossos record 700 units of wool, which equates to approximately the wool of 2,800 sheep so these numbers appear to be feasible (Nosch 2014a:374). Pylos, which controlled a third of the territory of Knossos, is attributed to having controlled about 10,000 sheep, which were recorded on a multi-flock tablet unlike Knossos, which formatted their records per flock (Rougemont 2014:343). Unfortunately, these two examples are the only examples of systematic flock records that have been discovered, and due to the lack of preservation at other palatial centres, it is unlikely that this number will increase (Rougemont 2014:343).

Figure 6. Π-N234, Palm-leaf tablet recording flock numbers controlled by Knossos, Knossos c.1400 – 1375BCE, Heraklion Museum (Photograph: Katherine Laczko).

3.4 Wool allocations

Wool was allocated to groups identified in various ways. Some of these ways were by their locations such as by villages, ethnic groups, or by the head of an organizational structures, such as the ‘collectors’ who were responsible for overseeing some textile manufacture (Rougemont 2014:358). An excellent resource for considering these varying designations can be viewed in the Lc(1) set from Knossos which gives several examples relating to ethnic designations and ‘collector’ groups (Firth & Nosch 2002:129, Nosch 2011:500). This example refers to the wool allocated to these groups, the production target, and the textiles produced within the allotted time given (Firth & Nosch 2002:129, Nosch 2011:500). This is a generalized list of frequent recipients of wool allocations, but we have evidence from Kadmeion (Thebes) naming certain houses for production on a domestic scale, which suggests that wool distribution was not restricted to large groups or communities but also

available to smaller entities working under the palatial system (Nosch 2011:499, Rougemont 2014:358). Wool was also directly sent to temples, or to buildings associated with divine figures which will be discussed in a later chapter.

3.5 Estimating required labour using experimental archaeology

The total number of individual workers was not recorded within the Linear B documentation, only the groups required to produce the assigned textiles. Experimental archaeology reverse engineers the targets provided in the Linear B tablets by calculating the time involved in production, such as spinning or weaving and dividing the labour required for each finished piece. Therefore, the total number of workers can be deduced by the volume of textiles being produced and consequently recorded.

Experimental research from the Historical- Archaeological Experimental Centre in Lejre, Denmark, used a number of experiments to draw tangible conclusions about methods used to construct Scandinavian Iron Age textiles (Andersson & Nosch 2003:198). Bronze Age Mediterranean techniques have many commonalities which can also be applied to this project. These trials found that the size of spindle whorls greatly impacted the thread able to be spun by each whorl, and a difference of only 5 to 10 grams would vastly impact the fineness of the spun thread (Andersson & Nosch 2003:198). The thickness of the yarn was also impacted by the quality of the raw wool being spun, with a mixed wool using fine fibres able to yield 14,000m of thread using a five-gram spindle whorl (Andersson & Nosch 2003:198). While a mixed wool of a coarser fibre with a thirty-gram spindle only yields 3,900m of thread (Andersson & Nosch 2003:198). Once the thread is spun, it then needs to be woven. This process undertaken on a vertical loom progresses at a rate of approximately 70cms per day, after about two days to prepare the loom for weaving (Andersson & Nosch 2003:199). A 70 x 70cm square of woven cloth in a simple 2/2 twill would require about 1,680m of spun wool (Andersson & Nosch 2003:199). Thereby in contrast, spinning the wool into thread took much of the time spent making textiles, while comparatively, weaving was a much faster task (Andersson & Nosch 2003:201).

Prior to being spun, the raw wool had to be sorted, cleaned, and prepared for spinning which impacted the time required to make textiles (Andersson & Nosch 2003:200, Nosch 2012:43). Using the Mycenaean textile *te-pa* as an example, which required seven *LANA* or 21kgs of raw wool, it is estimated that after cleaning, sorting, and processing would leave approximately 10kgs of clean wool to be spun and woven (Andersson & Nosch 2003:201, Nosch 2011:496). The experiment's rate of spinning yielded approximately 20m of thread per hour, or 1km of thread over 50 hours (Andersson & Nosch 2003:201). For the *te-pa*, this would require either 1950 hours of spinning for a single person on a thirty-gram spindle or about 7000 hours using a single five-gram spindle (Andersson & Nosch 2003:201). Even with a large household working together on a single textile, these figures suggest that textiles required hundreds to thousands of hours to produce, and many households were involved in the production of these textiles for trade (Andersson & Nosch 2003:201). By splitting a maximum of 7000 hours amongst many households, we can see that the numbers recorded in Linear B records translate to huge allotments of time and labour for each finished *te-pa* textile.

The scale of the textile industry as evident in the Linear B records could only have operated as a fundamental aspect of Mycenaean palatial economies. Due to the Mycenaean palaces producing similar textiles to each other, the market for these textiles was most likely other cultures. This suggests that the textile industry was operated on a scale intended to produce a commodity for trade and not just for local consumption.

Chapter 4: Maritime Archaeology and Maritime Trade in the Bronze Age Aegean

4.1 History of Mycenaean Trade

The Mycenaean textile industry operated on a scale intended as a primary trade commodity. Access with nearby cultures focused on maritime trade due to the ease of moving cargo long distances by sea. Trade partners were integral for the Mycenaean palaces which needed to source commodities which were not abundant locally, such as copper to create bronze. As previously mentioned, extant textiles are rarely preserved which requires archaeological evidence of different materials to map trade interactions, such as pottery sherds. Evolving technologies used by maritime archaeologists may introduce aquatic contexts in which Mycenaean textiles could exist which may introduce new archaeological evidence in the future.

Mycenaean exports took several forms, including private ventures and palatially owned industries. The textile industry, as clear in the texts relating to palatial administration and was a leading export for the palatial economy despite Linear B records not naming the locations for export (Tartaron 2013:24). Due to this, the focus of literature tends to lean heavily on palace-run exports as this is far easier to map through Linear B documents (Parkinson et al. 2013:414, Palaima 1991:274). However, it is still important to acknowledge that exports also operated through privately owned commerce, and although Mycenaean items may appear in different regions, this is not evidence of direct trade. It is also unclear as to whether the exports were transported by Mycenaean ships, or whether they relied on merchants who operated on a contractual basis for the Mycenaean palaces. Direct trade or gift exchange with Egypt which could equally have been facilitated through indirect merchant shipments or Mycenaean-owned ships. It is unlikely that Mycenaean ships sailed with the sole purpose of delivering goods to Egypt, as favourable trade winds allowed sailors to travel directly from Crete to Egypt but required ships to stay close to the Levantine coast when travelling back mainland Greece (Alberti 2012:23, Barber 1990:106, Wachsmann 2012:203 - 204). There are many Aegean trade routes which interlinked the islands with the mainland and subsequently facilitated trading with other regions. The Aegean has a considerable diversity of maritime

environments, with local regional variations and seasonal conditions (McGeehan Liritizis 1988: 239 Tartaron 2013:93). This made maritime trade dependent on both seasonal weather patterns and local conditions which restricted maritime trade for portions of the year. Furthermore, this would require the routes undertaken for these voyages to be flexible depending on the prevailing winds and conditions (McGeehan Liritzis: 1988:239, Tartaron 2013:93 – 138). For a comprehensive description of these routes and Aegean maritime passages, see Alberti 2021, McGeehan Liritzis 1988 and Tartaron 2013.

4.2 A Brief History of Aegean Trade

The dates of early Aegean occupation are constantly being reassessed as further evidence emerges, but comprehensive debate on subtle shifts in cultural progression from Neanderthal to 'behaviourally modern *homo sapiens'* is beyond the scope of this thesis (Broodbank 2016, Carter et al. 2019:2, Horejs et al 2015:290, Reingruber 2011). The rough framework for habitation of the Aegean, and the move towards maritime trade has a few generalised phases. These include the occupation and adaption of coastal environments to exploit marine resources, the beginning stages of 'seagoing,' and then progressing towards developing a mastery of 'seafaring' (Broodbank 2016:200, Horejs et al. 2015:291, Ward 2010:149). Evidence of Neanderthal populations begin to appear across the Mediterranean and extend to the modern Mediterranean islands (Broodbank 2016:204, Carter et al. 2019:1). Suggested dates of Neanderthal habitation fall within the Lower and Middle Palaeolithic era, with *homo sapiens* appearing within the Mediterranean basin from c. 50,000 years ago (Broodbank 2016:205, Carter et al. 2019:5). The first definite evidence of sea-crossing appears from the Aurignacian site of Fontana Nuova c. 30,000 years ago, with the last millennium of the Pleistocene beginning to exhibit more advanced seafaring (Broodbank 2016: 206 – 208). The arrival of Neolithic humans occurred at Knossos c. 7000 – 6000 BCE along with the emergence of Neolithic features such as pottery, the husbandry of domesticated sheep and increasingly intensive farming after the cold snap of c. 6200 BCE (Burke & Chapin 2016:24, Broodbank 2016:215, Horejs et al. 2015:293, 323, Molloy 2016: 3, Nosch et al. 2021:36, Reingruber 2011:293). However, Tisdell & Szizzero (2023:193 - 194) argue that the poor bio-geographic conditions were the primary agent to spur

Aegean trade, not an improvement and subsequent intensification after poor environmental conditions. Along with the taxonomic evidence of domesticated sheep, flax seeds, spindle whorls, loom weights, bone needles and other textile tools appear during the Neolithic period at Knossos (Burke 1997:416, Burke & Chapin 2016:20, Nosch et al. 2021:36). Goats and sheep also began to appear in Aegean art on Crete in the Pre-palatial period with goats painted in white, while images of sheep were depicted as red which matched extant breeds of sheep which had a reddish hue to their wool (Nosch et al. 39). After c. 2000 BCE new breeds of sheep which were selectively bred for maximised wool production and introduced to Greece from Anatolia (Burke & Chapin 2016:21). This progress enabled a drastic increase in textile production and led to the development of elaborate woven designs (Burke & Chapin 2016: 21). Maritime-led contact between the Aegean cultures was integral for shared growth due to the movement of key resources and hybridisation of new techniques and technologies (Alberti 2012:23, McGeehan Liritzis 1988:237).

Interregional trade began to gained momentum during the Middle Bronze Age, when Minoan Crete began to export significant quantities of agricultural goods to the Near East c. 1900 BCE, with Mycenaean centres following at the beginning of the Late Bronze Age (Dawson & Papadimitriou 2020:159, McGeehan Liritzis 1988:237, Molloy 2016: 3, Papadimitriou & Kriga 2013:10, Ward 2010:151). Prior to this period, Crete was an outlier in Aegean trade, only beginning to intensively trade with their neighbours, after the Greek mainland and nearby islands were already exchanging with the edge of the Adriatic (Alberti 2012:23). Influence from the Near East to Minoan Crete is evident in the dramatic increase in agricultural surpluses and large-scale trade administration (Papadimitriou & Kriga 2013:10, Tisdell & Szizzero 2023:193) This intensification of trade connected Minoan Crete to exotic materials such as gold, ivory, faience, and Egyptian luxury goods such as seals, scarabs and jewellery (Papadimitriou & Kriga 2013:11, Tartaron 2013:13). By the rise of the Mycenaean palaces, trade routes were already established and facilitated the movement of goods throughout the region (Tartaron 2013:21).

A primary focus of imports by both the Minoans and Myceneans was to source raw materials that were not available locally (predominantly metals such as copper), with the closest source Kythnos not being particularly rich in copper ore. Instead, Cyprus

was the primary supplier of copper ore to the Mycenaean kingdoms (Alberti 2012:25, Knapp 1990:137, Papadimitriou & Kriga 2013:13). In exchange, Mycenaean-made commodities such as wine, olive oil, timber, and our focus, textiles were used as exported goods (Carlson 2012:383, Dawson & Papadimitriou 2020:159, Hruby 2013:426, Ward 2010:150). Unfortunately, many of these items are archaeologically invisible, due to items being consumables, or due to the disintegration of organic materials through time. Instead, evidence of Mycenaean exports is more apparent through mapping the distribution of pottery, as containers for many of these materials used ceramic vessels, and the fragmented ceramics are significantly more durable than the items they contained (Tartaron 2013:6). Mycenaean pottery sherds appear in almost all sites throughout the Aegean, the coast of Asia minor, West of the Aegean, and throughout Egypt (Burns 2010:11, Carlson 2012:383, Dawson & Papadimitriou 2020:159, Sherratt 1994:35). Cline (2007:199) suggests that primarily trade was directed to the main palatial centres within the Aegean, with secondary redistribution from those centres, as opposed to direct international trade. This appears to be the most likely scenario due to the large storerooms found in the larger Mycenaean palaces. Secondary evidence of the rise of Mycenaean contact could be implied by the increased fortifications of newly contacted cultures (Knapp 1990:128). This seems dubious, as trade interaction should not be enough of a provocation for the drastic expenditure in both resources and time, merely by contact but not necessarily a threat directed from the Mycenaean kingdoms.

Of the localities importing Mycenaean goods, there is the question of whether the Mycenaean palaces had direct trade into the region, and by association, political interactions. This will be a brief discussion of archaeological evidence of trade with some of the neighbouring cultures (Fig 7.). This is by no means exhaustive, and due to the lack of tangible textile evidence, pottery will also be used as a secondary means of mapping trade with these regions (Tartaron 2013:23).

Figure 7. Map of cited trading partners (Map: QGIS 2024).

4.2.1 Anatolia

Mycenaean pottery rarely reaches Anatolian inland sites, which suggests that the spread of Mycenaean goods primarily existed within the sphere of maritime trade through indirect contact with vassal states (Dawson & Papadimitriou 2020:160, 168, Kelder 2004:51). Mycenaean vases were uncovered at the site of Maşat Hüyük in central Anatolia, but the lack of samples, and subsequent lack of Mycenaean pottery from Hattusa suggests that there is not enough evidence to conclude that the Mycenaean palaces had direct trade contact with the Hittites (Dawson & Papadimitriou 2020:160, Kelder 2004:51). Likewise, Anatolian items account for some of the lowest number of recovered imported objects found in Mycenaean sites when compared to their Near Eastern neighbours (Cline 2007:195, Kelder 2004:52). The lack of Mycenaean evidence in central Anatolia, and Anatolian evidence in Mycenaean territories, suggests they were likely not trading partners and that any items from the respective cultures were likely gained through indirect merchant trading.

Western Anatolia meanwhile has a mix of Anatolian and Mycenaean wares, particularly in Miletus at a rate which would be consistent with designating Miletus as a Mycenaean colony (Kelder 2004:50, Mee 1978:149, Vaessen 2016:45). Locally produced pottery seems to suggest an amalgamation of Anatolian and Mycenaean ceramic traditions which Vaessen (2016:58) claims is a result of diffusion between the Mycenaean settlers and existing Anatolian pottery styles. Cretan textiles, and textile traditions certainly made their way into Anatolia due to the adoption of Cretan-style discord loom weights during the period of Mycenaean colonies, but as previously mentioned, this was likely due to private merchant trading or Mycenaean colonies, not palatially administrated trading (Cutler 2012:151).

4.2.2 Cyclades

The islands of the Cyclades are a difficult network to summarize in this limited scope. Cycladic culture was affected by the advent of Minoanisation and then the subsequent Mycenaesation which dramatically increased in the LHIIIA period (Alberti 2012:32, Earle 2012:7). This process was accelerated as maritime trade intensified in the region and while the islands of the Cyclades have their own unique cultural heritage, this becomes muted as Mycenaean control rose in the area and used the Cycladic islands as a primary route to access the south-eastern Aegean (Alberti 2012:36, Earle 2012:20). Due to these reasons, Cycladic trade, while acknowledged as unique to the Mycenaean Greek mainland, or Mycenaean Crete, will not be a primary focus.

4.2.3 Cyprus

Cypriot imports begin sometime within the Late Hellenic/ Late Minoan I to Late Minoan IIIC contexts, with Cypriot artefacts not appearing on mainland Greece until LH IIIB, which was a period of dramatic increase in Cypriot imports (Cline 2007:195, Sherratt 1994:36). As previously mentioned, Cyprus was a key source of copper and timber with most of the copper found in Mycenaean contexts being sourced from Cyprus (Knapp 1990:137, Orphanides 2017:9). Cyprus also served as a waypoint for Aegean trade to access Africa and Asia which made it an integral waypoint and it gradually became Hellenised as Mycenaean control on the island increased (Knapp 1990:116, Orphanides 2017:8, Sherratt 2001:223). Mycenaean pottery was exported to Cyprus in large quantities throughout the Late Bronze Age, with over 4000 vessels found on Cyprus with the peak importation period occurring during the LH IIIA1 – IIIA2 (Cline 2007:196, Sherratt 1994:37). A debated term in the Linear B is *kn-pi-ri-jo* translated to ‘Cypriot’, and *a-ra-si-jo* as ‘*Alasiya* ‘or *‘Alasiyan’,* with either name likely being a reference to Cyprus (Cline 2007:199). During LM IIIA12 – IIIB the importation of Cypriot copper appears to drastically decrease which suggests that the Mycenaean copper supply had been replaced with a more favourable arrangement, possibly a Western source (Bassiakos & Tselios 2012, Knapp 1990:122,137).

4.2.4 Egypt

Trade with Egypt had begun by at least the Middle Minoan II period on Crete (Alberti 2012:30, Barber 2016:209, Kelder, Cole & Cline 2018:10, Papadimitriou & Kriga 2013:11, Wachsmann 2012:204). Evidence suggests some state-level interactions between the Minoans occurred with the Egyptian Middle Kingdom, but this was sporadic and likely facilitated through trade along the Levantine Coast (Kelder 2009:339, Papadimitriou & Kriga 2013:11). In the 18th Dynasty, Egypt expanded its influence in the Mediterranean, with evidence indicating a shift in military, trade, alliance, and gift exchange relations with the surrounding cultures (Harris 2012:76). One of the primary focal pieces of archaeology that link the Egypt to the Aegean appears during the reign of Amenhotep III in his mortuary temple of Kon el-Hetan (Bachhuber 2006:345). An inscribed statue bears place names in the Aegean (including both Minoan and Mycenaean settlements) and appears to record a voyage of gift exchange with Aegean states (Bachhuber 2006:345). Unlike this Egyptian record, the Mycenaean texts do not record the exchange of goods through trade or gift exchange. Linear B tablets at Knossos contain two references to the Egyptians, *mi-sa-ra-jo (*Egyptian) and *a3-ku-pi-to-jo* (Memphite or Egyptian), but no other texts at other Mycenaean settlements directly reference the Egyptians by name (Cline 2007:198).

Fragments of Mycenaean ceramics appear as far south as Amara West by the New Kingdom (c. 1550 - 1070 BCE), with samples dating the Late Hellenic IIIA – IIIB periods (c. 14th to 13th century BCE) (Dawson & Nikolakopoulou 2020:159, Kelder 2009:341, Kelder 2010:130, Spataro et al. 2019:683 – 684). These fragments primarily consist of closed form vessels, such as those used for oils, as olive oil was a desired commodity by the Egyptians (Cline 2007:196, Spataro et al. 2019:684, Van Wijngaarden 2011:237). Ceramic fragments from Amara West are indicative of perfumed oils being one of the Mycenaean luxury goods exported for trade, either directly or indirectly into Egypt (Kelder 2009:343, Kelder, Cole & Cline 2018:14, Sparato et al. 2019:696).

Due to the amount of pottery found throughout sites in Egypt, it is likely that Mycenaean products were sent directly from Greece to Egypt, which would have

undoubtedly travelled through maritime routes (Carlson 2012:383, Spataro et al. 2019:687). It is quite possible that the textiles were included in these shipments, but the ceramic evidence has been preserved where textiles have not. Qasr Ibrim has evidence of textile fragments from the Ptolemaic period, located close to the border of modern Egypt and Sudan (Adams 2007:202). The dominant fibre used was flax, with cotton gaining popularity through the history of the site (Adams 2007:202 – 203, Harris 2012:77). Wool appears in the archaeological record, a fibre predominantly imported into Egypt and one of the primary exports from the Mediterranean (Adams 2007:203). However, the surviving samples of wool date to well after the collapse of the Mycenaean culture, but the lack of extant evidence from a fragile organic material such as wool does not rule out its use in the region, especially when pottery fragments suggest Mycenaean luxury goods circulated within the Lower Kingdom of Egypt. Both the Mycenaeans and the Egyptians graded their cloth on a similar scale (Harris 2012:78). These Egyptian grades were, ‘royal linen’, ‘fine thin cloth’, ‘thin cloth’ and ‘smooth or ordinary cloth’ (Harris 2012:78).

A primary source linking the trade of textiles from Mycenaean Greece to Egypt exists in the iconographic representations of people from ‘Keftiu’ presenting offerings in the tombs of Rehkmire and Menkheperraseneb dated c. 1450 BCE (Barber 1990:109, Barber 2016:212, Harris 2012:75,82, Killen 2015:82). The evidence of Mycenaean contact is apparent in the iconography of Mycenaeans bringing offerings to the deceased, but also in tomb paintings where Barber (1990:109) suggests the reliefs mirror Aegean woven textiles including motifs of spirals and bulls’ head rosettes (Barber 2016:208,216, Cole & Cline 2018:14, Killen 2015:82). These themes also appear in other tombs, but the style and dating blurs the lines between the Aegean styles of Minoan and Mycenaean forms, (for a thorough breakdown of the Aegean textile-inspired designs, see Barber:2016). The exact location of ‘Keiftu’ is debated, either describing Cretan Mycenaean palaces or referring to Mycenae on the Greek mainland (Harris 2012:75, Cole & Cline 2018:13, Kelder 2020:45). Barber (2016:212) believes the name ‘Keftiu’, is a name for Crete and translates to, ‘Islands in the Midst of the Great Green (sea)’. There are also specific references to *Tj-n3-jj* (to be read as *Tanaja* or *Tanaju*) which directly refers to the Mycenaeans from mainland Greece (Cole & Cline 2018:14, Cline 2007:197, Kelder 2009:340, Kelder 2010:126). These

references occur during the reigns of Thutmoses III, Amenhotep III and Rameses II (Cline 2007:197, Kelder 2010:125).

Stylistic traits can be expressed through Mycenaean, Theran, or Minoan textile designs as all three contained ‘Aegean elements’ and had deeply influenced each other (Cutler 2012:145, Harris 2012:76). Similarly, a piece of c. LHIIIA2 fragmented papyrus appears to show Mycenaean soldiers, distinguished from the allied Egyptian soldiers by adorning boar tusk helmets and ox-hide shields (Figure 6.) (Barber 1990:110, Barber 2016:209, Cline 2007:197, Kelder 2010:127, Cole & Cline 2018:17). This could either suggest a Mycenaean military presence within the region to assist the Egyptians, or more likely due to the lack of Egyptian records, a group of Mycenaean freelance mercenaries (Cline 2007:197, Kelder 2010:127). Aegean designs also appear within Egyptian tombs, with patterning suggesting the design had either been copied from an imported textile design or was designed to mimic woven features (Barber 1990:106, Barber 2007:177, Harris 2012:85).

Figure 8. Mycenaean boar tusk helmet, 14th Century BCE, Mycenae, National Archaeological Museum, Athens (Photograph: Katherine Laczko).

The bulk of Egyptian imported goods were found in Mycenaean sites on Crete, but during LHIIIB there appears to be a shift towards more of these items instead being directed to mainland Greece (Cline 2007:191, Cline 2013:193). These items form a range of storage ceramics which suggests that perishable goods were imported, along with luxury items such as decorative scarabs, faience, and glass or stone figurines (Bachhuber 2006:345, Cline 2013:193). Less than half of the Egyptian imports were luxury and ritualistic items (Cline 2013:193, Kelder 2020:46). Kelder (2020:46) argues that the ritual or symbolic items imported into Mycenaean settlements were held with the same ritual importance as in the country of origin, with one fragmented plaque found within a cult centre (Figure 7.) (Van Wijngaarden 2011:226). This suggests a level of cross-cultural dissemination of religious practice between Egyptian and Mycenaean traditions. By the New Kingdom, the ruling classes of Mycenae and Egypt appeared to maintain close contact through continued reciprocal trade or gift exchange (Kelder 2010:137).

Figure 9. Faience tile bearing cartouche of Amenhotep III, c. Late 13th Century BCE, Mycenae, Archaeological Museum of Mycenae (Photograph: Katherine Laczko).

4.3 Considering bias in the archaeological record of Aegean trade

It is important to address the inherent biases present in our interpretation of the archaeological record. Much is based on the use of exotic materials of which only a minority could conceivably own to track all interaction between cultures. These items

are immensely useful to create connections linking a region of origin, and map possible routes until its location in situ. While these links are important to map cultural contact, prestige items only exist in these contexts due to the elites' conspicuous consumption to display status or wealth, and not from items circulated among most of the population (Legarra Herrero 2016:28, Molloy 2016:6, Van Wijngaarden 2011:228) However, Ward (2010:153) argues that the Aegean ceramics found in Egypt represent only moderate wealth, not only those of high-level elites. This claim seems ambiguous as the apparent social stratification in these societies would suggest that even moderate wealth, in this case the burials of artisans and mid-level managers, would still be within the minority.

One of the commonly acquired goods which may show social or cultural transmission are ceramic or metal items (Burns 2010:11, Dawson & Papadimitriou 2020:159, Molloy 2016:6, Sherratt 1994:35, Van Wijngaarden 2011:225). Often the ceramic container does not represent the commodity of value, these ceramic vessels can help identify a stylistic link to the origin of the product, and therefore the potential trade routes undertaken (Carlson 2012:383, Molloy 2016:6, Spataro et al. 2019:684).

From an archaeological perspective, we know very little about the motivations of ordinary citizens that were not wealthy enough to amass valuable grave goods, were not in a position of power that associated them with a formal title and were not mentioned in the written record. Similarly, our understanding of crafts produced from private Mycenaean households get lost in the magnitude of the palatial system (Parkinson et al. 2013:419, Van Wijngaarden 2011:228). Instead, elites tend to be seen as the primary agents driving trade, innovation and mediating positive changes in the communities (Legarra Herrero 2016:30, Molloy 2016:7, Voutsaki 2001:195). This factor becomes especially important in the Mediterranean as the climate can be unreliable and drastically affect food production, so these trade connections were integral to lower echelons of society (Legarra Herrero 2016:27, Tisdell & Szizzero 2023:193). The Mycenaean palatial economy was based on a system of redistribution from the palatial centres, to manage the labour and materials from workers to provide products for export, but also to manage allotments of food and the same raw materials as compensation for that labour (Parkinson et al. 2013:413 Tisdell & Szizzero 2023:197). There is also evidence that the Mycenaean palaces

acted as a central location for private enterprise to also operate within, with the suggestion that these systems became the foundation for the future Classical Greek Agora (Parkinson et al. 2013:413). This also applied to crafts which were not managed by palatial administration, such as the ceramics industry which appears to have mostly operated with little to no involvement from Mycenaean administration (Parkinson et al. 2013:419, Tisdell & Szizzero 2023:203). The amount of focused literature on the Linear B texts does skew our interpretation of all Mycenaean trade, with far more of an academic lens concentrated on the redistributive palatial systems and less on the development of industries prior to the rise of palatial control, or alternative trade models (Parkinson et al. 2013: 413,417). We cannot conceivably know the number of textiles being exported from the full range of Mycenaean settlements, we only have the figures to account for regionally distinct palatial economies, not a comprehensive view of all Mycenaean trade.

Using pottery sherds to map the trade of textiles is also not a definitive means of mapping all textile trade. Textiles were worn, and likely lasted for far less time than a ceramic item which may have been reused over and over. Conversely, textiles were lighter, easier to transport and could have been re-sold which may suggest that textiles could have travelled further abroad as a sole product where secondary ceramics may not be present (Droβ-Krüpe & Nosch 2016:319). Also, this argument only addresses the textiles for trade, not the potential scope of textiles produced by Mycenaean weavers and privately used by travelling civilians which can also distort mapping trade through surviving archaeological samples.

Further anomalies in the archaeological record are immigration patterns, and the social implications of the movement of people into these spaces. While we have archaeological material, which may suggest the country of origin or the workshops which produced items, we do not necessarily know the rate of migration between areas or how those movements directly affected the spread of archaeological materials outside of the trade (Molloy 2016:9). For example, Mycenaean designs may not have been incorporated into products for their artistic merit, but instead as a nostalgic symbol of a migrant's traditional heritage. The social infrastructure of these migrations is also worthwhile to consider, were migrants homogenized into their new environment, or did they exist in the periphery of the wider society (Molloy 2016:10)?

4.4 The importance and influence of maritime trade

Maritime trade was important in the Aegean for numerous reasons, such as contact with other Aegean islands, difficult terrain for land-based trading routes, the ability to trade across long distances and the ease of moving heavy cargoes. This interregional trade supported the development of craft specialisation as the international market became a profitable endeavour, and therefore justified the increased labour to produce specialty items by having access to more elite customers. Interestingly, Nosch (2016) discussed terminology being shared by both looms and ships in Ancient Greek texts, which may be a legacy of the interrelation between weaving and maritime export from the Mycenaean age.

Mainland Greece and Crete have fewer preserved textile remains compared to similar sites of the same era elsewhere in Europe and into the Near East during the Late Bronze Age (Barber 1990:104, Harris 2012:80). Therefore, we need to rely heavily on extant and iconographic sources for our understanding of the finished textiles that would be used for maritime trade (Harris 2012:80). Relative to the field of Mediterranean archaeology, maritime archaeology is comparatively in its early stages due to ever-evolving technologies which allow archaeologists to excavate sites (Carlson 2012: 380, McCarthy et al. 2019:3, Parker 2002:8). Physical excavations are done directly by employing scuba or by using remotely operated vehicles for greater depths (Parker 2002:9). However, the gold standard of archaeological practice is to record sites in situ, ideally by non-invasive scanning so that a digital copy can be studied without the destruction of the site or attributed expense (McCarthy et al. 2019:3, Parker 2002:10).

While the route of merchant ships is not necessarily followed on a static course, due to several factors with weather being a leading cause, we can observe aggregate data to map frequent routes of these ships by their most-likely depositional spread (Parker 2002:11, Wachsmann 2012:203). As discussed previously, these ships not only moved resources around the Mediterranean, but also spread ideologies, ideas and cultural practices which were both enabled by immigration, and through mutual cultural exchange.

4.4.1 Case Study: Uluburun

The Uluburun ship sank off the Lycian coast in the late 14th century BCE and despite the notable age of the vessel, the true value in this discovery was due to its use as being a heavily laden merchant ship which contained a variety of cargo (Bachhuber 2006:347, Harris 2012:63). While there was a wide range of goods found at the site, this discussion will focus on the recovered bulk items which are more indicative of the primary cargo, and pottery which is often presented as evidence for the nationality of the crew aboard.

The Uluburun ship was carrying at least 354 copper oxhide ingots (Figure 10), 121 copper bun ingots and a range of two handled copper ingots (Bachhuber 2006:348, Knapp 1990:120, Pulak 1998:193, Tartaron 2013:25). The copper cargo alone weighed approximately 10 tons which is of an equivalent size to similar metal cargoes from pharaonic records dealing with shipments from the Near East (Bachhuber 2006:348- 349, Burns 2010:14). Recovered pottery totalled to about 130 – 150 Canaanite amphorae, 7 late Cypriot pithoi, a selection of Levantine lamps and flasks, and more lamps of either a Cypriot or Levantine origin (Bachhuber 2006:347, Knapp 1990:120, Pulak 1998:201, Tartaron 2013:25). These Canaanite jars predominantly contained terebinth resin, olives and glass beads which suggests that the cargo was loaded at a Syro-Palestinian port (Bachhuber 2006:347, Pulak 1998:201). Approximately 175 cobalt, blue and lavender glass ingots were found on the site which likely also originated from the Syro-Palestine coast and Egypt due to similar terms featured on the Amarna and Ugaritic tablets as *mekku* and *ehlipakku (*Jackson & Nicholson 2010:300, Pulak 1998:202). At least nine or ten cultures are represented in the materials from the Uluburun site, which makes it difficult to determine a specific port of origin or its intended destination (Burns 2010:14, Ward 2010:155, Van Wijngaarden 2011:226). However, the prevailing theory amongst academics is that the Uluburun was likely making its way into the Aegean due to its Syro-Palestinian cargo (Burns 2010:14, Jackson & Nicholson 2010:300, Tartaron 2013 :26, Ward 2010:155).

Figure 10. Copper Oxhide ingot, 1650 - 1500 BCE, Poros, Heraklion Museum, Crete (Photograph: Katherine Laczko).

Seven Mycenaean pottery vessels were recovered from the site, dating to approximately Late Helladic IIIA2, which appear to be items used by the crew, rather than items for trade due to patterns of use (Bachhuber 2006:347, Knapp 1990:120). Another distinctly Mycenaean find from the site is a Mycenaean seal, likely a merchant's seal which suggests that there was a level of Mycenaean control over the items on board (Burns 2010:14, Knapp 1990:120).

It is unclear whether this large ship was operated as a standard merchant vessel, or if it used to carry cross-cultural reciprocal gift exchange (Bachhuber 2006:349, Jackson & Nicholson 2010:300, Tartaron 2013 :26, Van Wijngaarden 2011:226). The value of the bulk commodities from the Uluburun site could suggest one of these gift exchanges (Bachhuber 2006:349, Tartaron 2013:26, Van Wijngaarden 2011:226, Ward 2010:154). However, there is immense difficulty in distinguishing items as privately traded commodities, or the result of established negotiations between cultures (Bachhuber 2006:350, Van Wijngaarden 2011:226). Likewise, the bulk items on board suggest a cargo of Near Eastern commodities, but there is no definitive evidence to account for the nationality of the operators of the vessel, the exact route it was following or the ports it intended to dock at. From the evidence of the

associated cargo, debate can be made for several possible scenarios which would equally lead the Uluburun ship to its current position (Bachhuber 2006, Cline and Yasur-Landau 2007, Pulak 1998).

4.5 Textiles in marine environments

Textiles require exceptional conditions to survive decomposition, this is typically seen in arid climates, in permafrost, through the addition of preservatives such as tannins, through carbonization or by located in low oxygen environments (Andersson Strand et a. 2010:151, Burnham 1965:169, Peacock 2001:184, Peacock 2005:47). Marine environments have the unique opportunity to preserve items that may otherwise decompose on land due to the reduced oxygen in the environment, low to no light, and sustained temperatures. If they have survived the depositional processes, textiles are relatively stable in situ while they remain undisturbed and the site itself has no sudden changes in temperature or the introduction of oxygen. Textiles found in damp conditions face the danger of decomposition when micro-organisms, either bacterial or fungal are able to multiply and thereby consume the textile (Jones et al. 2007:10, Peacock 1996:35,37, Peacock 2005:49). This forms the basis of biodeterioration which can also be caused through chemical reaction alongside physical biodeterioration (Peacock 2005:50). The surrounding environment greatly affects the ability of materials to maintain their form, this includes sediment which can act as a barrier from the wider environment. However, too much sediment on the textile, or the increased pressure at depth can result in deterioration by overburden, which is when the pressure exerted on the textile will result in crushing the material and thereby destroys the artefact (Peacock 2005:48). The final predominant factor for the deterioration of textiles in marine environments is chemical hydrolysis which causes the rupture of the organic fibres into smaller and smaller units (Peacock 2005:50). This process will occur on some level, with the pH of the surrounding water, ambient temperature and possible burial in sediment all contributing to the speed of decomposition (Peacock 2005:36, Wachsmann 2012:208).

On recovery, one option for the slowing of bacterial growth is the use of biocides, but as these are highly toxic, with the preferred method of killing off bacteria is by alcohol

fumes and spraying with ethanol (Jones et al. 2007:10 – 11). Recommended practice is that any textiles found in marine environments and required to be removed from the site, are lifted while in contact with the surrounding sediment block (Jones et al. 2007:8, Gleba 2011:10). Unfortunately, carbonized fabrics in wet conditions become exceptionally fragile and will be highly unsuitable for any fibre analysis. This is in contrast to carbonized fabrics found in arid conditions where carbonization may help to maintain the structure of woven fibres (Andersson Strand et al. 2010:152, Burnham 1965:169, Gleba 2011:9, Jones et al. 2007:15, Peacock 2001:185). This method requires the textile to still be recognizable amongst sediment and separated from items which may make block-lifting difficult. Therefore, in situ preservation for artefacts is now standard practice in archaeology, unless the site is at threat, or recovery of artefacts for further examination would yield scientific significance (Peacock 2001:188).

The combination of factors requiring textiles, especially Mediterranean Late Bronze Age textiles to survive requires very narrow parameters, but there is a possibility for those qualities to exist at depth. Beyond the conditions alone, high maritime traffic in the region increases the chances for the ships carrying exported Mycenaean textiles to exist undiscovered in situ (Wachsmann 2012:203). For these reasons, textile archaeology would greatly benefit from an enhanced focus on these maritime sites. This may provide access to materials otherwise absent on land, and which were in the process of being exported, like the case of the Uluburun ship. As textiles themselves inform archaeologists about a range of factors about the societies which created them, the discovery and preservation of extant sources would be invaluable to the archaeological record.

Chapter 5: Maritime Trade of Textiles

5.1 The desirability of textiles as a trade commodity

Textiles were incredibly easy to export internationally as they were lightweight and compact which caused textiles to have transportation costs seven times lower than that of grain (Droβ-Krüpe & Nosch 2016:298). Also, due to the immense textile industry funded and facilitated under the Mycenaean palaces, textile workers under the palatial system were able to gain a level of specialisation that was difficult for smaller private ventures to compete with (Gleba 2011:6). Textiles were therefore cheaper to transport than raw materials such as ore, but the added value from workers under the *ta-ri-si-ja* system made this a highly profitable commodity for the Mycenaean kingdoms to trade through maritime routes in exchange for locally unavailable materials.

Taxonomic characteristics from spindles found at Midea show that the textiles produced in these areas focused on producing fine threads, and therefore made a fine, high-quality textile (Sabatini 2016:231). This indicates that Mycenaean-produced textiles were of supreme quality and therefore expensive and desirable. Wearing Mycenaean textiles indicated both wealth and influence, and within foreign countries this also carried the novelty of exotic colours and patterns identifiable by Mycenaean designs (Alberti 2012:25, Droβ-Krüpe & Nosch 2016:315). Likewise, less desirable fibres and colours were traded to display the acquisition of a foreign product and thereby carried a sense of prestige associated with the textile (Droβ-Krüpe & Nosch 2016:316).

The phenomena of Mycenaean contact between the north-eastern Aegean can be seen in a three-phased process which began with initial contact and then further developed as trade routes became established. These three processes are migration, acculturation and finally hybridisation, which are expressed within elements of Mycenaean influence within local material culture (Girella & Pavúk 2016:17). Changes become evident through the importation of Mycenaean pottery, and then the development of Mycenaean shapes within locally produced ceramics (Dawson & Papadimitriou 2020, Girella & Pavúk 2016:16, Spataro et al. 2019:687).

This was not a distinctly Mycenaean phenomena, as prior to the Mycenaean settlement on Crete, Minoan cultural influence was already apparent throughout the

Aegean. This influence was expressed through multiple forms, importation of Cretan-Minoan goods, and the adoption of stylistic traits in pottery, iconography, architecture and even textile tools (Vitale & Vitale 2013:44,52). Meanwhile in the 12th and 13th centuries BCE a trend of locally distinct, Mycenaean-inspired pottery forms began to appear across the Aegean (Dawson & Papadimitriou 2020:160). Mycenaean ceramics inspired, 'Mycenaean style', 'Rhodo-Mycenaean', 'Italo-Mycenean' and 'Cypriot-Mycenaean' pottery styles (Alberti 2012:25, Barber 2016:229, Dawson & Papadimitriou 2020:160). This suggests that Mycenaean pottery was viewed as exotic and desirable, which may have influenced potters to copy these shapes to produce local and comparatively inexpensive products for those who were unable to afford the real imported pottery. Faience sherds found in Mycenae were originally believed to be the result of gift exchange with Egypt, but isotopic analysis concluded that the material was likely copied and made by a local Aegean workshop (Kelder 2009:346, Lilyquist 1999:306, Van Wijngaarden 2011:241). This example demonstrates that cultural diffusion was also evident in the evolution of Mycenaean products in the same way that Mycenaean influences were incorporated into neighbouring cultures.

The occurrences of Mycenaean styles expanding outward are explained by the core and periphery model, with central areas disseminating their stylistic and cultural traits outwards to the peripheral regions (Harris 2012:64, Papadimitriou & Kriga 2013). Likewise, the spread of Mycenaean pottery traditions can also be attributed to the immigration of foreign peoples, to and from the Mycenaean settlements, with evidence of foreign immigrants creating expatriate communities in other cultural landscapes (Molloy 2016:2).

Southern Italy contains the highest concentration of Mycenaean and Aegean-style pottery outside of the Aegean, but this does not necessarily mean that these areas were trading with Mycenaean palatial entities directly (Dawson & Nikolakopolus 2020:170). Instead, it appears as though the Mycenaean pottery was acquired for stylistic reasons, and not as a container for another material (Dawson & Nikalakopolus 2020:170, Knapp 1990:128). Evidence for this belief is shown through

local imitation of Mycenaean ceramics and many authentic Mycenaean ceramics appearing in funerary contexts, alongside other valuable materials (Dawson & Nikolakopolus 2020:171, Knapp 1990:128). These items also appear frequently in connection to goods that were traded from, or through Cyprus which indicates that Cyprus was an important trade partner (Dawson & Nikolakopolus 2020:171, Sherratt 2001:224). Alternatively, Mycenaean migration into areas of Italy may suggest that locally produced ceramics could have been manufactured by Mycenaean craftsmen, which have influenced the potters to produce near identical forms as those from their country of origin (Knapp 1990:128).

Distinct Mycenaean iconography begins to appear in this period where stylistic influences favoured Mycenaean styles over Minoan designs. Minoan textile designs had complex, colourful patterns with texture likely provided by beading alongside highly ornate, florally inspired patterns (Blakolmer 2012: 330, Murray 2016:46, 72). These Minoan patterns fade out by LHIIIB and instead are replaced with the Mycenaean scatter patterns of ‘dots, dashes and crescents’ or otherwise plain fabrics with decorative trims or fringes (Blakolmer 2012:330, Murray 2016:72 – 78). The differences in Minoan to Mycenaean textile artistic styles are a far more complex topic than can be covered in this chapter, but this gives a brief overview of how the textile designs move from more intricate designs towards repetitive motifs with a focus on banding, or decorative trims. Murray (2016:91) suggests this is due to the more efficient production of the base textile, which was then adorned with intricate trims, fringes, or borders to produce a higher quality textile.

5.2 Alternatives to the conventional trading of textiles

Ancient Mediterranean economies had multiple different trade models, so this chapter will explore how palatially administrated textiles could have been consumed by other entities within the Mycenaean kingdoms aside from traditional trade for an equivalent value in goods.

Gift exchange, or administrative trade was a sizeable component of trade within the Bronze Age, and a key driver in the exchange of resources between cultures (Alberti 2012:23, Killen 2015:416, Tartaron 2013:24, Voutsaki 2001:195). The terminology of ‘gift exchange’ is intrinsically problematic as a modern understanding of gifts are

either based on an emotional connection with the recipient, or linked with an event, such as a birthday or holiday (Bachhuber 2006:349). Alternatively, gift-exchange can be interpreted as a pre-payment for the return of desired commodities (Cline & Yasur-Landau 2007:126, Voutsaki 2001:206). A more accurate term would be closer to a reciprocal negotiation of resources, but this is far more difficult to adopt than the established academic description.

It is highly likely that Mycenaean textiles were used by the kingdoms in formal gift exchange with international trade partners. Regularly used commodities were imported from neighbouring regions, copper and tin were required for creation of bronze and not available in large quantities within Mycenaean territories (Killen 1984:262, Kristiansen 2013:6). Of the Ld(1) Linear B store records in Knossos, the term *xenwia* is recorded (Killen 1984:262). The translation is not definitive, but the term is believed to refer to cloth stored exclusively to be a gift for diplomats, or for 'guest welcoming' (Killen 1984:262, Killen 2015:417). The quality associated with *xenwia* cloth is debated, as the term *xenwia* never occurs in relation to *e-qe-si-ja*, the Linear B term for cloth of a higher quality (Killen 1984:264). This can be interpreted in multiple ways, either *xenwia* infers a high-quality textile, or that *e-qe-si-ja* textiles were reserved for another use (Killen 1984:264). Similarly, the *e-qe-ta* type may have also been a tangible benefit of association with the palatial elite, and those only within the inner circle may have been able to access these textiles at their own discretion, or within an arrangement for their personal use (Nosch 2014a:387). The Ld series tablets define these textiles as being richly coloured and patterned, which juxtapose the description of other finished products which just depict the logogram for the type of textile, but not any associated decorative elements (Nosch 2014a:387).

Iconographic evidence of the gift exchange of cloth appears both in Mycenaean and Egyptian sources, such as the previous mention of images in the tombs Rehkmire and Menkheperraseneb dated c. 1450 BCE (Barber 1990:109, Barber 2016:212, Harris 2012:64, Killen 2015:82). There also appears to have been an interest in Mycenaean perfumed oil, another specialisation controlled by the Mycenaean palaces. Sherds associated with pottery for perfumed oils occur with such frequency in the Amarna deposits that this is believed to also have been used as a prominent

Mycenaean greeting gift due to their use in ritual applications (Kelder 2010:132 – 134, Killen 2015:418). Similarly, olives and olive oil were also a requested import from the Mycenaeans as they served several purposes, ritual to culinary and were unable to be mass cultivated in Egypt (Kelder 2009, Kelder 2010:134). Evidence of the value and subsequent import of olives from the Aegean is shown throughout Egyptian iconography, including the use of olive branches in images of funerary bouquets and reference to ritual oils in extant sources (Kelder 2009:345 – 346, Kelder, Cole & Cline 2018:14).

Textiles are also likely to have been used as a form of payment or rations for workers within the Late Bronze Age (Gleba 2020:3335, Harris 2012:73, Nosch et al. 2013:474). The palatial elite were also given an allotment of linen; however, this was of such a quantity that it is unlikely to be kept for exclusively personal use. Instead, it is more likely that this linen was used as a currency for trade, gift-giving or even for sails (Hruby 2013:425). Laurion silver found in the shaft graves of Mycenae likely came to Mycenae through gift exchange with other Mycenaean settlements at the rise of Mycenae as the predominant Mycenaean palace (Kelder 2020:42). Metals were often circulated by gift exchange through the Mediterranean, which is evident in the Amarna Letters, and Egyptian records of exchanging metals into the Near East (Bachhuber 2006:350).

5.3 Votive Offerings, *Potnia* and her relation to wool and textiles

Potnia was the Mycenaean goddess associated with lambs, sheep, wool and textiles (Nosch 2014b:9). Potnia was not a goddess exclusively worshipped by the Mycenaeans as Potnia is also represented across Minoan and Mycenaean iconography and appears to have been consistent in her worship through Minoan and Mycenaean traditions (Boloti 2017: 3). Potnia was not the only figure to receive offerings of wool, Knossos Od(2) tablets also record wool for the goddess Eleuthia, written as *e-re-r-ti-ja* which demonstrates that while Potnia is often referenced in the Linear B, she is not the single deity involved with the textile industry (Boloti 2017:3, Lupack 2011:208, Nosch 2014a:375). Likewise, Poseidon is assigned wool and cloth offerings in tablets from Knossos and Pylos (Boloti 2017:13).

Potnia is often referred to as ‘the mistress’ as *po-ti-ni-ja-we-ja* and held as one of the primary female divinities in the Mycenaean texts (Nosch 2014a:373). One of the most striking representations of Potnia occur as ‘Potnia Theron, Mistress of Animals’ from a fresco in Akrotiri where she is offered saffron and surrounded by young girls collecting crocus flowers (Figure 11) (Barber 2007:176, Boloti 2017:4, Murray 2016:69). The collection of these two flowers implies that the women featured in the fresco are moving from youth to womanhood through an initiatory process under the supervision of Potnia, and by collecting these flowers they can begin learning how to make and dye textiles (Barber 2007:176, Burke & Chapin 2016:27, Boloti 2017:4, Murray 2016:69). Thereby, the movement from childhood into maturity for women was associated with their ability to produce textiles for the household (Murray 2016:70). This may also have accompanied a ritual where the saffron dyed cloth was spun, woven and dedicated to the temple of Potnia (Boloti 2017:5, Burke 2010:77).

Figure removed due to copyright restriction

Figure 11. Relief of Potnia Theron, Akrotiri Xeste 3, Room 3, 1st Floor c.1500 - 1650 BCE, Prehistoric Museum of Thera, Santorini (Photograph: Photographer unknown: Thera Foundation).

Iconographic evidence of richly patterned textiles tends to focus on goddesses, priestesses, or other forms of worship within the Aegean frescoes which demonstrates that the use of ceremonial clothing was an important aspect of cult activities and the individual's role within that process (Boloti 2014, Boloti 2017:3, Murray 2016:44). Reliefs recovered from Mycenae show a seated figure, believed to represent a goddess being attended by worshippers with this theme repeated in frescoes, rings and reliefs (Murray 2016:49). Much of the iconography surrounding the processions associated with ritual garb, the gift of cloth and deities are often represented in Minoan art (Boloti 2017:7, Burke 2010:77) However, with the continued traditions and cross-cultural ritualistic worship of the same goddess, and in some cases, in the same areas, it would be fair to suggest these traditions were comparable to later Mycenaean adaptions (Boloti 2017:8, 14, Burke 2010:77). Later Mycenaean motifs are also associated with these images of deities with the associated patterns incorporated into Mycenaean textiles, like spirals, rosettes and lozenges which suggests the adoption and adaption of these traditions (Blakomer 2012: 330, Murray 2016:51).

Specialised cloth was produced for the use by the Mycenaean sanctuaries (Gleba 2020:3329). This cloth was also used as a form of payment for those who worked within the temple complex (Droβ-Krüpe & Nosch 2016:300). Providing offerings to the temples and partaking in rituals made the temple complex one of the driving factors in the Bronze Age economies of not only Mycenaean settlements, but much of the Near East (Droβ-Krüpe & Nosch 2016:300). These offerings comprised of food to be consumed within a short period, or textiles that were able to be used or stored by the temples (Droβ-Krüpe & Nosch 2016:301). There is a question of whether these offerings were intended to be for votive use, or to support the ongoing religious establishment, which likely comprised a mix of both due to the sheer volume of products afforded to the temples (Lupack 2011:208). Boloti (2017:8) asserts that the presentation of raw wool was not intended to be used to make textiles in ritual contexts, and instead it was purely to serve votive use without any additional craft. Perfumed olive oils were also used to anoint votive fabrics, with evidence of the practice at Pylos from the tablet Py Fr 1225 referring of perfumed oils for textiles as an offering to Potnia, *u-po-jo po-ti-ni-ja* (Gulizio 2012: 283, Kelder 2009:343, Killen 2015:11).

While flocks of wethers were used for palatial wool production, flocks comprising of ewes and lambs appear more frequently as associated to Potnia or Hermes, instead of a collector or non-collector group (Killen 2015:5, Nosch 2014a:396, Nosch 2014b: 3, Nosch 2021:42). The Linear B records associated with these lambs also link to *ta-to-mo*, referring to these lambs being kept in either a stall or a pen suggesting these animals lived under special conditions as animals dedicated to a divinity (Nosch 2021:43). Administered by the *wanax*, records show land in the main religious district, *pa-ki-ja-ne* to be dedicated to the goddess Potnia (Palaima 1997:410). Likewise, some roles within textile production were also directly controlled by the *wanax*, such as the Kadmeion (Thebes) tablet Of 36, a woman is termed the manufacturer of 'luminous cloth', *no-ri-wo-ki-de* and resided within the temple complex of Potnia, *po-to-ni-ja,* and under the direct control of the *wanax* (Lupack 2011:209, Palaima 1997:411). In the Knossos records, KN Dp 997, 7206 we also have references to new fleeces (those from the first shearing of a lamb), designated to Potnia as *po-ka* (Freo et al. 2010:342, Killen 2015:7).

Textiles and their tools were included within funerary deposits and votive offerings by the Mycenaeans (Gleba 2011:5, Gleba 2020:3329). This suggests that items associated with the creation of textiles held a ritualistic significance beyond the utility of the item itself. Potnia, as an example may have been a targeted figure for worship by textile workers as due to her association with lambs, sheep and textiles.

5.4 Further evidence of votive offerings and their use within the Mycenaean palace

The function of the *wanax* is believed to have been a role which operated within both a palatial and religious context, as is common with the ruling classes of many Bronze Age civilizations, notably Egypt where divinity and ruling are indistinguishable, and the Hittite ruler who was head of the army, king, priest, and administration (Killen 1985:242, Palaima 1995:130, Tisdell & Szizzero 2023:195). This deems the *wanax* as the top of the social pyramid which overlooks palatial, administrative, and religious functions (Lupack 2011:209, Palaima 1995:125, Tisdell & Szizzero 2023:195). The *wanax* is recorded to have participated in both ceremonial and cultic roles within the religious sphere, with evidence of the *wanax* being directly concerned with supplying the banquet for an initiatory ritual within the PY Un 2 tablet, and offerings to Poseidon on the Un 718 and Un 853 tablets (Hruby 2013:424, Palaima 1995:131, Palaima 1997:409). Likewise, the *wanax* is linked to several roles within textile production, such as the fullers and finishers which may relate to their products be reserved for either palace or votive use (Palaima 1997:412). This extends to the *wanax* having their own purple dye workshop at Knossos under their exclusive control (Palaima 1995:133, Palaima 1997:273).

While the administrative and religious spheres certainly account for the consumption of palatially manufactured textiles in the Linear B texts, the scale of the production would not account for the volume of products made, and the burden of costs associated with their creation. Therefore, Mycenaean palatially-produced textiles must have operated with maritime trade as a focal piece of the wider Mycenaean economic system.

Conclusion

Textile artefacts convey a great deal of information about their construction, their use in cultural contexts and hint at aspects of the wider society they existed within. The Mycenaean palatial textile industries were well funded, carefully administrated, and mass exported. Maritime export is the only logical conclusion when faced with the evidence of the scale of the industry as recorded in the surviving Linear B tablets, iconographic representations, and the archaeological evidence. Maritime archaeology may increase chances of extant textile sources where marine conditions could have the ability to preserve ancient textiles in situ which would have biodegraded on land. Certainly, with the advancing technologies of technical diving and submersibles, archaeologists with skills in both maritime archaeology and textile archaeology practices could be tasked with emerging Late Bronze Age sites in regions previously unexplored. This requires the intersection of these two fields of study, due to the volume of Mycenaean textiles exported through maritime routes and the value of textile artefacts to the archaeological record.

References

Adams N. K. 2007 Political affinities and economic fluctuations: the evidence from textiles. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society,* pp. 201 - 207. Oxford: Oxbow Books.

Alberti, M. E. 2012 Aegean trade systems: Overview and observations on the Middle Bronze Age. In M. E. Alberti and S. Sabatini (eds) *Exchange Networks and Local Transformations: Interaction and Local Change in Europe and the Mediterranean from the Bronze Age to the Iron Age*, pp. 22 – 43, Oxford: Oxbow Books.

Andersson Strand, E. and M. L. Nosch, M.-L. 2003 With a little help from my friends. Investigating Mycenaean textiles with help from Scandinavian experimental archaeology. *METRON. Measuring the Aegean Bronze Age. Proceedings of the 9th International Aegean Conference*, pp. 197 – 206. New Haven, Yale University, 18-21 April 2002.

Andersson, E. Martensson, L. Nosch, M. L & L. Rahmstorf 2008 New research on Bronze Age textile production, *Bulletin of the Institute of Classical Studies* 51(1): 171 – 174.

Andersson Strand, E., Frei, K. M., Gleba, M., Mannering, U., Nosch, M.L. and I. Skals 2010 Old Textiles – New Possibilities, *European Journal of Archaeology* 13(2):149 – 173.

Andersson Strand, E. 2012a. The textile *chaine operatoire*: Using a multidisciplinary approach to textile archaeology with a focus on the ancient near east, *Paleorient* 38(1/2)21 – 40.

Andersson Strand, E. 2012b From spindle whorls and loom weights to fabrics in the Bronze Age Aegean and Eastern Mediterranean. In M. L. Nosch and R. Laffineur (eds) *Kosmos: Jewellery, Adornment and Textiles in the Aegean Bronze Age: Proceedings of the 13th International Aegean Conference/ 13e Rencontre Égéenne internationale, University of Copenhagen, Danish National Research Foundation's Centre for Textile Research 21 – 26 April 2010*, pp. 207 – 214. Leuven, Liege: Peeters.

Bachhuber, C. 2006 Aegean interest on the Uluburun ship, *American Journal of Archaeology* 110(3):345 – 363.

Barber, E. 1990 Reconstructing the ancient Aegean/Egyptian textile trade, *Textiles in Trade: Proceedings of the Textile Society of American Biennial Symposium,*

September 14 – 16, 1990, Washington DC. Nebraska: University of Nebraska, Lincoln.

Barber, E. J. W. 2007 Weaving the social fabric. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society*, pp. 174 - 178. Oxford: Oxbow Books.

Barber, E. J. W. 2016 Minoans, Mycenaeans, and Keftiu. In. M. C. Shaw and A. P Chapin (eds) *Woven Threads: Patterned Textiles of the Aegean Bronze Age*, pp. 205 – 237. Oxford: Oxbow Books.

Bassiakos, Y. and T. Tselios 2012 On the cessation of local copper production in the Aegean in the 2nd millennium BC. In G. Papasavvas and V. Kassianidou (eds) *Eastern Mediterranean Metallurgy in the Second Millennium BC*, pp. 151 – 161. Oxford: Oxbow Books.

Becker, H. 2022 Pigment nomenclature in the ancient Near East, Greece, and Rome, *Archaeological and Anthropological Sciences* 14: 1 – 25.

Bender Jorgensen, L. 2007 The world according to textiles. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society,* pp.7 – 12. Oxford: Oxbow Books.

Bennett, J. 2001 Agency and bureaucracy: Thoughts on the nature and *extent of administration in Bronze Age Pylos. In S. Voutsaki and J. Killen (eds) Economy and Politics in the Mycenaean Palace States: Proceedings of a Conference Held on 1-3 July 1999 in the Faculty of Classics,* pp. 25 – 37. Cambridge: Cambridge Philological Society.

Blakemore, J. W. O. 2003 Children's beliefs about violating gender norms: Boys shouldn't look like girls, and girls shouldn't act like boys, *Sex Roles* 48(9/10):411 – 419.

Blakomer, F. 2012 Body marks and textile ornaments in Aegean iconography: Their meaning and symbolism. In M. L. B. Nosch and R. Laffineur (eds) *Kosmos: Jewellery, Adornment and Textiles in the Aegean Bronze Age: Proceedings of the 13th International Aegean conference/13e Recontre égéenne international, University of Copenhagen, Danish National Research Foundation's Centre for Textile Research, 21 – 26 April 2010*, Aegaeum 33, pp. 325 – 333. Liege: Peeters.

Bohn, C. 2004 Clothing as a means of communication. Alemania. Traducido de la versión alemana:"Kleidung als Kommunikationsmedium,

in dies., *Inklusion, Exklusion und die Person". Konstanz:* 1 – 21.

Boloti, T. 2014 e-ri-ta's dress: Contribution to the study of the Mycenaean priestesses' attire. In M. Harlow, C. Michel and M. L. Nosch (eds) *Prehistoric, Ancient Near East and Aegean Textiles and Dress*, pp. 245 – 270, Oxford: Oxbow Books.

Boloti, T. 2017 Offering of cloth and/or clothing to the sanctuaries: A case of ritual continuity from the 2nd to the 1st millennium BCE in the Aegean? In C. Brons and M. L. Nosch (eds) *Textiles and Cult in the Ancient Mediterranean*, pp. 3 – 16. Oxford, England; Philadelphia, Pennsylvania: Oxbow Books.

Breniquet, C. and C. Michel, 2014 Wool economy in the ancient Near East and the Aegean. In C. Breniquet and C. Michel (eds), *European Science Foundation Exploratory Workshop on Wool Economy in the Ancient Near East and the Aegean: From the Beginnings of Sheep Husbandry to Institutional Textile Industry Corporate Author; European Science Foundation Exploratory Workshop on Wool Economy in the Ancient Near East and the Aegean: From the Beginnings of Sheep Husbandry to Institutional Textile Industry* (2012: Nanterre, France), pp. 1 – 12. Oxford, England; Havertown, Pennsylvania: Oxbow Books.

Broodbank, C. 2016 The origins and early development of Mediterranean maritime activity, *The Journal of Mediterranean Archaeology* 19(2):119 – 230.

Buckner, W. 2021 Disguises and the origins of clothing, *Human Nature* 32: 706 – 728.

Burke, B. 1997 The organization of textile production on ancient Crete in R. Laffineur and P. P. Betacourt (eds) T*EXNH: Craftsmen, Craftswomen and Craftsmanship in the Aegean Bronze Age: Proceedings of the 6th International Aegean Conference, Philadelphia, Temple University 18 – 21 April 1996* 16(2) pp. 413 – 424. University of Texas at Austin: Université de Liège.

Burke, B. 1999 Purple and Aegean textile trade in the early second millennium B.C., *Meletemata: Studies in Aegean Archaeology Presented to Malcolm H. Wiener as he enters his 65th year*, pp. 75 – 82.

Burke, B. 2010 Cloth production in the Mycenaean world in *From Minos to Midas ancient cloth production in the Aegean and in Anatolia*, pp. 64 – 107. Oxford: Oxbow Books.

Burke, B. and A. P. Chapin 2016 Bronze Age Aegean cloth production: A cottage industry no more in M. C. Shaw and A. P. Chapin (eds) *Patterned Textiles of the Aegean Bronze Age*, pp. 17 – 38. Oxford: Oxbow Books.

Burnham, H. B. 1965 Çatal Hüyük: The textiles and twined fabrics, *Anatolian Studies* 15: 169 – 174.

Burns, B. E. 2010 *Mycenaean Greece, Mediterranean Commerce, and the Formation of Identity*. New York: Cambridge University Press.

Carlson, D. N. 2012 The seafarers and shipwrecks of Ancient Greece and Rome. In B. Ford, D. L. Hamilton and A. Catsambis (eds) *The Oxford Handbook of Maritime Archaeology,* pp. 379 – 405, Oxford: Oxford University Press.

Carter, T., Contreras, D. A., Holcomb, J., Mihailovic, D. D., Karkanas, P., Guérin, G., Taffin, N., Athanasoulis, D.and C. Lahaye 2019 Earliest occupation of the Central Aegean (Naxos), Greece: Implications for the hominin and *Homo sapiens*' behavior and dispersals, *Science Advances* 5: 1 – 9.

Ciszuk, M. 2007 The academic craftsman – A discussion on the knowledge of craft in textile research. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society,* pp. 13 – 16. Oxford: Oxbow Books.

Cline, E. H. 2007 Rethinking Mycenaean international trade with Egypt and the Near East. In M.L. Galaty and W. A. Parkinson (eds) *Rethinking Mycenaean*

Palaces II, pp. 190 – 200, Los Angeles: Cotsen Institute of Archaeology Press.

Cline, E. H. and A. Yasur-Landau 2007 Musings from a distant shore: The nature and destination of the Uluburun ship and its cargo, *Journal of the Institute of Tel Aviv University* 34(2): 125 – 141.

Collard, M., Tarle, L. and D. Sandgathe 2016 Faunal evidence for a difference in clothing use between Neanderthals and early modern humans in Europe. *Journal of Anthropological Archaeology* 44: 235 – 246.

Crane, D. 2000 *Fashion and its Social Agendas: Class, Gender, and Identity in Clothing*. Chicago: University of Chicago Press.

Cutler, J. 2012 Ariadne's thread: The adoption of Cretan weaving technology in the wider Southern Aegean in the Mid-Second Millennium BC. In M. L. Nosch and R. Laffineur (eds) *Kosmos: Jewellery, Adornment and Textiles in the Aegean Bronze Age: Proceedings of the 13th International Aegean Conference/ 13e Rencontre Égéenne internationale, University of Copenhagen, Danish National Research Foundation's Centre for Textile Research 21 – 26 April 2010*, pp. 145 – 154. Leuven, Liege: Peeters.

Daters C. M. 1990 Importance of clothing and self-esteem among adolescents. *Clothing and Textiles Research Journal* 8(3): 45 – 50.

Dawson, H. and I. Nikolakopoulou 2020 East meets West: Aegean identities and interactions in the Late Bronze Age Mediterranean, *eTopoi. Journal for Ancient Studies* 7: 155 – 192.

De Fido, P. 2001 Centralization and its limits in the Mycenaean palatial system. In S. Voutsaki and J. Killen (eds) *Economy and Politics in the Mycenaean Palace States: Proceedings of a Conference Held on 1-3 July 1999 in the Faculty of Classics*, pp. 15 – 24. Cambridge: Cambridge Philological Society.

Droβ-Krüpe, K. and M. L. Nosch 2016 Textiles, trade and theories: How scholars past and present view and understand textile trade in the Ancient Near East and the Mediterranean in antiquity. In K. Droβ-Krüpe and M. L. Nosch (eds) *Textiles, Trade and Theories: From the Ancient Near East to the Mediterranean: [colloque Tenu Du 11 Au 14 Novembre 2015 À Kassel]*, pp. 293 – 329. Ugarit-Verlag.

Earle, J. W. 2012 A Cycladic perspective on Mycenaean long-distance exchanges, *Journal of Mediterranean Archaeology* 25(10): 3 – 25.

Fowles, J. 1974 Why we wear clothes, *ETC: A Review of General Semantics* 31(4): 343 – 352.

Firth, R. J. and Nosch, M. L. B. 2002 Scribe 103 and the Mycenaean textile industry at Knossos: The Lc(1) and Od(1)-Sets, *Minos* 37–38:121 – 142.

Firth, R. 2007 Re-considering alum on the Linear B tablets. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society,* pp. 130 – 138. Oxford: Oxbow Books.

Freo, M. D., Nosch, M. L. and F. Rougemont 2010 The terminology of textile in the Linear B tablet, including some considerations of Linear A logograms and abbreviations in C. Michel, C. and M. L. Nosch (eds) *Textile Terminologies in the Ancient Near East and Mediterranean from the Third to the First Millennia BC*, pp.338 – 373. Oxford; Oakville: Oxbow Books.

Galaty M. L. 2016 The Mycenaeanisation Process. In E. Gorogianni, P. Pavúk and L. Girella (eds) *Beyond Thalassocracies: Understanding Processes of Minoanisation and Mycenaeanisation in the Aegean*, pp.207 – 218. Oxford: Oxbow Books.

Gasbarra, V. 2016 Mycenaean textile memories in Homeric terminology, *Athens Journal of Philology* 3(4): 251 – 262.

Gillian, I. 2023 Clothing and the discovery of science, *Foundations of Scienc*e: 1 – 30.

Girella, L. and P. Pavúk 2016 The nature of Minoan and Mycenaean involvement in the Northeastern Aegean in E. Gorogianni, P. Pavúk and L. Girella (eds) *Beyond Thalassocracies: Understanding Processes of Minoanisation and Mycenaeanisation in the Aegean*, pp.15 – 42. Oxford: Oxbow Books.

Gleba, M. 2011 Textile studies: Sources and methods, *Kubaba* 2: 3 – 30.

Gleba, M. 2014 Sheep to textiles: approaches to investigating ancient wool trade. In K. Droβ-Krüpe (ed) Textile Trade and Distribution in Antiquity, pp. 123 – 133, Wiesbaden, Germany: Harrassowitz.

Gleba, M. 2020 Domestic Archaeology: Textiles of Northern Mediterranean in *Encyclopedia of Global Archaeology*, pp. 3329 – 3337. Cham: Springer International Publishing.

Gleba, M. and S. Harris 2019 The first bast fibre technology: Identifying splicing in archaeological textiles, *Archaeological and Anthropological Sciences* 11: 2329 – 2346.

Guzlizio, J. 2012 Textiles for the gods? Linear B evidence for the use of textiles in religious ceremonies In M. L. B. Nosch and R. Laffineur (eds) *Kosmos: Jewellery, Adornment and Textiles in the Aegean Bronze Age: Proceedings of the 13th International Aegean conference/13e Recontre égéenne international, University of Copenhagen, Danish National Research Foundation's Centre for Textile Research, 21 – 26 April 2010*, Aegaeum 33, pp. 279 – 295. Liege: Peeters.

Harris, S. 2012 From the Bronze Age parochial to the universal: Comparing cloth cultures in the Bronze Age, *European Journal of Archaeology* 15(1): 61 – 97.

Haskell, H. W. 2004 Wanax to Wanax: Regional trade patterns in Mycenaean Crete, *Hesperia*. Supplement Vol 33: 151 – 160.

Haugan E. & B. Holst 2014 Flax look-alikes: Pitfalls of ancient plant fibre identification. *Archaeometry* 56(6):951 – 960.

Holman, R. H. 1980 Clothing as communication: An empirical investigation. In Jerry C. Olson and Ann Abor (eds) *NA – Advances in Consumer Research* 7: 372 – 377. MI: Association for Consumer Research.

Horejs, B., Milié, B., Ostmann, F., Thanheiser, U., Weninger, B. and A. Galik 2015 The Aegean in the early 7th Millennium BC: Maritime networks and colonization, *Journal of World Prehistory* 28(4): 289 – 330.

Hruby, J. 2013 Crafts, specialists and markets in Mycenaean Greece: The palace of Nestor, craft production, and mechanism for the transfer of goods, *American Journal of Archaeology* 117: 423 – 427.

Jackson, C. M. and P. T. Nicholson 2010 The provenance of some glass ingots from the Uluburun shipwreck, *Journal of Archaeological Studies* 37: 295 – 301.

Jones, J., Unruh, J., Knaller, R., Skals, I., Raeder-Knudsen, L., Jordan-Fahrbach, E. and L. Mumford 2007 Guidelines for the excavation of archaeological textiles. In. C. Gillis and M. L. B. Nosch (eds) *First Aid for the Excavation of Archaeological Textiles*, pp. 5 – 29. Oxford: Oxbow Books.

Judson, A. P. 2000a Scribes as editors: Tracking changes in the Linear B documents, *American Journal of Archaeology* 124(4): 523 – 698.

Judson, A. P. 2000b T*he Undeciphered Signs of Linear B: Interpretation and Scribal Practices*. Cambridge: Cambridge University Press.

Karagianni A. 2015 Linear B administration: The communicative aspects of written media and the organization of the Mycenaean bureaucracy in *Written and Unwritten Communication in Pre-Modern Societies*. Materiale Textkulturen: de Gruyter Verlag.

Kelder, J. M. 2004 Mycenaeans in western Anatolia, Talanta 36 – 37: 49 - 85.

Kelder, J. M. 2009 Royal gift exchange between Mycenae and Egypt: Olives as "Greeting gifts" in the Late Bronze Age Eastern Mediterranean, *American Journal of Archaeology* 113(3): 339 – 352.

Kelder, J. M. 2010 The Egyptian interest in Mycenaean Greece, *Jaarbericht Ex Oriente Lux* 42: 125 – 140.

Kelder, J. M., Cole, S. E. and E. H. Cline 2018 Memphis, Minos and Mycenae: Bronze Age contact between Egypt and the Aegean. In J. Spier, T. Potts and S. E. Cole (eds) *Beyond the Nile: Egypt and the Classical World*, pp. 9 – 17. J Paul Getty Museum: California.

Kelder, J. M. 2020 A thousand black ships: Maritime trade, diplomatic relations, and the rise of Mycenae in R. Strootman, F. van del Eijnde and R. van Wijk (eds)

Empires of the Sea: Maritime Power Networks in World History, pp. 39 – 51. Leiden, Netherlands: Brill.

Killen, J. T. 1985 The Linear B tablets and the Mycenaean economy. In. A. M. Davies and Y. Duhoux (eds) *Linear B, a 1984 survey: proceedings of the Mycenaean Colloquium of the VIIIth Congress of the International Federation of the Societies of Classical Studies (Dublin, 27 August-1st September 1984)*, pp.241 – 305. Bibliotheque des cahiers de l'Institut de linguistique de Louvain 26, Louvain-la-Neuve: Cabay.

Killen, J. T. 2001 Some thoughts on Ta-ri-si-ja in S. Voutsaki and J. Killen (eds) *Economy and Politics in the Mycenaean Palace States – Proceedings of a Conference held on 1 – 3 July in the Faculty of Classics, Cambridge*, pp. 161 – 175. Cambridge: Cambridge Philological Society.

Killen, J. T. 2007 Cloth production in Late Bronze Age Greece: the documentary evidence. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society, pp. 50 – 58.* Oxford: Oxbow Books.

Killen, J. T. 2015 *Economy and Administration in Mycenaean Greece. Collected Papers on Linear B.* M. Del Freo (ed) Rome: CNR, Istituto di studi sul Medterraneo antico.

Kittler, R., Kayser, M. and M. Stoneking 2003 Molecular evolution of *pediculus humanus* and the origin of clothing. *Current Biology* 13: 1414 – 1417.

Knapp, B. A. 1990 Ethnicity, entrepreneurship, and exchange: Mediterranean inter-island relations in the Late Bronze Age, *The Annual of the British School at Athens* 85:115 – 153.

Knappett, C. 2016 Minoanisation and Mycenaeanisation: A commentary. In E. Gorogianni, P. Pavuk and L. Girella (eds) *Beyond Thalassocracies: Understanding Processes of Minoanisation and Mycenaeanisation in the Aegean*, pp. 202 – 206. Oxford: Oxbow Books.

Kristiansen, K. 2013 Theorising exchange and interaction in the Bronze Age in M. E. Alberti and S. Sabatini in *Exchange Networks and Local Transformations: Interaction and Local Change in Europe and the Mediterranean from the Bronze Age to the Iron Age*, pp. 6 – 8. Oxford: Oxbow Books.

Kundel, C. 1976 Clothing practices and preferences of blue-collar workers and their families, *Home Economics Research Journal* 4(4): 214 – 266.

Laurito, R., Frangipane, M., Andersson Strand, E., Möller-Wierling, Nosch, M. L., Wisti Lassen, A. and A. Rast-Eicher 2009 Arslantepe, Malatya (Turkey): Textiles, tools and imprints of fabrics from the 4th to the 2nd Millennium BCE, Paléorient 35(1):5 – 29.

Lilyquist, C. 1999 On the Amenhotep III inscribed faience fragments from Mycenae, *Journal of the American Oriental Society* 119(2): 303 – 308.

Lujan, E. R. 2013 Mycenaean textile terminology at work: The KN Lc(1)-tablets and the occupational nouns of the textile industry in *Textile Terminologies in the Ancient Near East and Mediterranean from the Third to the First Millennia BC,* pp. 374 – 387. Oxford; Oakville: Oxbow Books.

Lupack, S. 2011 Redistribution in Aegean palatial societies: A view from outside the palace: The sanctuary and the Damos in Mycenaean economy and society, *American Journal of Archaeology* 115: 207 – 217.

Marin-Aguilera, B., Iacono, F. and M. Gleba 2018 Colouring the Mediterranean: Production and consumption of purple-dyed textiles in pre-Roman times, *Journal of Mediterranean Archaeology* 31(2):127 – 154.

Martensson, L., Nosch, M.L and E. A. Strand 2009 Shape of things: Understanding a loom weight, *Oxford Journal of Archaeology* 28(4):373 – 398.

Mazow L. B. 2013 Throwing the baby out with the bathwater: Innovations in Mediterranean textile production at the end of the 2nd/beginning of the 1st millennium BCE. In M. L. Nosch, H. Koefoed and E. Andersson Strand (eds) *Textile Production and Consumption in the Ancient Near East: Archaeology, Epigraphy and Iconography*, pp. 215 – 223. Havertown: Oxbow Books.

McCarthy, J., Benjamin, J., Winton, T. and W. van Duivenvoorde 2019 The rise of 3D maritime archaeology. In J. K. McCarthy, J. Benjamin, T. Winton and W. van Duivenvoorde (eds) *3D Recording and Interpretation for Maritime Archaeology,* pp. 1 – 10, Springer International Publishing.

McGeehan Liritzis, V. 1988 Seafaring, craft and cultural contact in the Aegean during the 3rd millennium BC, *The International Journal of Nautical Archaeology and Underwater Exploration* 17(3): 237 – 256.

Mee, C. 1978 Aegean trade and settlement in Anatolia in the second millennium B.C., *Anatolian Studies* 28(1): 121 – 156.

Michel, C. and M. L. B. Nosch 2010 Textile terminologies in *Textile Terminologies in the Ancient Near East and Mediterranean from the Third to the First Millennia BC, pp. Ix – xix.* Oxford; Oakville: Oxbow Books.

Min, S. 2015 Gendered role communication in marketing blue-collar occupational gear and clothing in the United States, *Fashion and Textiles* 2(24): 1 – 12.

Murray. S. P. 2016 Patterned textiles as costume in Aegean art. In M. C. Shaw and A. P. Chapin (eds) *Woven Threads: Patterned textiles of the Aegean Bronze Age*, pp. 43 – 103. Oxford: Oxbow Books.

Nash, J. and C. Sidhu 2023 'Pink is for girls, blue is for boys' exploring brand gender identity in children's clothing, a post-evaluation of British retailer John Lewis. *Journal of Brand Management* 30: 381 – 397.

Nosch, M. L. B 2000 Acquisition and Distribution: ta-ra-si-ja in the Mycenaean Textile Industry in C. Gillis, C. Risberg and B. Sjoberg (eds) *Proceedings of the 6th International Workshop, Studies in Mediterranean Archaeology*, Pocket Book 154, pp. 43 – 61. Jonsered, Sweden: Paul Astroms forlag.

Nosch M. L. B. 2004 Red coloured cloth in the Linear B archives. In L. Cleland, K. Stears and G. Davies (eds) *Colour in the Ancient Mediterranean World*, pp. 32 – 38. Oxford: Archeopress, BAR International Series.

Nosch, M. L. B. 2011 The Mycenaean administration of textile productions in the palace of Knossos: Observations on the Lc(1) textile targets, *American Journal of Archaeology* 115(4): 495 – 505.

Nosch, M. L. B. 2012 From texts to textiles in the Aegean Bronze Age. In M. L. B. Nosch and R. Laffineur (eds) *Kosmos: Jewellery, Adornment and Textiles in the Aegean Bronze Age: Proceedings of the 13th International Aegean conference/13e Recontre égéenne international, University of Copenhagen, Danish National Research Foundation's Centre for Textile Research, 21 – 26 April 2010*, Aegaeum 33, pp. 43 – 56. Liege: Peeters.

Nosch, M. L., Mannering, U., Andersson Strand, E. and K. M. Frei 2013 Travels, transmissions and transformations – and textiles in S. Bergerbrant and S. Sabatini (eds) *Counterpoint: Essays in Archaeology and Heritage Studies in Honour of Professor Kristian Kristiansen*, pp. 469 – 476. Oxford: Archaeopress

Nosch, M. L. B. 2014a Mycenaean wool economies in the latter part of the 2nd millennium BC. In C. Breniquet and C. Michel (eds) *Wool Economy in the Ancient Near East*, Vol 7, pp. 371 – 400. Oakville: Oxbow Books.

Nosch, M. L. B. 2014b The Aegean wool economies of the Bronze Age, T*extile Society of America Symposium Proceedings, Biennial Symposium Proceedings: New Directions: Examining the Past, Creating the Future*. Los Angeles: California, September 10–14: 1 – 13.

Nosch, M. L. B. 2016 The loom and the ship in ancient Greece: Shared knowledge, shared terminology, cross-crafts, or cognitive maritime-textile archaeology? In H. Harich-Schwarzbauer (ed) *Weaving the Fabric in Antiquity: Materiality, Representation, Epistemology, pp. 109 – 131*. Havertown: Oxbow Books.

Nosch, M. L., Ulanowska, A., Zebrowska, K., Bigoraj, K. and A. Grezak 2021 Sheep – 'a factory without waste'. Comparative, interdisciplinary, and diachronic views on sheep in the Aegean Bronze Age in R. Laffineur and T. G. Palaima (eds) *ZOIA. Animal-human interactions in the Aegean Middle and Late Bronze Ages.* Aegaeum 45, pp. 35 – 49. Leuven and Liege: Peeters.

Nosch, M. L. 2020 Textiles. In I. S. Lemos and A. Kotsonas (eds) *A Companion to the Archaeology of Early Greece and the Mediterranean*, Vol 1(1), pp. 589 – 602, New York: John Wiley & Sons, Inc.

Orphanides, A. G. 2017 Late Bronze Age socio-economic and political organization, and the Hellenization of Cyprus, *Athens Journal of History* 3(1): 7 – 20.

Palaima, T.G. 1991 Maritime matters in the Linear B tablets, *Thalassa : L'Egée préhistorique et la mer. Actes de la troisième rencontre égéenne internationale de l'Université de Liège, Station de recherches sous-marines et océanographiques (StaReSo), Calvi, Corse, 23-25 avril 1990. Aegaeum 7. Annales d'archéologie égéenne de l'Université de Liège*, pp. 273 – 310, Leuven and Liege: Peeters.

Palaima, T. G. 1995 The nature of the Mycenaean Wanax: Non-Indo-European origins and the priestly functions, *Aegaeum* 11: 119 – 139.

Palaima, T. G. 1997 Potter and Fuller: The royal craftsmen, Techne: Craftsmen, Craftswomen and Craftsmanship in the Aegean Bronze Age, *Aegaeum* 15: 407 – 412.

Papadimitriou, N. and D. Kriga 2013 ‘Peripheries’ versus ‘cores’: The integration of the secondary states into the world-system of the Eastern Mediterranean and the Near East in the Late Bronze Age (1600 – 1200 BC) M. E. Alberti and S. Sabatini (eds) in *Exchange Networks and Local Transformations: Interaction and Local Change in Europe and the Mediterranean from the Bronze Age to the Iron Age*, pp. 9 – 21. Oxford: Oxbow Books.

Parker, A. J. 2002 Maritime archaeology in the Mediterranean, *Malta Archaeological Review* 6: 8 – 14.

Parkinson, W. A., Nakassis and M. L Galaty 2013 Crafts, specialists, and markets in Mycenaean Greece: Introduction, *American Journal of Archaeology* 117: 413 – 422.

Peacock, E. E. 1996 Characterization and simulation of water-degraded archaeological textiles: A review, *International Biodeterioration & Biodegradation:* 35 – 47.

Peacock, E. E. 2001 The contribution of experimental archaeology to the research of ancient textiles. In P. W. Rogers, L. B. Jørgensen and A. Rast-Eicher (eds) *The Roman Textile Industry and its Influence*, pp. 181 – 192. Oxford: Oxbow Books.

Peacock, E. E. 2005 The biodeterioration of textile fibers in wet archaeological contexts with implications for conservation choices, *Proceedings of Intrecci Vegetali e Fibre Tessili da Ambiente Umido: Analisi Conservazione e Restauro: Atti (Trento, 28–30 Maggio 2003), Incontri di Restauro*, 46 – 61.

Perivoliotis M. C. 2005 The role of textile history in design innovation: A case study using Hellenic textile history, *Textile History* 36(1): 1 – 19.

Pilcher, J. 2010 What not to wear? Girls, clothing and 'showing' the body, *Children and Society* 24(6): 461 – 470.

Pulak, C. 1998 The Uluburun shipwreck: an overview, *The International Journal of Nautical Archaeology* 27(3): 188 – 224.

Reingruber, A. 2011 Early Neolithic settlement patterns and exchange networks in the Aegean, *Documenta Praehistorica* 38: 291 – 306.

Rosenfeld, L. B. and T. G. Plax 1977 Clothing as communication, *Journal of Communication* 27(2): 24 – 31.

Rougemont 2001 Some thoughts on the identification of the "collectors" in the Linear B tablets in S. Voutsaki and J. Killen (eds) *Economy and politics in the Mycenaean palace states: proceedings of a conference held on 1-3 July 1999 in the Faculty of Classics*, pp 129 – 138. Cambridge, Havertown: Cambridge Philological Society.

Rougemont, F. 2007 Flax and linen textiles in the Mycenaean palatial economy. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society,* pp. 46 – 49*.* Oxford: Oxbow Books.

Rougemont, F. 2014 Sheep rearing, wool production, and management in Mycenaean written documents. In C. Breniquet and C. Michel (eds), *European Science Foundation Exploratory Workshop on Wool Economy in the Ancient Near East and the Aegean: From the Beginnings of Sheep Husbandry to Institutional Textile Industry Corporate Author; European Science Foundation Exploratory Workshop on Wool Economy in the Ancient Near East and the Aegean: From the Beginnings of Sheep Husbandry to Institutional Textile Industry (2012: Nanterre, France), pp. 340 – 370.* Oxford, England; Havertown, Pennsylvania: Oxbow Books.

Sabatini, S. 2016 Textile tools from the east gate at Mycenaean Midea, Argolis Greece, *Opuscula- Annual of the Swedish Institutes at Athens and Rome* 9: 217–247.

Sabatini, S., and S. Bergerbrant, 2019 Textile Production and Specialisation in Bronze Age Europe in S. Sabatini and S. Bergerbrant (eds) *The Textile Revolution in Bronze Age Europe: Production, Specialisation, Consumption*, pp. 1 – 14, Cambridge: Cambridge University Press.

Shaw, M. 2010 A fresco of a textile pattern at Pylos: The importation of a Minoan artistic technique, *British School of Athens Studies* 18: 315 – 320.

Shaw, M. C. & A. P. Chapin 2016 Palace and household textiles in Aegean Bronze Age art. In M. C. Shaw, A. P. Chapin, E. J W. Barber, G. Bianco, B. Burke, E. C. Egan, & S. P. Murray. (eds) *Woven Threads: Patterned Textiles of the Aegean Bronze Age* (Vol. 22) pp -105 – 130. Oxford: Oxbow Books.

Schon, R. 2011 Redistribution in Aegean palatial societies by appointment to his majesty the *Wanax*: Value-added goods and redistribution in Mycenaean palatial economies. *American Journal of Archaeology* 115: 219 – 227.

Sherratt, S. and Sherratt, A. 1993 The growth of the Mediterranean economy in the early first millennium BC, *World Archaeology* 24(3): 361 – 378.

Sherratt, E. S. 1994 Patterns of contract between the Aegean and Cyprus in the 13th and 12th centuries BC, *Κυπριακή Αρχαιολογία Τόμος III (Archaeologia Cypria 3)*: 35 – 46.

Sherratt, S. 2001 Potemkin palaces and route-based economies. In S. Voutsaki and J. Killen (eds) *Economy and Politics in the Mycenaean Palace States: Proceedings of a Conference Held on 1-3 July 1999 in the Faculty of Classics*, pp. 214 - 238. Cambridge: Cambridge Philological Society.

Solomon, M. R. 1982 Self-consciousness and clothing. *Personality and Social Psychology Bulletin* 8(3): 508 – 514.

Spataro, M., Garnett, A., Shapland, A., Spencer, N. and H. Mommsen 2019 Mycenaean pottery from Amara West (Nubia, Sudan), *Archaeological and Anthropological Sciences* 11:683 – 697.

Tartaron T. F. 2013 *Maritime Networks in the Mycenaean World*. Cambridge: Cambridge University Press.

Tisdell, C. A. and S. Svizzero 2023 *The Sustainability and Development of Ancient Economies: Analysis and Examples.* London: Routledge.

Torlina, J. (2011). *Working class: challenging myths about blue-collar labor*. Boulder, Colorado: Lynne Rienner Publishers.

Toups, M. A., Kitchen, A., Light, J. E. and D. L. Reed 2011 Origin of clothing lice indicated early clothing use by anatomically modern humans in Africa. *Molecular Biology and Evolution* 28(1): 29 – 32.

Trnka, E. 2007 Similarities and distinctions of Minoan and Mycenaean textiles. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society, pp. 127 – 129*. Oxford: Oxbow Books.

Vaessen, R. 2016 Cosmopolitanism, communality and the appropriation of Mycenaean pottery in western Anatolia, *Anatolian Studies* 66: 43 – 65.

Van Wijngaarden, G. J. 2011 Tokens of a special relationship? Mycenaeans and Egyptians. In K. Duistermaat, & I. Regulski (eds) *Intercultural contacts in the ancient Mediterranean: proceedings of the International Conference at the Netherlands-Flemish Institute in Cairo, 25th to 29th October 2008*, pp. 225-251, Orientalia Lovaniensia Analecta; Vol. 202). Leuven and Liege: Peeters.

Vitale S. and T. H. Vitale 2013 The Minoans in the Southeastern Aegean? The evidence from the ‘Serraglio’ on Kos and its significance. In M. E. Alberti and S. Sabatini (eds) *Exchange Networks and Local Transformations: Interaction and Local*

Change in Europe and the Mediterranean from the Bronze Age to the Iron Age, pp. 44 – 59. Oxford: Oxbow Books.

Voutsaki, S. 2001 Economic control, power and prestige in the Mycenaean world: The archaeological evidence. In S. Voutsaki and J. Killen (eds) E*conomy and Politics in the Mycenaean Palace States: Proceedings of a Conference Held on 1-3 July 1999 in the Faculty of Classics*, pp. 195 – 213. Cambridge: Cambridge Philological Society.

Wachsmann, S. 2012 Deep-submergence archaeology. In B. Ford, D. L. Hamilton and A. Catsambis (eds) *The Oxford Handbook of Maritime Archaeology*, pp. 202 – 231, Oxford: Oxford University Press.

Ward, C. A. 2010 Seafaring in the Bronze Age Aegean: Evidence and speculation. In D. J. Pullen (ed) *Political Economies of the Aegean Bronze Age*, pp.149 – 160. Oxford: Oxbow Books.

Wild, J. P. 1988 *Textiles in Archaeology*. Princes Risborough: Shire.

Wild, J. P. 2007 Methodological introduction. In C. Gillis and M. L. B. Nosch (eds) *Ancient Textiles: Production, Crafts and Society*, pp. 1 – 6. Oxford: Oxbow Books.