

Commodity, Commerce, and Economy: Re-Evaluating Cotton Production and Diffusion in the First Millennium

By

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Abstract

The history of global communication networks has come to the fore in recent years, particularly in the period of transition from late antiquity to the early medieval period. Much of the current scholarship has placed the Mediterranean at the center of exchange networks, focused on high-status hubs of elite long-distance interaction, leading to an acceptance of the core/periphery paradigm of trade directionality between the Mediterranean and its frontiers. The present dissertation challenges this model by tracing the spread of a single consumable to map pathways of non-elite exchange in areas peripheral to the Mediterranean system. Analysis of cotton evidence from the first to eighth centuries in relation to plant evolutionary biology and ecological adaptation demonstrates that there were at least two cotton diffusion networks in the ancient world. One, which connected India to the Mediterranean, is emphasized in the literature to show the economic importance of long-distance trade. The other network connected communities through Africa and the Middle East, and appears to have had a greater impact on the global spread of cotton. This second network also led to significant regional specialization in textile production at an earlier date than previously recognized. As the textile industry was significant to the ancient economy, these findings demonstrate the need to rethink accepted reconstructions of commercial networks in the first millennium.

For my husband, Krys

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Chapter One: Textiles as Historical Sources, an Introduction to a Study of Cotton

Introduction: Textiles in historical research

Textiles were one of late antiquities' bulk trade goods, important components of everyday material culture; as clothing and furnishing they were used to express status, religion, political power and affiliation through their materials, forms, and motifs. The traditional narrative of textiles in late antiquity is that amongst the wealthy and those wishing to project wealth, there was an increased demand for textiles produced from uncommon fibres (with a variety of decorative techniques) as visible statements of both social and personal identities, thereby making luxury textiles an attractive and profitable trade good.¹ These features have also made textiles of particular interest to art historians, who have used the iconography found on luxury silks and tapestry woven wool and linen decoration to date artefacts, ascribe origin, deduce cultural influence and interaction, and more recently, identify trade relationships.² However, this has also created a situation in which non-luxury textiles are often overlooked.

¹ Droß-Krüpe 2014, VIII; Thomas 2016a, 11. This generally refers to silks, but finely woven linen could also fit into this category. While it is clear the 'status' textiles were being traded long distances, the scale of the impact this had on the economy is debateable, and was clearly not static. For determining relative values for textiles, see Thomas 2016b. For changes to the production and consumption of silk, as well as its availability to people across classes, see Galliker 2014, cf. Oikonomidès 1986; Cutler 2002 and 2011; Jacoby 2004 and 2006; Parani 2008, which argue for silk's elite status. For local imitation of luxury textiles, see also Muthesius 1990, 1993 and 1994; Canepa 2014; Thomas 2012a. Arguments that trade in luxury textiles had a significant economic impact in late antiquity have been particularly noteworthy in discussions of trade networks along the Indian Ocean, such as Parker 2004; Albaladejo Vivero 2013; Seland 2014a; Barnes 2017.

² The role of textiles in historical studies and museum exhibitions is discussed further in chapter two.

As most textile manufacture was in non-luxury textiles for everyday use, it is these products that were driving textile production as an industry. This study proposes a model for how textiles as a commodity can be used as historical sources to illuminate the social and economic contexts of the ancient world in which they were made and distributed through a case study of one particular fibre, cotton. The multiple reasons for the choice of cotton will be detailed in greater depth below, but the first and foremost of these is because it is distinct amongst the textile fibres of the wider Mediterranean region in that its history of use, from its introduction to its diffusion and finally widespread adoption, largely falls within the period of recorded history. The combination of text and archaeological remains allows for the creation of a timeline of the transmission of cotton,³ and a model of cultural and economic movement.

As a consequence of Rome's near-continual expansionist policies, new regions of the Mediterranean (and beyond) were increasingly being brought within a larger network of exchange from approximately the third century BC, opening new markets for increased production and introducing new trade goods.⁴ From the start of the Roman period through to at least the third century, there are clear indications that as trade over long distances and between neighbouring empires increased, there was more investment in infrastructure, including maintenance of roads and harbours, and increased interaction between markets, making long-distance travel cheaper and safer.⁵ Textiles were certainly among the goods travelling along these routes, ideal commodities as they were highly mobile and durable; they were not very heavy, took up little space, could be used to fill spare cargo room, were less vulnerable to the elements than other trade goods, and luxury textiles could realise a high

³ See appendix 1 for a list of all sites where cotton was identified used in this work.

⁴ This followed the conquest of the Italian Peninsula and the Punic Wars. See Woolf 1992; Hingley 2005; Hopkins 2009.

⁵ Flohr 2014, 5. While both risk and cost were decreasing, it was still expensive and land transport in particular was high risk and time consuming. Bang 2008, 136-137. This has led many to conclude that overland trade was occasional rather than consistent such as Kingsley and Decker 2001, 12; Bagnall 2005, 196. This, along with a discussion of the third century, will be returned to in chapter three.

profit.⁶ However, such long-distance networks were not the only markets for which textiles were being produced; local, regional and inter-regional networks were all functioning simultaneously, and textiles were moving along all of them. Because so much of the interest in textiles has focused on iconography, typically found on what would have been expensive fabrics of silk and fine linen, non-luxury textiles moving along the short- to medium-distance networks have often been disadvantaged in discussions of the textile economy.

Textiles comprise one of the largest corpora of archaeological material from the late antique and early medieval worlds, but only in certain parts of the Mediterranean, particularly Egypt and the Near East. However, they are rarely used as historical sources beyond the aforementioned studies by art historians. Despite their importance to society and the economy, a fact emphasised by some economic historians,⁷ textiles have rarely been discussed as historical documents studied for the wider synthesis of their social and economic impact due to issues of both their preservation and acquisition. Their early classification by scholars as decorative objects, with focus primarily placed on production processes and iconography rather than their distribution and consumption, delayed the adoption of any methodological advancements which would have allowed them to be used as indicators of communication networks as ceramics and coins have been. This has been slow to change, despite advances in modern technology which have drastically increased the scope of possible analysis of the material remains, and the increasing refinement of archaeological methods which are resulting in greater amounts of raw data being available to scholars.

This delay is due equally to the relative newness of interdisciplinary approaches within the field of textile studies as it is to the geographic distribution of the evidence. As will be seen, textiles are rarely the focus of researchers who deal primarily with the written sources, which often detail the tax payments and contracts associated with the textile industry and trade, a trait

⁶ Flohr 2014, 5.

⁷ For example, Wickham 2005, 700; 2009, 221.

often shared with the archaeologists excavating them. At the same time, textile scholars tend to not fully utilise the written material, focusing somewhat uncritically on select texts, such as the oft cited first-century *Periplus Maris Erythraei* (*Periplus of the Erythreian Sea*, hereafter *PME*), despite the wealth of additional material (particularly papyrological) that is available in collected archives.⁸ The problem of the geographic distribution is more difficult because it is a problem of the evidence itself rather than how it is used. Textiles will only be preserved in certain climatic conditions, typically dry desert or sterile environments. Concentrations of textiles found in several regions, such as Egypt, the Near East (and, to a lesser extent, Italy, North Africa and Arabia), have resulted in numerous studies discussing textiles as regional products rather than dynamic regional and trans-regional trade goods; as a result, parallel traditions of textile scholarship have developed.⁹

While there are increasing attempts to remedy this, such as Kerstin Droß-Krüpe's 2014 edited volume *Textile Trade and Distribution in Antiquity* (the proceedings of the first conference of the same name) and its 2016 follow up *Textiles, Trade and Theories, From the Ancient Near East to the Mediterranean*, by trying to deal with all textiles everywhere they often fail to create a larger framework for understanding comparative differences between types of textiles or the mechanisms of their trade.¹⁰ Nevertheless, recognition of the problem represents the first step. Analysis of the textiles, written sources, other production materials,

⁸ The historical basis for this is discussed in Droß-Krüpe 2014. There are a few notable exceptions, particularly Wipszycka 1965.

⁹ Flohr 2014, 1. For Roman Italy, there has been much written on the wool production and manufacture and its economic geography (for example Morel 1978; Frayn 1984; Jongman 2000), despite there also being a productive linen industry in Italy (Gleba 2004), while for Egypt the focus has been primarily on manufacturing processes and local economy of the various stages of production, primarily for linen (such as McGing 1990; Granger-Taylor 1998; Pritchard and Verheken-Lammens 2001; Litinas 2004).

¹⁰ Many of the studies in these edited volumes examine only certain collections or regions, thereby offering little comparative analysis, and continue to focus on either production or on ancient texts that discussed the movement of textiles. See also, Rogers. *et al.* (eds.) 2001; Schrenk (ed.) 2006; Nosch, *et al.* (eds.) 2014. While the contributions in these volumes offer valuable insight into textiles in the ancient world, their differing focuses and approaches, as well as the aforementioned gaps in methodology, hinder the ability to create a larger understanding of the social and economic function of the material.

and economic theories can be interlinked to structure new discussions of the economies and interactions of the ancient world.¹¹ However, to achieve this, the full operational scope of both production and distribution/consumption needs to be fully considered, and through a variety of evidence types. This study undertakes this challenge by focusing on a single fibre, cotton.

Why cotton?

The study of cotton as a commodity is not new, and as a fibre it has long been considered an important part of the development of the global economy in the modern era. Most recently, both Giorgio Riello's 2013 *Cotton: The Fabric that Made the Modern World*, and Sven Beckert's 2015 *Empire of Cotton: A New History of Global Capitalism*, attempted to tie the emergence of industrial movements to the development of a global cotton trade. Both texts examined the importance of cotton to the structures dictating social formation and economic growth in the west, Riello in the framework of industrialisation of eighteenth-century Europe, and Beckert in the plantations of nineteenth-century America, India and West Africa. While both Beckert and Riello acknowledge that cotton was already a global commodity by the beginning of the second millennium, they do not delve into the importance of the process of how this global spread occurred.¹² Instead they both relied heavily on the established narrative that had been established decades before; that while cotton was found outside of the Indian subcontinent in antiquity, particularly in Egypt and Nubia in Africa, as a commodity the history of cotton was intricately tied to the expansion of maritime trade that occurred in the centuries after the spread of Islam and the development of western trade with India,¹³ visually demonstrated in the map Riello included in his book [fig. 1.1].

¹¹ Droß-Krüpe 2014, VIII, although the attempts in the volume Droß-Krüpe (ed.) 2014 were largely regional.

¹² Riello 2013, 5; Beckert 2015, xiii.

¹³ Riello 2013, 50; Beckert 2015, 3-22, with a separate discussion of New World cotton. Beckert is more global in his view of cotton as an early commodity, but still emphasizes India as the centre of the cotton world. The spread of the cotton industry out of India is especially highlighted in the publication history of Riello. The edited volume of Riello and Parthasarathi (eds.) 2009, specifies the time period from 1200 to 1850, and the edited volume of Riello and Roy (eds.) 2009 is even more restricted, from 1500 to 1850. The temporal framing exhibited

This has also been the case of studies of cotton in the medieval world. Maureen Mazzaoui's 1981 *The Italian Cotton Industry in the Later Middle Ages, 1100-1600* emphasised the importance of cotton from the Near East, particularly Syria, in enabling mass production in the Italian cotton industry and the transmission of widespread cotton use to Northern Europe. Jong-Kuk Nam's 2007 *Le commerce du coton en Méditerranée à la fin du Moyen Age* also examined the role of the Mediterranean as a conduit for the introduction of cotton into Europe, expanding the geographic bounds of Mazzaoui's study, and reinforcing the importance of the Near East in providing quality raw material. However, both works built off the assumption that the cotton being cultivated in the Near East was ultimately an Indian product, and that its spread into Europe (as an agricultural crop as well as a textile fibre) was a next stage in the development of Islamic Indian Ocean trade.¹⁴

These works have important methodological implications for the integration of the study of commodities into social and economic history, treating the twelfth through fifteenth centuries (Mazzaoui and Nam) and seventeenth through nineteenth centuries (Riello and Beckert) as important turning points in the history of cotton, junctures in the shift from cotton being a crop associated with the Islamic world and Indian Ocean trade to a global commodity that led to extensive cultural and economic change. Their larger conclusions are correct. The introduction of cotton into Europe had a lasting effect on the trajectories of a number of economies. It is clear that mass production leading up to the Industrial Revolution, in which cotton played an integral role, reconfigured the world economy to centre on Europe and later the Americas at the expense of economic development in the east, but understanding the history of cotton in the centuries preceding this shift is integral to understanding that process. By discounting the early history of cotton production, diffusion and consumption, evidence of an

in these studies are characteristic of numerous studies of the early cotton industry and trade, including Mazzaoui 1981; Barnes (ed.) 2004; Nam 2007; Philiponeau 2009. It was also taken up in a popular history of the fibre, such as Yafa 2005.

¹⁴ Mazzaoui 1981, 9-10 ; Nam 2007, 97.

important step in the development of the global economy has been overlooked. While it is clear that the developments described by Mazzaoui, Nam, Riello and Beckert greatly impacted world systems and interaction, tying the diffusion and development of the cotton industry so strictly to these late industrial movements does not acknowledge what is being revealed by new archaeological exploration.

In the introduction to his volume, Riello described the importance of understanding the development of the cotton industry in identifying wider economic trends, arguing:

Cotton was over a millennium one of the most important industries in the world... Hence cotton can be used as a lens through which to read other global phenomena that cotton came to exemplify and possibly explain. In this sense, a book on global cotton is also an example of how global economic history can be written.¹⁵

However, as a cursory summation of early pre-medieval cotton, he wrote:

A thousand years ago, the presence of cotton was limited. Raw cotton was cultivated and manufactured only in specific parts of the world. Slowly, it entered into the consuming habits of millions of people, especially in the Indian subcontinent.¹⁶

The purpose of this dissertation is to challenge such reductive conclusions regarding the early cotton industry (particularly in the regions of Africa, the eastern Mediterranean, and the Middle East) and what can be revealed about economic networks in these areas as they transitioned from antiquity to the medieval period. To this end, it will explore the use of textiles as historical source materials, and the ways they can be integrated in economic, social and cultural histories. It will show that cotton in late antiquity was being transmitted on at least two, possibly more, overlapping but distinct networks. Of these one was independent of overt influence from Mediterranean economic centres, suggesting that the communities on the peripheries of the Roman and post-Roman empires were pursuing their own economic strategies. In particular, the importance Africa played in the diffusion of cotton will be emphasised. In doing so the

¹⁵ Riello 2013, 2.

¹⁶ Riello 2013, 1.

importance of the various stages of textile production and distribution on local economies as well as regional and trans-regional communication networks will be highlighted.

As stated, cotton is ideal for this kind of study because it was not native to any of the regions being considered; extensive (though uneven) archaeological investigation of these areas has indicated a rough *terminus post quem* for its introduction into each of the different regions. The material evidence from these excavations, as well as texts that mention cotton, will be systematically examined in the following chapters, and considered in relation to evidence of exchange networks, agricultural practices and environmental history in order to understand the process of cotton's transmission as a domesticated crop, textile fibre and trade good. However, a few opening remarks on cotton as historical evidence and the geographic and temporal limits of this study are necessary.

The oldest evidence of domesticated cotton in the world, dating to around the fourth millennium BC, has been found in the region of Baluchistan in modern day Pakistan.¹⁷ Trade networks and the spread of goods from the Indian subcontinent have been extensively examined throughout the periods of antiquity, and cotton has often formed a part of these studies.¹⁸ As will be shown, the presence of cotton in the archaeological record has typically been interpreted within a framework of Indian exchange networks, even when it has been accepted that the cotton itself was not from India. To critically examine such assumptions, this study will begin with the evidence of cotton on the African continent, which genomic sequencing of the two domesticated species of Old World cotton has shown developed independent of the Indian subcontinent,¹⁹ and will synthesise the evidence of cotton without the premise of Indian influence. The areas discussed will be Nubia, Egypt, North Africa, the Horn of Africa, Arabia (particularly western Arabia along the Red Sea with references to

¹⁷ Moulherat *et al.* 2002. However, as shown later in this chapter, this does not mean that all domesticated cotton derived from this region.

¹⁸ This bibliography is extensive, but has most recently been summarized and analysed in Tomber 2009 and 2018; Seland 2010 and 2014a; Ray 2014.

¹⁹ See section on 'Taxonomy' on chapter two, 58.

Eastern Arabia and the Persian Gulf), the Levant (encompassing modern day Israel, Jordan, Syria and Iraq), and the area of modern day Iran, with brief considerations of the Caucasus and Central Asia, where early cotton specimens have also been found [fig. 1.2].²⁰ Although the geographic spread of this study is wide, the incidence of cotton finds in each is so far small enough to provide manageable datasets; the implications of the size of these datasets, as well as issues with quantification, will be addressed in the discussion of methodology below.

Along with a wide geographic spread, this study also covers a wide time period, with the majority of focus on the first through ninth centuries AD. However, to achieve an understanding of the process of adoption, and how cotton was functioning within cultural and economic networks, it is necessary to look past its presence in a single place and time. Contrary to what may be implied by theories such as Andrew Watson's 'agricultural revolution',²¹ cotton did not appear in several different areas all at once through the same diffusion event; it was a gradual process that, though not linear, can be seen as forming patterns that map onto evidence of exchange connections between the regions in question. Through these patterns, relationships between regions can be explored and trade partnerships defined not as static entities but as reflections of adaptive processes that responded to changing socio-political, economic, and climatic environments.

Structure and methodology

As mentioned, because genomic sequencing has indicated domestication of an African cotton species, this study examines the evidence without the presumption that evidence of cotton is also evidence of a trade relationship with India or demand created in the context of that trade. Chapters two to four are structured thematically. The second chapter situates this dissertation within the field of textile studies; how textiles have been used in the past, how new scientific advances are opening avenues of inquiry to scholars outside of art history, and how

²⁰ A table of all sites and finds of cotton discussed in this work can be found in appendix 1.

²¹ This is discussed in detail in chapter seven.

textiles can function in an interdisciplinary study, themes carried through in the next two chapters. How we understand a commodity is affected by how we understand economic function, and vice versa. Therefore, chapter three looks at economic modelling; the historiography of the ancient economy through late antiquity, the role of trade with India, and the narrative of African history are all examined to determine how current narratives of both trade and the cotton industry have been constructed. Chapter four looks at the social production within the textile industry in general. This is difficult to parse by fibre, but what becomes apparent is there were different modes of production, all of which had social and economic implications for the wider population. Ultimately, this chapter looks at how the textile industry was formed and who participated in it.

The subsequent three chapters shift from a thematic to geographic organisation in order to trace the diffusion and consumption of cotton and reframe current discussions of directionality. Chapter five examines the presence of cotton specifically in Nubia, and how this changes the position Nubia is traditionally placed by scholars in relation to Egypt and the wider Mediterranean. The historiography of Nubian studies in the past has been closely tied to the field of Egyptology, with Nubia framed as a subsidiary state. Chapter five examines this claim through the evidence of communication networks. Chapter six looks at the diffusion of cotton into Egypt, North Africa and the Horn of Africa. Egypt has received the most attention in discussions of cotton outside of India because of its role as an intermediary between the Red Sea (and Indian Ocean) and the Mediterranean, but the evidence of cotton there is actually quite restricted and suggests the presence of a pan-African network instead. Finally, chapter seven explores the spread of cotton into the Middle East, where its distribution clearly demonstrates the presence of multiple intersecting cotton networks, with at least one originating in India and one on Africa. The possibility of a further network in Central Asia will also be considered. The results of the study are therefore two-fold; the first economic—it demonstrates that cotton was a diversified crop prior to the spread of Islam, whose spread tracks

multiple communication networks—and the second cultural—it also shows that the textile industry involved large parts of the ‘invisible’ population, Africa was playing a large part in the development of commodities trade in late antiquity, and land-routes were important avenues for trade goods. These conclusions largely depart from current assumptions about cotton culture and the directionality of trade, and insist on a re-evaluation of our understanding of networks in the late antique and medieval worlds.

Text

Historical studies that have attempted to incorporate both text and archaeology have tended to privilege one over the other, and using areas of data agreement as confirmation of assumptions, rather than looking at each independently and reconciling similarities and differences.²² However, a means to overcoming such deficiencies is to treat the texts themselves as archaeological objects, thereby giving a base for comparison. Surviving texts from antiquity through the medieval period provide a wealth of information on both the textile industry and trade, which is perhaps why some have formed such a significant part of textile scholarship. However, as Droß-Krüpe has discussed, there is a lack of integration between texts and the remaining textile materials,²³ and the texts that are used by textile historians are not necessarily treated with a critical eye; issues of accuracy and genre are often left unengaged. In terms of cotton, this is particularly true in the use of the (previously mentioned) *PME*, which has been used as proof of an extensive cotton trade between India and Rome via the Red Sea.²⁴ Subsequent finds of cotton fragments at archaeological sites along Egypt’s Red Sea coast have been used as corroboration of the text in the secondary literature.²⁵ A critical examination of both *the PME* and its implications along with the cotton finds appears in chapter six, but it is

²² Bowman and Wilson 2009, 10-11.

²³ Droß-Krüpe 2014.

²⁴ For example, Albaladejo Vivero 2013; Gurukkal 2013; Parker 2004; Seland 2014aa and 2016; Wild and Wild 2014a.

²⁵ This has formed the basis of economic discussions of cotton in antiquity in Bagnall 2005; Droß-Krüpe 2013; Gurukkal 2013; Parker 2004; Tomber 2009; Wild 2006; Wild and Wild 2004; and others. These sites are discussed in chapter six, starting on 215.

used here to illustrate the way in which text has often been given a place of primary value over other types of artefacts, even amongst some textile historians. Many ancient writers (historians, geographers and chroniclers) referred to different aspects of textile production and trade; for example, Herodotos (c. 484-425/413 BC), Pliny (AD 23-79), and the rhetorician Ioulios Polydeukes, more commonly known as Pollox (second century AD), all specifically refer to cotton cultivation.²⁶ However, the veracity of the information provided by these texts is inconsistent; volumes have been dedicated to each examining the complex factors influencing their writings and what the implications are for historical understanding.²⁷ Care should therefore be taken when using such sources, particularly in relation to the more marginal areas of the empire under consideration where these writers would have been referring to other sources.

A second body of texts that can be mined for information on textile production and trade are the large collections of Egyptian papyri stored in institutional archives throughout the world, as well as collections of ostraka and wooden tablets (typically treated like their papyri counterparts).²⁸ Although papyri are most often associated with Egypt, they have been found throughout the Mediterranean and Middle East, from sites such as Nessana in the Negev Desert,

²⁶ These considerations in relation to the texts (Herodotos' *Histories*; Pliny's *Natural History*; and Pollox's *Onomastikon*) are explored further in chapters five and six.

²⁷ Herodotos in particular is the subject of an extensive critical bibliography of his writing and sources, recently in Vignolo Munson (ed.) 2013, vols. I and II; and more specifically in relation to Egypt in Lloyd 2007; Moyer 2011, 42-84. For Pliny as a source of information as well as a cultural artefact, see Gibson and Morello (eds.) 2011; Murphy 2004. Pollox's *Onomastikon* is typically described as a lexicographical text, but it is also quite descriptive, as will be seen in its treatment of cotton. For a discussion of this text in relation to this genre, see Dickey 2007, 96.

²⁸ This is also the approach Bagnall takes in his volume on the theoretical use of papyri in the writing of history, where he notes 'What these materials generally have in common is that they were used for written artefacts with no particular pretensions to permanence... When greater permanence was the goal, the ancients used stone or sometimes metal... Such inscriptions generally had a purpose of public display, also distinguishing them from the most (though not all) texts on papyrus and the materials we assimilate to papyrus.' Bagnall 1995, 7-8. This volume in its entirety was highly influential in my own approach to this class of evidence, and largely informed the methodological discussion above. A table of the documents discussed in this dissertation can be found in appendix 2.

Masada on the Dead Sea, Dura-Europos in the Euphrates Valley, and at Petra in Jordan, as well as ostraka from Bu Njem in Libya and Masada.²⁹ While the sheer quantity of material recovered from Egypt and the broad scope of matters that refer to would seem to set those documents apart, as more and more comparable examples have been found throughout other regions it has become apparent that the transactions, events, and concerns recorded in Egypt are similar to those that were being detailed elsewhere and do not represent a unique tradition of record keeping.³⁰ In addition to private letters, documents were created by private individuals to protect property rights (including slaves and animals); record debts, collections and payments; legal disputes; contracts; and transactions.³¹ Official documents of the state are an additional trove of tax and census records. However, while the collections of papyri found in Egypt are certainly extensive,³² there are also large gaps in the record, both in terms of geography and time period.³³ Roger Bagnall attributes these gaps to two circumstances of preservation: climate and the patterns of use.³⁴ Like textiles themselves, papyri are best preserved in dry, arid environments and as they were serving a particular function in, and segment of, society they were not used uniformly. The papyri largely dealt with legal matters and therefore tend to provide the most information about male property owners. Women and the poor appear far less

²⁹ Bagnall 1995, 8. For Nessana see Casson and Hettich 1950; Kraemer Jr. 1958. For Masada see Cotton and Geiger 1989. For Dura-Europos see Welles *et al.* 1959. The Petra papyri have been published in four volumes, Frösén *et al.* 2002; Koenen *et al.* 2013; Arjava *et al.* 2007; Arjava *et al.* 2011. For Bu Njem, see Marichal 1992; Adams 1994 and 1999. Another extensive collection of documents come from Vindolanda, in Britain, where a number of wooden tablets were found. The tablets have been the subject of several studies of their content in relation to the social and economic networks in Roman Britain, including Bowman and Thomas 1983; Bowman and Thomas 2003; Evers 2011. A collection of wool textiles was also recovered from the site and analysed in Wild 1979; Cork *et al.* 1997. However, a full discussion of these textiles is outside the scope of this study.

³⁰ Bagnall 1995, 9; Bagnall 2005, 188.

³¹ Bagnall 1995, 11.

³² There are in fact so many documents in collections, many have not yet been transcribed or critically translated.

³³ Texts have also been found in Nubia, using a Meroitic script, but to the best of my knowledge few refer to trade and none mention cotton. The texts are mostly in stone, but have also been found on papyri, ostraka, skins, wood. More than half of the texts recovered have been classes as funerary inscriptions of epitaphs. Rilly and de Voogt 2012, 10.

³⁴ Bagnall 1995, 8-12.

frequently. Literacy may have also been a limiting factor.³⁵ But there is also simply the element of chance, in both preservation and discovery. As excavations continue, more documents will surely be discovered, and it is hoped that some of the gaps will be narrowed.

Papyri are rarely found in a complete state, and a certain amount of text loss is to be expected. Formulaic documents, such as tax receipts and contracts, can often be reconstructed with a high degree of probable accuracy through comparison between texts; more personal writing presents greater challenges, and the modern editor must rely on the structure of the text itself to help reconstruct it.³⁶ The reconstructed text therefore inherently includes the editor's own assumptions and interpretations within. As this dissertation is a synthetic study of multiple types of evidence, and not a critical examination of the papyri, it relies on critical editions of texts that have already been transcribed, restored where needed, and in many cases translated. Because mentions of cotton are frequently included as small parts of larger texts, the problem of reconstruction is often not an issue; where there are questions due to the preservation of the text, this is noted and explored. In all cases, the critical editions of the documents used were listed in the *Checklist of Editions of Greek, Latin, Demotic, and Coptic Papyri, Ostraka and Tablets*.³⁷ Most of these texts, along with collection and publication histories (and in some cases photographs), are available through the online database papyri.info, hosted by the Duke Collaboratory for Classics Computing and the Institute for the Study of the Ancient World.³⁸

Finally, it is impossible to talk about textile trade and production in the early Islamic period without referring to the Cairo Genizah. While many Genizah documents were examined by S. D. Goitein who published a number of volumes on them from the 1960s to the 1990s,³⁹

³⁵ In general, it is assumed that the majority of the population of Roman and late antique Egypt were illiterate, that the wealthy were more likely to be literate than those less well-off, and men more than women. Bagnall and Cribiore 2006, 6.

³⁶ Bagnall 1995, 59, 25-26.

³⁷ The current incarnation of the list was edited by J. D. Sosin *et. al.*, hosted by Duke University at <https://library.duke.edu/rubenstein/scriptorium/papyrus/texts/clist.html>.

³⁸ <http://papyri.info>. It also includes a document word search tool.

³⁹ Goitein 1967; 1971; 1978; 1983; and posthumously 1988; 1993.

they were not comprehensive and there are ongoing efforts to create online databases of the texts held in multiple collections.⁴⁰ For Greek texts, the online Thesaurus Linguae Graecae, hosted by the University of California Irvine, has similar features, as well as hosting an online version of the Liddell-Scott-Jones Lexicon.⁴¹ These tools have been extremely important in identifying and managing one of the well-known problems in identifying textiles in ancient documents, that of terminology. The word search tools allow for quick identification of texts that used the various terms that have been proposed for cotton. Analysis of these terms and the documents in which they appear has made it increasingly clear that assumptions regarding terminology have been one of the most influential factors in how cotton is treated in the secondary literature, and therefore requires a more thorough examination.

Terminology

How to grapple with the issue of determining the meanings of terms related to textile products and the textile industry is a problem that textile historians (and often times historians in general) have debated for decades, often with little success. There are several reasons for this, including assumed contextual knowledge on the part of the ancient authors and the evolving nature of language, particularly in relation to goods that were traded between regions and cultures with the frequency of textiles.⁴² As the textile historian John Peter Wild noted:

A significant problem impeding our exploitation of such sources is the impenetrable nature of much of the technical vocabulary. I can speak from personal experience only of Greek and Latin, but I think the difficulty is general... To discover the meaning of a specific textile term, a lexicon is a good place to start, but a bad place to end... There is the problem of semantic shift; for as technology develops, and particularly clothing fashions change, old words take on new layers of meaning.⁴³

⁴⁰ This includes the Cambridge Digital Library (<http://cudl.lib.cam.ac.uk/collections/genizah/1>) and the Friedberg Genizah Project through the Friedberg Jewish Manuscript Society (<http://fjms.genizah.org>). Both include varying levels of word search functionality.

⁴¹ <http://stephanus.tlg.uci.edu>.

⁴² For an overview of historical problems with textile terminology, see Galliker 2014, 102-105.

⁴³ Wild 2005, 5.

This was certainly the case for cotton, and as will be seen, many of the terms that have been interpreted as cotton by modern scholars were also used to refer to linen or finished products of no discernible specific fibre type in ancient texts. While in some instances, a case for cotton can be made from context, such ambiguity raises questions not only of when a term refers to cotton, but also what the ancient understanding of textiles that were imported from great distances were and what were considered their important features.

The use and cultivation of cotton in Greco-Roman Egypt is mentioned in many ancient sources. Herodotos, one of the earliest to describe cotton, wrote of two breastplates that had been dedicated by King Amasis of Egypt to the gods in Sparta and Lindos in the *Histories*; he describes each as being made of linen embroidered with gold and ‘wool from trees’, i.e. cotton.⁴⁴ In his *Onomastikon*, Pollox describes the Egyptians as producing ‘a kind of wool made from a tree’ which was comparable to linen.⁴⁵ It is from these descriptions of ‘wool from trees’ and similar that the word used most clearly for cotton in some late antique Greek papyri derived; the word for wool (ἔριον) and the word for wood or tree (ξύλον) were combined to become ἐριόξύλον (ἐρεόξύλον), wood-wool or tree-wool, a visual description of the raw material of cotton. Evidence for the use of the word in Egypt was first identified in the Egyptian papyrus P.Iand.7.142 (AD 164-165), which probably originated near Kysis in the Kharga Oasis

⁴⁴ ‘...καὶ γὰρ θώρηκα ἐλήρισαντο τῷ προτέρῳ ἔτει ἢ τὸν κρητῆρα οἱ Σάμιοι, ἐόντα μὲν λίνεον καὶ ζῶων ἐνυφασμένων συχνῶν, κεκοσμημένον δὲ χρυσῷ καὶ εἰρίοισι ἀπὸ ξύλου... τοιοῦτος ἕτερος ἐστὶ καὶ τὸν ἐν Λίνδῳ ἀνέθηκε τῇ Ἀθηναίῃ Ἀμασις...’; ‘The Samians had stolen this breastplate the year before they had stolen the bowl; it was made out of linen, had a large number of creatures woven into it, and was embellished with gold and **cotton** thread... Amasis dedicated another one like it to Athena in Lindos.’ Herodotos, *Histories* 3.47, trans. Waterfield 1998, 189 (emphasis my own). The phrase ‘εἰρίοισι ἀπὸ ξύλου’ literally translates to ‘wool from wood’.

⁴⁵ ‘...ἤδη δὲ καὶ παρ’ Αἰγυπτίοις ἀπὸ ξύλου τι ἔριον γίνεται, ἐξ οὗ τὴν ἐσθῆτα λινῇ μᾶλλον ἢ τις φαίη προσοικεῖναι, πλὴν τὸ πάχος... ἐνδοθεν ἐξαιρεῖται τὸ ὥσπερ ἔριον, ἀφ’ οὗ κρόκη γίνεται...’; ‘And even now, **a kind of wool is made by the Egyptians from a tree**, cloths of which one might compare to linen except as regards thickness... a sort of wool is taken from the inside from which thread is made.’ Pollox, *Onomastikon* 7.75, trans. in Clapham and Rowley-Conwy 2009, 245 (emphasis my own).

of the Western Desert. Identified as an accounting of local farms and their products, one entry is notable for its inclusion of ἐρεόξυλ(α) as a crop.⁴⁶

The association of other terms that have been understood by scholars in the past to mean cotton are not as certain. For example, P.Vindob.G.408222 (AD 125-175, also known as the Muziris Papyrus),⁴⁷ a second-century cargo list of goods imported into Egypt, includes an item referred to as σχιδῶν, which was interpreted as cotton by Wild.⁴⁸ However, this is an unusual term. The lexicon of Hesychios defines the word σχίδα·σχίδος as σινδόνοϛ (a type of cloth) or πῆγμα (something joined together).⁴⁹ While σινδόνοϛ (σινδῶν, ὄνοϛ, ἥ) likely derived from Ἰνδός, used by Herodotos to describe Indians or the Indus River,⁵⁰ a fact which led Wild to interpret the fabric as cotton along with the description of other goods of Indian origin,⁵¹ the term itself seems more generally to refer to a finely woven cloth, not a fabric woven from cotton fibres. Herodotos also uses the term when describing bandages used in mummification in Egypt,⁵² which in the archaeological record are predominantly made of linen. It is obvious context is important in deciphering what the material really was, but how that term was understood, particularly important in addressing the issue of demand, is clearly more difficult to address.

⁴⁶ Winter and Youtie 1944, 250.

⁴⁷ Muziris has been generally accepted to be the site of Pattanam on the coast of Kerala, although debate over this identification still exists. For a bibliography of this debate, see Darley 2013, 366 fn. 697.

⁴⁸ Wild 1997, 291-292. This papyrus was originally published in German by Harrauer and Sijpesteijn 1985 (who translated the term as sheets), translated into English by Casson 1990, and it is also the subject of Casson 1986; Thür 1987; 1988. The *Thesaurus Linguae Graecae* lists no other uses of this term.

⁴⁹ Hesychios, *Lexicon*, 3010.

⁵⁰ Herodotos, *Histories* 3.38 and 4.44, respectively.

⁵¹ This included a reference to Gangetic nard, also known as spikenard, which is an essential oil derived from flowering plants found in China, Nepal and India.

⁵² “Ἐπεὰν δὲ παρέλθωσι αἱ ἑβδομήκοντα, λούσαντες τὸν νεκρὸν κατελίσσουσι πᾶν αὐτοῦ τὸ σῶμα σινδόνοϛ βυσσίνης τελαμῶσι κατατετμημένοισι, ὑποχρίοντες τῷ κόμμῳ, τῷ δὲ ἅντι κόλλης τὰ πολλὰ χρέωνται Αἰγύπτιοι.” ‘Once the seventy days are over, they wash the corpse and then wrap the whole of its body in bandages made out of fine linen cloth cut into strips. The bandages have gum (which is usually used in Egypt instead of glue) smeared on the underside.’ Herodotos, *Histories* 2.86, trans. Waterfield 1998, 127.

Another example of the use of σινδόνης comes from Strabo's first-century *The Geography*. When describing India, he writes that some trees bloom wool (ἐπανθεῖν ἔριον) from which finely woven fabrics are made (εὐητρίους ὑφαίνεσθαι σινδόνας).⁵³ This passage again is clearly referring to cotton, but the word 'σινδόνας' is being used as a generic word for fabric, not the word that indicates the fibre itself. P.Vindob.G.40822 has frequently been used to show cotton from India being transported from the Red Sea Coast to the Nile and up to Alexandria,⁵⁴ but was the defining characteristic of the fabric that it was made of cotton? Was it cotton, or another type of finely woven fabric?⁵⁵ While it is likely that at least some σινδών

⁵³ 'διὸ καὶ τοὺς κλάδους φησὶν εὐκατμπεῖς εἶναι τῶν δένδρων, ἐξ ὧν οἱ τροχοί· ἐκ δὲ τῆς αὐτίας ἐνίοις καὶ ἐπανθεῖν ἔριον. ἐκ τούτου δὲ Νέαρχος φησι τὰς εὐητρίους ὑφαίνεσθαι σινδόνας, τοὺς δὲ Μακεδόνας ἀντι κναφάλλων αὐτοῖς χρῆσθαι καὶ τοῖς σάγμασι σάγης'; 'For this reason also, he adds, the branches of the trees from which the wheels of carriages are made are flexible; and for the same reason even wool blossoms on some. From this wool, Nearchus says, finely threaded clothes are woven, and the Macedonians use them for pillows and as padding for their saddles'. Strabo, *Geography*, 15.I.20, trans. Jones 1966: 32-33.

⁵⁴ Wild 1997: 291-292; Albaladejo Vivero 2013: 146; Droß-Krüpe 2013: 152. One side of the papyrus contains a contract drawn up, probably in Muziris, with one of the goods described is Gangetic nard, placing the origin of at least some of the cargo in India, although I would postulate that given the seasonality of trade, length of voyages, and other ports passed between India and the Red Sea, it does not follow that the entire cargo originated there.

⁵⁵ It should also be noted that India was not just producing cotton textiles in the period of late antiquity, but also textiles of linen, silk, jute, hemp, and even wool. Owing to the climate of the Indian subcontinent, very few textile remains have been found in archaeological contexts, but where fibres have been obtained, linen and silk, as well as cotton, have been found. Gulati 1965; Allchin 1969; Janaway and Coningham 1995, 157. While the finds of cotton have been acknowledged in the literature, finds of other fibres have generally been ignored by textile historians. For example, see Wild and Wild 2004, 20. Archaeobotanic remains are also rare, but have demonstrated that flax was also being cultivated in India. Fuller 2008 provides a summary of the evidence of both cotton and flax cultivation in India. And linen as a textile fibre is also recorded in ancient Indian texts. Late Vedic texts spanning the period of the first millennium record clothing made from a number of fibres, including cotton, wool and linen. Ray 2018, 291. The *Kautilīya Arthaśāstra*, a text on governance and the local economy compiled for the Chief Minister of Chandragupta composed between AD 50 to 125 (although revised and added to probably through the third century AD) also records that fabric of cotton linen, silk and wool was used to make clothing. *Kautilīya Arthaśāstra*, 2.11.97-115. Ray 2018 also provides a summary of Indian texts and the fibres they describe being used for textiles. It is conceivable that textiles of these other fibres (particularly linen and silk) were also being traded across the Indian Ocean, but have been unidentified because of ambiguous terminology. The attribution of certain textile fibres to India in the finds from the Egyptian port sites has been based on spin-direction, which is the twist of the spun yarns indicating spinning technique (see chapter two and appendix 3). Z-spun has been taken to indicate Indian origin, and s-spun to indicate local Egyptian origin. As there are so few finds of ancient textiles in India, the attribution of a single spin-direction was based on later textiles. Wild *et al.* 2008, 146 has urged

referenced in trade documents was cotton, the use of the word does not imply that the specific fibre used was the defining characteristic; rather, the term more generally seems to refer to a finished textile product, and can open the possibility that even when referring to textiles from India, the use of the term does not make for certain fibre identification. While context can sometimes be used to determine the likely fibre, this also relies on the assumption that the writer definitively knew what they were talking about. The *PME* clearly illustrates this point.⁵⁶

Casson may have been the most influential person in creating the narrative of the scale of cotton demand in Roman trade with his translation of the *PME*. In his ‘Appendix 4’ of the text, he notes that the general term ὀθόνιον, which has no inherent connotation to fibre type in its general usage,⁵⁷ is used to refer to textiles originating and moving to locations all over the Indian Ocean littoral: From Egypt to Arabia, from India to the Western Indian Ocean, and together with the word σηρικόν for silks that probably originated in China.⁵⁸ Casson wrote that ὀθόνιον originating in India must have been cotton because one of the last mentions of it in the text uses the word κάρπασος to describe it.⁵⁹ This is a cognate of the Sanskrit word for cotton, कर्पास (*karpāsa*), which also serves as the root for the Hebrew כרפס (*karṗās*).⁶⁰ He maintains that it should therefore be understood that all instances of ὀθόνιον originating in India refer to cotton. However, κάρπασος is only used once, towards the end of the text, to refer to a production material, and there is nothing to indicate that all of the ὀθόνιον from India

caution when using solely spin-direction to prove textile attribution, and while cotton finds from the sites of Berenike, Myos Hormos and Abu Sha’ar have had both s-spun and z-spun cotton and wool, only s-spun linen has been found. See chapter six, section beginning on 215 for references to the excavations and finds. This may be an avenue for further investigation.

⁵⁶ Casson acknowledges that while σινδόνης usually means linen, in the *PME*, because it is presumably referring to textiles from India, it must mean cotton. Casson 1983, 202-203.

⁵⁷ *TLG*, 1200; it typically refers to linen.

⁵⁸ Casson 1989, 292.

⁵⁹ ‘...καρπάσου καὶ τῶν ἐξ αὐτῆς Ἰνδικῶν ὀθόνιον τῶν χυδαίων ‘; ‘...cotton and the Indian cloths made from it, those of ordinary quality. *PME*, 41.14.6., trans. Casson 1989, 76-77. Whether this refers to spun cotton thread or raw cotton is not specified, but there have been no finds of wads of cotton from Red Sea ports, so it is probably that this is a reference at least to something that has received initial processing.

⁶⁰ Mazzaoui 1981, 9.

was made from it. Further, in Latin the word *carbasus*, also from the Sanskrit, is typically used to mean sails.⁶¹ Is it possible this was a specific reference to cotton sails used by Indian merchants? The archaeology suggests that this may be a possibility; at both Berenike and Myos Hormos on Egypt's Red Sea coast, cotton fragments with stitching consistent with depictions of ancient sails have been found in large quantities.⁶² Even if one assumes all mentions of Ἰνδικῶν ὀθόνιον (6:31:1, 31:10:23, 41:14:6, 48:16:15-16) were meant to refer to the same thing, leaving three instances of ὀθόνιον (51:17:13, 14:5:11-2, 6:3:1-2) without any kind of descriptor, there is nothing to indicate what kind of fabric was being imported from India or that the author had an understanding of the fibres being used in Indian textile production. If it was cotton, there is nothing to indicate that it was understood to be such, or that the fibre type is what made it special as an import. This is important for how a text such as the *PME* is used to discuss both the scale of the cotton trade on the Indian Ocean and how it generated demand in the Roman world; this will be returned to in later chapters.

Βύσσος is another term that has been taken to have meant cotton in some instances, but which more commonly was used for linen. Philostratos is typically pointed to for this term as he used it several times in his descriptions of the clothing of the elites in India.⁶³ Pollox also refers to βύσσος λίνου (linen thread) made by the Indians, which is also often assumed to be a reference to cotton.⁶⁴ However, this is based on the assumption that India was only exporting cotton. It is also possible that Pollox was actually referring to Indian linen,⁶⁵ or that since he

⁶¹ For example, in Vergil's *The Aeneid*: 'Iamque dies alterque dies processit, et aurae vela vocant tumidoque inflator carbasus austro'; 'A day passed, then another. Breezes called our sails. The canvas puffed out in the south wind...'. Virgil, *Aeneid*, 3.356-357, trans. Ruden 2008, 58; "Anna, vides toto properari litore; circum undique convenere; vocat iam carbasus auras, puppibus et laeti nautae imposuere coronas"; "Anna, you see the whole shore in tumult. They come from everywhere. Sails draw the breeze. Sailors in joy hang garlands on the sterns". Virgil, *Aeneid*, 4.416-418, trans. Ruden 2008, 82.

⁶² Wild and Wild 2001; Wild 2004a; Whitewright 2007b; 2014; Blue *et al.* 2011.

⁶³ Philostratos, *Apollonios of Tyana* 2.20.

⁶⁴ 'καὶ τὰ βύσσινά, καὶ ἡ βύσσος λίνου τι εἶδος παρ' Ἰνδοῖς'; 'and made of linen, and the linen thread made by the Indians.' Pollox, *Onomastikon* 7.75, trans. my own. Wild argues that this is a reference to a cloth made of both linen and cotton. Wild 1997, 289.

⁶⁵ See this chapter, fn. 55.

supposedly uses several terms to refer to cotton within a short section,⁶⁶ he may have been unfamiliar with the subject and was relying on several different sources. At the very least, it indicates that Pollox did not connect the βύσσοις λίνου from India with the ἀπὸ ξύλου τι ἔριον grown in Egypt. Such confusion in textile terms between authors may not have been uncommon. Casson records the differences in meaning of μολόχιναι between different authors, demonstrating that inconsistency in the language of textiles.⁶⁷

Ewa Wipszycka suggested that the number of words that seem to have been used interchangeably for linen and cotton meant that what was being referred to was the fineness of the cloth rather than a specific fibre;⁶⁸ while, this is very rarely acknowledged when discussing texts that seem to refer to cotton, I agree with Wipszycka but would take it a step further, and propose that the terminology also indicates that there was little understanding that the material being describes as ἐριόξυλον was in fact the same as σχιδῶν/ σινδόνοις/ κάρπᾶσοις/ βύσσοις coming from India (assuming many, if not all, such references were indeed for cotton). Instead, while the first term was clearly referring to a raw fibre (possibly also κάρπᾶσοις), the other three (again, possibly also κάρπᾶσοις) were referring to types of finished products. This has implications for how the rise of cotton on the peripheries of the Roman empire should be interpreted. As will be shown, the increase in cotton use and cultivation is often attributed to Roman demand, and a desire to source cotton elsewhere when India was no longer able to meet that demand. However, if there was not the recognition that what was being grown in Africa was the same as what was being imported from India, this argument makes little sense, and the rise of cotton must have a different cause.

⁶⁶ See this chapter, fn. 45.

⁶⁷ Casson 1983, 202-207. Droß-Krüpe 211, 27-29 argues against the use of this term for cotton, and Lombard 1978, 113-115 suggests the term actually refers to ‘sea-silk’, made from filaments secreted by pen shells.

⁶⁸ Wipszycka 1965, 40.

Archaeology

The other major sources of knowledge of the textile industry are the remains found in archaeological excavations. In addition to archaeological textiles themselves, this includes archaeo-floral and faunal remains, as well as tools and the remains of installations related to textile production. For the textiles, only specimens that were derived from thoroughly documented and published excavations were considered in this study; in general, this means excavations conducted after 1960.⁶⁹ Textiles from these sites generally come from cemeteries or middens (rubbish heaps), though some come from domestic and public structures as well; the means of deposition within each context creates preconditions with which the material within must be understood. Textiles from cemeteries, for example, are not always the textiles that were used in life.⁷⁰ Those from middens are typically small, worn fragments, many of which exhibit signs of re-use, suggesting long life-cycles of the materials.

Finds within both domestic and public structures tend to be, like those from middens, fragmentary, but not deliberately deposited as in the previous two contexts—they represent incidental losses. Textiles from mixed contexts, where the remains from different time periods were artificially jumbled, or those where dates could not be determined were also not used, though in the course of this research this restriction applied to only a single site. The reason for these omissions is that in tracing the geographic adoption of cotton, knowing the approximate dates of samples was necessary. The fibres of archaeological textiles were often identified visually with the aid of microscopic examination during artefact processing, though differentiating between plant fibres was not always done.⁷¹ When magnified, the difference

⁶⁹ The most notable exception to this is sites from Nubia, many of which date to the early twentieth century, but which reported much information on their textiles finds, and which have also recently been the subject of thorough re-examination by Elsa Yvanez (Yvanez 2015).

⁷⁰ This was the subject of a paper I delivered at the Leeds International Medieval Congress in 2017, currently being prepared for publication.

⁷¹ For example, at Mons Claudianus, discussed in chapter six, excavators only distinguished between plant and wool fibres, without identifying the type of plant, due to unfamiliarity with the materials.

between the fibres is clear; whereas linen fibres have a jointed appearance, cotton has a characteristic concave structure [fig. 1.3]. Fibre identification can also be done using DNA sequencing, discussed below.

The issue of fibre identification is particularly important for cotton. Because it was assumed to have largely been transmitted by Arab traders throughout the Mediterranean after the spread of Islam, early excavators were not looking for cotton amongst textile finds and it is therefore possible that cotton textiles were misidentified. This is less of a concern for more recent archaeological excavations, but re-examination of previous finds have revealed occasional instances of cotton. For example, Jane Batcheller's study of the fourth- to fifth-century textiles from Karanis, a site in the Egyptian Fayyum Oasis, held at the Bolton Museum (from excavations carried out by the University of Michigan in the 1920s and gifted by the Kelsey Museum) found two fragments out of 300 that had been identified as wool but were actually mixes of cotton and wool. Batcheller determined that while it is likely that there are also misidentified cotton fragments held in the main collection of Karanis textiles at the Kelsey, they probably represented an equally small percentage of the overall assemblage.⁷² This is addressed further in chapter five, but based on current evidence, the apparent low incidence misidentified cotton suggests it has not occurred on a great enough scale to impact this study.

In addition to the finds of finished textiles, this study relies heavily on archaeobotanic evidence, in the form of seeds of the cotton plant, the capsules and bolls in which the cotton fibres were held, and other remains of the plant. As with the textiles, seeds and other plant remains are only preserved under certain conditions, and they have not always been collected in excavations; the widespread collection of seeds and other small organic materials became possible only after sifting and flotation became common practice on archaeological sites. Cotton seeds in particular are often found carbonized or desiccated in residential settings, likely the result of processing within domestic structures and possibly also the result of oil extraction

⁷² Batcheller 2002, 107.

for fuel. Seeds of domesticated plants in archaeological contexts are generally seen as an indication of local cultivation,⁷³ and that is the interpretation used here. One of the patterns that will be examined is the difference between sites where seeds and evidence of cultivation are clearly found, and those where only textiles are found without any evidence of local cultivation.

The final type of archaeological evidence to be considered are the tools of textile production found within sites. In most cases, these tools are not associated with specific fibre types, but these materials are still important for examining the social and economic implications of textile production in general. Evidence includes implements used for spinning (distaffs, spindles, and spindle whorls), weaving (loom fittings, combs and warp weights), and dyeing (dyeing vats and dyestuffs). The spindle whorls in particular are significant because they are one of the only tools that may have been differentiated based on the textile materials being used, as the fibre used may have dictated the weight and shape of the whorl.⁷⁴ This type of analysis is still relatively new, and as a result spindle whorl weights are frequently not reported.⁷⁵

In all cases, the dates reported by excavators were used for both sites and individual finds in this study. Some dates were established by radiocarbon dating, and those are noted. Date ranges were recalibrated using the OxCal 4.3 program, using the IntCal13 calibration curve, the most up-to-date for the regions,⁷⁶ and where there were differences it is noted. Most

⁷³ Bouchaud *et al.* 2011, 408. The exception for cotton is when whole cotton bolls or seeds with fibres still attached are found, which could be the result of local cultivation but could also indicate transportation of the raw material. However, such finds are quite rare.

⁷⁴ Spindle whorls were used to prolong the duration of spin and the added weight increased the tension of the finished yarn. Langgut *et al.* 2016, 974. The dimensions and weight of the spindle whorl determines how thick the yarn will be by dictating the speed of rotation while spinning. Shorter, more delicate fibres, such as cotton, require lighter spindle whorls that are able to spin faster, while wool and flax, which are longer and stronger fibres, require heavier spindle whorls. Kossowska-Janik 2016, 108-109. A brief overview of spinning and weaving technology can be found in chapter four, and more on looms and dyes in appendix 4.

⁷⁵ For this reason, it was not possible to make a comparison of the spindle whorls across sites to help determine what fibre they may have been used for, but such an endeavour would be a worthwhile pursuit in the future.

⁷⁶ Höflmayer 2016.

archaeological finds were determined by context and associated artefacts, such as ceramics, and therefore are presented as approximate date ranges. In all cases, the dates are only able to give a *terminus post quem* for the artefacts found. When discussing the appearance of cotton, then can also only indicate dates by which cotton had already been introduced; that is, the earliest finds of cotton at a site are not necessarily representative of when it was introduced. They can only indicate that by this date, cotton was known. Therefore, this study will be more concerned with trends and patterns than it will be with fixed dating chronologies.⁷⁷ Further radiocarbon dating of finds will make some refinement of these dating issues possible, as will, hopefully, further excavations.

Regarding the technical production of textiles

Understanding the technical process of textile production, and spinning in particular, can be difficult because while financial concerns of textile producers are well documented in papyri and texts, little information about the steps taken to make textiles, the organisational structures, or the artisans themselves, has been preserved. The issue of the social production is the subject of one of the following chapters, but it is necessary to address the technical production of textiles as well. Aspects of the technical production can be pieced together by the archaeological finds of tools used and anthropological study of local traditions, particularly in the case of spinning. As will be discussed, there were multiple modes of textile production; textiles could be made in the home, either by professionals brought in or by family members, they could be commissioned from workshops, bought ready-made, bought used, inherited, and repurposed.⁷⁸ Some of these modes left more physical evidence than others. For instance, the documents show several instances of ‘ordering’ textiles directly from the artisan.⁷⁹ In the case

⁷⁷ See appendix 1 for a list of sites where evidence of cotton has been found, arranged chronologically.

⁷⁸ Thomas 2007, 154. Husselman 1961 includes references to items of clothing being pawned, suggesting an industry built on second-hand textiles as well.

⁷⁹ In BGU 7.1564 (AD 138) a banker is authorised by ‘clothing collectors’ working for the Prefect of Egypt to make an advance payment to weavers from Philadelphia in the Fayyum for items needed by the armies of Cappadocia. Lewis and Reinhold 1966, 515-516; Wild 2003a,

of commissioned textiles, there is also evidence that patrons had a certain degree of say in the look of the finished product. Patterns drawn on papyri and found in middens around settlements have been interpreted as sections of ‘pattern books’ or ‘cartoons’ for weaving [fig. 1.4],⁸⁰ and there is evidence that weavers specialised in certain patterns.⁸¹ Evidence of the purchase of ready-made textile, however, is more indirect.

Spinning of raw materials into yarn ready for weaving was a separate step in the production process distinct from weaving, and again was undertaken in a variety of contexts. Spinning as an industry and step in professional textile production is examined in greater detail in chapter four. Much of what is known of the process of spinning comes from observational anthropological studies conducted by Grace Crowfoot in the early twentieth century, as well as a few images from Egyptian and Roman wall paintings and references in Classical texts. In setting the scene of the Fates spinning in his poem of the marriage of Peleus and Thetis, Catullus wrote:

Hands spun endlessly, the ritual task, the left holding the distaff wound
with soft wool, the right carefully forming the thread with fingers supine
then twisting on sloping thumb the smooth-weighted spindle, snipping
teeth keeping the thread always even.⁸²

Such descriptions largely match evidence from Roman wall paintings. Two different spinning traditions have been identified throughout the Old World based on geographic region, the impact of which will be discussed later. While there is little evidence in the archaeological

39. Many preserved papyri record large textile orders on behalf of the state, such as P.Oxy.36.2760 (AD 179-180) where 775 blankets were ordered for the army, or P.Graux.30.col.7 (AD 155), which recorded an order of 6,700 items of clothing for prisoners from weavers of the Arsinoite nome. Wild 2003a, 42-43. For a discussion of the process of ordering textiles by individuals, see Bogensperger 2016, although I disagree with the characterisation of two letters (SB 6.9025 and SB 6.9026, both from the second century AD) dealing with cotton. These letters are analysed in chapter six.

⁸⁰ Horak 1992, 63-92; Stauffer 1995, 12; 2008.

⁸¹ SB 10.10759 (AD 33-34) recorded the wages for weavers (significantly of both genders; this point will be expanded on in chapter three), listed according to certain numbers of ἀντοπ(), which Litinas has convincingly interpreted as indicating weavers who worked in a certain number of patterns. Litinas 2013, esp. 119-120.

⁸² Catullus 64 *Epyllion*, 322-328, trans. Uzzi and Thomson 2015, 115. The account describes the use of a drop-spindle. Wild 2000, 210.

record to differentiate spinning traditions amongst the different fibres, this is perhaps one area where the treatment and preparation of cotton may have been unusual.

In the 1920s, Grace Crowfoot, accompanying her archaeologist husband John Crowfoot on his excavations in Sudan, recorded the traditional means of cotton spinning of the local population, making several significant observations. First, while she wrote that a native bamboo ‘gin’⁸³ was sometimes used in the processing of the raw fibre, it was more common to skip this step and to instead remove the lint directly from the seed while in the process of spinning, keeping the fibres in their ‘natural order’ and resulting in a more durable thread.⁸⁴ Spinning the lint directly off the seed could account for concentrations of seeds found within domestic structures (although these finds largely occur outside of the Sudan). Simple distaffs, when used, functioned in holding the spun cotton thread [fig. 1.5].⁸⁵ While there is no evidence of a similar lack of preliminary processing of cotton fibres in ancient practice, the archaeological evidence does suggest similarity in the actual process of spinning. Within a grave at the Meroitic Nubian site of Ballana, a complete wooden spindle with a spindle whorl affixed to the top by an iron hook was found (fig. 1.6),⁸⁶ such a tool could be used in two methods of spinning, either drop-spinning or hand-spinning.⁸⁷ In the 1920s, the Crowfoots observed Sudanese women using both methods, with spindles nearly identical to the tool found in the Ballana grave, with the whorl affixed to the top (fig. 1.7),⁸⁸ known as a ‘high-whorl

⁸³ Non-mechanical gins take the form of a roller worked over a hard, flat surface to separate the cotton lint from the seed.

⁸⁴ Crowfoot and Crowfoot 1921, 21-22; Crowfoot 1924, 84.

⁸⁵ Crowfoot and Crowfoot 1921, 22.

⁸⁶ Grave B58. More spindles and spindle whorls were found in other graves in varied states of completion. Williams 1991, 159.

⁸⁷ In drop-spinning the spindle is dropped with a twist that in turns twists the fibres as it falls; in hand-spinning the spindle is rotated by hand or by rolling it down the thigh. Yvanez 2016, 155. For the technique of ancient spinning, see Wild 1988, 28-29.

⁸⁸ Crowfoot and Crowfoot 1921, 22.

spindle'. Images from Egypt also indicate the use of spindles with the whorl attached at the top (fig. 1.8).⁸⁹

The act and imagery of weaving held particular significance in the ancient world, which is explored more in chapter four, as is the question of the distinction between professional and domestic production, while chapters five and six will discuss different types of loom technologies.⁹⁰ Comparative studies of weaving techniques have led to the assumption of an overall uniformity across large geographic expanses,⁹¹ although there do seem to have been some differences depending on fibre. It should be noted that not all finds of textiles are as helpful in determining weaving technique as others; while complete pieces (whether garments or furnishings) are preferable, edges, necklines, decorative elements, and pieces with sewing all give important clues to the construction. For example, the selvedge edges of cotton fragments found at Qasr Ibrim demonstrated two different weaving techniques to secure the edges of the woven fabric; some used self-bands, associated with the Egyptian linen weaving tradition, and some used reinforced selvedge edges, commonly used in wool weaving.⁹² Tracing similarities in technique, particularly in cotton as it spread throughout the Mediterranean and Red Sea hinterlands, can reveal information not only about the process of the spread, but also possibly the origin of textiles as they were used as trade goods. While a methodology for this has not yet been developed, and could itself be the subject of another dissertation, possible means of carrying such a project forward will be discussed in the final chapter of this study.

⁸⁹ By contrast, the spindle whorls in India and Europe were usually attached at the bottom, the 'low-whorl spindle'. Barber 1991, 67. Position of the whorl did not in itself have an impact on the direction of spinning, and both high- and low-whorls spindles could be used with the drop-spinning method. Langgut *et al.* 2016, 974-975.

⁹⁰ More information on looms can also be found in appendix 4.

⁹¹ Granger-Taylor 1982, 3. Due to limited textile finds in some regions, this is based on both textiles as well as the tools found.

⁹² Self-bands describe multiple wefts being woven into the warp together, reinforced selvedges refer to bundles of warp threads being woven together. Jones and Oldfield 2006, 27-28; Jørgensen 2008, 135.

Quantification and scale

This study concerns two major questions regarding the textile industry and the spread of cotton as a crop and a commodity: how to identify adoption rather than incidental or occasional use, and how to define and identify cotton production itself. For the former, it means determining whether evidence is showing a meaningful presence of cotton, as in the Egyptian Western Desert, or if its appearance is merely the result of occasional trade contact without any real impact on local economies, as was apparently the case at Karanis in the Fayyum Oasis.⁹³ For the latter, it can be even more difficult, as there were multiple steps in textile production, carried out in different places and by different groups of people. For example, at both Timgad, in modern Algeria, and Pompeii in southern Italy, the presence of a large textile industry was determined based on evidence of dye workshops and fulleries.⁹⁴ However, both of these can represent terminal steps in the production process (as fulling can also feature repurposing, it can even be classed as secondary production),⁹⁵ and in both cases, little evidence of weaving has been found.⁹⁶ It is therefore difficult to know the true extent of the textile industry at either site, and if they did represent terminal steps, where primary production took place.

Due to the imprecise and accidental nature of both archaeological preservation and excavation, there will always be a degree of uncertainty in interpretations drawn from such evidence. Attempts to apply processes of mathematical quantification are seeking to standardise and account for such apparent deficiencies. In the past, this has relied heavily on various statistical models, such as regression analysis to establish correlation between datasets.⁹⁷ These studies have largely relied on documents for indices of economic

⁹³ Both sites are discussed in chapter six.

⁹⁴ Wilson 2001 for Timgad; Flohr 2011a; 2011b; 2013; 2016b for Pompeii. In the fulling process, finished textiles were worked to remove grease, and to soften and felt the fabric.

⁹⁵ When dyeing occurred depended on the fibre being used; wool was typically dyed before spinning while linen and cotton after. Shamir 2002, 25.

⁹⁶ Wilson 2001, 285; Flohr 2016b, 66.

⁹⁷ Bowman and Wilson 2009, 13 give the example of commodity prices and the distance from consumption centres. The principles of such statistical application are described in Hudson 2000; and as they are used in the study of the ancient economy in Bagnall 1992; Temin 2013a;

quantification such as prices and scale of production, although as Alan Bowman and Andrew Wilson have pointed out, the figures featured in these documents are often unreliable.⁹⁸ Instead, in their 2009 edited volume *Quantifying the Roman Economy, Methods and Problems*, methodologies for the quantification of archaeological artefacts were utilised.

Rather than determining which documents contain accurate information based on assumption, they proposed that artefact distribution could help towards understanding production and trade in terms of several inter-related processes, including production infrastructure, movement of goods, comparison between artefact types, and the constraints dictating how goods were moving; the papers in the volume theorised that by examining what types of artefacts were found at various types of settings, the context of the social and economic environment of the transportation and consumption of various goods could be illustrated.⁹⁹ This is the method in which cotton is examined in the following chapters, using documents as both written records but also as artefacts themselves. While it is impossible to reconstruct an entire material culture in absolute terms from recovered artefacts, comparisons of proportions amongst different types of textiles will be considered to determine the penetration of cotton into the agricultural and textile cultures of the sites in which it is found.¹⁰⁰ There is one caveat to this method, and that is the case of the archaeobotanical evidence. Because seeds, capsules,

2013b, esp. 12-16; 2016. In the field of maritime archaeology and shipwrecks regression analysis has been used to show commercial networks using shipwreck locations and artefact distributions, concluding that goods tended to travel within specific discrete regions of the Mediterranean rather than throughout its entirety. See Parker 2008; Harpster 2017.

⁹⁸ Bowman and Wilson 2009, 10. Bowman and Wilson also state that while these studies are often forthright in acknowledging that the models created using such documents are based on unverifiable assumptions, they continue to rely on them. Bowman and Wilson, 2009, 14.

⁹⁹ Bowman and Wilson 2009, 63-64. The importance of comparative analysis in determining both production and consumption is also highlighted, in the same volume, by Fulford 2009, 250-251 and Harris 2009, 262-263.

¹⁰⁰ This method is proposed as an alternative to attempts of modelling in absolute terms in Wilson 2009, 217. Proportional quantification has often been used in studies of ceramics (and was used extensively in Darley 2013, but to the author's knowledge, has not been widely used in synthetic textile studies. However, during the final preparations of this thesis, Bouchaud *et al.* 2018 was published which takes a broadly similar approach to the cotton finds of many of the same archaeological sites, but the approach to the texts is different, and the two works come to very different conclusions.

etc., unlike other types of artefacts, do not form an active part of material culture, in that they were either used to grow plants or discarded as a waste by-product in production, and the fact that they are generally only found if certain processes are being carried out in excavation, archaeobotanic finds are unlikely to be representative of the scale of agricultural activity occurring within a site. For that reason, this study accepts the common view that the presence of seeds indicates local cultivation, referenced above, without any further attempt to draw assumption of scale in the absence of other cotton evidence.

Horde and Purcell, Wickham

The usefulness of quantification relies on its ability to account for changes in different regions at different times.¹⁰¹ In their 2000 volume *The Corrupting Sea, A Study of Mediterranean History*, Peregrine Horde and Nicholas Purcell showed that the relationship between people and their environments along the Mediterranean coasts was dictated by micro-ecologies that shaped their movements and interactions along networks, and made ‘connectivity’ a theme of the study of the Mediterranean. Chris Wickham approached the region from the question of material exchange (focusing on ceramics) in *Framing the Early Middle Age, Europe and the Mediterranean, 400-800* (2005), concluding it was the bulk trade of agricultural items and mass produced common goods that drove economic systems. These studies have proven highly influential, paving the way for widespread consideration of climate and environment in the study of the Mediterranean, as well as reframing the understanding of geographic regions and the scale of interaction between them. By examining early cotton production and exchange networks, this thesis expands both the geographic and temporal bounds of these conclusions; first by looking at the inland regions of Africa and the Middle East, where there is early evidence of cotton cultivation, as ecological regions of connectivity rather than marginal landscapes on the edges of empire; and second by re-examining the spread

¹⁰¹ Bowman and Wilson, 2009, 47.

of the cotton in terms of processes, rather than viewing it as a consequence of long-distance trade.

It should be noted that while Horden has been sceptical of the same methodological application to desert regions (specifically the Sahara) that had been used in the Mediterranean, because of the lack of state control over the its territories and the lack of fixed routes,¹⁰² what has become clear throughout the progression of this study, which has largely focused on what would have been considered marginal areas to the imperial powers of the Mediterranean, is that such central power was unnecessary for the establishment and maintenance of connectivity. The exchange networks through which cotton was moving show that significant exchange was conducted through a series of overlapping regional systems engaged in a variety of interactions, making these structures economically and culturally more significant than the occasional long-distance trade of luxury goods.

Conclusion

As stated, there are two larger aims of this study, which, although generally focusing on two different aspects of the function of material culture within an economic study, are in fact interrelated. This study uses cotton to examine both the place of textiles in the economy and the development of communication networks in the peripheral regions of the Mediterranean world; this reveals not only the complexity of modes of production of textile goods, but also the previously misunderstood history of cotton diffusion throughout the first millennium and the importance of peripheral networks that functioned around what have been considered the economic centres of the ancient world. This study will reveal that cotton was transmitted along multiple networks in the first millennium, and that cotton originating in Africa was as important as Indian cotton, if not more so, to the diffusion of the commodity throughout the Mediterranean, the Middle East, and later into Europe.

¹⁰² Horden 2012, 29-31.

This in turns highlights the cultural importance of Africa and trade routes through the continent as well as with its neighbours, something which in the time period discussed has typically been overlooked or discussed in the context of service to Roman centres. In terms of the larger economic impact of textiles, this study will demonstrate that textile production involved large segments of the population, and that while much has been written of the luxury textile that defined the long-distance maritime textile networks, short- and medium-distance networks were also important—and often more important—to textile markets. The methodological aim of exploring these various threads is that this study will help to define the important place textiles held in the ancient economy, and how they can be used to better understand the economic interaction and development of the first millennium.

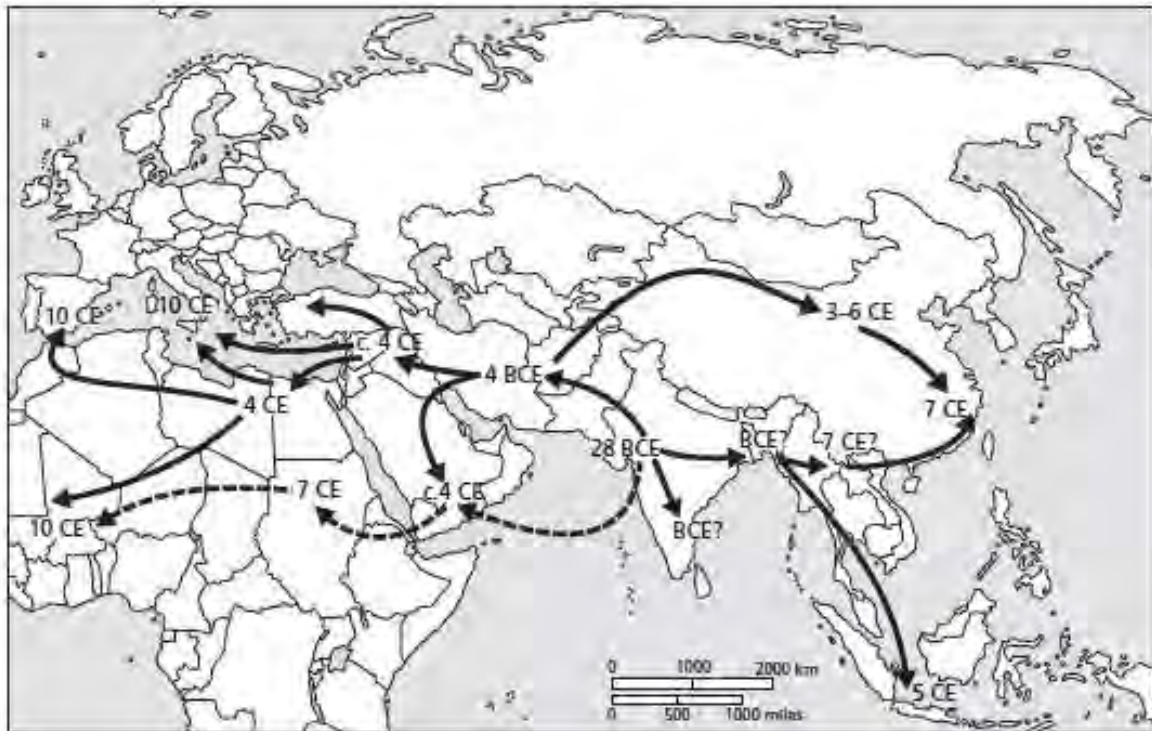


Figure.1.1 Proposed map of the spread of cotton. Reproduced from Riello, 2015: 40.



Figure 1.2 Map overview of areas discussed

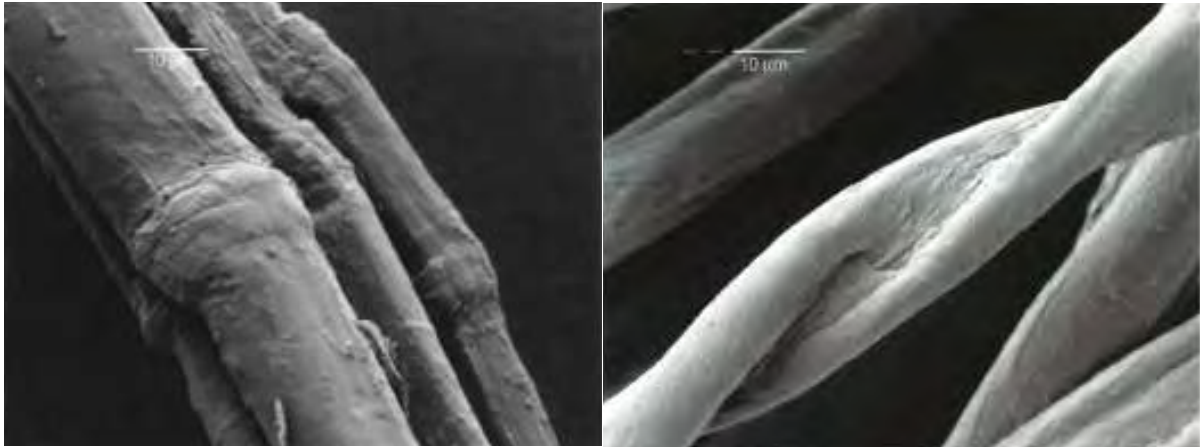


Figure 1.3 Linen fibre (left) compared to cotton fibre (right), displaying characteristic concave structure. Reproduced from Batcheller 2002, 138-139



Figure 1.4 Papyrus pattern cartoon for tapestry woven decoration, Egypt, fourth to sixth centuries, museum number T.15-1946. © Victorian and Albert Museum, London



Figure 1. 5 Woman spinning cotton in Sudan c. 1921. Raw cotton is held in the left hand while the spindle is held in the right. Reproduced from Crowfoot 1921, 83.

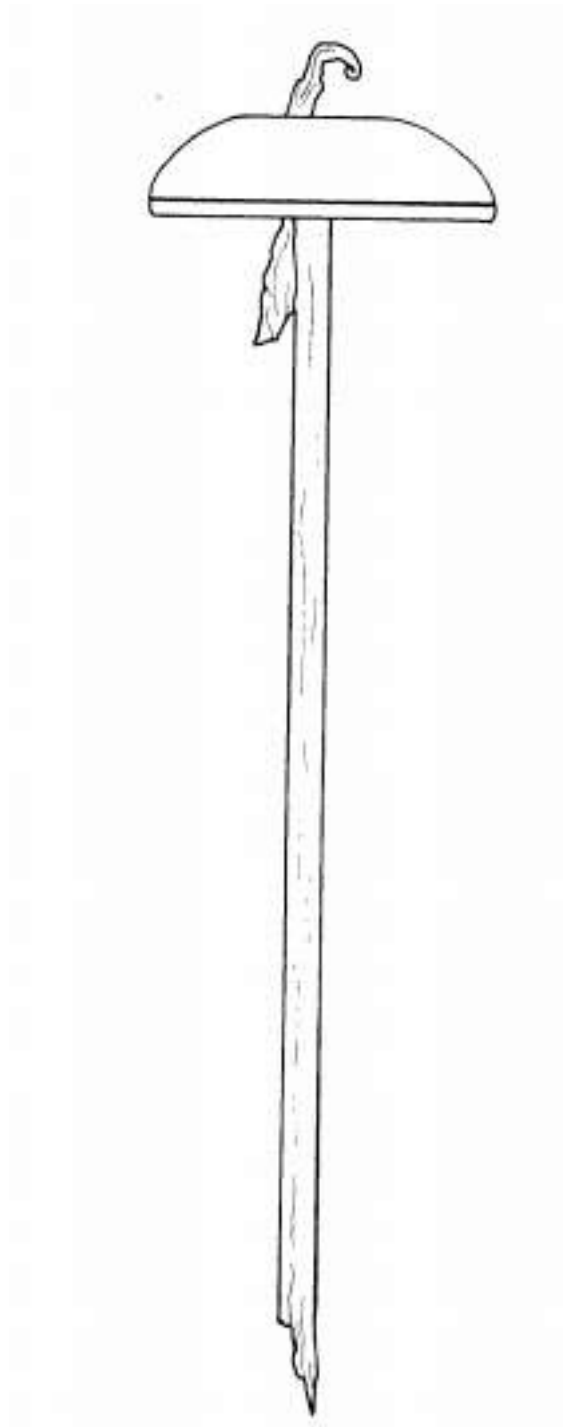


Figure 1.6 Meroitic spindle with the spindle whorl and iron hook still attached, from Grave B58 at Ballana. Reproduced from Williams 1991, 247.

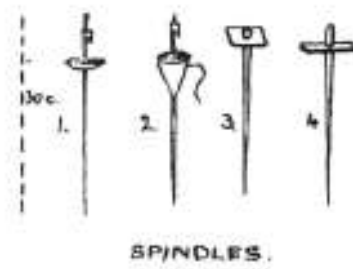


Figure 1.7 Examples of spindles used in Sudan in the 1920s. Reproduced from Crowfoot and Crowfoot 1924, 39.



Figure 1.8 Facsimile of scene from the Tomb of Khnumhotep, Beni Hasan, Egypt, from the Middle Kingdom, tempera on paper, by Norman de Garis Davies (1865-1941). The spinner on the right uses a spindle with the whorl attached at the top. Reproduced from the Metropolitan Museum of Art, New York (creative common license).

Chapter Two: The Historical Context, Textile Studies and Interdisciplinary Approaches

Introduction: What do we have and how do we use it?

Historically, scholarship of textiles has placed more emphasis on their decorative programmes as modes of expression rather than the functional utility of textiles as objects of everyday use. As a result, textiles have largely been the purview of art historians. This is not such a different situation from other artefacts, but whereas objects in other materials, such as ceramics, have readily made the jump from pure art historical studies to wider economic and social histories, there are particular qualities of textiles that have hindered their ability to make a similar transition. Therefore, current narratives of textile production and consumption are incomplete, and this bias in the information begins with the types of textiles that have received the most attention. Because art historians were interested in iconography and motifs of textiles, they tended to focus their attentions on the most highly decorated examples: silks (largely preserved in church treasuries across Europe) and the tapestry woven ‘Coptic’ textiles from Egypt. The preference for richly decorated textiles in luxury materials is not only found in academic studies, and such textiles have also featured heavily in museum exhibitions of many of the cultures of the Mediterranean region, influencing public perceptions of ancient textile cultures.¹ But the focus on these luxury examples, both in academic and public discourse, has

¹ Recent museum exhibitions of exclusively late antique textiles include *Late Antique Textiles and Modern Design*, The Metropolitan Museum of Art (New York), 11 November, 2016- 1 October, 2017 *Designing Identity, the Power of Textiles in Late Antiquity*, Institute for the Study of the Ancient World (New York), 25 February- 22 May, 2016; *Coptic Textiles from Egypt*, The National Maritime Museum (Haifa), 25 December, 2010- 15 May, 2011; and *Late Antique Textiles from Egypt*, Museum of Applied Art (Vienna) and the Whitworth Art Gallery

skewed how textiles are discussed in other areas of ancient life. In many economic studies where textiles are discussed, the silk industry, and ‘Coptic’ textiles in Egypt, are used as stand ins for textiles in general.² This has largely been because of perceived problems with textiles as evidence, and what was thought could be done with them. Silk is addressed further in chapter three, but because of its ubiquity as a term in textile studies, ‘Coptic’ textiles should also be explored.

‘Coptic’ textiles

In the early Christian period, the basic garment for both sexes was a long loose tunic (similar to that used in Roman times) woven to shape on the loom and referred to as a *chiton* or *tunica*, often with two coloured bands called *clavi* running the full length and over this was a rectangular cloth called a *himation* or *pallium* [fig. 2.1].³ In late antique Egypt these tunics could be made from either linen or wool, but they often included tapestry woven dyed wool decorations of varying quality.⁴ The term ‘Coptic’ is still used to describe these textiles from roughly the third to eighth centuries AD, though in recognition of its limitations and implied cultural significance, its use is increasingly falling out of use in current scholarship.⁵ This is partly due to the difficulties in creating a classification system due to the collection issues outlined below, and partly because the term ‘Coptic’ has strict cultural associations related to a certain segment of the Egyptian population in the first millennium AD.

(Manchester), 7 December, 2005- 5 May, 2006 and 20 May- 10 September, 2006. Textiles have also featured prominently in general exhibitions of late antiquity and the Byzantine world, such as *Egypt, Faith after the Pharaohs*, British Museum (London), 29 October, 2015- 7 February, 2016; *Byzantium and Islam, Age of Transition*, The Metropolitan Museum of Art (New York), 14 March- 8 July, 2012; and *Byzantium 330-1453*, Royal Academy of Arts (London), 25 October, 2008- 22 March, 2009.

² For example, in Laiou (ed.) 2002, there are chapters devoted to numerous industries in the Byzantine world such as mining (Matschke 2002), stone-working (Sodini 2002), and ceramics and glass (François and Spieser 2002), the only contribution on textiles looks at the silk industry (Muthesius 2002). This pattern can also be found in the collected studies in Jacoby 1997; McCormick 2001, 719-729;

³ This garment would be shorter for men and longer for women. King 1996, 1.

⁴ Wool is more receptive to dye than linen. Kirstein 1999, 14.

⁵ Persson 2012, 3.

The word ‘Copt’ comes from the Arabic *Qibt* (قبط) meaning Egyptian, and the term was originally used exclusively for native Egyptians.⁶ The Coptic Church was said to have been founded by Saint Mark in AD 42, and currently forms the largest Christian denomination in Egypt. The Copts of Egypt were ethnically Egyptian, often spoke Coptic rather than Greek,⁷ and until the Council of Chalcedon (AD 451) were considered part of mainstream Christendom; thereafter disagreement regarding the nature of God between the pro-Chalcedonian Melkites and the Miaphysite Coptic bishops led to a schism and the parallel development of two churches in Egypt.⁸ The Copts were subsequently condemned as heretical, although several attempts were made by the Byzantine emperors to unify the churches.⁹ Such reconciliation never occurred and the Copts remained a marginal cultural force within the empire, but textiles ascribed to them have been used as models for all of late antiquity, although it is clear that not all tapestry-decorated textiles were being created by the Coptic community. It is likely that some of the decorated textiles referred to as ‘Coptic’ were indeed made within this community, many would not have been. Yet, the term persists and has become the basis for establishing a chronology of textile progression in Egypt based on style.¹⁰ And while it has often been acknowledged that a stylistic chronology for these textiles is too simplistic and often contradicts evidence from scientific dating methods (discussed further later in this chapter), a more comprehensive methodology for classification has yet to be devised and widely accepted.¹¹

⁶ The Arabic itself was from the Greek word *Aigyp̄tos* (Αἰγύπτιος). Van Strydonck et al. 2004, 231.

⁷ Coptic is a late form of Egyptian adapted to the Greek alphabet, but with the inclusion of several signs from Demotic Egyptian, which also includes many Greek loan words.

⁸ Wipszycka 2007, 343-4; Meinardus 2015, 52-54.

⁹ King 1996, 5. The emperor Zeno (r. 474-475, 476-491) issued his theological treatise, the *Henotikon* (ἐνωτικόν), addressed to the Miaphysite clergy and laity of Egypt, Libya and Pentapolis, to mediate the split caused by the Chalcedonian Creed, but Pope Felix III (r. 483-492) refused to support the document. During the reign of Justinian (r. 527-565), several attempts were made to impose the Chalcedonian Creed on the Copts, but they ultimately failed. Meinardus 2015, 54.

¹⁰ Stauffer 1995, 5.

¹¹ Thomas 2007, 142; Persson 2012, 3.

Problems with textile evidence

The first step to creating a methodology for integrating textiles into social and economic history is to acknowledge the ‘problems’ with textile evidence that have plagued scholars in the past and meant that textiles remained within the domain of art historians, even as those scholars sought to exploit more interdisciplinary methodologies. One such issue is how textile collections in institutions (museums and universities), which are often treated as a separate corpus to textiles found in modern archaeological excavations, were acquired; this corpus primarily originated in Egypt. In 1983, all exports of antiquities from Egypt, already heavily restricted, were prohibited and no new textiles have legally made their way into institutions or private collections.¹² Other countries that had not yet established such policies quickly followed. The result has been that the majority of late antique to early medieval textiles held in collections outside the countries in which they were found were excavated in the late nineteenth and early twentieth centuries, a fact that has had lasting implications for both the study and the public perception of textiles; because of the archaeological practices of the time, these collections are built largely on fragments that have neither an established date nor a provenance with which to situate them in current scholarship.

From the start of these excavations, a series of highly publicised projects heightened the public’s fascination with ancient Egypt, resulting in expeditions being sent from all over the world to collect artefacts.¹³ In addition to some genuine scholars, these expeditions were

¹² Egypt’s first law aimed at protecting antiquities was a decree under Mehmed Ali in 1835 that prohibited the unauthorised removal of artefacts from the country, and in 1874 a law was passed stating that all undiscovered antiquities were the property of the Egyptian government regardless of the status of the excavator. However, antiquities continued to flow out of the country, particularly after the start of British occupation in 1882. Gange 2015, 80-83. Law no. 14 of 1912 further restricted export by stating that an export license for antiquities could only be obtained from the Department of Antiquities. Law no. 215 of 1951 completely banned the export of antiquities unless there were several similar items in Egyptian collections and the Department of Antiquities had provided specific written permission.

¹³ This included the discovery of new tombs in the Valley of the Kings, and excavations at Thebes, Saqqara and Amarna. The 1880s and 1890s represented particularly intense phases of exploration in Egypt (Persson 2012, 5), driven in part by the foundation of the Egypt Exploration Fund (now the Egypt Exploration Society) by the novelist Amelia Edwards (1831-

often led by treasure hunters and amateur archaeologists, many of whom nevertheless became famous names. Consequently, most early excavations were conducted without the stringent protocols and standards required in modern archaeological practice.¹⁴ This has had a profound effect on the field of textile studies. As popular interest in the cultures of ancient Egypt grew, so too did the demand for the elaborately decorated textiles that began to be uncovered from late Roman and early Christian cemeteries. Collectors put value on bright colours, figures and intricate composition rather than an understanding of function and utility of the textiles in ancient life, so decorative elements tended to be removed from the basic weaves of fabrics, which were then ultimately discarded.¹⁵ Two of the best known, and heavily exploited, sites for the acquisition of textiles at the time, Antinoöpolis (Antinoé) and Krokodilopolis (Arsinoë), provide good case studies for understanding the different treatment such sites received.

Antinoöpolis, situated on the eastern bank of the Nile approximately half-way between modern Cairo and Luxor [fig. 2.2], was founded by the Emperor Hadrian (r. AD 117-138) and was at its zenith between the fourth and sixth centuries AD, before eventually being abandoned in the tenth century. In 1896, the French archaeologist Albert Gayet began work at the site, devoting his first season to the various temple structures.¹⁶ The second and third seasons were devoted to four of the city's cemeteries, in which Gayet uncovered thousands of textiles, as well as many other artefacts later exported to museums for display.¹⁷ In his first publication of

1892) and the archaeologist Reginald Stuart Poole (1832-1895). The Fund was able to finance expeditions led by many who would become leading archaeologists of the time, including Édouard Naville (1844-1926), Flinders Petrie (1853-1942), and Francis Llewellyn Griffith (1862-1934). Edwards' *A Thousand Miles up the Nile* (London, 1877) has been credited with instigating the movement for the preservation of monuments in Egypt. Gange 2015, 78.

¹⁴ Thomas 2007, 141.

¹⁵ Thomas 2007, 141.

¹⁶ Gayet ultimately conducted field seasons at Antinoöpolis from 1896 through 1905, gaining the epithet 'the archaeologist of Antinoé'. There is some question regarding his claims to have continued travelling to Egypt and excavating after this point, and it is possible that some of the textiles added to French collection in the early 1900s and 1910s by Gayet may have actually been purchased in the Cairo *souks*. Hoskins 2004, 5-15.

¹⁷ The four cemeteries were categorised chronologically, cemetery A (*Nécropole égyptienne*) contained small mud-brick chambers with unadorned wooden sarcophagi and the bodies

the textile finds, Gayet did not provide measurements, sketches, photos, precise descriptions of designs and motifs, information on the materials or structures, precise find-spots, or identification numbers for the individual finds;¹⁸ this became a trend of his excavations that continued in subsequent reports.¹⁹ In his publication of finds from the third campaign, Gayet claimed that in the two months he excavated, he opened approximately two thousand graves, ‘fifty from the pharaonic necropolis, three hundred from the Greco-Roman, five hundred from the Byzantine, and over a thousand from the Coptic’ which uncovered items he claimed were ‘...of inestimable value for the history of art.’²⁰ However, he failed to keep any documentation of the material, limiting the academic value of his finds, and illustrations of the aftermath of his digs show the damage of his collection practices [figs. 2.3 and 2.4]. The textile fragments were ultimately treated as decorative art pieces by Gayet, despite his exultations of their value; in the succeeding years, Gayet had an auction of his personal textile collection,²¹ held exhibitions of the textiles along with public lectures and ‘fashion shows’ of models wearing replica robes [fig. 2.5], and published cursory accounts of his findings with entreaties for further funding.²² Even in this period, Gayet’s methodology was questioned and criticised by other Egyptologists; when the British papyrologist J. de M. Johnson and his team arrived in Antinoöpolis in 1913 in search of papyri fragments, he criticised Gayet’s ‘attack on the

wrapped in mummy bandages with amulets; cemetery B (*Nécropole romaine*) consisted of masonry tombs with the un-mummified bodies wrapped in bandages and with portraits painted on shrouds or encaustic on wood covering the faces (similar to those found in the Fayyum); cemetery C (*Nécropole byzantine*) had burials similar to those found in cemetery B but the bodies were clothed in elaborate costumes (the Persian style *Antinoé riding coats* were found in these graves); and cemetery D (*Sépultres coptes*) which consisted of bodies buried in the sand with either of shroud or in clothing. Hoskins 2004, 7-8; Gayet 1898.

¹⁸ Gayet 1897a; 1897b; Hoskins, 2004, 7.

¹⁹ Gayet published the results of his campaigns in a series of articles. See Gayet 1897a; 1897b; 1899; 1902; 1903a; 1903b; 1904; 1906; 1908; 1910; 1911; 1912a; 1912b.

²⁰ Gayet 1898, trans. Hoskins 2004, 7-8.

²¹ Rutschowskaya 1990, 150.

²² Hoskins 2004, 11-16.

cemeteries and temples of the city’ and noted that ‘the site suffered severely.’²³ Yet when sites were excavated with scientific aims in this time period, the consequences of earlier excavations and inconsistent application of methodology had a similar impact on the artefacts collected as Gayet’s chaotic collection practices had.

Krokodilopolis also underwent successive years of haphazard excavation and plundering. Located in the Fayyum Oasis [fig. 2.2], it was first excavated in the later seventeenth century by the German theologian and linguist Father Johann M. Vansleb (1635-1679), but it was not until 1886 that the first serious scientific expedition was carried out by the archaeologist Georg Schweinfurth (1836-1925), who also mapped the topography of the site. Schweinfurth was inspired to explore the site by the art dealer Theodor Graf (1840-1903) who had claimed to have found a high volume of textiles there in 1882; however, Graf himself never published his finds, and as a result the information regarding the Graf textiles remains ambiguous.²⁴ Unlike Gayet, who was interested only in collecting decorated fragments, Schweinfurth sought to reconstruct the costumes of antiquity, keeping garments whole rather than separating and preserving only the decorative elements.²⁵ He also kept detailed records, compared to other excavators of the time, attaching pre-printed labels stating the name of the finder, the year and the provenance, with find numbers added later and occasionally exact find spots and comments [fig. 2.8].²⁶ However, this treatment was inconsistent, and many fragments

²³ Johnson 1914, 169; Ironically, included in Johnson’s article was a photograph of Johnson’s team of diggers below a cloud of dust hacking away at the site with pick axes [figs. 2.6 and 2.7]. Johnson 1914, pl. XXVI, 174.

²⁴ Textiles attributed to Graf are known in collections, but their origins remain a mystery. Josef von Karabacek, an Austrian orientalist, wrote that the Graf excavations took place at night at an unnamed site that could not be revealed because the locals feared the repercussions of their unauthorised excavations from the antiquities service of Egypt. Von Karabacek 1883a, 4; Von Karabacek 1883b, 24-25. Franz Bock stated the Graf textiles were from Arsinoë. Bock 1887, 2. Alois Riegl compiled a catalogue of the Graf textiles and attributed them to a site near Saqqara, though it is not known where he got this information. Riegl 1889. For further detail on the history of these excavations, see Fluck 2006, 20-22.

²⁵ Fluck 2006, 20.

²⁶ Fluck 2006, 21-22. The site was further destroyed in 1886 when it was plundered and demolished by a group of *sebakhin*, people who dug at ancient sites for fertiliser, and by the

were collected without comment. As at other sites throughout Egypt, these textiles were sent to institutions in continental Europe, mainly for display; without any information on their date or provenance, sometimes without any indication of even what site, these textiles had been given limited further consideration.

The allure of the ancient textile fragments gradually began to wane at the turn of the century, as Gayet found when he was unable to find a financial backer for further excavations, and expeditions were no longer being sent out expressly to locate graves so they could be stripped of their textile finds. As modern archaeological practice became more widespread, concerned with preserving and documenting all finds, interest in textiles has begun to grow again. But the issue of the textiles excavated in the late nineteenth and early twentieth centuries has remained. Since then sites have been excavated with increased systematic protocol and documentation, which has resulted in differing treatment in the literature between textiles from earlier and more recent excavations, and differing perceived ‘usefulness’, compared to earlier finds.²⁷ The situation of earlier finds is particularly difficult when discussing cotton, as even approximate dating and provenance of finds is necessary to understand the process of fibre diffusion. However, new applications of chemical analysis are increasingly allowing for previously disregarded textiles to be brought back into the fold of scientific study. The initial focus was on dating, as dating methodologies are more straight forward, and having a date range at least begins to allow for the creation of a comparative framework. However, advances in isotope analysis and DNA sequencing are also showing promising initial results in both dating and determining origin.

Dating archaeological textiles

Before the adoption of chemical based dating methods, there were two commonly used techniques for determining the dates of artefacts, archaeological (only applicable for textiles

end of the nineteenth century the site had been used as a source of stones for the nearby village and partially cultivated. Fluck 2006, 18.

²⁷ Thomas 2007, 142.

uncovered in excavations in contexts that could be associated with other dateable objects or strata) and art historical.²⁸ In archaeological dating, the final object within a layer when sealed provides the *terminus post quem* date; much of the content of the layer could be older, but for most objects there is no archaeological way of establishing how much older.²⁹ There have also been cases when stratigraphic layers may not be deposited chronologically, such as has been found in Karanis.³⁰ Additionally, this means of dating does not take the life cycle of a textile into account. Textiles could be used for decades after they were they were produced, then repaired or recycled, and if expensive, passed down within families,³¹ making their date of deposition significantly later than the date of their production.

Art historical dating has often been used for textiles that lacked archaeological context, and dates the opposite end of a textile's life cycle, the date of production. This method relies on chronologies established by comparison of textile decoration with the styles and motifs of pieces in other media, such as paintings, sculptures and mosaics.³² Such comparisons have formed the basis for the majority of textile studies. Patterns and motifs were categorised and separated chronologically based on similarities to materials in other materials,³³ after the analysis of iconography, secondary analysis of techniques and materials attempted to narrow the date range.³⁴ This included spinning and weaving techniques, though certain technologies are known to have been in use for long periods of time,³⁵ and as will be discussed in chapter

²⁸ These methods are often referred to as 'conventional' dating.

²⁹ Wild 2007, 22.

³⁰ At Karanis it has been suggested that people would throw their rubbish through the open windows of abandoned buildings, so that when the upper floor layers finally collapsed, they deposited earlier objects on top of later ones, resulting in a confused chronology. Wild 2007, 22.

³¹ Bagnall 1993, 33; Poblome 2004, 492.

³² van der Plicht and Bruins 2001: 1155; Bruins and van der Plicht 2001, 1321; Van Strydonck *et al.* 2004, 231.

³³ Schluck 2007, 191. Occasionally textiles will have the year of their manufacture inscribed on them, but these tend to be silk textiles (occasionally fine linen) and are not found before the early Islamic period. Van Strydonck *et al.* 2004, 231

³⁴ Schluck 2007, 191.

³⁵ Van Strydonck *et al.* 2004, 231. As a result, art historians tend to date textiles to only within a range of one to two centuries, sometimes even longer.

four, these were slow to change and uneven across geographic regions. As will be seen, this means of dating has often been shown to often be inaccurate.

Other attempts at dating have focused less on the textiles themselves than on evidence provided by terminology in the written record.³⁶ Endeavours to identify garments in the archaeological record by their names in documents found that (in most cases) it was impossible to move past initial speculation, though there were a few notable exceptions.³⁷ And while chronological distribution charts of terms and descriptors indicate variable concentrations of use, as seen in the distribution of cotton terms in the first chapter, there are two major problems with this approach; first, the papyri show that textile words were in use for long periods of time,³⁸ and second, many words were used to refer to the same kind of textile and vice versa. It is therefore not possible to use descriptions and terms in the documents as a means of precise dating. Chemical based means of dating, on the other hand, are increasingly popular as the more accurate alternative to archaeological or art historical dating, though some means of testing are more useful than others.

Chemical identification of the pigments used in archaeological textiles has also been used as a method of dating; this is seen as less subjective than stylistic comparison, and the testing is far cheaper than radiocarbon dating.³⁹ However, it is also less accurate and only

³⁶ Harald Froschauer attempted to see if terms found in documents could be compared to the extent textile record to find parallels that could be used to secure a date range. The study involved collecting textile and textile related terms from Greek documentary papyri and Coptic references to garments in the Coptic documentary texts which included many Greek and Arabic loan words. Preliminary work on the Greek documentary papyri was done by Harrauer and Horak, unpublished, but analysis of Coptic documentary papyri used were published by Hasitzka 1998; 2003. Froschauer, 2007, 231.

³⁷ Two green riding coats have been preserved in Berlin at the Skulpturensammlung und Museum für Byzantinische Kunst (inv. nos. 9695 and 9923) as well as a fragment of one at the Henry Art Gallery in Seattle (inv. no. 83.7-5) seem to be similar to items recorded in a Greek list of garments dating to the fifth to sixth century (P.Mich.14.684) which mentioned a ἄρμαπαύσιν πράσινον which could be translated as a 'green military coat'. The editor of the text assumed ἄρμαπαύσιν was derived from ἄρμελαύσιον from the Latin *armilausea* or *armiclausa* meaning military cloak. Froschauer 2007, 231.

³⁸ Froschauer 2007, 232.

³⁹ Investigation of the dyes used in decorated Egyptian textiles based on chemical reactions was first conducted by Rodolphe Pfister in the 1930s, but today chemical dye analysis is most

applicable for dyes that were limited by geography and time period.⁴⁰ Because dye analysis is only able to identify what dyestuff was used, it is only possible to date a textile to the period after use of a dyestuff first appears in a geographic area.⁴¹ However, not every dyestuff is suitable for dating analysis. Certain sources of dyes and pigments were so ubiquitous there are no meaningful dates regarding their use; others occur so infrequently in a given region, it is probable that the textiles that used them were actually imported, rather than produced locally.⁴² Finally, the results obtained from dye analysis might not actually represent a random sampling, as there is a tendency to test textiles with several different dyes or decorative elements, and therefore the results are not representative of the larger textile corpus.⁴³ Such uncertainty suggests the applicability of dye analysis for relative dating purposes rather than absolute dating.⁴⁴ By comparison, radiocarbon dating has proven to be far more useful, and should become the standard dating method.

commonly conducted using high performance liquid chromatography (HPLC) and the basic protocol set forth by Jan Wouters and Noemi Rosario-Chirinos, who first used HPLC on four decorated fragments from the third to eighth centuries in 1992. For detailed description of the protocol and its applications, see, Wouters and Rosario-Chirinos 1992; Orska-Gawrys *et al.* 2003, 240; Hofmann-de Keijzer *et al.* 2007, 214.

⁴⁰ For example, the results of such analysis has shown that there were ten dyes and pigments that were frequently used in textiles from Egypt, with seven that were rarer, and one type of yellow that remains unidentified. Hofmann-de Keijzer *et al.* 2007, 214. For an overview of dyes, see appendix 4.

⁴¹ The plant and animal species used as dyestuffs often flourished only under certain climatic conditions and were therefore geographically limited before they began to be traded over long distances. Verheeken 2007, 206. New trade routes, trade relationships and political alliances opened new routes for dyestuffs to reach the regions of the Roman whorls, and can therefore be of use in looking at communication networks, but this is outside the scope of this study.

⁴² Verheeken 2007, 207, discussing use of dye in Egypt. While this is not useful for dating, it is for the larger question of textile mobility along networks.

⁴³ Verheeken 2007, 207.

⁴⁴ This has not kept some from trying to utilise dye analysis for absolute dating. Dye analysis was conducted on a tunic from the Coptic Museum in Cairo that had been stylistically dated to the sixth or seventh century. The dyes identified as being used in the textile were madder with an iron mordant to produce brown, madder with a source of indigotin to create purple and dark blue and green threads were made again using a mixture of indigotin and a yellow, most likely weld. That authors suggest that these mixtures proved that the textile dated from the sixth to seventh century because such combinations were common in those centuries, as is known from documentary evidence. Abdel-Kareem *et al.* 2010; 2011. However, there is no evidence that these combinations are specific to these time periods, and analysis of larger sample size of textiles which have been both conventionally and radiocarbon dating has shown that these dyes

Although radiocarbon dating has increasingly become recognized as the best method for precise dating of archaeological textiles from unknown contexts, this has not always been the case. Radiocarbon dating was first formulated in the 1940s by the American physical chemist Willard Libby (1908-1980),⁴⁵ based on the principle that radiocarbon (^{14}C), a radioactive isotope of carbon, is constantly being created in the atmosphere and combining with oxygen to form radioactive carbon dioxide. This then enters all living matter, into plants through photosynthesis and then up the food chain. When an organism dies, the radiocarbon begins to undergo the process of radioactive decay and the amount present in an organism decreases at a predictable rate.⁴⁶ Therefore, the basic rule for radiocarbon dating is simple: the older an object is, the less radiocarbon it will contain. In particular, it has been seen as an ideal method for dating textiles because the amount of time between the harvest of the raw material and manufacture of the textile is thought to have been minimal.⁴⁷ While this is fundamentally an oversimplification of the process of radiocarbon dating, it demonstrates the importance of the development of a means of objective and widely applicable dating.

Textile scholars were historically slow to adopt radiocarbon dating, or prevented from using it altogether, for a variety of reasons. First, although refinement of the process has resulted in the ability to use smaller samples in the process of testing, it ultimately remains destructive. It is also not wholly accurate,⁴⁸ as radiocarbon levels in the atmosphere have not been consistent throughout history, with fluctuations occurring as a result of celestial

were actually being used in various combinations for centuries. For example, see Kirstein 1999, 15; Coombs *et al.* 2002, 116; Kajitani 2006, 102. It seems that the authors were actually misapplying the concept behind dating through dye analysis to confirm earlier results of another dating method, neither of which can be used for absolute dating purposes. It also demonstrates the problems inherent in attempting to draw conclusions from small sample sizes when attempting to discuss dating and dating methods of archaeological textiles.

⁴⁵ Libby was awarded the Nobel Prize in Chemistry in 1960 for his contribution.

⁴⁶ The half-life of ^{14}C is 5,730 years which means the concentration of ^{14}C will decrease by approximately one per cent every eighty-three years. De Moor 2007, 99.

⁴⁷ Van Strydonck *et al.* 2004, 232.

⁴⁸ While the process gives the most accurate results for objects that are between 2,000 and 20,000 years old, it cannot produce reliable results for materials that are less than 350 years old, potentially confusing results from textiles found in mixed contexts. De Moor 2007, 99.

phenomena and more recently, the detonation of nuclear bombs.⁴⁹ Therefore all dating results need to be calibrated against a curve created by the accurate measurements of dendrochronology, though even after this calibration, dates are reported with an uncertainty of about a century (although this varies by sample). Finally, the process itself remains expensive, sometimes prohibitively so, and is highly sensitive to external contamination that might occur during handling, archiving, conservation, transport, or storage of textile samples.⁵⁰

Early applications of radiocarbon dating initially contributed to the perception of a lack of precision and resulted in scepticism regarding its efficacy as a dating method; the resulting late adoption of radiocarbon dating has played a role in the lack of integration of textile evidence into historical discussions. After the method was developed, the French archaeologist and collector Pierre du Bourguet (1910-1988) analysed two fragments from his own collection to test it on textiles, one which he had stylistically dated to the fifth to seventh centuries (No. 21 in his own catalogue) and one to the twelfth or thirteenth century (No. 23). He published the results in 1957,⁵¹ and had two more fragments tested the following year, previously dated to after the eleventh century (Nos. 36 and 45) [figs. 2.9 and 2.10]. The results showed that, with the exception of No. 21, all of the fragments were significantly earlier than du Bourguet thought;⁵² his resulting 1958 report criticised the radiocarbon dating method as highly inaccurate.⁵³ As art historians gave more credence to the well-respected du Bourguet than the reports of the lab (if they had even seen them), there was a widespread acceptance that radiocarbon dating was unsuitable for textiles.⁵⁴ The use of radiocarbon testing in the 1990s to

⁴⁹ De Moor 2007, 100.

⁵⁰ Van Strydonck *et al.* 2004, 232. The presence of fungi and sewing threads from repairs and later reuse of textiles can also skew the results. De Moor 2007, 99.

⁵¹ du Bourguet 1957.

⁵² Further testing done by Van Strydonck and Bénazeth established calibrated ages between the sixth and ninth centuries. Van Strydonck and Bénazeth 2014, 3.

⁵³ du Bourguet 1958; Van Strydonck and Bénazeth 2014, 1.

⁵⁴ The fragments in question have been retested by contemporary scholars to confirm the earlier dates. Van Strydonck and Bénazeth 2014, 2-4.

date the Shroud of Turin, in which three labs reported the same dates,⁵⁵ represented something of a breakthrough, and the 1990s saw the first comprehensive study of the radiocarbon dates of several visually related late antique textiles undertaken.⁵⁶

After a series of studies using radiocarbon dating in the early 2000s began to return dates that were significantly earlier than the dates attributed to textiles based on stylistic comparison, the method began to gain more widespread acceptance and more institutions sought to have their collections analysed, sometimes with surprising results necessitating reconsiderations of conventional dating methods.⁵⁷ However, revising conventional dates based on a few radiocarbon dated examples should be done with caution. In 2000, a group of twelve stylistically related wool textiles that had been conventionally dated to the eleventh and twelfth centuries were tested and the results showed that not only were they from a much earlier period, there was also a wider spread in the probable ages, from the fourth to eighth centuries [fig. 2.11].⁵⁸ The spread of dates suggest that unlike some other art forms, the decorative styles

⁵⁵ Damon *et al.* 1989.

⁵⁶ In 1993, Antoine De Moor's catalogue of Flemish private collections included the results of extensive radiocarbon dating, and showed dates ranging from the fifth to the twelfth centuries, greatly extending the chronology du Bourguet had proposed and illustrating the problem of using stylistic elements alone to determine date. De Moor 1993. For current ¹⁴C dating protocols for textiles, see Hajdas *et al.* 2014.

⁵⁷ For example, a child's knitted sock from Egypt currently in the Katoen Natie collection had been art historically dated to the fourth to sixth century, but was ¹⁴C dated to cal. AD 70-340 (1830 ± 50 BP), giving it a higher degree of probability that the sock actually dates to the second to third century. The Royal Ontario Museum in Toronto has eleven Egyptian knitted socks that had been stylistically dated to the fourth to fifth century (Burnham 1972); the Victoria & Albert has four socks dated to the fourth to fifth century based on archaeological excavation (Kendrick 1921); the Museo Egizio in Turin has one child's sock and a pair of adult socks stylistically dated to the fourth to sixth centuries (Del Francia Barocas 1998); the Städtischen Museum in Braunschweig has one sock which they generally dated to the Byzantine period (Nauerth 1989); the Royal Museum of Art and History in Brussels has one similar sock dated to the fourth to fifth century (Bruwier 1997; Lafontaine-Dosogne 1988; Rassart-Debergh 1988); and finally the Musée des Tissus de Lyon has one sock dated to either the Roman or Byzantine period; all of these dates ranges should now consider the earlier period as well. Van Strydonck *et al.* 2004, 233.

⁵⁸ De Moor 2007, 100; Van Strydonck *et al.* 2004, 240. The earliest results were cal. AD 250-570 (1630 ± 60 BP, sample DM113D) and the latest were cal. AD 540-870 (1350 ± 70 BP, sample DM 85). All results are reproduced in fig. 2.8.

associated with textiles were slow to change,⁵⁹ and do not necessarily correlate to the chronologies of motifs found on other objects. Such findings are increasingly highlighting the fact that textile chronologies based on iconography are insufficient, and that discussions of textiles need to move beyond the methodologies of art history.

Because textiles are currently being radiocarbon dated independently rather than as part of a wider dating effort, information regarding testing results is highly dispersed and sporadic. In an effort to make the dates from these efforts more widely available, allowing for more effective synthesis, the Universität Bonn, in collaboration with the Katoen Natie collection in Antwerp and the Institut Royal du Patrimoine Artistique in Brussels, have created an online database for reporting the results of radiocarbon dating. By making the corpus of radiocarbon dated textiles available in one place, the creators have expressed the expectation that it will enable scholars to ‘apply’ these dates to other textiles that are considered related, whether through iconography or production.⁶⁰ While this project represents an important step towards increased collaboration within the field, it also highlights several areas where current methodologies have not been reconciled with means of analysis. First, as the database is self-reported, there are inevitably gaps in the information provided.⁶¹ Second, as has been demonstrated, stylistic similarities do not necessarily indicate similarities in date. Finally, the majority of the textiles reported are listed with an unknown provenance. For example, of the thirteen samples of reported cotton in the database, only one has an associated find spot [fig. 2.12], and this entry is actually incorrect; the felt hat, inv.no.2003.2101.4, from Domitianè

⁵⁹ This pattern has also been noted in Byzantine metalwork. Leslie Brubaker, personal communication.

⁶⁰ This in itself requires an adequate sample size of ‘like’ textiles to make sure that the results show an average distribution, and are not just outliers. In this case, the creators of the database have designated a required sample size of ten in order to produce a statistically viable result. Schrenk 2009, http://www.textile-dates.uni-bonn.de/the_project_start.php. Last accessed 28 January 2019.

⁶¹ At the time of writing, for example, institutions in North America, many of which have very large collections of textiles from the late antique through early Islamic periods, are under-represented.

(Kainè Latomia) in Egypt's Eastern Desert is wool, not cotton.⁶² Regardless, the lack of provenance complicates the value of the information provided in the database as it is fundamental to understanding the production, distribution, and consumption of the material. Therefore, new methods of comparison must be devised for dealing with such objects.

Provenance and origin

As the issue of textile dating became somewhat resolved, focus shifted to a means of determining provenance and/or origin. This has involved a spectrum of methods from archive hunting to elemental analysis. Unfortunately, because of the standards of documentation when the majority of these textiles were collected, it is the exception rather than the rule that close examination of archives can shed much light on the find spots of specific textiles. One example of such an attempt was recently carried out by the Victoria and Albert Museum (V&A) in London on textiles attributed to the British Egyptologist Flinders Petrie (1853-1942). Petrie first visited Egypt in 1880 and spent the next fifty years excavating there.⁶³ His excavations are now considered advanced for his day for the systematic methodology he employed, including documentation and use of seriation, practices which he passed down to the many assistants he trained.⁶⁴ Petrie was also known to keep excavation notebooks, logs of finds and personal diaries when he was in the field, as well as publishing extensively on his fieldwork and the artefacts that were found and distributed to institutions, including the V&A. In an effort to determine provenance of the textiles in the V&A collection, Petrie's writings were examined by Ruiha Smalley looking to match his records against the database of the museum's textiles.⁶⁵

⁶² Cardon *et. al.* 2011, 52.

⁶³ He was the first chair of Egyptology named at a British university, holding the post at University College London between 1892 and 1933.

⁶⁴ One of these assistants was Howard Carter (1874-1939) who discovered the tomb of Tutankhamun in 1922.

⁶⁵ Smalley 2015, 135. Although only eighty-one of the Egyptian textiles in the V&A's collection are credited as coming from Petrie, the acquisition records show that Petrie was also a driving force behind many of the other donations of textiles made to the museum, many of which originally came from Petrie's excavations. It should also be noted that both Petrie and his contemporaries often purchased textiles from various sites and bazaars in Egypt, making

While the study did help to clarify the context of a few of the textiles, it was determined that even with Petrie's attention to detail, there was not enough information recorded at the time of excavation or acquisition to suggest a provenance for specific pieces, and that further study would not yield additional useful results.⁶⁶ Even with what was considered the highest standards of documentation of the day, trying to use this information to reconstruct the context is next to impossible.

Another common means used to determine not necessarily the provenance of a textile, but the place of origin (which may or may not have been the same), is analysing the spin-direction of yarns. This refers to the direction in which fibres were spun to create a thread, either to the left or to the right, which creates a 'lean' of the fibres within the finished yarn. In the secondary literature, yarns are thus described as being either s-spun or z-spun [fig. 2.13]. The spin-direction of a yarn is the direct result of the manner in which it is spun,⁶⁷ which is claimed to be culturally determined, and therefore the different spin-directions represent distinct spinning traditions in different geographic regions.⁶⁸ In Egypt, where linen had long been the dominant textile fibre, most textiles have s-spun yarns because wet flax fibres have a natural tendency to twist in that direction; in the northern and eastern regions of the Mediterranean where both wool and flax were used, yarns have tended to be z-spun, a pattern also found in the textiles from India, Central Asia and the Middle East.⁶⁹ Unlike flax, the textile fibres in these regions either had a natural right twist (cotton and hemp) or no natural twist (wool and other animal hair).⁷⁰

any attribution of these textiles, even in contemporary documentation, suspect. Persson 2012, 10.

⁶⁶ Smalley 2015, 145.

⁶⁷ For a discussion of spinning and spin direction, see appendix 3.

⁶⁸ Barber 1991, 65.

⁶⁹ Barber 1991, 65-66.

⁷⁰ Barber 1991, 65-66; Bellinger 1962, 6-10. It has additionally been speculated that in areas where the dominant textile fibres have no natural twist, the incidence of right-hand dominance amongst the population may have resulted in a tradition of z-spun yarns; left-handed people would have had to adapt to using a right-handed technique, in order to maintain the strict tradition of lean direction. However, this may not have been the case, detailed in appendix 3.

As a result, spin-direction has often been cited as a means for determining if not where a textile was found, at least where the yarn was spun and perhaps where it was woven. In Egypt, s-spun textiles have been seen as locally produced while z-spun textiles were seen as imported;⁷¹ such distinctions have been used extensively to distinguish between cottons produced in Egypt and Nubia, and those produced in India. However, as more archaeological textiles have been examined, it has led to questions about how firm this rule really was.⁷² Textiles which contain yarns of both spin-directions, and those exhibiting spin-directions not ‘native’ to their region, but with no clear link to a region where that spin-direction was the tradition, often remain uncommented on.⁷³ I find caution should be used when applying this reasoning to cotton fibres; there are enough examples of z-spun cotton yarns in Egypt in regions far removed from Indian trade routes, and textiles with both s-spun and z-spun yarn.⁷⁴

It has been proposed that elemental analysis could be used to determine the origin of wool by examining the strontium isotopes found in the fibres.⁷⁵ In a pioneering study, modern sheep hair was analysed for strontium isotope ratios against those found in the environment the sheep lived in to see if a determination could be made regarding the relationship between the two in a way that could be replicated in analysis of historical textiles.⁷⁶ The study concluded that it was possible to trace animal hair back to a specific geographic location, and that this could be applied to archaeological textiles.⁷⁷ Despite this early success, there have still been

⁷¹ Casson 1989, 17; Wild 1997, 298; Wild and Wild 2007, 211-20.

⁷² Wild *et al.* 2008, 146.

⁷³ For example, Livingstone 2009 identifies z-spun cotton found in Kellis as likely imported from India, but makes no mention of the z-spun wool found at the same site. See appendix 3 for more on spin direction.

⁷⁴ These are discussed in appendix 3. Caution is also urged by Bender Jørgensen 2017, 238-239, as more contradictions in the evidence are found.

⁷⁵ Frei *et al.* 2009a; 2009b; 2010. Hair in particular often contains elevated trace element concentrations. Attar *et al.* 1990. Use of stable Strontium isotopes from human bone and tooth enamel as means to reconstruct human migration has been widely used, as detailed in Frei *et al.* 2009a, 253; Frei *et al.* 2009b, 1965.

⁷⁶ Frei *et al.* 2009a, 252; Frei *et al.* 2010, 2136-2137.

⁷⁷ A pilot study to determine the Strontium isotope ratios of Iron Age wool textiles and leather fragments from a bog in Schleswig-Holstein, Germany, found that strontium isotope tracing could be used to determine the place of origin of the flock, based on the assumption that

few applications of strontium isotope analysis on hair fibres,⁷⁸ but it is worth considering whether this type of analysis can be conducted on textiles of other fibre types as well. It has been demonstrated that plants also maintain average strontium isotope variation from the soils in which they grow,⁷⁹ meaning that it may eventually be possible for similar analysis to be carried out on plant-based textiles, such as flax or cotton.

Finally, DNA testing and genomic sequencing are being used in a variety of ways to explore textiles and the information that can reveal. Such means have been used not only to identify types of fibres in small or visually ambiguous samples and to corroborate previous classifications,⁸⁰ but also to identify specific species which could potentially be used to indicate origin. A 2011 study of archaeological wool fragments from sites in Denmark, Belgium and Greenland determined that it was possible to extract and amplify mitochondrial DNA to sequence the samples and compare them to samples from native modern sheep breeds of the regions in question.⁸¹ Further DNA testing has so far been limited; identification of fibres, animal breeds, and in some cases, dyes used, have limited synthetic value in current methodological frameworks that continue to largely focus on site specific chronologies and categorisation of ‘like’ materials. However, in the case of cotton, genomic analysis has revealed some highly significant findings regarding taxonomy and evolution of the plant, which form the basis of this study.

strontium isotopic compositions in woollen textiles would reflect the bioavailable strontium of their respective grazing lands. Von Carnap-Bornheim *et al.* 2007; Frei *et al.* 2009a. The process was replicated on textiles from the Iron Age site of Huldremose in Jutland, Denmark. Frei *et al.* 2009b.

⁷⁸ This is perhaps because even though elemental concentrations are high in hair, strontium levels are still relatively low, making recovery of a large enough sample to carry out analysis difficult. Other considerations include the effect of the preservation environment on the material, contamination, and the dyes used. Frei *et al.* 2009a, 253; Frei *et al.* 2010, 2317.

⁷⁹ Such as Poszwa *et al.* 2004; Benson *et al.* 2006; Bentley 2006.

⁸⁰ Good 2001, 218; Wild 2007, 3; Cybulska *et al.* 2008, 72. It should be noted that certain plant bast fibres (where the fibre is spun from the plant stem, such as flax and hemp) contain so little DNA material that it can be difficult to attain a sufficient sample for identification purposes. Haugan and Holst 2014, 952. The issue of fibre identification will be addressed shortly.

⁸¹ Ørsted Brandt *et al.* 2011, 209-221.

Taxonomy and distribution of cotton

Cotton belongs to the tribe *Gossypieae*, part of the Malvaceae family, consisting of nine genera of which *Gossypium* is the largest and most widely distributed.⁸² Divergence of the genus occurred between ten to fifteen million years ago followed by rapid speciation and multiple transoceanic dispersals resulting in near worldwide distribution, centred on several primary areas of diversity.⁸³ There are more than fifty species of *Gossypium*,⁸⁴ and new ones continue to be discovered.⁸⁵ Morphologically, the species range from herbaceous shrubs to small trees, perennials and annuals.⁸⁶ One feature that makes the genus *Gossypium* unique is that of the more the fifty species it encompasses, four were independently domesticated by ancient societies in separate domestication events, the New World allopolyploids *G. hirsutum* and *G. barbadense*, and the Old World diploids *G. arboreum* and *G. herbaceum*.⁸⁷ Based on the genomic diversity identified in the Old World species of *Gossypium* and their centres of species diversity as compared to the New World species, it has been suggested that the genus *Gossypium* originated in Africa,⁸⁸ though the origins of the cultivated species and domestication have long been debated, discussed below.

The fruits of the cotton plant form capsules, called bolls, which are divided into three to five loculi, each of which contain several seeds with the fibres attached.⁸⁹ All *Gossypium* species have seeds with short fibres (fuzz) which in the wild species retain their circular shape

⁸² Wendel and Grover 2015, 7.

⁸³ Seelanan *et al.* 1997; Wendel and Cronn 2003; Wendel *et al.* 2010, 3; Wendel and Grover 2015, 28-29.

⁸⁴ Fryxell 1978; Wendel and Cronn 2003, 139.

⁸⁵ Fryxell 1992; Fryxell *et al.* 1992; Alvarez and Wendel 2006; Wendel and Grover 2015; Stewart *et al.* 2015; Gallagher *et al.* 2017.

⁸⁶ Wendel and Cronn 2003, 139. The morphologies of many of the known species of cotton have been detailed in Fryxell 1978. For a summary of the development of annual forms of *Gossypium* from perennial and the spread of photoperiod-neutral species, see Brite and Marston 2013, 41-42.

⁸⁷ Wendel *et al.* 2010, 1. Diploid refers two sets of chromosomes from the same species, allopolyploid refers to two or more sets of chromosomes from different species, indicating that the New World cultigens were the result species crossbreeding.

⁸⁸ Wendel and Grover 2015, 30-32.

⁸⁹ Bouchaud *et al.* 2011, 407.

after being shed by the opened capsule, making them generally ill-suited to textile production.⁹⁰ The domesticated species have a second layer of longer fibres (lint) which have thinner secondary walls that form flattened ribbon shapes when they desiccate, twisting and forming a characteristic convoluted structure.⁹¹ The lint is what is harvested to be spun into yarn. The two Old World cotton species, *G. herbaceum* and *G. arboreum*, are very similar in appearance. While both are technically shrubs, modern *G. herbaceum* tends to be a bit smaller, reaching heights up to 1.8 meters with broad lobed leaves and rounder, smoother bolls;⁹² in contrast modern *G. arboreum*, referred to as ‘tree cotton’ though it is not an actual tree, can reach up to two meters with narrow lobed leaves and tapered, roughly pitted bolls.⁹³ Both of the Old World species are generally more resistant to drought and pests than their New World counterparts,⁹⁴ but they have gradually been superseded by the New World varieties.

The genus *Gossypium* has been divided into nine genome groups based on their genetic diversity and geographic distribution [fig. 2.14]. Genome group A contains the two domesticated Old World species, *g. arboreum* and *g. herbaceum*. The two domesticated New World species, *g. hirsutum* and *g. barbadense* are in a hybrid genome group, AD. Genome group D dispersed to the Americas sometime between five and ten million years ago via a transoceanic event; between one and two million years ago, a second transoceanic dispersal of an A genome species (similar to *G. herbaceum*) to the Americas hybridised with a D genome species resulting in the new genome AD genome group.⁹⁵ There are five species in the AD genome group, of which two were independently domesticated. Only the A and AD group have the elongated lint fibres necessary for spinning.⁹⁶

⁹⁰ Fryxell 1963, 196-197; Wendel *et al.* 2010, 13.

⁹¹ Wendel *et al.* 2010, 13-14. This characteristic allows for definitive fibre identification using optical microscopy. Batcheller 2002, 107.

⁹² Kulkarni *et al.* 2009, 70.

⁹³ Selective breeding in the modern era means we do not know what the ancient species would have looked like. Kulkarni *et al.* 2009, 70.

⁹⁴ Bouchaud *et al.* 2018, 382.

⁹⁵ Paterson *et al.* 2012, 423, which resulted in chromosome doubling

⁹⁶ Wendel *et al.* 2010, 13-14.

Compared to the history of the Old World species, theories of domestication of the New World species of cotton has been relatively straight forward. *G. hirsutum* was widely distributed through Central America, northern South America, the Caribbean and a few islands in the Pacific; *G. barbadense* was spread over a slightly more southern region of South America, with large regions of overlap in the Caribbean which resulted in degrees of hybridisation between the two species.⁹⁷ The oldest surviving remains of *G. hirsutum* have been found in Mexico, while the oldest of *G. barbadense* come from coastal Peru, and these have commonly been accepted as approximations of their sites of their domestication.⁹⁸ Greater species diversity of Old World cotton increases the uncertainty of the relationships between the species, and has led to more debate regarding the domestication and spread of cotton. Due to the apparent similarity between the two species, in both their modern geographic spread and appearance, it was initially thought that *G. arboreum* derived from *G. herbaceum* early in the history of cultivation somewhere in the region of Arabia or India,⁹⁹ but comparison of their genomes has determined that despite appearances, the genetic variation displayed between the two actually indicates divergence much earlier than their domestication,¹⁰⁰ sometime between 400,000 and 2.5 million years ago.¹⁰¹ There are two important implications of this finding; first, this suggests that the two species did not necessarily originate in the same place, and second, that there were two independent domestication events.

There is limited evidence for identifying the points of origin or domestication of either species. A wild variation of *G. herbaceum* ssp. *africanum*, that may represent a wild progenitor of the domesticated form, is currently found in the regions of modern Botswana and Lesotho, but these regions are geographically removed from known historical or contemporary cultivation sites. A primitive form of domesticated *G. herbaceum* ssp. *acerifolium* can be

⁹⁷ Wendel and Grover 2015, 36; Wendel *et al.* 2009, 16.

⁹⁸ Wendel *et al.* 2010, 16-17.

⁹⁹ Hutchinson 1954, 232-233.

¹⁰⁰ Wendel *et al.* 1989, 1796; Wendel *et al.* 2009: 13; Renny-Byfield *et al.* 2016, 1941.

¹⁰¹ Renny-Byfield *et al.* 2016, 1946.

currently found on the East African and Arabian coasts suggesting diffusion northward into Africa, Arabia and Persia,¹⁰² although there is not enough data to determine when this may have occurred. The presence of this subspecies has led to two theories about the spread of domesticated *G. herbaceum* species; one that it spread after domestication of *G. herbaceum* took place in southern Africa, and the other that domestication took place either in southern Arabia or Ethiopia and *G. herbaceum* then spread back into Africa.¹⁰³ There is, however, very little evidence of cotton in southern Arabia prior to the medieval period, as discussed in chapter seven, and this theory seems highly speculative in the face of more compelling evidence placing the domestication of *G. herbaceum* in Africa. East Africa has additionally been proposed as a site for domestication because of the diversity of wild perennial *Gossypium* species found there in the twentieth century, although they are not lint producing.¹⁰⁴

The presence of *G. herbaceum* ssp. *africanum* in southern Africa continues to provide the strongest evidence for the domestication of *G. herbaceum*. It has been noted that the majority of species of *Gossypium* have relatively small geographic distributions, which would be modified by human mediation during the process of domestication;¹⁰⁵ the wild species would have a restricted geographic range which would be extended over the course of domestication diffusion, followed by a period of ‘intensive agronomic development’ and wider diffusion.¹⁰⁶ By this model, domestication probably would have taken place somewhere in the savannah region of sub-Saharan Africa and gradually expanded from there. The lack of evidence can be attributed both to a lack of archaeological investigation of the area, but also to

¹⁰² Hutchinson 1954.

¹⁰³ Kulkarni *et al.* 2009, 71. Hutchinson 1954 speculated that Arab mariners took *G. herbaceum* ssp. *africanum* back with them to Arabia where it was domesticated, resulting in all forms of *G. arboreum* as well as *G. herbaceum* ssp. *acerifolium*, which he said was then re-introduced to Africa after the Arab conquest; this is the model repeated in Kulkarni *et al.* 2009. Hutchinson later altered this theory, stating that *G. herbaceum* ssp. *africanum* was not the wild ancestor of domesticated *G. herbaceum*, that domestication took place either in Arabia or in Baluchistan. Santhanum and Hutchinson 1974; Kriger 2005, 89.

¹⁰⁴ Summarised in Bouchaud *et al.* 2018, 413-414.

¹⁰⁵ Wendel *et al.* 2010, 11.

¹⁰⁶ Wendel *et al.* 2010, 15.

poor preservation of organic materials in the more humid climate. Further excavations and new means of genomic analysis may provide more information in the future.

There have been no wild forms of *G. arboreum* yet identified; it occurs only in its cultivated form in a wide geographic area from China to Africa,¹⁰⁷ but a primitive perennial variety, *G. arboreum* ssp. *indicum*, is thought to have spread from western India.¹⁰⁸ And as previously mentioned, the oldest evidence of domesticated cotton in the world, dating to the fourth millennium BC and thought to be *G. arboreum*, has been found in the region of Baluchistan in modern day Pakistan.¹⁰⁹ Comparative and genetic analysis has offered divergent theories; two geographic regions have been identified as possible locations for the wild progenitor species, Madagascar and the Indus Valley.¹¹⁰ The Indus Valley is the current centre of diversity for variants of the species *G. arboreum* and the location most favoured as the original site of its domestication, although it has been noted that current centres of diversity do not necessarily correspond to the historic places of origin.¹¹¹ The current distribution of *Gossypium* has seen the Old World domesticated species used less and less; while *G. arboreum* is still cultivated in India and Pakistan and *G. herbaceum* can be found in some regions of West Africa, western Egypt, and Iran, these account for a very small percentage of overall global cotton production.¹¹² While there is sufficient evidence to support the argument that *G.*

¹⁰⁷ Renny-Byfield 2016, 1941. In terms of historical cultivation, this may be because there remain large sections of sub-Saharan Africa that have not been archaeologically investigated, and sites of early cultivation have either not been found or preserved.

¹⁰⁸ Wendel *et al.* 2010, 16.

¹⁰⁹ Moulherat *et al.* 2002. No similarly aged textiles from *G. herbaceum* have been identified, but the geographic distribution of variants prior to the development of the modern textile industry indicates that the history of domestication of *G. herbaceum* is at least as long as that of *G. arboreum*. Wendel *et al.* 2010, 15.

¹¹⁰ In Madagascar, two 'primitive' variants of *Gossypium* were described by French botanist Henri Perrier de la Bâthie, one a wild arboreal form found in the xerophytic forests, and the other a primitive cultigen only found with human settlements perhaps modeling the domestication of *G. arboreum*. Hutchinson 1954, 232; Wendel *et al.* 2010, 16.

¹¹¹ Wendel *et al.* 2010, 16.

¹¹² *G. barbadense* is the species of Pima and Egyptian cotton, grown Central Asia, Egypt, Sudan, India and the United States, which accounts for less than ten percent of total global cotton production; *G. hirsutum* makes up over ninety percent in more than 40 nations around the globe. Wendel *et al.* 2010, 16.

herbaceum was domesticated in Africa and *G. arboreum* was domesticated in South Asia,¹¹³ the dominance of India in discussions of cotton, even in Egypt and Africa, has persisted.¹¹⁴ However, DNA sequencing of a fourth-century AD cotton sample from Qasr Ibrim in Nubia, one of the earliest sites of confirmed cotton cultivation in Africa (discussed at length in chapter five), demonstrated that the cotton being grown in Lower Nubia was *G. herbaceum*.¹¹⁵ Not only does this indicate a sub-Saharan connection, it also shows that the cotton being cultivated in late antique Africa was a native variety, not an import from India. This study will begin with the earliest evidence of cotton on the continent of Africa, addressing three overarching questions tying together all of its aims: what can we determine about the spread of cotton from these areas, how does this reflect communication and exchange in the Roman and post-Roman world, and how does this change our historical understanding of cotton and the continent of Africa.

Conclusions

In the literature, there has been a tendency to treat the entire textile industry as a single entity. However, selective bias of the evidence used in these discussions, such as texts or certain types of textiles, have resulted not only in textile studies largely being isolated from other disciplines, but also in the uneven discourse regarding the industry and the different fibres. This is very apparent when examining the history of cotton. The study of cotton, like all textiles, has been restricted by a number of factors. In addition to inconsistent excavation methods and poor documentation protocols, the privileging of silk and ‘Coptic’ textiles at the expense of more representative assemblages of their non-luxury counterparts has meant that old narratives

¹¹³ Palmer *et al.* 2012, 2032.

¹¹⁴ Bouchaud *et al.* 2018 is the most recent iteration, which argues that the large-scale importation of cotton from India spurred the expansion of cotton cultivation in Africa. It is a narrative that has also influenced other fields. In their study of the evolution of various cotton species, Wendell *et al.* 2010 wrote that diffusion of cotton from India into Egypt and Western Africa ‘occurred with the advent of the modern textile industry’ and became the dominant type of Old World cotton before the introduction of New World cotton.

¹¹⁵ Palmer *et al.* 2012, 2034.

about other fibres have remained largely unchallenged, despite new evidence being found. Scientific advances in the field of textile studies are helping to contextualise this evidence and are allowing for re-interpretations of various textiles including cotton, especially in dating, fibre and species identification, and genomic.

The later in particular has been especially significant because it paved the way for the examination of cotton through multifaceted economic networks on different sides of the Indian Ocean, both in relation to the textile industry as a whole, as a crop, and as a commodity. What is clear is that cotton did not originate in a single place, and finds of cotton outside of India prior to the spread of Islam are not necessarily indications of connections with South Asia or evidence of large-scale long-distance trade networks. Instead, what the examination of the evidence of cotton in late antiquity in the following chapters shows is that cotton was moving along multiple networks, in response to different demands and through different processes, as a commodity of regional and inter-regional exchange.



Figure 2.1 C. Fifth century tunic, undyed linen with wool tapestry Dionysian decoration, said to be from Akhmim, Egypt. Accession number 26.9.9, © Metropolitan Museum of Art, New York.



Figure 2.2 Krokodilopolis and Antinoöpolis in the Nile Valley, sites of early excavations.



Figure 2.3 Discarded bodies following Gayet's excavations of the cemeteries of Antinoöpolis. Reproduced from Gayet 1902.



Figure 2.4 Discarded bodies following Gayet's excavations of the cemeteries of Antinoöpolis. Reproduced from Gayet 1902.



Figure 2.5 Models wearing replica robes from Antinoöpolis in 1903. Reproduced from the Musée de Tissus, Lyon, <http://www.mtmad.fr/Lists/Ressources/antinoe/05-le%20chale%20de%20sabine.pdf>.



Figure 2.6 Workers from Johnson's 1913 excavations at Antinoöpolis. Reproduced from Johnson 1914, pl. XXVI.



Figure 2.7 Workers from Johnson's 1913 excavations at Antinoöpolis. Reproduced from Johnson 1914, pl. XXVI.

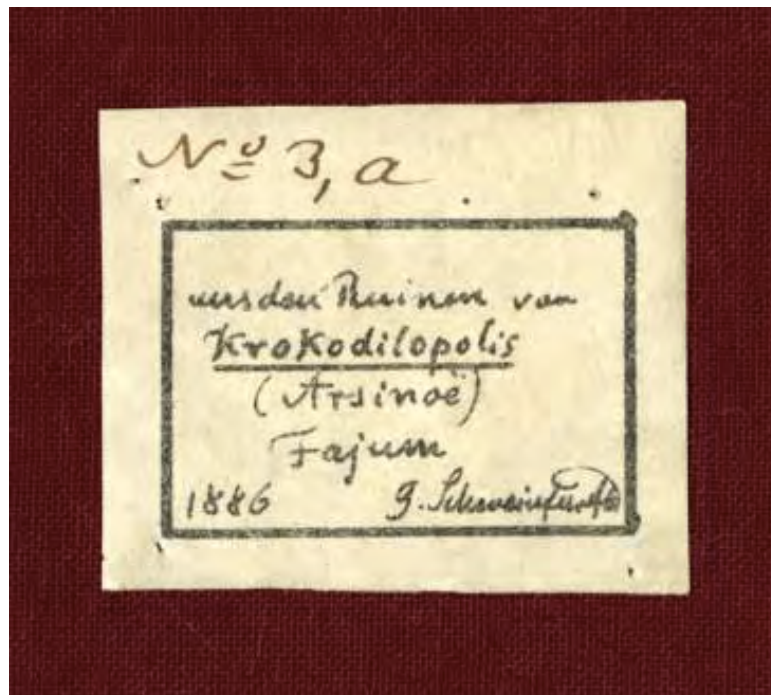


Figure 2.8 Find tag from Georg Schweinfurth's excavations of Krokodilopolis. Reproduced from Fluck 2014, 15 (© Skulpturensammlung und Museum für Byzantinische Kunst).



Figures 2.9 and 2.10 Photographs of Du Bourguet's original textiles (black and white) before testing, and the remaining fragments (colour) after testing of textiles no. 36 (left) and no. 45 (right). Reproduced from Van Strydonck and Benazeth 2014, 2.

Sample	Lab code	¹⁴ C age (BP)	Calibrated age (68.2%)	Calibrated age (95.4%)
DM113D	UtC-9431	1630 ± 60	AD 340 (4.2%) AD 370	AD 250 (95.4%) AD 570
DM88B	UtC-9049	1615 ± 40	AD 380 (64.0%) AD 540	
DM88C	UtC-9051	1590 ± 40	AD 400 (38.4%) AD 470	AD 340 (95.4%) AD 550
DM119D	KIA-10569	1585 ± 30	AD 480 (29.8%) AD 540	
DM123	UtC-2612	1540 ± 60	AD 420 (68.2%) AD 540	AD 380 (95.4%) AD 570
DM119	UtC-2619	1530 ± 70	AD 430 (26.0%) AD 470	AD 410 (95.4%) AD 560
DM88D	UtC-9050	1485 ± 40	AD 480 (42.2%) AD 540	
DM88E	KIA-10570	1470 ± 35	AD 430 (68.2%) AD 600	AD 410 (95.4%) AD 650
DM119C	UtC-7253	1450 ± 50	AD 430 (68.2%) AD 610	AD 400 (95.4%) AD 660
DM119B	UtC-7240	1420 ± 60	AD 540 (67.1%) AD 620	AD 430 (95.4%) AD 660
			AD 630 (1.1%) AD 640	
			AD 560 (68.2%) AD 640	AD 530 (95.4%) AD 660
			AD 560 (17.8%) AD 590	AD 460 (1.6%) AD 500
			AD 595 (50.4%) AD 655	AD 530 (93.8%) AD 680
			AD 560 (68.2%) AD 670	AD 460 (1.0%) AD 490
				AD 530 (92.5%) AD 720
DM88	UtC-9052	1380 ± 40	AD 620 (4.7%) AD 630	AD 740 (2.0%) AD 770
			AD 635 (63.5%) AD 685	AD 590 (92.0%) AD 720
DM85	UtC-2620	1350 ± 70	AD 620 (53.3%) AD 730	AD 740 (3.4%) AD 770
			AD 740 (14.9%) AD 780	AD 540 (95.4%) AD 870

Figure 2.11 Table of radiocarbon dates from a group of twelve stylistically similar tunics. The wide array of date ranges indicates the possibility of a long span of use of these types of decoration. Reproduced from Van Strydonck et al. 2004, 239.

textile-dates.info/textile_list_start.php?displaycolumns=display&searchformdisp=display


Collection/Museum	Textile	Historical dates	Sample	Findspot
Collection/Museum	Picture Technique Type	Date	Calendar-Date, 2 σ (95.4%)	Location/Town PDF
Belgium, Antwerp, Katoen Natie	cf. comments		415 CE (95.4%) 540 CE	
Belgium, Antwerp, Katoen Natie	cf. comments		528 CE (68.2%) 605 CE 429 CE (26.1%) 494 CE 510 CE (1.1%) 517 CE	
Belgium, Antwerp, Katoen Natie	embroidery		767 CE (92.5%) 890 CE 726 CE (2.9%) 738 CE	
Belgium, Antwerp, Katoen Natie			860 CE (86.6%) 988 CE 805 CE (5.6%) 842 CE 777 CE (3.2%) 791 CE	
Denmark, Copenhagen, Davids Samling Copenhagen		inscription 912-913		
Egypt, Domitianè/ Kainè Latomia		felt hat	End of 1st century CE	Domitianè/ Kainè Latomia
England, Oxford, Ashmolean Museum	tabby with tiraz-inscription	inscription 932		
Germany, Berlin, Museum für Islamische Kunst	tabby with tiraz-inscription	inscription 914/915		
Germany, Berlin, Skulpturensammlung und Museum für Byzantinische Kunst	weft looped weave		209 CE (89.4%) 342 CE 165 CE (4.3%) 195 CE 140 CE (1.8%) 155 CE	unknown
Germany, Lüneburg, Museum Lüneburg	tabby with tiraz-inscription	tiraz-inscription 1st half of the 10th cen.		
Kuwait, Kuwait City, Kuwait National Museum		inscription 914-915		
United States of America, Boston, Museum of Fine Arts		inscription 932		
Vatican City State, Vatican City, Bibliotheca Apostolica Vaticana		inscription 1037-1038		

Figure 2.12 Screenshot of search results from the textile-dates.info database restricting for cotton 'material'. The only entry with a find spot is highlighted.



Figure 2.13 Diagram showing s-spun and z-spun threads. Reproduced from Wikimedia Commons

Genome (no. of species)	Recognized species	Geographic distribution
A (2)	<i>G. arboreum</i> , <i>G. herbaceum</i>	Africa, Asia
B (3–4)	<i>G. anomalum</i> , <i>G. triphyllum</i> , <i>G. capitis-viridis</i> , (<i>G. trifurcatum</i>)	Africa, Cape Verde Islands
C (2)	<i>G. sturtianum</i> , <i>G. robinsonii</i>	Australia
D (13–14)	<i>G. thurberi</i> , <i>G. armourianum</i> , <i>G. harknessii</i> , <i>G. davidsonii</i> , <i>G. klotzschianum</i> , <i>G. aridum</i> , <i>G. raimondii</i> , <i>G. gossypoides</i> , <i>G. lobatum</i> , <i>G. trilobum</i> , <i>G. laxum</i> , <i>G. turneri</i> , <i>G. schwendimanii</i> , (<i>Gossypium</i> sp. nov.)	primarily Mexico, with range extensions into Peru, Galapagos Islands, Arizona
E (5–9)	<i>G. stocksii</i> Mast., <i>G. somalense</i> (Gurke) J.B. Hutch., <i>G. areysianum</i> Deflers, <i>G. incanum</i> (O. Schwartz) Hillc., <i>G. trifurcatum</i> , (<i>G. benadirensis</i>), (<i>G. bricchettii</i>), (<i>G. vollesenii</i> Fryxell), (<i>G. trifurcatum</i>)	Arabian Peninsula, Northeast Africa, Southwest Asia
F (1)	<i>G. longicalyx</i>	East Africa
G (3)	<i>G. bickii</i> , <i>G. australe</i> , <i>G. nelsonii</i>	Australia
K (12)	<i>G. anapoides</i> , <i>G. costulatum</i> , <i>G. cunninghamii</i> , <i>G. enthyle</i> Fryxell et al., <i>G. exiguum</i> Fryxell et al., <i>G. londonderriense</i> Fryxell et al., <i>G. marchantii</i> , <i>G. nobile</i> Fryxell et al., <i>G. pilosum</i> Fyell, <i>G. populifolium</i> (Benth.) F. Muell. ex Tod., <i>G. pulchellum</i> (C.A. Gardner) Fryxell, <i>G. rotundifolium</i> Fryxell et al.	Northwest Australia, Cobourg Peninsula, Northern Territory, Australia
AD (7)	<i>G. hirsutum</i> , <i>G. barbadense</i> , <i>G. tomentosum</i> , <i>G. mustelinum</i> , <i>G. darwinii</i> , <i>G. ekmanianum</i> , <i>Gossypium</i> sp. nov.†	New World tropics and subtropics, including Hawaii, the Wake Atoll, and the Galapagos Islands

† J.F. Wendel, C.E. Grover, J. Jareczek, and J.P. Gallagher, unpublished data, 2014.

Figure 2.14 Table of diversity and geographic distribution of major *Gossypium* species. Reproduced from Wendel and Grover 2015, 28.

Chapter Three: Economic Modelling, Trade, Continuity and Change

Introduction: Understanding the late antique economy

In order to use the diffusion of cotton to trace communication networks in the first millennium, means of modelling the economies of the late Roman and early medieval worlds and recognising changes and continuities in these systems need to be understood. This first requires a review of the history of the discourse in modelling the economies of the first millennium the discourse around periods of transition. More has been written about the late Roman economy than the early medieval, perhaps because the papyri from Egypt provide more documentation for that time period. However, a central theme in the scholarship of both has been a debate about the role and scale of trade as a mechanism for economic development, although the geographic spread of these discussions has been uneven. India has received the bulk of attention in academic studies, while areas such as Africa (below the Roman provinces in Egypt and North Africa) have received less consideration. This has had a direct impact on the structural narrative of early cotton in the first millennium. Despite the majority of archaeological cotton (outside of India) from this time period being found on the peripheries of the Roman empire in Africa, cotton is still often associated with Indian trade and Roman demand for luxury goods.¹ And even though this study will largely be concerned with these peripheries, it is useful to understand the discussions of economic modelling as the Mediterranean has been seen as a centre of consumption that dictated terms with its trading

¹ The value of the cotton goods that were imported from India is debated, although Casson speculated that there were a variety of qualities represented. Casson 1983, 202-203.

partners. This chapter will overview the historic debates that have taken place in economic modelling of the late Roman and early medieval economies, and then look to the historiography of trade with both India and Africa to understand the differing treatments they have received in the scholarship. It will also examine the interactions of the peripheral and frontier regions with the central Roman administration and economic structures as reflected in academic literature. It will conclude with a framework to place cotton as a commodity within these historical discussions, pursued in the remaining chapters.

Ancient economies and early models: Rostovtzeff, Jones, and Finley

While there is generally common agreement of the major economic enterprises in the ancient world (agricultural production, commercial manufacturing, trade, and mining),² scholars have used a wide variety of approaches in their attempts to model such economies. Some have chosen to focus on the legal framework of production and trade,³ some on coins and monetisation,⁴ or on the urban/rural divide,⁵ and others have sought to define both the structure and scale of economic performance,⁶ to list a few. Yet in general, historians of the ancient economy are all attempting to answer similar questions: What laws governed ancient economic life? Who defined those laws and drove economic growth? What was the level of state interference? How did markets function? What factor did social status play in the ancient economy? And the answers to most of these questions hinge on whether the ancient economy should be seen as a single entity, a continuation through several successive empires, or as regional structures maintaining multiple relationships and networks.

To answer these questions in terms of an economic system, there are certain constraints which must first be identified and defined. For example, if seeking to determine

² As detailed in Mattingly and Salmon 2001, 3; Bowman and Wilson 2009, 3.

³ Kehoe 1997; 2007; 2014 focus on the impact of the Roman legal structure in the rural economy

⁴ Such as Howgego 1992; 1994; King and Wigg (eds.) 1995; Duncan-Jones 1998.

⁵ For example, Rathbone 1991; Kehoe 1992; Aubert 2001. This has also led to new discussions about the problems of attempting quantification, such as Bowman and Wilson 2009.

⁶ Duncan-Jones 1990; 2006; Bang 2007; 2008; 2009; Temin 2001; 2013b; 2016, and others.

the extent of economic growth, it must first be determined what the parameters for identifying growth are, and what the causes were. Determining the factors that would typically be used to indicate growth, such as wages or living standards, are difficult with an incomplete archaeological record and texts with unreliable or even contradictory figures. The issue of growth illustrates the complex nature of discussions of the ancient economy. The result has been a diverse body of literature. Yet the arguments within the early studies largely worked within a single variously named binary framework of ‘modernists’ and ‘primitivists’, ‘free-trade markets’ and ‘taxes and redistribution’, ‘substantivists’ and ‘formalists’, and ‘maximalists’ and ‘minimalists’. Despite the differing terms, these are all describing the same overall dichotomy that dominated the debate around the ancient (particularly Roman) economy for decades in the mid-twentieth century. At its heart are two economic models, the first in which the economy is seen as driven primarily by trade and market growth, and the second in which the economy is seen as subject to extensive state interference and was driven by a centralised system of taxation and resource redistribution. There are three figures most commonly referred to as the generators of these arguments, Mikhail Rostovtzeff (1870-1952), Arnold Hugh Martin Jones (1904-1970) and Moses Finley (1912-1986).

Rostovtzeff was the first to frame a position in this debate in 1926, suggesting that while wealth in the Roman Empire was primarily accumulated from commerce through the second century, these profits were increased by subsequently lending out money or investing in land.⁷ Rostovtzeff suggested that in this period, much production occurred in the provinces because the natural resources and superior quality of workers in these areas allowed the provinces to prosper in competition with the urban areas of the northern Mediterranean.⁸ According to Rostovtzeff, the declining economy of the later Roman period was a direct result

⁷ Rostovtzeff 1926, 153.

⁸ Rostovtzeff implied that consumption centres moved as a result of production centres shifting from urban areas. Rostovtzeff, 1926. This argument has largely been replaced by more demand oriented arguments, where the production centres moved because the consumption centres moved. Andreau 2002, 41.

of the government policy of requisition beginning under Trajan (AD 98-117), which favoured the urban centres to the detriment of the provinces and commercial production.⁹ In this model, not only was the period defined by a gradual and continual economic decline, but it was also marred by legal and social tension.¹⁰ While there was some variation in the causes for the perceived economic decline of the later centuries of the Roman Empire,¹¹ Rostovtzeff's narrative of persistent deterioration and repressive state interference endured into the 1960s.

In 1964, Jones sought to change the direction of this narrative, rejecting the idea of 'class-struggle' and perpetual decline, instead arguing for a late Roman empire made vulnerable by successive policies causing economic stagnation, though ultimately brought down by external forces. He also rejected Rostovtzeff's assertion that wealth in the Roman empire was built on the back of commerce, arguing that the late Roman economy was chiefly driven by agriculture and the land tax paid on agricultural lands, while taxes on trade and commerce contributed relatively little to the state's revenue and 'drove merchants and craftsmen of the empire to desperation...'.¹² The implication was that there was wide inequality in potential earnings from agricultural activities compared to trade in the ancient world, and that commerce never played a significant economic role in the empire. What caused the decline, Jones argued, was not state policy that suppressed production and caused a collapse in trade revenues, but that the tax burden imposed by the state increased significantly in the fourth century to pay for an expansive army and state bureaucracy, which then crippled the high production areas.¹³

⁹ Rostovtzeff 1926, 353-392.

¹⁰ The fact that Rostovtzeff was a Russian emigre forced to flee after the revolution in 1918 may have influenced his emphasis on economic decline spurred on by an oppressed peasant class seeking to upend the Roman aristocracy.

¹¹ For example, Piganiol sought to blame the decline and fall of the empire specifically on Germanic tribes, though writing in Paris in the later 1940s following the conclusion of WWII may mean this was not a dispassionate choice. Piganiol 1947; 1949.

¹² Jones maintained that the tax was so oppressive, some merchants were forced to sell their own children. Jones 1964, 871.

¹³ Jones 1964, 812-823.

A similar approach was also used by Finley, who is often referenced in the same context as Jones, in the 1970s but influenced by the anthropological relativism that arose in the 1960s. Finley wrote that modern economic theories and principles could not be used to understand ancient economies because in these societies economics was not treated as a separate cultural entity. Rather than an economy driven by a central rational policy, Finley seemed to argue they were driven largely by social concerns with little integration, growth or technological advancement, claiming ‘... ancient society did not have an economic system which was an enormous conglomeration of independent markets...’¹⁴ Furthermore, in a style similar to Rostovtzeff, Finley modelled the Roman Empire and its economy as a series of oppositional forces forming an overall economic structure, with chapter headings such as ‘Masters and Slaves,’ ‘Landlords and Peasants’ and ‘Town and Country’ in his 1973 book on the ancient economy, emphasising internal competition and opposing economic interests as fundamentals. He also rejected the idea that there was any kind of larger integration in the ancient world, writing:

The roll of nearly all the great centres – Athens, Syracuse, Cyrene, Rome, Alexandria, Antioch, Constantinople – can be called without going more than a few miles inland. For a long time, everything beyond this thin belt was periphery, land to be drawn upon for hides, food, metals and slaves, to be raided for booty, to be garrisoned for defence [sic], but to be inhabited by barbarians, not by Greeks or Romans.¹⁵

Finley’s emphasis on the city at the centre of a system that consumed resources drawn from its peripheries portrayed the economy as one of self-preservation and self-interest rather than growth and expansion. Agriculture was the main economic driver; commercial trade in the ancient world was characterised by non-specialist production, high transportation costs and an over-emphasis on luxury goods, for which the market was small. And like Jones, Finley

¹⁴ Finley 1973, 22. Peter Temin directly referenced this line in his description of Rome as a market economy, writing ‘... ancient Rome had an economic system that was an enormous conglomeration of interdependent markets’ (Temin 2001, 181), illustrating Finley’s continued influence in debates of the Roman economy.

¹⁵ Finley 1973, 30.

seemed to take the view that the state actively sought to suppress private commerce in the fourth and fifth centuries;¹⁶ as a result, the status of artisans and merchants in Finley's model was lower. As the elites poured money into land rather than trade, artisans and merchants were given only limited economic influence on institutions.¹⁷

Moving on from the debate

Keith Hopkins was the first to develop a hybrid 'taxes and trade' framework, which, as the name suggests, was founded on the observation that as collection of taxes in the later Roman Empire shifted from in kind to coin, trade was also increasing.¹⁸ In this model, taxes (and rents, which functioned as a similar revenue source to taxes and were increasing as a result of conquest)¹⁹ were collected from provinces to pay for the soldiers protecting the frontiers of the outer provinces, the central government in Rome, and the services both provided; in order to raise the cash to pay these taxes, the 'tax-exporting' provinces had to earn money through trade.²⁰ Over time, this led to increased agricultural production, division of labour, artisanal production, urbanisation, and development of both local and long-distance commercial markets.²¹ Hopkins modified this model slightly over the years to respond to changes in the scholarship. For example, in the original model, Hopkins argued that part of what made the system function was the fact that taxation was relatively low.²² Later, he made a distinction between the amount of tax that actually made it to the state coffers, 'transmitted tax', and the

¹⁶ As noted in Wilson and Bowman 2018, 3, this was despite the publication of Tenney Frank's five volume *Economic Survey of Ancient Rome* between 1933 and 1940.

¹⁷ Kingsley and Decker 2001, 3-5.

¹⁸ Hopkins 1980, 101.

¹⁹ Hopkins 1980, 104.

²⁰ The example situation provided by Hopkins was that peasants would grow surplus food, and in order to pay their taxes, sell it at local markets where it would be consumed by artisans. The artisans, in turn, would produce higher value goods that would be exported to the frontier provinces and the city of Rome. Hopkins 1980, 101-102.

²¹ According to Hopkins, this also had an impact on the tax-importing regions of the empire. Soldiers and government officials began to purchase their own food and goods with money, and this increased the number of people offering services to soldiers and officials in the outer provinces and Imperial centre, causing increased monetisation. Hopkins 1980, 102.

²² Hopkins 1980, 116-120.

taxes levied against the citizens which he said were likely unofficially regressive as those collecting taxes, generally already wealthy, imposed lighter taxes on the elites while transferring the burden to those who were poorer, resulting in the complaints of heavy taxation often found in the documents.²³

Hopkins approached the issues of integration and growth by attempting to answer the wider question of whether the Roman economy should be seen as a continuation of other ancient economies or as a distinct phenomenon. Hopkins argued that there were identifiable indicators of growth in the late Roman economy that were the result of integration, including a rise in both agricultural and non-agricultural production, division of labour and the spread of technology.²⁴ These were not observed in the Hellenistic world and were therefore seen as a product of entering the Roman system.²⁵ However, in Hopkins' model this growth is largely restricted to the period between the third and fourth centuries, not throughout the entire history of the Roman Empire, implying that for much of Rome's history there was little actual growth or indication of integration.²⁶ The later change was spurred on by the development of long distance commerce. While the application of this hybrid model has been largely accepted by scholars,²⁷ it has really only been in the last few decades that the regional operation of exchange networks have been fully studied.

A 'global' late antiquity?

The debate has moved on with the widespread acceptance of the importance of production and commerce to the Roman economy; while the state was controlling certain markets (particularly in relation to food production) demand for artisanal goods was shaping exchange networks and driving specialisation independent of state intervention. Questions now centre on characterisations of urban and rural interaction, supply chains, integration,

²³ Hopkins 2002, 204.

²⁴ Hopkins, 2002, 219.

²⁵ Bowman and Wilson 2009, 25.

²⁶ Millet 2001, 31.

²⁷ Wilson and Bowman 2018, 4 on the current state of scholarship.

investment capabilities and strategies, and the difference in regional markets. As will be discussed later, the significance and magnitude of regional exchange have been highlighted in various studies of the Roman provinces in the later Roman period, particularly in relation to Egypt and North Africa. However, the majority of studies leading into the twenty-first century continued to maintain the core dynamic of centre/periphery interaction, with an emphasis on the Mediterranean and, in the case of Egypt the Nile, as facilitators of trade while giving far less consideration to land-based networks and evidence of multi-directional exchange activity around the Roman cities. The Roman Mediterranean was constructed as the centre from which goods, ideas and money emanated out to the provinces; when things were imported into the empire, they tended to be luxuries, with the areas marginal to the main Roman trade zone treated as intermediaries.²⁸ As will be shown throughout the discussion of cotton in subsequent chapters, the peripheral regions of the Roman world were forming their own networks to mediate cultural and economic exchange independent of the Mediterranean centre.

The continued adherence of the structural model of the centrality of the Roman economic structures in directing the development of global networks is partially because of what evidence has traditionally been used to model economic interaction. In the past, the sheer number of Roman sources in the written record gave the impression of an all-encompassing system of consumption in which the economic strategies of Roman trading partners were subsumed by, and subservient to, the empire's. Yet, as archaeological investigation of both the peripheral areas and the Roman centres continue, the evidence is proving that although the pull of the Roman economy was significant, and that a more nuanced picture of regional interaction is required.²⁹ This was the subject of a multi-year research programme 'The Economy of the

²⁸ Especially for Africa, see Adams 1977 and Munro-Hay 1982.

²⁹ As will be seen, particularly in relation to the historiography on trade with India, 'global' trade in the Roman period has maintained Roman demand was stimulating global interaction, a key theory taken up in studies of textiles and cotton which is examined more fully in chapters five and six. The push for global contextualisation of the Roman empire and a 'global late antiquity' has not yet received the widespread attention that its chronological successor in the east, the Byzantine empire and a 'global Middle Ages', has in recent years, though this has

Roman Empire: Integration, Growth and Decline’, organised by Bowman and Wilson from 2005 to 2010 and funded by the Arts and Humanities Research Council (AHRC). These studies will be returned to shortly, but first, I will propose a second reason for the continued dominance of models that emphasise the Roman-centric construction of late antiquity.

A new trend within discussions of the ancient economy has been the application of the modern theory of New Institutional Economics (NIE). Scholars such as Peter Bang, Elio Lo Cascio and Dennis Kehoe have argued that studies focused on either the idea of ‘redistribution’ or ‘administered trade’ are inherently ineffective because they fail to detail the specificity of markets in different regions, the impact this had on system formation, and how the state responded to differing regional situations.³⁰ Application of the NIE framework, in which the institutions of the economic system were evaluated in relation to scale and performance of the system over time to determine the ‘operation of markets’, allows scholars to address the relative economic growth in relation to questions of integration.³¹ ‘Institutions’ in this theory, according to Douglass North, are considered to be a series of constraints, both informal (e.g. norms, customs, and traditions) and formal (e.g. laws and constitutions), acting on social, political and economic interactions to create order and reduce uncertainty within society.³²

Application of NIE to the study of ancient economy has been useful in a number of ways, particularly in studies of various types of trade and the role of transaction costs in mediating interaction.³³ However, unlike modern economists, historians of the ancient economy are constrained by information loss and the lack of verifiable quantitative data in the

been changing. Notable exception are Horden and Purcell 2000 and Wickham 2005, which were discussed in chapter one, and the studies of the Bowman-Wilson project, discussed later in this chapter. This emphasis on ‘global’ studies builds off trends advocating for widespread integration of the medieval east and west in a variety of fields and leading to promising new methodological approaches. For methods across disciplines, see Holmes and Standen (eds.) 2018; Belich *et al.* (eds.) 2016.

³⁰ Lo Cascio 2006, 215. See also Duncan-Jones 1990; Temin 2001 and 2013; Erdkamp 2005; Kehoe 2005 and 2014; Bang 2008 and 2009.

³¹ Temin 2013, 24; Bang 2009, 197; Lo Cascio 2006, 215.

³² North 1991, 97.

³³ For example, Lo Cascio 2006; Seland 2014b; Kessler and Temin 2007.

written record; there are gaps in the available documentation, questions of veracity and sourcing of ancient authors, and the inability of assess enforcement of laws and regulations produced and used by institutions. This requires the use of ‘normative assumptions’ to fill these holes and take the place of verifiable fact in order to create trendlines and statistical models.³⁴

Acknowledgment of this problem has led some scholars to use proxies for traditional measures of economic growth and intensity.³⁵ But even use of such proxies requires a level of assumption that can make distinguishing trends difficult. In responding to Elio Lo Cascio’s use of urbanisation as a means of quantifying demographic and economic change in the Roman empire,³⁶ Bagnall points out that there is not a consensus on what constituted ‘urban’ in late antiquity, and large gaps in the documentation recording populations inhibit analysis of change over time.³⁷ Further adaptation of the classic NIE framework to include a fuller integration of archaeological material into discussions of performance (similar to the approaches taken in the studies organised by Bowman and Wilson, discussed below) may alleviate some of the necessary assumption in applying the model, but as discussed in chapter one, quantifying archaeological material presents its own methodological challenges.³⁸

A further problem with NIE is that because it relies on a framework of institutions, it focuses on areas where we have knowledge of the institutional structure, i.e. the central Roman administration. It is therefore Roman-centric out of necessity. While this is not a problem for understanding the internal structure of the Roman economic system, it does little to advance knowledge of what was going on outside of it, or how the Roman system interacted with non-Roman systems. In his review of *The Cambridge Economic History of the Greco-Roman World*

³⁴ Hobson 2015, 27.

³⁵ Lo Cascio 2007 discusses attempts at quantify both GDP and per capita income, arguing that proxies such as ubranisation and evidence of rates of smelting activities from the pollution levels of ice cores can demonstrate growth and intensity of economic activity.

³⁶ Lo Cascio 2009.

³⁷ Bagnall 2009.

³⁸ This is a critical part of the discussion in Bowman and Wilson 2009, the introduction to the volume in which Lo Cascio 2009 and Bagnall 2009 appear.

(2007) which used NIE as the core organisational principle, Bang explained the model in the field of ancient economics as examining how ‘economic choices and incentives are shaped by cultural and social organization’,³⁹ which has shifted the focus away from questions of structure towards those of performance, necessitating temporal contextualisation.⁴⁰ Little is said of geographic contextualisation. Indeed within the volume, the study of the Greco-Roman economy is largely treated as a single unit, with only the final section out of seven devoted to studies of regional development.⁴¹ There is a single chapter devoted at the end to ‘The Frontier Zones’ which spans from Hadrian’s wall to Meroitic Nubia, but spends much time on regions that were considered provinces of the Roman empire, such as North Africa, and their contribution to agriculture and military provisioning.⁴² The peripheral regions of Africa, the Sahara and Nubia, are discussed only on the last page. Of Nubia, David Cherry said:

Silverware, bronze vessels, lamps, glass, and pottery were exported across the southern Egyptian frontier to Meroë. Almost nothing is known about what was obtained in exchange, but it is likely to have included ivory and gold.⁴³

Of the Libyan Oases, he claimed:

The Garamantes of the Fezzan are known to have buried Roman glassware with their dead. But in its scale and in its impact on the regional economy, trans-Saharan trade was probably of little importance.⁴⁴

The trade systems of both regions are constructed in relation to the Roman centre, and because of that were deemed of little importance, but that is because this volume was not a study of the economy of the wider Greco-Roman world, but of the Greco-Roman interior. The

³⁹ Bang 2009, 197.

⁴⁰ Bang 2009, 201.

⁴¹ Scheidel *et al.* (eds.) 2007. Throughout the previous six sections, Egypt and the broadly defined Near East are often allocated their own chapters, but still as provinces within the Greco-Roman empires. The final section is divided into four chapters: ‘The Western Provinces’, ‘The Eastern Provinces’, ‘Roman Egypt’, and ‘The Frontier Zones’. This broadly matches the methodological approach discussed by Lo Cascio in which the application of NIE enables the study of ‘the performance of the Roman Empire as a unified political organization over time...’. Lo Cascio 2006, 218.

⁴² Cherry 2007, 720-734.

⁴³ Cherry 2007, 740.

⁴⁴ Cherry 2007, 740.

focus on the performance of the economy meant that places outside the Greco-Roman empires, but which were interacting with it and with each other—India, China, Africa, Northern Europe—were not be discussed.⁴⁵ Over a decade has passed since this volume was published, and the economic activities of these peripheral areas are receiving more attention, as will be discussed shortly. But it illustrates an impediment the use of NIE in its current form has in understanding global interaction and movement; until the structure and operation of systems outside the centre (and therefore outside the integrated unit) are understood, it is not possible to fully contextualise the ancient economy.

The Bowman-Wilson group

In the preface of their first volume of the series *Oxford Studies on the Roman Economy*, the result of the AHRC funded project entitled ‘The Economy of the Roman Empire: Integration, Growth and Decline’, Bowman and Wilson described the need for better understanding and integration of the material evidence (archaeological and documentary) to advance the debate on the Roman economy.⁴⁶ Their five year project has so far resulted in the publication of four monographs,⁴⁷ focusing on areas of the economy where there is enough raw data to provide ‘a series of performance indicators which could track variation across space and time, and might enable a comparison of performance against the economies of other periods and cultures’.⁴⁸ The focus of each volume on methods of quantification, settlement and urbanisation, agriculture, and trade and commerce respectively has allowed for a wide ranging set of studies in which regional patterns are contextualised within both their temporal and geographic contexts. The end result has been a framework in which both archaeological and documentary evidence can be used to observe changing trends in both structure and

⁴⁵ It should also be noted that the volume is centred on the time period from classical Greece to Imperial Rome; late antiquity, which for the purposes of the volume begin in the third century AD, is treated as the epilogue.

⁴⁶ Bowman and Wilson (eds.) 2009, v.

⁴⁷ Bowman and Wilson (eds.) 2009; 2011; 2013; Wilson and Bowman (eds.) 2018.

⁴⁸ Bowman and Wilson (eds.) 2009, v.

performance, in which different regions can be examined as both independent entities as well as within a foundation of the late Roman economy as a whole.

The final volume of the series is particularly relevant to the current study. Focused on trade and commerce in the period from 100 BC to approximately AD 350, it demonstrates a possibility for mediating between the methodologies of NIE and new archaeological discoveries, and gives equal attention to trade within the empire as it does to trade outside the empire. Towards the latter category, the editors note that it is only recently trade beyond the borders of the empire has received any kind of substantial attention; when it was discussed it was also treated separately from Roman trade as a distinct entity.⁴⁹ The studies in the section evaluate the relationship between the southern and eastern frontiers and Rome, revealing their fundamental nature to the Roman economic system as a whole. The present study builds off this framework by also examining evidence of discrete interaction of the cultures in these frontier zones with each other.

Of particular note in this volume was a discussion by Colin Adams on the reciprocal nature of state intervention and private commerce in Nile transport in Egypt. Much has been written about the maritime trade routes of late antiquity, featuring prominently in studies of trade because it was assumed to be safer, quicker, and more cost effective than land based trade.⁵⁰ While this may have been largely true, the development of private commercial networks on the Nile that were also transporting state goods highlight several other considerations. The first is obvious; goods had to be transported from ports to inland cities, and throughout the Roman empire, extensive road networks connected these areas; in Egypt, several trans-desert routes ran through the Eastern and Western Deserts connecting the Red

⁴⁹ Wilson and Bowman 2018, 13 fn. 43 provides a bibliography.

⁵⁰ Jones 1964, 841-844; Finley 1973, 30, 126; Duncan-Jones 1974, 1; Bagnall 1985, 5; 2005, 196; Casson 1994, 149. The full scope of the debate of this differentiation, particularly in relation to Egypt, is outlined in Adams 2012.

Sea ports and oases to cities on the Nile River.⁵¹ Second, sea travel was not without risk, and was seasonally dependant.⁵² In the case of the Red Sea, wind patterns meant it was always difficult to sail to the northern regions, regardless of the season.⁵³ Adams' *Land Transport in Roman Egypt, A Study of Economics and Administration in a Roman Province* (2007) makes the case that in fact, land and sea transport were often different steps within the same exchange network, both with a range of risk and costs. While Adams specifically looks at the impact of land routes in Egypt, he still frames the discussion around the Nile river, discussing land trade specifically as a means to reach it.⁵⁴ However, the evidence of cotton shows that desert caravan routes were connecting regions throughout Africa and Arabia, as will be discussed in detail in chapters five, six and seven.

Historiography of trade with India

Studies of Rome's long-distance trade networks have tended to focus on trade with the east, and particularly on trade with India and other regions of the Indian Ocean littoral, at the expense of the study of other regions.⁵⁵ Because it has been studied so extensively elsewhere, its treatment here will be brief. Exploitation of the monsoon winds by Greek and later Roman merchants opened up direct trade routes from the Red Sea to the southern Indian coast; exactly when this happened is unclear, but these routes were being utilised by the first

⁵¹ Five routes have been found connecting Red Sea port cities to the Nile valley, although they were not all being used simultaneously, from Abu Sha'ar to Kainepolis (Qena), Myos Hormos (Quseir al-Qadim) to Koptos, Marsa Nakari to Apollonopolis Magna (Edfu), Berenike to Apollonopolis Magna, and finally Berenike to Koptos. Wilson 2015, 14. The phases of the two main ports, Myos Hormos and Berenike, will be discussed in chapter five. The cities of the oases in the Western Desert were also connected to a number of cities in the Fayyum and Nile Valley including Apollonopolis Magna, Abydos, Panopolis, and Krokodilopolis. Adams 2007, 30-32.

⁵² Casson 1994, 149-151.

⁵³ Whitewright 2007a.

⁵⁴ In discussing the possibility of longer journeys, he was largely dismissive, claiming, 'At any rate, a 500km journey by land in Egypt is unfeasible. No one would seriously consider travelling such a distance by land in the Nile Valley (this is over half its length), and no part of Egypt lay this far from the Nile'. Adams 2007, 13. The importance of the Nile River to both private and state sponsored commerce is also the focus of Adams 2018.

⁵⁵ Darley 2013, 63.

century AD.⁵⁶ Evidence of materials of Indian origin found in archaeological contexts in the Roman world and vice versa demonstrate the extensive communication networks along which people and goods were moving, reinforced by a number of texts.⁵⁷ As a result, the majority of studies looking at trade between the Roman Mediterranean and the Indian Ocean have been concerned with questions of power relations (was India dependant on Rome or was Rome dependant on India) and the role and level of interference of the state,⁵⁸ the development of the networks and the impact of external influences,⁵⁹ texts that refer to contact through the Indian Ocean,⁶⁰ and the types of goods that were moving through maritime trade networks.⁶¹ There have been few attempts at quantifying the scale of this trade, often relying on assumptions of its importance to both the Roman and Indian administrations, and those that have tend to rely on texts.⁶² The reasons for this lie in the political history of India and the ingrained assumptions that became part of the established scholarly discourse.

Nineteenth-century British imperialism sought to create parallels between the British and Roman empires to legitimise their role as the western inheritors as the world imperial

⁵⁶ The writer of the *PME* attributes the ‘discovery’ of the monsoon winds to an explorer named Hippalos (57.19.2-7), but there is little evidence that such a figure really existed, and his story is likely more of a creation myth to emphasise the opening of an important route. Hatcher 2013; Tchernia 2016. Pliny (*Natural History* 6.100-104) also discusses the monsoon winds, but he calls the winds themselves Hippalos and was likely getting his information from at least two sources: Juba (r. 30-25 BC) referencing older sources and traders from between AD 49-52. De Romanis 1988, 5-13; Tchernia 2016, 231.

⁵⁷ Darley traces the prevailing ‘theoretical concept’ of connectivity back to McCormick’s 2001 *Origins of the European Economy* and its use of material objects found removed from their point of origin and textual references as indicative of ‘broader networks of movement’. Darley 2013, 57.

⁵⁸ For example, Ray 1986; 1989; 1993; 1996a; 1996b argue that Rome was highly dependent on Indian trade infrastructure while Gurukkal 2013 and 2016 argue that India’s organization could not compete with Rome’s and therefore could not have maintained a dominant role in a trade relationship.

⁵⁹ Karttunen 1995; Ray 2000; 2014.

⁶⁰ Casson 1986; 1989; 1990.

⁶¹ Tomber 2000; 2012; 2018; Seland 2011; 2014.

⁶² This is especially emphasised in Ray 1993. Even in works that strive to incorporate archaeological evidence with texts, the texts are presumed to be accurate and demonstrating a high-intensity trade relationship, and therefore the archaeology is treated far less critically. For examples, see Seland 2010; 2014; 2015.

system.⁶³ The significant trade interests of the British Empire in India were initially represented by the British East India Company, largely run by bankers and magnates of shipping and textile production who came to wield substantial power within the subcontinent.⁶⁴ From 1757 until 1858 it was effectively running the country, functioning as a state within a state, and its influence continued even after the Indian Rebellion of 1857 when rule was transferred to the Crown, a period known as the British Raj which lasted until 1947. Adhering to the notion of a cultural hierarchy, colonial British scholars sought to place the European Roman Empire in the position of exploitative dominance over India, mirroring their own trade relationship at the time.⁶⁵ This has particular ramifications for how cotton has been situated within this narrative.

Initially cotton fabric was the main commercial product of the British East India Company, which held monopolies on both the production and distribution of Indian cotton material, setting prices to their own benefit.⁶⁶ By the late eighteenth century, the Industrial Revolution in England meant cotton fabric made of raw made from the Americas in British factories was outperforming Indian cotton and the East India Company had to adopt new policies, typically damaging to Indian producers, to compete.⁶⁷ The result was an ingrained association between Indian exploitation and cotton as a commodity.

After India was granted independence in 1947 and began to make its presence in the global economy felt, the narrative shifted from one where the Roman Empire was exploiting Indian resources and driving economic interaction between the two to one that rejected such implicit Eurocentrism and posited that an unstable Roman economy was actually dependant on eastern trade and the maritime routes of the Indian Ocean as a sources of revenue.⁶⁸ These positions continue to be debated. However, the inherent assumptions in both arguments is that

⁶³ Butler 2012, 34-47.

⁶⁴ Travers 2008, 35-37.

⁶⁵ Rawlinson 1916; Warmington 1928; Wheeler 1954.

⁶⁶ Morris 1983, 561-562; Chaudhuri 1983, 810.

⁶⁷ Clément 2014, 586-594.

⁶⁸ Darley 2013, 96.

the long-distance trade between the Roman world and India was large scale and highly significant to the Mediterranean.

The evidence of trade between communities of the Indian Ocean littoral and Rome is clear. Hoards of Roman coins have been found in India,⁶⁹ and sherds of Roman transport amphorae have been uncovered from excavations of several coastal settlements in the Eastern Indian Ocean.⁷⁰ At the port cities of Berenike and Myos Hormos on the Red Sea, sherds of common Indian ware and Indian rouletted ware, one of which had Tamil-Brahmi characters on them, have been found,⁷¹ as well as fragments of cotton which probably originated in India,⁷² and large quantities of black pepper, beads and teakwood.⁷³ These finds have been used to suggest that there was an Indian community residing on the eastern coast of Egypt,⁷⁴ perhaps within a context similar to Haour's stranger-trader model, discussed below.⁷⁵ There are also several texts that refer to trade along the Indian Ocean, which, while demonstrating the presence of such trade do not indicate the intensity of scale.

Strabo, Pliny and Ptolemy all describe coastal areas of India as trade destinations,⁷⁶ and Pliny in particular describes a drain on currency as a result of large scale trade with India and Arabia.⁷⁷ Strabo claimed 120 ships would sail from the Egyptian Red Sea ports to India every year.⁷⁸ The *PME*, written anonymously in the first century and interpreted as a handbook for merchants, describes trade between the Egyptian coast of the Red Sea and other locals on

⁶⁹ For example, Gupta 1965; 1972; Turner 1989; Ray 1993; Turner and Cribb 1996.

⁷⁰ For an overview of the archaeological evidence of contact between India and the Roman Empire, see Wendrich *et al.* 2003; Tomber 2009; 2018; Sidebotham 2011; Sidebotham and Zych 2012; Seland 2014a.

⁷¹ Sidebotham 2011, 75-76; Salomon 1991.

⁷² Van Waveren and Wendrich 1995; Wild and Wild 2004; 2007; 2014a; 2014b; 2014c; Handley 2011. These fragments will be discussed in greater detail in chapter five.

⁷³ Cappers 1998, 311-319; Vermeeren 1999, 319; Wild 2004, 61; Gurukkal 2013, 185-188; Cobb 2018.

⁷⁴ Tomber 2009, 78.

⁷⁵ See this chapter, 111; Haour 2012, 2013.

⁷⁶ Strabo, *Geography*, 2.5.12, 17.1.45; Pliny, *Natural History*, 6.96-111; Ptolemy, *Geography*, 7.5-6.

⁷⁷ Pliny, *Natural History*, 6.26, 12.41.

⁷⁸ Strabo, *Geography*, 2.5.12.

the Indian Ocean coasts.⁷⁹ P.Vindob.G.40822, already referenced several times, records a second-century loan agreement between an Alexandrian lender and maritime trader in Muziris in India, as well as details of the trans-oceanic route, the camel caravan from the Red Sea coast to Koptos, and the river route up the Nile to Alexandria.⁸⁰ It also records the receipt of goods at the port (either Berenike or Myos Hormos) including Gangetic nard (spikenard) on the verso, and the route goods will take to get from the coasts to Alexandria. There are also ostraka from Koptos recording the clearance of cargoes to be sent across the desert to the Red Sea,⁸¹ and a set of ostraka known as the Nicanor Archive from Koptos acknowledging the receipt of goods from camel caravans from the Red Sea Coast.⁸² And finally, although it does not refer specifically to trade journeys, Book Eleven of the *Christian Topography*, most likely dating to the sixth century and detailing the animals and plants of India, has been used extensively to demonstrate trade between India and the Mediterranean.⁸³

In India, there are Tamil poems that seem to reference trade between India and Rome.⁸⁴ However, other than Pliny's complaint about currency transfer to the east (which may be a rhetorical exaggeration),⁸⁵ and Strabo (explored further in chapter six) there is little information these sources provide regarding the scale and consequence of this trade. There have been two recent studies that comprehensively summarised the existing scholarship

⁷⁹ The veracity of this text is explored in chapter five.

⁸⁰ Harrauer and Sijpesteijn, 1986; Casson 1986; 1990; Thür 1987; 1988. The etymology of the word *σχιδών*, found in this papyrus and taken by some to mean cotton, is discussed in chapter one.

⁸¹ Maxfield 2003.

⁸² Fuks 1951; Tomber 2000, 624; Gurukkal 2013, 185.

⁸³ For example, Kirwan 1972; Ray 2004, 20-21; Sarris 2006, 13; Peacock and Blue 2007: 4; Parker 2009: 89; Seland 2012: 81. The *Christian Topography* was written by an Alexandrian merchant, attributed to a Cosmas Indicopleustes, but the earliest evidence of this attribution does is from the eleventh century, long after the main text was written, and there is no evidence in the text to suggest the author travelled to either India or East Africa past the cape. Kirwan 1972, 169. A historiography of critical reactions to this text can be found in Darley 2013, 109-113, who also argues for a critical reading of the entire work within the context of geographical writing. Darley 2013, 116-119.

⁸⁴ Gurukkal 2013, 182.

⁸⁵ Darley 2013, 87-88.

regarding the evidence of trade on the Indian Ocean, though coming to conflicting conclusions on the significance and wider economic impact on the Roman and early medieval world.

Eivind Heldaas Seland, in his 2014 article ‘Archaeology of Trade in the Western Indian Ocean, 300 BC–AD 700’ in the *Journal of Archaeological Research*, credited Finley as the cause for the widespread downplaying of the scale and significance of long-distance trade in the Indian Ocean, despite the ‘proof’ in ancient sources that significant amounts of goods and money were being exchanged at the port cities dotting the Indian Ocean coasts.⁸⁶ Though he did not attempt a systematic quantification of the evidence available, Seland concluded that:

...the collected volume of imported pottery yet recovered from western Indian Ocean settings would easily fit within a single ancient trading vessel, and we will never be able to quantify the volume of trade. Nevertheless, there is no doubt anymore that Indian Ocean commerce was large scale, long-lived, and extensive in terms of the places, vessels, people, and economic assets involved.⁸⁷

Even while acknowledging the implicit contradiction in the evidence of interaction between Rome and India, Seland maintains the narrative of largescale trade and implied economic significance. The fiscal portion of this argument may be confirmed by Pliny and Strabo; Pliny noted that ships docking in the Red Sea ports were subject to a tax equal to one quarter the value of its cargo, which based on the figures of the ship *Hermapollon* referenced in P.Vindob.G.40822, multiplied by the 120 ships Strabo discusses, would have been a substantial source of tax income for the state.⁸⁸ However, there are reasons to question the Strabo’s numbers,⁸⁹ and it has been suggested that the archaeology is showing something different in terms of material exchange. In her 2013 PhD dissertation *Indo-Byzantine Exchange, 4th to 7th Centuries, A Global History*, Rebecca Darley took a very different view. By comparing the proportions of Roman finds in Indian contexts against the finds of local

⁸⁶ Seland 2014a, 386.

⁸⁷ Seland 2014a, 386.

⁸⁸ Wilson 2015 examines these calculations.

⁸⁹ Fauconnier 2012, in examining the intensity of Greco-Roman led trade in the Indian Ocean, concludes that there is no way of verifying Strabo’s numbers; the available evidence points to the presence of Greco-Roman traders and ships, but there is no way to quantify their presence.

Indian finds, primarily coins and ceramics, she concluded that while there was evidence that the contact between the Roman world and India changed from the first to seventh centuries, there is little evidence that the networks of the Indian Ocean were as consequential to either Rome or India in terms of intensity of cultural interaction as had been generally assumed.⁹⁰

The issue of scale of trade between the Roman world and Indian Ocean communities, especially those in India, is also important in understanding the development of cotton as a global commodity. While the prevailing narrative of Rome's extensive trade relationship with India was being devised in the nineteenth and early twentieth centuries, several texts and papyri from Egypt mentioning cotton were translated and immediately read as evidence of trade along this network,⁹¹ and that cotton was commonly used throughout the Roman Empire.⁹² Subsequent finds of cotton from archaeological excavations were interpreted within this narrative,⁹³ the link between India and cotton having long been established; as cotton was seen as having originally come from India, and as Indian trade seemed to have been significant, cotton must have been frequently traded along the route. This narrative has had surprising longevity in the face of increasing archaeological evidence to the contrary (examined in greater detail in chapters five and six), but may in part be because Africa continues to be relegated to a subordinate position in discussions of transmission and diffusion in the ancient world. The continued emphasis on long-distance trade in luxury goods on the Indian Ocean has created a self-reinforcing narrative of exchange within these areas to the detriment of other types of trade that were demonstrably also occurring, and may have had a greater impact on the development of trade networks throughout the transitions of the first millennium.⁹⁴ The case of another

⁹⁰ Darley 2013, esp. 398-402.

⁹¹ Both Warmington 1928, 210-12 and Griffith and Crowfoot 1934, 5-12 refer mainly to classical literary sources. The issues with the terms used in these texts was discussed in chapter one. Winter and Youtie 1944, 249-258 looks at SB 6.9025 and SB. 6.9026, both of which use forms of ἐπιόξυλον.

⁹² Winter and Youtie 1944, 250-251.

⁹³ Discussed in chapter six.

⁹⁴ Some of examples of works that stress the importance of Indian Ocean trade on the Roman economy, see Warmington 1928; Wheeler 1954; Casson 1989; Sidebotham 1996; 2011; Young

region rich in natural resources and linked to regions of the Roman empire through both direct and indirect trade networks, Africa, illustrates this problem.

Historiography of trade with Africa

The uneven treatment between the further reaches of the Roman trade zones is particularly evident in discussions of the African continent, where Egypt and East Africa have been well integrated into discussions of long-distance trade as ports for the Red Sea and Indian Ocean traders, but North Africa tends to have its economic agency and contributions limited to agricultural output (and the concurrent goods that travelled with them, such as the ever ubiquitous African Red Slip Ware and cook-ware from North Africa) while the Saharan and sub-Saharan regions are generally treated as incidental occasional providers of exotic materials and slaves. Despite the increasing literature on both Egypt and North Africa, regions that have come to be known as ‘the bread basket’ of the Roman world because of the scale of their grain production which was redistributed throughout the empire, in general Africa continues to remain isolated in discussions of trade in the ancient world. The reasons for this, as in India, stem from Africa’s colonial history, and the ramifications continue to influence historical discussions.

Herodotos, Pliny, and Strabo all wrote of North Africa (including Egypt), and superficially the Sahara based on reports from trade journeys and occasional raids across the deserts, but provided very little information on West Africa.⁹⁵ East Africa was discussed by the second-century geographer Claudius Ptolemy and the anonymous *Christian Topography*.⁹⁶

2001; Whittaker 2004; McLaughlin 2010; Fitzpatrick 2011 while emphasising that Rome did not control maritime interaction on the Indian Ocean; Power 2012 but as an extension of the Red Sea, which also facilitated interaction between East Africa and Arabia, and as a prelude to increases in the early Islamic period; Seland 2014a.

⁹⁵ Herodotos, *Histories*, 4.181-185; Pliny, *Natural History*, 5.1-11; Strabo, *Geography*, 17.1-3.

⁹⁶ Ptolemy, *Geography*, book 4 is on east Africa, while book 1 covers Egypt. Ptolemy used the earlier works of Hipparchus of Nicaea (second century BC) and Marinus of Tyre (c. 100 AD), as well as the accounts of travelers and merchants in his work. Geus 2013, 219. He may have also used official Roman administrative documents in Alexandria, Ptolemy’s own city of

However, it is doubtful whether any of these authors had much personal knowledge of these regions, with the exception of Strabo who travelled through Egypt and Ethiopia.⁹⁷ Pliny had been using the writings of Juba II of Mauretania as source material,⁹⁸ and in addition to ruling a North African kingdom, it has been suggested that Juba participated in exploration of the African continent,⁹⁹ recorded in fragments that made up a treatise known as *Libyca*. From the surviving fragments, this work seems to have been divided into several books describing the flora and fauna, geography, and possibly also the inhabitants of the northern regions of Africa.¹⁰⁰ And the *Periplus of Hanno* is perhaps another exception, purportedly a translation of a tablet the Carthaginian explorer Hanno is said to have hung upon his return from a sea voyage down the western coast of Africa recounting his journey;¹⁰¹ although, the veracity of this text has been questioned.¹⁰²

It was not until the Muslim expansion into Africa and the general rise in popularity of Arab geographic and travel literature that Africa began to be written about on a greater scale by people who had either travelled there or were able to source first-hand accounts. However, writers such as Al-Mas'ūdī (c. 896-956), Al-Bakrī (c. 1014-1094) and Ibn Baṭūṭah (1304-1368/69), though historians as well as geographers, were not historians of Africa, and their writings concern particular regions of the continent at particular points in time; they did not attempt histories showing how such regions had changed over time.¹⁰³ Nevertheless, these accounts continued to be used by European historians and geographers seeking to incorporate

origin. The *Christian Topography* also includes an account of Aksum (The *Christian Topography*, book 2).

⁹⁷ Although Ptolemy was from Alexandria, it is not suggested that he travelled to the places he described in his writing; his *Geography* was based on earlier treatise by Marinus of Tyre.

⁹⁸ See this chapter, fn. 56.

⁹⁹ Gozalbes Cravioto 2011.

¹⁰⁰ Roller 2003, 191. The surviving fragments have been collected in translated in Roller 2018.

¹⁰¹ The earliest copy of the text is found in the tenth-century Codex Palatinus Graecus 398 (55r-56r) held at the Heidelberg University Library, which also contains copies of the anonymously written *PME* (40v-54v) and the *Periplus of the Euxine Sea* (30v-40r) by Arrian. Darley 2013, 126.

¹⁰² See Germain 1956; Hair 1987; Clark 1998, 95-97.

¹⁰³ Fage 1981, 26; Insoll 2004.

Africa into their own writings, and maps drawn by al-Idrisi (1100-1165) and later Leo Africanus (born al-Hasan ibn Muhammad al-Wazzan al-Fasi, c. 1494-1554) were copied by European cartographers until the late sixteenth century.¹⁰⁴

The interior of Africa remained largely unknown to the west until the European ‘Age of Exploration’ in the fifteenth century, which resulted in several popular written accounts describing the continent, though even then aspects of the physical landscape remained a barrier (both real and imagined) to European investigation of the continent. Such explorations began with the coastal regions which offered entrée to trade with the societies on the Atlantic and Indian Ocean coasts, though this did not change attitudes towards areas beyond the coasts. In his account of his time on the West Coast, the French explorer Jean Barbot (1655-1712) wrote that he had been told of the ‘treacherous disposition of the inhabitants’ of the interior, and the ‘ravenous wild beasts which swarm those countries... [and] deter the boldest and most resolute man from undertaking such journeys’.¹⁰⁵ The depiction of an untamed landscape fed into the prevailing racism of the time and mapped the common conception of Africa created by white Europeans. Philip Dormer Stanhope, Fourth Earl of Chesterfield (1694-1773), wrote in a letter to his son that ‘the Africans are the most ignorant and unpolished people in the world, little better than lions, tigers, leopards and other wild beasts, which that country produces in great numbers’.¹⁰⁶ The African continent was seen as empty of civilisation and therefore devoid of history prior to the arrival of white Europeans, a dangerous and unknown environment. As Georg Hegel argued in his 1837 volume, *The Philosophy of History*:

Africa proper, as far as History goes back, has remained — for all purposes of connection with the rest of the World — shut up; it is the Gold-land compressed within itself — the land of childhood, which lying beyond the day of self-conscious history, is enveloped in the dark mantle of Night... At this point we leave Africa, not to mention it again. For it is no historical part of the World; it has no movement or development to exhibit. Historical movements in it — that is in its northern part — belong to the Asiatic or European World. Carthage displayed there an important transitional phase

¹⁰⁴ Hallett 1963, 191.

¹⁰⁵ Barbot, trans. in Churchill and Churchill 1732, 187.

¹⁰⁶ Stanhope XC, 119; Hallett 1963, 199.

of civilization; but, as a Phoenician colony, it belongs to Asia. Egypt will be considered in reference to the passage of the human mind from its Eastern to its Western phase, but it does not belong to the African Spirit. What we properly understand by Africa, is the Unhistorical, Undeveloped Spirit, still involved in the conditions of mere nature, and which had to be presented here only as on the threshold of the World's History. Having eliminated this introductory element, we find ourselves for the first time on the real theatre of History. It now only remains for us to give a prefatory sketch of the Geographical basis of the Asiatic and European world.¹⁰⁷

Here Hegel highlighted the difference in treatment between Africa and Asia, including India, and how they would be treated in the historiography of the time; Asia was on par with Europe, and Africa was not. The growing 'scientific revolution', preceded by both the Enlightenment and the Renaissance, was perceived as the natural progression of Graeco-Roman heritage and therefore European history was the source of understanding of world connections.¹⁰⁸

However, this did not deter the European powers of the time from competing for control of the abundant natural resources of Africa regardless of the native populations, and rivalry for primacy in the exploitation of the continent resulted in many expeditions beyond the coastal regions.¹⁰⁹ The interest (and enmity) of the European states eventually permeated into the popular imagination and the image of Africa became one of 'sites of timeless truth, objects of longing for deep antiquity and of melancholic reflection on its decadence'.¹¹⁰ The themes of an inhospitable landscape and dangerous animal life reinforced the narrative of an impenetrable and isolated continent. In 1810, writing in the *Proceedings of the African Association* the English geographer and historian James Rennell (1742-1830) wrote:

Penetrated by no inland seas, like the Mediterranean, Baltic or Hudson's Bay; nor overspread with extensive lakes, like those of North America; nor having, in common with other continents, rivers running from the centre to the extremities, but, on the contrary, its regions separated from each other by the least practicable of boundaries, arid deserts of such formidable extent, as to threaten those who traverse them, with the most horrible of all deaths, that arising from thirst! Placed in such circumstances, can we be surprised either

¹⁰⁷ Hegel 1837, 109-117.

¹⁰⁸ Fage 1981, 30.

¹⁰⁹ Hallett 1963, 195-196; Beinart 2000, 271.

¹¹⁰ Scheele and McDougall 2012, 2.

at our ignorance of its interior parts, or of the tardy progress of civilization in it?¹¹¹

Such views persisted even into the twentieth century, when in 1913, historian Charles Prestwood Lucas (1853-1931) wrote ‘the geographical configuration and natural features of Africa’ made ‘it singularly difficult of entry whether by land or sea’.¹¹² Even as travel into the interior increased, as well as the travel narratives that followed, myth mixed with fact regarding Africa, its native population, and its history endured.

The construction of Africa by historians of the colonial period relied uncritically on the assumptions and racial prejudices of their earlier counterparts, many of whom had themselves never set foot in Africa.¹¹³ The native Africans were portrayed as unsophisticated, unable to adapt their environment to their needs as Europeans envisioned they themselves had, and without a sense of progress. This in turn influenced colonial assumptions regarding the destructiveness of African agricultural practices, portrayed simply as a process of brute force ‘levellers’,¹¹⁴ rather than reflecting the true adaptation and innovation imbedded within African cultivation practices. Much of this narrative was perpetuated by European missionaries in Africa, who, unlike the traders who first penetrated the coastal regions, were attempting to change African society,¹¹⁵ but they were also responsible for some of the earliest attempts at writing actual historical accounts of the regions they were in. The result has been a historical partition of Africa based on the religious and cultural distinctions found by the missionaries and early explorers, which have persisted into academia. In particular, North Africa and Egypt are often treated as part of the Mediterranean, separated from ‘Africa’ by the empty expanse of the Saharan Desert.¹¹⁶

¹¹¹ Rennell 1810, 211-212.

¹¹² Lucas 1913, 8-9.

¹¹³ Afigbo 1993, 42.

¹¹⁴ Beinart 2000, 277.

¹¹⁵ Fage 1981, 28.

¹¹⁶ Afigbo 1993, 42; Scheele and McDougall 2012, 4.

Saharan and sub-Saharan communities were therefore removed from any connection to the civilisations of the ‘Romanised’ world of the Mediterranean, and remained the ‘Dark Continent’.¹¹⁷ The southern regions were further divided between the east coast (mainly discussed in terms of Indian Ocean trade and the impact this had on the development of global trade networks),¹¹⁸ the west coast, and the interior. The written history of the latter two began in the tenth century with the Muslim expansion and its later reception was shaped by the series of armed conflicts between the European colonial rulers and locals in the mid-nineteenth century.¹¹⁹ Such partitioning is still found in current scholarship. But what has changed through the course of twentieth century and into the twenty-first century, gradually at first but rapidly accelerating in the past forty years, is the recognition of Africa’s long and rich history, and the changing perspective on the Eurocentric framing of Africa and its external relationships. A large part of this is due to the rise of African environmental history as a discipline and its role in re-evaluating colonial tropes such as ‘degradation’ and ‘decline’, and an increasing interest in the intersection of environmental history and economic development.¹²⁰ This will be explored further in chapters five and six.

This frame is important in understanding the current scholarship on trade in late antiquity and the role of Africa’s participation in commercial networks. For the African continent, by far the most space has been devoted to Egypt (followed by North Africa more generally), treated both as a unique case study, and a significant producer within the wider Mediterranean system.¹²¹ This is partly the result of the huge corpus of papyri that have been uncovered, as discussed in chapter one,¹²² and partly on the legacy of the wider fascination

¹¹⁷ Afigbo 1993, 42.

¹¹⁸ Afigbo 1993, 42.

¹¹⁹ Soares 2014, 29.

¹²⁰ Carruthers 2004, 385-391.

¹²¹ Rathbone 2002, 157.

¹²² Bagnall 2005, 187. However, as detailed earlier, discoveries of large amounts of papyri from sites throughout the Levant and Middle East reflect similar concerns and issues in the documentation as those in Egypt, indicating that neither the issues nor the practice of documentation were unique to Egypt. In fact, as stated by Bagnall, hardly any sites have been

Pharonic Egypt continues to instil. Consequently, Egypt and North Africa have been subject to their own models as parts of the ‘Romanised’ world. This will be examined in greater detail in chapters five and six, but the basic framework these models have historically taken have been formed by the idea that trade relationships were dominated by Roman centres on the Mediterranean.

Modelling the Egyptian economy

The abundance of written evidence from Egypt and the preference of early historians (such as Rostovtzeff and Finley) to use documents over archaeological evidence has resulted in an over-reliance on papyri in discussion of the Egyptian economy, with lagging consideration of integration with studies of other material remains; indeed the majority of studies looking exclusively at the late antique Egyptian economy have been conducted by papyrologists.¹²³ The number of documents and the information they contain in the past created a perception of the ‘specialness’ of Egypt in considerations of the wider Mediterranean and exchange relationships. Consequently, new examinations of the Egyptian economy have been predicated on the publishing schedule of new collections of papyri.¹²⁴ This is not to say the information contained in the papyri has not been important in understanding the development of the Egyptian economy. Until the late 1960s and Naphtali Lewis’ 1968 publication of *Inventory of Compulsory Services in Ptolemaic and Roman Egypt*, it had generally been

excavated without finding at least some papyri, though finds of writing are rarer in the west due to climate conditions. Bagnall, 2005, 189. As noted, ostraka from Bu Njem in Libya and the Vindolanda tablets from Britain suggest that similar transactions and facets of life were documented, and such writings were not restricted to the societies of Egypt and the Near East.

¹²³ Van Minnen 2007; 207. For example, see, Lewis 1983; Bowman 1986; Keenan 1985; 1993; Rathbone 1991; 2002; Bagnall 1992; 2005. It should be noted that the late 1980s represented something of a turning point in the integration of papyrological and archaeological evidence, following observations on the field made in Bagnall 1988, and many papyrologists, including Bagnall and Rathbone, have led their own expeditions into the field. Van Minnen 2010, 443.

¹²⁴ The lack of published papyri from the late Roman period was blamed for the lack of discussions of the late antique economy in Egypt during the renewed interest in economic studies in the 1980s. Kennan 1985, 23-24. This gradually changed as a number of archives were re-examined in the 1990s within the context of each other. For example, see Rathbone 1991; Kehoe 1992; Alston 1995.

accepted that there was administrative and economic continuity from Ptolemaic to Roman to Byzantine Egypt.¹²⁵ What Lewis showed was that there was a marked difference after Trajan (r. 98-117), when local individual offices became the norm, and consequently the late Roman and Byzantine economies could not be treated as a single linear progression. Lewis' more comprehensive 1983 *Life in Egypt under Roman Rule* fell short of proposing a model for the Roman Egyptian economy, but lay a foundation to be taken up and explored by later scholars with themes of rural subsistence agriculture, heavy taxation, slave labour organisation, and private maritime commerce.

Egypt has since been subject to the same debates of modelling as the rest of the ancient world, although the amount of papyrological evidence has also enabled increased attempts at quantification.¹²⁶ Debate over whether observed growth in the Egyptian economy was the result of an increasing population (which eventually grew so large it succumbed to diminishing returns)¹²⁷ or was the result of demonstrable economic gain (through technological and trade advancements)¹²⁸ has led to several in-depth studies of the demographics.¹²⁹ Rather than the 'proto-feudal state' described by earlier scholars where economic growth and social mobility were suppressed by the interests of the elites and heavy taxation after the reforms of the third century,¹³⁰ these studies have shown something different. Examination of land and tax registers demonstrate that rural areas participated in diverse economic activities to enhance their own economic position;¹³¹ by the late Roman period, even peasants in the rural areas of the valley were participating in the monetised economy,¹³² and the economy of Roman Egypt seems to

¹²⁵ Bagnall 2005, 192.

¹²⁶ For example, Bagnall 2005; Carrié 1997; Bowman 2009; Harper 2016.

¹²⁷ As argued in Frier 2001; Lo Cascio 2009.

¹²⁸ For example, Wilson 2006; Jongman 2007; Boozer 2015b.

¹²⁹ Scheidel 2001; 2002; Alston 2001; 2002; Pudsey 2011; after Bagnall and Frier 1994.

¹³⁰ Described in Bagnall 2005, 190. The historiography is laid out in Keenan 1993, 141-144.

¹³¹ Bowman 1985; Bagnall 1992

¹³² Rathbone 2002, 162.

have not been very different from the rest of the Roman system.¹³³ Its role within this system, as both a production and consumer centre, has resulted in the adoption of a variety of contextualisation approaches.

As a generality, it appears that the population of Egypt grew in the early Roman period,¹³⁴ but throughout wider late antiquity phases of expansion were interspersed with abrupt population changes. Various proposals for the causes of these interruptions have examined both the effects of disease—and in particular three disease events: the Antonine plague (c. AD 165-180), the Cyprian plague (c. AD 250-270), and the Justinianic plague (AD 541)—¹³⁵ combined with climatic events.¹³⁶ The Cyprian plague, named for the early bishop of Carthage (AD 248/249-258) who wrote of it,¹³⁷ coincided with what has been dubbed the ‘crisis of the third century’. While the narrative of the third century as one of civil war, economic depression,¹³⁸ and political instability leaving the Roman Empire on the brink of

¹³³ For this reason it has been suggested by papyrologists that the documents from Roman Egypt could help to provide a model for the rest of the empire. Rathbone 2002.

¹³⁴ Van Minnen 2007, 209

¹³⁵ Harper 2016, 806. The pandemic during the reign of Marcus Aurelius (AD 161-180 and whose family name, Antoninus, gave the pandemic its name) has been the source of much debate. Some have argued that the Antonine plague devastated Roman Egypt with a mortality rate commonly estimated to be between ten and thirty percent. Duncan-Jones 1996; Scheidel 2002; Harper 2016, 2017: 100-115. It was noted that leading up to the pandemic, land prices, rents and wages were all increasing, with real wage growth outpacing the others and indicating intensive growth to coincide with the population expansion; after the pandemic, the population decrease led to a decline in rents, though only a small increase in wages as the demand for labour was offset by reduced market activity. Harper, 2016, 806. However, figures for mortality rates are highly speculative, and

¹³⁶ Haldon *et al.* 2018a, b, and c, a review of Harper 2017 in three parts, critically evaluates the evidence of high mortality rates of these disease events, and notes that there is very little information on which to base the assumptions, instead arguing that there was likely a confluence of events that lead to demographic change that included environmental and social factors.

¹³⁷ Harper 2016, 806.

¹³⁸ For example, the Romans had previously allowed Egypt to retain its own monetary system based on the silver *tetradrachm*, equated to the Roman *denarius* even though the silver content was much lower, providing stable currency conversion through the third century. In some cases, coins were not silver alloys at all, but were gilded in silver. It is unclear how the process of exchange for such coins functioned. Beginning in AD 250, mints ceased to issue new *sesterces* or *denarii* and old coins were melted down, with the *antoninianus*, equivalent to two *denarii*, the only silver coin in circulation. An attempt at reform by the emperor Aurelian (270-

collapse has been largely rewritten to acknowledge the regional variation within the empire,¹³⁹ it remains clear that in the middle of the third century, between the reigns of Decius (r. 249-251) and Aurelian (r. 270-275) and up to the beginning of the reign of Diocletian (r. 286-305), significant forces were contributing to changes in the social and economic structures of the Mediterranean.¹⁴⁰ In Egypt, this was reinforced by a papyrus, P.Oxy.12.1411 (AD 260) in which the *strategos* ordered all those involved in financial and commercial transactions to accept the new imperial coinage, suggesting a widespread currency collapse.¹⁴¹ Additional collections of documents demonstrate extreme variability in prices, rents and wages,¹⁴² and the loss of monetary independence after Diocletian enacted his reforms beginning in AD 284.

However, Egypt remained an important source of many staple goods for the rest of the empire, most importantly grain, but also olive oil, wine, textiles and minerals. Recent studies of the operation of the Egyptian economy have focused on the scale of rural production and the structure of land ownership,¹⁴³ but little on its role in non-agricultural production for export.¹⁴⁴ Egypt's position between the Indian Ocean and the rest of the Roman world also

275) in 274 failed and caused prices to rise sharply, precipitating a monetary collapse. See Haklai-Rotenberg 2011; Harper 2016.

¹³⁹ Bowman and Wilson 2009, 52. In the decades leading up to the Justinianic Plague, the first instance of bubonic plague to hit Egypt which had an estimated mortality rate of approximately one-third, although sources vary (Little 2007), wheat prices rose while rents and wages seemed to hold steady or decline as the population increased; after the plague, this trend reversed itself, and wheat prices fell while wages, land prices and rents all increased (Harper 2016: 808). Demographic trends compared to prices, wages, and rents therefore show that population growth and economic growth were not necessarily linked, and that there was great variation in the late Roman Egyptian economy. Hobson 2015 examines this time period from a socio-economic perspective, and concludes that by the Vandal period, there had been a period of urban and economic growth built on diversified agriculture and commerce.

¹⁴⁰ Haldon *et al.* 2018a, b, and c argue that reliance on the plague narrative does not adequately explain that changes that occurred in the third century, and suggests wider environmental forces than the cycle of the Nile floods should be considered in conjunction with socio-economic and cultural history.

¹⁴¹ Bowman and Wilson 2009, 51-52.

¹⁴² Van Minnen 2007, 209; Harper 2016, 808.

¹⁴³ Rathbone 1991; 2002; Bagnall 1993; 2005; Sarris 2006.

¹⁴⁴ Sarris writes that the high-density urban areas may have actually been a disincentive in Egypt towards production of long-distance export, despite the ability to produce on a large scale. Sarris 2006, 11, 195-197.

raised its significance as the middleman between Rome and the east.¹⁴⁵ Likewise, Egypt's large population and density of urban areas were also markets for goods and foodstuffs produced throughout the empire, and trade was not in a single direction.¹⁴⁶ Whereas scholars previously had believed that the ease of transport along the Nile and relative low cost meant that overland trade, facilitated by camels and donkeys, was marginal at best,¹⁴⁷ the discovery and excavation of towns and villages in both the Eastern and Western deserts as well as the port cities along the Red Sea coast indicate that caravan routes were also important in facilitating trade for Roman economic centres.¹⁴⁸ Berenike and Myos Hormos on the Red Sea were hubs for goods from the east while Mons Claudianus and Mons Porphyrites further inland were significant for their mines,¹⁴⁹ and the oases of the Western Desert provided staple foodstuffs.¹⁵⁰ As will be seen in chapter five, Nubia has been included within this aspect of the system, depicted as a subsidiary to Egypt, useful for its access to the African interior. This construction of the Egyptian economy centres on access to the Nile and its role as a trade corridor, but so far here has been little study of possible interactions between regions that did not involve the Nile Valley centres.

North Africa, Aksum, and the Roman Empire

While historically not receiving as much scholarly attention as Egypt, both North Africa and the Kingdom of Aksum have recently been the subject of a number of studies that looked at their respective relationships with the Roman Empire, the former as a province, the later as a trade 'middle man' and economic dependant, and both for roles as goods and resource providers. The historiography of late antique North Africa and the Kingdom of Aksum, like

¹⁴⁵ For example, Sidebotham 1996b; 2009; Burstein 2001; Seland 2011; Tomber 2012.

¹⁴⁶ Kingsley and Decker 2001, 4-5; Bagnall 2009.

¹⁴⁷ For example, Lewis wrote that 'overland transport was often only a stage preceding or following shipment by water'. Lewis, 1983, 142.

¹⁴⁸ Bagnall noted the role of the Nile in facilitating the accumulation of wealth via commerce, both in agricultural goods produced in Egypt and in the transport of goods from the Red Sea. Bagnall 2005, 197.

¹⁴⁹ Bagnall 2005, 196.

¹⁵⁰ Bagnall 2008a, 116; 2016, 31.

that of India, is intrinsically linked to the colonial and post-colonial discourse, as well as burgeoning nationalism after the countries of North Africa gained their independence, or were restored to independence in the case of Ethiopia, following the end of World War II.¹⁵¹ The colonial governments had sought to depict themselves as the inheritors of the Roman legacy and ‘Roman’ Africa, a connection meant to justify their colonial rule,¹⁵² similar to the British approach to India. The earliest excavations of Roman period Africa tended to be carried out by the colonial armies, the local colonial governments, and government servants,¹⁵³ clearing and publishing large sites with varying degrees of scientific detail in what David Mattingly and Bruce Hitchner referred to as the ‘archaeology of empire’.¹⁵⁴ Consequently, many of the earlier studies focused on the process of ‘Romanisation’ and ‘civilizing’ of the native peoples.¹⁵⁵

After the rise of independence movements in North Africa post World War II, this began to shift, and by the 1970s it was instead popular to emphasise indigenous defiance to Roman rule and class distinctions that fuelled it.¹⁵⁶ In both instances the contemporary political climates were being projected back into history; in particular, the discussion began to focus on the differing peoples of Roman North Africa and the interactions between nomadic and settled communities.¹⁵⁷ The mountains and frontiers became seen as regions of resistance of the native nomads to the conquering settlers,¹⁵⁸ areas characterised by overlapping social, ethnic, religious and linguistic communities functioning in the liminal spaces between the ‘barbarians’ outside the borders and ‘civilisation’ within.¹⁵⁹ The backward projection of modern political

¹⁵¹ Mattingly and Hitchner 1995, 169; Cordovana 2012, 459; Vanacker 2014, 98.

¹⁵² Mattingly and Hitchner 1995, 169; Munzi 2006, 73-74; 2012, 81; Vanacker 2014, 98; Mattingly 2016, 11-12.

¹⁵³ Vanacker 2014, 98

¹⁵⁴ Mattingly and Hitchner 1995, 169.

¹⁵⁵ Cordovana 2012, 459 For example Broughton 1929.

¹⁵⁶ Mattingly and Hitchner 1995, 170; Cordovana 2012, 460; Vanacker 2014, 98; Versluys 2014. For example, Laroui 1970; Thébert 1978; Shaw 1995.

¹⁵⁷ Vanacker 2014, 98.

¹⁵⁸ Vanacker 2014, 99.

¹⁵⁹ Elton 1996; Cordovana 2012, 458.

divisions and borders persists in discussions of the ‘Romanisation’ of North Africa,¹⁶⁰ and its history in the development of global trade is still framed by discussions of the Roman economy, although, as will be shown, methodological and archaeological advances in the study of the Sahara may be beginning to change this.

The historical situation in Ethiopia, site of the ancient empire of Aksum, was somewhat different. The region was one of the few in Africa to largely maintain (deferential) independence from European powers, but its modern political borders were created by the nineteenth-century expansion of colonialism around it, cutting across ‘ancient and diverse socio-cultural, economic, ideological and linguistic landscapes’.¹⁶¹ Eritrea, along the northern coast of Ethiopia and which had also been within the territory of Aksum, did not share in Ethiopia’s political fate, and was an Italian colony from the 1880s to the 1940s, after which it became a part of Ethiopia. When Eritrea declared its independence following a long period of conflict, it sought create a distinct identity from Ethiopia, despite the many aspects of shared heritage, and this is reflected in modern scholarship which tends to emphasize the differences between ‘Eritrean Adulis’ and ‘Ethiopian Aksum’, even as it becomes clear their independent histories were more intertwined.¹⁶² The political history of Adulis and Aksum will be returned to shortly, but in terms of the study of the Aksumite empire, successive wars and political instability in the twentieth century have resulted in loss of material culture and interruptions of archaeological excavation since the first major excavation was undertaken in 1906.¹⁶³ When

¹⁶⁰ Cordovana 2012, 458.

¹⁶¹ Finneran 2007, xv.

¹⁶² Finneran 2007, xvi.

¹⁶³ Pankhurst 1999 describes the British incursion in 1868 below Maqdala mountain and subsequent looting of the royal treasury and principal churches (noting that the British Library acquired at least 350 Ethiopian manuscripts from the raid), as well as the Italian fascist occupation from 1935 to 1941 which saw many artefacts sent to Italy, and repatriation attempts. Peacock and Blue 2007a, 1 discusses disruptions that have occurred due to armed conflicts in the region from the War of Eritrean Independence between 1961 and 1991, the concurrent Ethiopian Civil War from 1974 to 1991, and the Eritrean-Ethiopian War from 1998 to 2000; the final peace treaty for this conflict was only recently agreed in 2018. For a history of excavation, see Darley 2013, 168.

Aksum appeared in Greek texts, particularly after the fourth century conversion of King Ezana to Christianity, it was seen as confirmation of the regions development as a response to Indian Ocean trade.¹⁶⁴

Sub-Saharan and Saharan Africa were known to many Roman writers, and those from North Africa may have had interactions with the peoples from these regions.¹⁶⁵ When these regions appear in Roman writings, it is from the perspective of an outsider (often without first-hand knowledge of the area), lacking in insight to the social, political or economic relationships of the local communities; often time the cultural superiority of the Romans was emphasised, with the native populations outside the province of North Africa depicted in a derogatory light.¹⁶⁶ Nineteenth-century studies that relied on these accounts in their constructions of Africa in the Roman period accepted these assertions, without the aid of the archaeological excavations which would later illustrate the social and economic vitality of the region.¹⁶⁷ The spread of Christianity into North Africa and beyond resulted in the province and its frontiers appearing more in the written documents, but these tended to be written by religious figures, and were therefore dominated by discussions and arguments of religious doctrine and practice.¹⁶⁸ As the Romans implemented systems designed to regulate the Latin-speaking towns and rural estates within the North African province and their neighbours,¹⁶⁹ their interactions with the Saharan communities increased as well.

¹⁶⁴ These texts are addressed in the next section and in chapter six.

¹⁶⁵ See this chapter, 93.

¹⁶⁶ They were depicted as a product of their wild environment rather than dominating the environment to suit their needs, as the Romans portrayed themselves as doing. Vanacker 2014, 101.

¹⁶⁷ Shaw 1980. Although Shaw acknowledged the importance of the catalogues of inscriptions discovered in North Africa, he noted the potential of archaeology to reveal greater structural knowledge of both the urban and rural environment.

¹⁶⁸ Sears 2011, 11; Connah 2015, 47. For example, the writings of Tertullian (c. AD 155-c. 240) from Carthage and Augustine of Hippo (AD 354-430) from Numidia were both concerned with the development of church doctrine, not recording the social construction of North Africa and its neighbours.

¹⁶⁹ Stone 2014, 565. Productive agriculture developed during the Carthaginian period, resulting in surplus grain and other foodstuffs that were available for export. Connah 2015, 47. The

Modelling the North African and Aksumite economies

Roman North Africa in the past was typically placed within the structure of an overall imperial strategy that resulted in significant political and economic intervention,¹⁷⁰ involving increasing organised urbanisation, forcing the native nomadic people to adopt a settled lifestyle in a defined space where their movements could be controlled, and an overall process of ‘Romanisation’.¹⁷¹ This was thought to have resulted in increased militarisation in the pre-desert and recurring conflicts with the nomadic tribes, especially as landholding in Roman Africa became associated with wealth.¹⁷² It was framed as a top down process where Roman elites and officials forced social, political and economic change onto the conquered peoples of North Africa and exerted continued pressure on their economic interests to maintain control. Such theories are reflected in discussions of cultural as well as material changes too; in the example of cotton, its spread is often attributed to Roman demand and incentivisation as its area of influence grew.¹⁷³

As the areas of North Africa continued to be excavated through the 1980s and 1990s, this construction fell out of favour, with new data revealing dynamic social and economic interaction throughout Roman Africa, based on cooperation and mutual interest. While there were several small rebellions against the Romans, rather than wiping out the rebellious tribe once they were defeated the Romans would either place the tribe under military supervision or subject them to a treaty using the threat of further aggression to ensure adherence.¹⁷⁴ In advancing their own interests, the Romans sought to undermine the creation of a confederation

presence of Latin-speaking communities is documented through the development of new urban areas and extensive finds of inscriptions. Leone 2003.

¹⁷⁰ For recent examples, see Lo Cascio 2006 and 2007.

¹⁷¹ For discussions and bibliographies of the debate of the term ‘Romanisation,’ its application to different regions of the Roman world, and the context of its use going back to the nineteenth and early twentieth centuries, see Thébert 1978; Mattingly (ed.) 1997; Woolf, 1998; Hingley 2008; 2013; Cordovana 2012; Versluys 2014; Lulić 2015.

¹⁷² Hobson writes that by the first century, wealth and land acquisition in North Africa were closely linked. Hobson 2015, 43, 62.

¹⁷³ This is thoroughly examined, and discounted, in the course of chapters five, six, and seven.

¹⁷⁴ Mattingly 1992, 47.

to tribal resistance to ‘avoid warfare and to promote socioeconomic and political development’¹⁷⁵ through a variety of diplomatic means—giving assistance and refuge to allies, arbitrating disputes, promotion of local elites, and recruitment into the Roman military— while also managing to exert power outside of their territorial zones.¹⁷⁶ Thus the process of Roman expansion into North Africa was not linear, but differed by region and over time.¹⁷⁷

A distinction between nomads and settled peoples is also not reflected in the material culture or archaeological evidence, instead showing that there was significant interaction and cooperation between the two, blurring the lines between two individual communities.¹⁷⁸ Where conflicts did arise, it was in response to differing cultural attitudes towards land and authority as the Roman made what had been considered public land, or at least land of ambiguous ownership, into private land and large tenant estates. As Orietta Cordovana further illustrates through several inscriptions describing local *conductors* in economically and socially important roles, it was in fact local elites and leaders who pushed for more integration with the Romans.¹⁷⁹ While urbanisation remained concentrated in the coastal areas and adjacent hinterlands, settlements and forts increasingly appeared in the pre-desert and desert regions. The reasons for both of these developments seem to have been the same, trade.

The long Mediterranean coast of the North Africa gave easy access to merchants from across the Mediterranean region, and the ability to export large amounts of agricultural products were important to both the economy of the region and the wider Roman world,¹⁸⁰ the result of increased demand from the Italian peninsula. Studies of North African ceramics have been used to illustrate the reach of goods from the province. North African amphorae,

¹⁷⁵ Mattingly 1992, 46.

¹⁷⁶ Mattingly 1992, 43-50.

¹⁷⁷ Sears 2011, 144-149.

¹⁷⁸ Cordovana 2012, 471.

¹⁷⁹ Cordovana 2012, 473-474.

¹⁸⁰ Grain was of course the largest contributor, but North Africa also exported significant quantities of olive oil, wine, *garum* and other commodities. Stone, 2014, 366; Connah 2015, 65. For olive oil see Mattingly 1988a; Mattingly 1988b; for wine, Wilson 2002b, 262-264; for *garum*, Slim *et al.* 2004, 264-297.

cookware and African Red Slip Wares (ARS) have been documented in finds from across the Roman Empire frequently linked with agricultural commodities.¹⁸¹ These finds peak around the third and fourth centuries,¹⁸² showing the sustained export of goods from North Africa even during the troubled third century and after the reforms of Diocletian,¹⁸³ and continued until the sixth century.¹⁸⁴ Studies using mean evidence of production of ARS as a proxy for the relative health of the economy were important steps in relating archaeological finds and material culture to constructions of the Roman North African economy; in their 1988 study of the aggregate evidence of ARS production and distribution, Elizabeth Fentress and Philip Perkins demonstrated the links between the production of ARS, its distribution, and the construction of public buildings in its production centres, suggesting both could be seen as indicators of available capital.¹⁸⁵ As the dataset of ARS assemblages grew with increased excavation, similar analysis demonstrated that there was high variability in the structure, scale and performance of the regional economies within the empire.¹⁸⁶ Of particular note is the fact that economic vitality

¹⁸¹ Amphorae and cook-ware have been associated with exports of olive oil and wine, while African Red Slip Ware is more frequently associated with the export of grain. Bonifay 2004, 477-479; 2018, 336-338; Leitch 2010, 15-16. Fentress and Perkins 1988, and Fentress *et al.* 2004 demonstrated the links between ARS and variability in the regional economies of the Roman empire, demonstrating the patterns of interaction by overlapping evidence of consumption at various sites in the Mediterranean with evidence of production in North Africa.

¹⁸² Leitch 2010, 16.

¹⁸³ Another development in the Roman period was the increasing exploitation of marginal uncultivated land, often in the pre-desert frontier areas. The *Lex Manciana*, recorded in inscriptions from the Bagradas valley in Tunisia, and ranging in date from the reigns of the emperors Trajan (r. 98-117) to Septimius Severus (r. 193-211), documents lease agreements for imperial lands that show the imperial government was interested in converting as much arable land as possible for agricultural use by extending favourable terms for the cultivation of unused land. Further refinement of the law came in the *Lex Hadriana de Rudibus Agris* under the emperor Hadrian (117-138), known from a fragmentary second-century inscription from Ain-el-Djemala (*CIL VIII* 25943). The *Lex Hadriana* included parts of multiple documents, allowed for the terms established by the *Lex Manciana* to be applied more widely. This also provided a mechanism by which frontier land could be subsumed into agricultural estates, indicating that the dynamics between the ‘centre’ and ‘periphery’ were continually changing, and that the frontier was not envisioned as an actual border. Kehoe 1984, 243; 2007, 59. However, the scope of the application of the *Lex Manciana* is unknown. Hobson 2015, 57.

¹⁸⁴ Fentress *et al.* 2004, 159.

¹⁸⁵ Fentress and Perkins 1988, 210-211.

¹⁸⁶ Fentress *et al.* 2004.

was not restricted to the coasts; during the second and third centuries, settlement patterns show an increase in growth of inland sites.¹⁸⁷

Aksum, has been treated more like Nubia, as a peripheral area whose history and economy were closely linked to external Roman trade interests, in this case on the Indian Ocean due to its prominent position at the entrance to the Red Sea.¹⁸⁸ The port city of Adulis and the inland city of Aksum began as two separate city states, but by the third century AD Adulis seems to have been subsumed by Aksum (which may have been exerting influence as early as the mid-first century), and the Aksumite Empire flourished from the third to seventh centuries.¹⁸⁹ Evidence of the port of Adulis and Aksum's participation in the maritime trade networks of the Indian Ocean is found in ancient texts,¹⁹⁰ and the finds of Aksumite coinage throughout the Indian Ocean littoral.¹⁹¹ The *PME* lists a number of goods that were passing through the port of Adulis (prior to the consolidation of the Aksumite empire), including fabrics, brass, copper, iron, and Italian wine,¹⁹² while Pliny also mentions slaves.¹⁹³ Other African products likely passing through the port of Adulis included tortoise shell, ivory, horn, and wild animals.¹⁹⁴ The wealth and power of the Aksumite empire is attested to in both its remaining stone structures,¹⁹⁵ and an anecdote by sixth-century Byzantine historian Prokopios

¹⁸⁷ Fentress *et al.* 2004, 158.

¹⁸⁸ Munro-Hay 1996, 405; Glazier and Peacock 2007, 7-8; Seland 2012, 77; Zazzaro 2013, 5.

¹⁸⁹ Glazier and Peacock 2007, 8.

¹⁹⁰ Both Pliny and the *PME* describe the port of Adulis and its activities before it was incorporated into Aksum: Pliny, *Natural History*, 6.34; *PME*, 4.1. Adulis is also mentioned after it became a port of Aksum: *Christian Topography*, 2.46 and 2.63, Prokopios *Histories Wars*, 1.20.9-12.

¹⁹¹ Aksum was the only known Medieval sub-Saharan society to have its own coinage, which it began issuing in the third century, originally based on the weight standards of the Roman system (Munro-Hay 1999, 12; Phillipson 2009, 362), examples of which have been found in India and Arabia, particularly Yemen. Phillipson 2000, 823; Munro-Hay 1989, 85. Aksum ceased minting and issuing new coinage in the early seventh century. Munro-Hay 1999, 19; Phillipson 2009, 367.

¹⁹² However, excavators have noted that there is little archaeological evidence of these items. Peacock *et al.* 2007, 128.

¹⁹³ Pliny *Natural History*, 6.34; Munro-Hay 1991, 144.

¹⁹⁴ Munro-Hay 1982, 109; Glazier and Peacock 2007, 129.

¹⁹⁵ Phillipson 2000, 476.

(c. AD 500-c. 554) in which the emperor Justinian (r. 527-565) sought the help of the Aksumite king to destroy the monopoly the Sasanians had on the silk trade.¹⁹⁶ While these documents all record Aksum's interaction in the Roman Indian Ocean trade, there were other trade networks contributing to Aksum's economic and political position.

Increasingly, land-routes leading from the African interior to the coastal regions are being recognised for their economic importance, as well as the connections between the communities on both sides of the Red Sea. Growing research on the Garamantes culture in the Libyan Desert (discussed in detail in chapter six) is showing an advanced agricultural society in the desert frontier regions of North Africa, while evidence of the interactions between Aksum and Arabia are increasingly showing extensive and sustained contact. As with Nubia, discussions of trade in North Africa and the Horn also frequently discuss exchange with the African interior, including for slaves and wild animals.¹⁹⁷ However, these studies are still mainly focused on the goods being traded into the Roman Empire, not how these peripheral regions may have interacted with each other.¹⁹⁸

The process of trade expansion in Africa was being driven by a combination of economic mechanisms, one of which was integration of the provinces of Egypt and North Africa into the Roman system. However, the indigenous populations reacted differently to the social and economic changes, particularly as they related to the changing status of land and land rites. As the Roman land surveyor Agennius Urbicus wrote in the fourth century:

¹⁹⁶ Prokopios *Histories of the Wars*, 1.20.9-10.

¹⁹⁷ Connah 2015, 65.

¹⁹⁸ More recently, there have been studies looking at the sporadic *mapalia* (portable huts used by nomadic tribes) and later more regulated and periodic *nundinae* (a market) that formed the nexus of interaction between the settled communities and nomadic tribes in the frontier regions. As the central government began to exert more control over these marginal regions, they increasingly sought to take advantage of the tax opportunity such markets provided. These markets were often held on land with ambiguous legal definition as what had been public pasture land used by the nomadic tribes was transformed into privately held (usually in large estates) agricultural land, becoming taxable land worked by tenant farmers, accelerating the spread of economic transformation of the peripheral regions of the empire. Cordovana, 2016, 487-493.

It is not easy for disputes of this type between communities and private individuals to arise in Italy. But they often occur in the provinces, especially in Africa, where private individuals have estates no less extensive than the territory belonging to communities. Indeed, many estates are far bigger than territories. Moreover, private individuals have on their estates a not insubstantial population from the lower orders, and villages scattered around their country house {*villa*} rather like *municipia*.¹⁹⁹

Historians of West Africa have been at the forefront in emphasizing the importance of African networks and the development of trans-Saharan trade routes, although Roman historians are starting to explore these frontiers as well. The development of trans-Saharan trade has historically been closely linked with the Arab conquest of North Africa and the activities of Arab traders,²⁰⁰ but, historians of West Africa have developed a different model for understanding the region's role in the development of global networks based on trade diasporas and 'stranger-trade' networks peoples originating along the route and consisting of limited and 'dispersed but socially highly interrelated communities.'²⁰¹ These communities acted as institutional regulators based on trade and business relationships between individuals on either side of the Sahara.²⁰² While identification of such trade communities through material culture can be difficult,²⁰³ and application of the model has only been carried out on communities in the early medieval period and later, it provides an interpretive model for attempting to understand connections throughout Africa in the period of late antiquity that were not being

¹⁹⁹ *Inter res.p. et privatos non facile tales in Italia controversiae moventur, sed frequenter in provinciis, praecipue in Africa, ubi saltus non minores habent privati quam res.p. territoria, quin immo multi saltus longe maiores sunt territorii, habent autem in saltibus privatis non exiguum populum plebeium et vicos circa villam in modum municipiorum.* Agennius Urbicus, *De Controversiis Agrorum*, trans. Campbell 2000, 42-43.

²⁰⁰ This has been largely based on the appearance of caravan routes in later Arab geographic texts. For example, Ibn Hawqal described several trans-Saharan caravan routes that passed through the oases of the Western Desert, including ones that led to Ghana, the Maghreb, and Barca on the Libyan coast through the Fazzān. Ibn Hawqal *Kitāb ṣurat al-Arḍ* 153. But Islam has also been described as a 'unifying ideology' that facilitated trade over large geographic areas (Swanson 1975; Triaud 1985; 272-273), a theory critiqued in Haour 2013, 66-67, who proposes that there were likely greater links between the movement of goods and proselytising. This point is returned to in chapter six.

²⁰¹ Haour 2012, 451.

²⁰² Haour 2012, 2013.

²⁰³ Haour 2013, 73-78.

driven by Roman intervention. The evidence of a shared cotton culture amongst the communities of the Saharan, moving into Western Africa, will suggest the presence of these connections prior to the spread of Islam.

Conclusions

Examining the ancient economy through the production and movement of objects and materials is augmenting past studies that have been heavily reliant on texts. There are two economic questions this thesis examines: first, what the evidence of cotton networks can reveal about the role of textile production in society and how trade was structured (particularly in terms of the relationship between central and periphery); and second, the extent to which we can see continuity in the role of trade in the economy from late antiquity through the early medieval period. To answer these questions, it is necessary to understand the historical debates that have taken place surrounding the ancient economy, and what has influenced those debates. In the regions examined in this study, the impact of colonial rule from the eighteenth through early twentieth centuries, and the contemporary racism too often used to justify European presence in regions under colonial rule, have been highly significant in discussions of both trade and cultural interaction.

The economy of the late antique Mediterranean was a dynamic and multi-layered system, which archaeological evidence is increasingly showing relied on numerous forms of exchange for growth. However, the form of these exchanges in scholarship has been heavily influenced by the European colonial experience. India, which had been economically important to the fortunes of Britain in the seventeenth and eighteenth centuries, has been advanced as one of the most important trading partners of the Mediterranean region through the sixth century, resulting in an argument that it was long-distance trade that drove the Roman economy, despite still unanswered questions regarding the scale of these exchanges. Africa was treated differently, seen as ‘empty’ prior to European colonization, and therefore of little consequence to the development of global trade networks. The areas of Africa that are depicted as having

any kind of impact in this time period, Egypt, North Africa, and Aksum are still generally discussed in terms of how they related to an overall Roman economic strategy, rather than how they held agency themselves. And their exchange networks are frequently discussed in terms of supply to the rest of the Roman empire. More nuanced models are clearly needed.

By focusing on the objects that were moving along these exchange networks, from production through distribution, the means and scale of economic contribution being made by these regions are highlighted. As more archaeological excavations are undertaken, this is becoming increasingly possible, as demonstrated by Wickham's use of ceramics in his global study of the early Medieval period.²⁰⁴ However, textiles were an equally important commodity in this time period, and it is worth exploring how they can similarly contribute to our understanding of economic networks. The following chapters will examine how the study of cotton as an economic commodity can shed light on the form, scale and institutions of exchange in the first millennium, and will provide a new model for understanding exchange in the peripheral regions of the late antique and early medieval Mediterranean and Africa. Before analysing the diffusion of cotton, both in its cultivation and its use, it is important to define the social context of textiles in general, particularly their production, to understand their integration in the economic and cultural contexts of the late antique society. It is through the comprehension of the importance of the textile industry that the significance of the process of cotton transmission becomes apparent.

²⁰⁴ Wickham 2005.

Chapter Four: Social Production of Textiles

Introduction: Textile production in the economy

The function of textiles in the economy can be broken down into two processes, production and distribution/consumption. By studying these processes independently, a range of social and economic questions can be examined on a more granular level: resource availability, demographics of economic participation, urban versus rural economies, technological adaptation, etc. While much has been written of the agricultural systems in the Mediterranean in terms of their socio-economic contexts, particularly in relation to food production,¹ non-agricultural production also held an important place in the economy.² Textiles themselves bridged the two, serving a number of societal and economic functions. In addition to providing clothing and home furnishings for people at every level of society, high quality textiles could serve as long term investments, a way of easily storing wealth that were often passed down through generations.³

The industry must have been large scale. However, as discussed in chapter one, there are several issues that arise when trying to discuss the textile industry within a larger Mediterranean discourse. The foremost of these is that the survival of evidence is so widely dispersed, which has created ‘regional clusters’ removed from any sense of larger historical narrative.⁴ The question then becomes how similar were the textile industries in the different

¹ For example, studies of the Roman agricultural economy have focused on grain (Erdkamp 2005; Kessler and Temin 2007), wine (Thurmond 2017; Purcell 1985), and olive oil (Hitchner 2002), in addition to the examples from North Africa.

² Poblome 2004, 492.

³ Bagnall 1993, 33; Poblome 2004, 492.

⁴ Flohr 2014, 1.

regions of the Mediterranean and Middle East? And can the evidence from one region stand in for the larger whole? Was the industry of Roman Italy related to the extensive textile industries of Roman Egypt or Asia Minor, or the areas outside of direct Roman influence, such as Nubia? This chapter will piece together evidence from different parts of the wider Roman world (though by necessity relying heavily on Egypt) to attempt to answer these questions, and illustrate the larger importance of the textile industry to local economies throughout the Mediterranean in late antiquity. The implications of the significance of the textile industry on the development of the cotton industry and how people interacted with it will be carried forward in subsequent chapters.

Though evidence of both production and distribution of textiles are equally fragmentary, the issue of production has received more academic attention in the past. British Antiquarian James Yates' (1789-1871) *Textrinum Antiquorum, An Account of the Art of Weaving Among the Ancients*, published in 1843, and German archaeologist Hugo Blümner's (1844-1919) *Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern*, published in 1912, were both early attempts at defining and quantifying late antique textile production, both relying exclusively on classical Greek and Latin literature at the expense of discussions of archaeological finds.⁵ Ewa Wipszycka's 1965 *L'Industrie textile dans l'Égypte romaine* explored the organisation of the textile industry in Roman Egypt, looking at references from the papyri, and the economic position of the artisans themselves rather than the function of textiles in the economy.⁶ Since then, scholarship has expanded the scope of evidentiary documents, combining classical literature with technical handbooks and both official and private papyri,⁷ but the wider integration of archaeological evidence of textile production with these texts remains relatively new; as more tools associated with production

⁵ Wild 2000, 209.

⁶ She was especially interested in specialisation within the industry.

⁷ Parca 1999, 20; Wild 2000, 210. There are several compendia of papyri that contain valuable information on the late antique textile industry (Wild 2003a, 38), including Turner 1980; Bowman 1986; Bagnall 1993; Bagnall and Cribiore 2006.

are found, more information on technical production is revealed. But the best resource for understanding the mechanisms of production remain the texts. The issues that arise from these documents, discussed in introductory chapter, are numerous. They are usually incomplete, and generally assume a background knowledge of process or, often in the case of private letters, dialogue that is lost to the modern reader.⁸ Also, as detailed in the introduction, terminology can be confusing, and semantic shifts over time can be difficult to identify.⁹

The majority of the written documents giving insights into the textile industry are found in the corpus of Egyptian papyri, in both official and private documents. These texts highlight an industry differentiated by specialisation of both the steps of production and, in some cases, the fibre being used;¹⁰ wool cleaners (ἐριοπλύται), wool workers (ἐριουργοί), flax workers (σιππινάριοι), wool weavers (λανάριοι), linen weavers (λινουργοί), fullers (γναφεῖς), and dyers (βαφεῖς) are only some of the textile professions recorded as having their own guilds in Egypt.¹¹ Many of the documents also record requests for materials rather than explicit references to the act of production, such as warp and weft threads for weaving or tools for spinning.¹² However, despite the differences in document type, the descriptions they give of the late antique textile industry, combined with artefacts associated with textile production from sites across the regions being studied, indicate that many elements of production were the same regardless of geographic location or the fibre used; where differences in modes of production are explicit, it seems to be in the grade of textile being produced, rather than strictly fibre or the technology employed in the region. That being said, not all fibres were used to make all grades of textiles. Some of the differences between the fibres are examined below.

⁸ Wild 2003a, 38.

⁹ Wild 2000, 209. For examples beyond those described for cotton, see Wipszycka 1965, 17-46.

¹⁰ Wipszycka 1965, 103-128; Bagnall 1993, 82.

¹¹ Pleket 1988, 31-32; Poblome 2004, 493; Drexhage 2007, 172-173, 176. Notably, there are no guilds for spinners in any of the documents. Benda-Weber 2013, 173. This will be discussed later in this chapter.

¹² For examples, see P.Lund.4.14 (AD 275-299), P.Oxy.8.1142 (AD 275-299), and SB 14.12140 (fourth century AD). Bagnall 1993, 43.

Brief history of fibres

Until the wider appearance of cotton in the later part of the first millennium AD, linen and wool were the two primary textile fibres used throughout the Mediterranean and the Middle East. Before the conquest of Egypt by Alexander the Great (r. 336-323 BC) and the introduction of Greek rule, linen was the main textile fibre used in Egypt and it was widely regulated by the state.¹³ These controls were important as flax cultivation greatly impoverished the soil and required a process of field rotation, planting once every four to six years; state control was therefore as much about maintaining quality as it was about protecting supply.¹⁴ Despite such long fallowing, flax was abundant in Egypt, fed by the flood cycles of the Nile, and was a desirable fibre choice during the heat of the Egyptian summers. Yet flax cultivation and linen production were not practiced solely in Egypt. Linen was also produced in many regions of Italy (initially by the Etruscans and then the Romans, well into the imperial period)¹⁵ and even as far as India;¹⁶ by the reign of Augustus (r. 27 BC-AD 14), linen was being produced in many Roman provinces.¹⁷ From the middle of the second century, linen was also an important product of the Levant,¹⁸ but the industry went into decline after the Arab conquest.¹⁹ The Roman spread into Sicily and the Iberian Peninsula provided additional sources of linen, as did

¹³ The state dictated land for flax cultivation, distributed seed and supervised the harvest and yield; the production of linen cloth was equally scrutinized. Parca 1999, 20. Linen continued to be the primary textile product of Egypt well into the medieval period, which is discussed further in chapter seven.

¹⁴ Poblome 2004, 500.

¹⁵ However, Egyptian linen was considered to be of higher quality than its Italian counterpart. Sebesta 1994, 66-67.

¹⁶ Fuller and Madella 2001, 337-338.

¹⁷ Sebesta 1994, 70.

¹⁸ Despite the increasing popularity of linen, wool remained the dominant fibre type, as will be discussed in chapter six. Raheel 1993, 124; Shamir 2002, 19. Textile finds from earlier sites indicate that linen was known in the Neolithic period in both the Levant and Anatolia, but it is unclear if it was produced there. Noy 1986, 44; Kawami 1992, 7.

¹⁹ Although Wild posits that high-quality linen from the Levant may have continued to be traded in Constantinople by Syrian merchants (Wild 2003b, 141), both Shamir and Amar state that linen was largely imported after this point, most notably from Egypt. Shamir 2002, 19-20; Amar 1998, 114.

Cilicia and Syria;²⁰ Damascus and Berytus in particular were well known for their flax plantations.²¹ However, Egyptian linen remained consistently the most sought after, and the association between the two has continued.

There is little explicit information in the documents regarding the linen industry, perhaps because the centre of Egyptian linen production was the Nile Delta where relatively few papyri have survived,²² and there are only scattered references to linen production outside this region, particularly in the Oxyrhynchite nome. The villages of Isieion Panga and Antipera Pela in particular are mentioned for their flax production,²³ and it is also referenced in Senokomis in the Western Toparchy,²⁴ in Netneou,²⁵ and Lithines, both estates of the Aprion family whose residents are recorded borrowing money with interest to be paid in flax.²⁶ There is also the archive of a linen merchant from Oxyrhynchos, Aurelius Leonides, son of Theon, consisting of thirteen texts covering a span of twenty years (312-334 AD). Most of the documents are applications for land leases for flax cultivation, though one records a flax purchase;²⁷ the documents also reveal that Leonides was a member of a guild, and that he had an extensive business network spanning beyond the borders of Oxyrhynchos,²⁸ and demonstrating the extent of connectivity associated with the textile industry.

²⁰ Sebesta 1994, 67 fn. 26.

²¹ Written sources record linen weaving as major industries in Galilee, Laodicea, Sidon, Byblos, Tyre and Scythopolis, which housed an imperial linen weaving factory, as well as throughout Egypt. Sebesta 1994, 73; Poblome 2004, 493.

²² Mayerson 1997, 203. This seems to extend even to areas where papyri have been largely preserved. At Kellis, in the Dakhla Oasis of the Western Desert, flax capsules of been found, indicating local production, but the papyri and the Kellis Account Book (discussed in chapter five) give no mention of flax as a commodity, though there is mention of a linen weaver. Bowen 2002, 87.

²³ Rowlandson 1996, 18-19. For Isieion Panga, P.Oxy.1.103 (AD 316), P.Oxy.31.2585 (AD 315), P.Oxy.45.3255 (AD 315) and 3257 (AD 318), and PSI 5.469 (AD 334). For Antipera Pela, P.Oxy.45.3256 (AD 317-318), P.Oxy.45.3258-59 (all dated to AD 319), P.Oxy.45.3260 (AD 323).

²⁴ P.Oxy.8.1130 (AD 484) and P.Oxy.72.4918 (c. 494-496) both record interest paid to an Alexandrian *pragmateutes* in flax.

²⁵ P.Laur.3.75 (AD 574).

²⁶ Hickey 2012, 34.

²⁷ Luijendijk 2010, 583.

²⁸ P.Oxy.45.3261 (AD 324) and P.Oxy.45.3262 (AD 328). Luijendijk 2010, 583-587.

The documents of the Cairo Geniza show that flax remained an important industrial crop into the Islamic period, though they typically record raw flax being traded, not linen fabric.²⁹ This may be unsurprising as in the Roman period it seems that the areas of linen production were not necessarily the same as the areas of flax cultivation, a situation which may have continued into the Islamic period. As will be discussed later, this is a major difference to the wool and cotton industries, where production seems to have been closely linked to local herds and cultivation; a possible explanation may be that, unlike wool and cotton, flax was used to produce both every-day fabrics and finely woven high-status fabrics requiring specialised artisans.³⁰ The rise of the Tulunids in Egypt (868-905 AD) saw renewed interest of the state in the management of the Egyptian linen industry. The Tulunid leader Ahmad ibn Tulun (r. 868-884 AD) attempted to create a monopoly on the flax market in the eastern Mediterranean, actively promoting demand for Egyptian linen both at home and abroad, attracting traders from Iraq, North Africa and other parts of the Islamic trading zones.³¹ Wheat fields were requisitioned by the state and converted for flax cultivation, a process that was accelerated when the Fatimids came to power in 969;³² by this time, flax grown in Egypt was being used by the textile industries of both Sicily and Tunisia and fuelling demand from European and Arab traders.³³ This shift in agricultural focus from wheat production to flax transformed the Egyptian economy from one centred on foodstuff agriculture to one focused on the textile industry, and could help explain the lag in the adoption of cotton in Egypt after the spread of Islam compared to other areas.³⁴

²⁹ Goitein 1961, 178.

³⁰ Bagnall, 1993, 33. There is evidence that finely woven cotton was being produced in Nubia, especially the capital city of Meroë, and perhaps distributed throughout Meroitic lands, but there does not seem to be a similar disconnect between cultivation and production, a point which will be discussed in chapter four.

³¹ Mayerson 1997, 204.

³² Until this point, wheat had been the main agricultural crop in Egypt. Udovitch 1988, 66; Frantz-Murphy 1981, 277.

³³ Frantz-Murphy 1981, 277.

³⁴ This is explored in chapters six and seven.

While flax was consistently important to the Egyptian economy, after the region was conquered by Alexander the Great wool also gained prominence.³⁵ Wool was used throughout the Mediterranean and Middle East, and evidence suggests that while there were regional breeds, sheep were also selected based on desired characteristic of the wool produced; after the Second Punic War, the rise of estates breeding large sheep herds (called *latifunda* and found mostly in Italy) allowed for experimentation in selective breeding.³⁶ The first century Roman agriculturalist Columella (AD 4-70) documented attempts by his uncle to experiment with crossbreeding African rams with his Italian sheep to attain a finer quality and colour,³⁷ a practice which Michael Ryder has suggested was widespread.³⁸ By the first century BC, selective breeding had resulted in sheep lacking pigment, producing white fleece for easy dying;³⁹ this breed remained popular, and early Christian art often depicts white sheep and rams rather than the more common brown.⁴⁰ While the majority of sheep were raised and their wool processed locally, not all wool was equal and there are indications of an industry for wool export.⁴¹ In general, wool produced in Egypt was considered of a lower quality (with the exception of that produced in the Nile Delta), and Egypt may have imported certain varieties of wool from the Aegean and the Middle East to supplement local production⁴²

From the Aegean, the coasts to Phrygia, Galatia and Cilicia were recorded by Herodotos as being large high-quality wool producing areas.⁴³ By the fourth century AD, Anatolia and

³⁵ Bagnall 1993, 33, 82-83; Mayerson 1997, 203.

³⁶ Sebesta 1994, 67.

³⁷ Columella *Agriculture*, 8.2, 4-5; Wild 2000, 2010.

³⁸ Ryder 1983, 158-164. However, it has also been suggested that selective breeding was rare, limited to only the largest farms. Frayn 1984; 32-33.

³⁹ Sebesta 1994, 67 fn. 22.

⁴⁰ Wild 2003b, 141. Although wool was being produced everywhere, selective breeding for desired qualities, such as length and colour of fibre may have created markets for fleece from certain regions.

⁴¹ A letter from the second century AD, P.Fouad.77 (second century AD), from a wool merchant in Egypt to a business partner coming from Rome illustrates the business connections of the wool industry. Drexhage 1991, 30; Droß-Krüpe 2013, 150.

⁴² Parca 1999, 20.

⁴³ Herodotos *Histories*, 5.49; Hanfmann 1983, 11; Drexhage 2007, 169; Benda-Weber 2013, 171.

Syria had become major wool producers, and to a lesser degree, Greece and the Nile Delta of Egypt.⁴⁴ Sheep shearing was performed twice a year,⁴⁵ and was usually done by the shepherds, as was the washing while the carding, combing and spinning of the fibre likely took place in the home.⁴⁶ Wool was not regulated as strictly as linen, perhaps because it was considered common and, unlike linen or silk, was largely worked in smaller workshops.⁴⁷ Wool was also more receptive to dye than linen, and was often mixed with linen to create a decorated fabric, typically dyed before it was spun.⁴⁸ In such textiles the warp threads were more frequently made of linen while the weft was a dyed wool, and when not included directly in the weave, decorations in wool could either be tapestry woven into the ground cloth or could be sewn on to a plain garment.⁴⁹ Sheep's wool was not the only animal fibre used in textile production; goat and camel hair were also used for course textiles, though they were never terribly common. Where large numbers of textile have been recovered from sites in Egypt, goat hair typically accounts for less than three percent of the total assemblages.⁵⁰ Textiles made of the hair of other animals tend to be coarser than those made of wool, with shorter, thicker fibres,⁵¹ and were likely not used for garments.

A fuller discussion of the cultivation and production practices of cotton will be undertaken in the next three chapters, but it merits introduction here in terms of the discussion of the production of non-luxury textiles. Modern cotton has very specific conditions under which it can thrive; it demands at least 500mm of annual rainfall, and any deficit must be made

⁴⁴ Wild 2003b, 141.

⁴⁵ Wild 2003b, 141.

⁴⁶ Parca 1999, 20. As with linen, there is little direct evidence in the texts of wool processing. Wild 2003b, 141.

⁴⁷ Parca 1999, 20.

⁴⁸ Shamir 2002, 25.

⁴⁹ Kirstein 1999, 14. In the cases where the decorations were sewn on, they could be removed from a garment when it wore out and applied to a new one, extending the life of the decoration. Kirstein 1999, 15. Fabrics with these sorts of tapestry woven decorations were referred to as 'Coptic textiles' in the past, though this term has fallen out of favour.

⁵⁰ Batcheller 2001, 38.

⁵¹ Batcheller 2001, 38.

up through irrigation.⁵² However, the root of the plant cannot become waterlogged, and therefore water must be regulated; as will be shown in subsequent chapters, cotton cultivation typically occurs in areas where water resources could be controlled through irrigation. This may be one of the reasons cotton is not cultivated in the Nile Valley until much later.⁵³ Synthesis of cotton finds from the first several centuries of the first millennium also shows that in general finds of cotton textiles are rare outside areas where there is also evidence of local cultivation, the significant implications of which are parsed in chapter five along with a discussion of the exceptions in the Eastern Desert.

The fibre of the cotton plant, as described in chapter one, grows within round bolls and, when collected, must be removed from the seed before it can be spun into yarn. If the treatment of cotton was analogous to that observed by Crowfoot in modern Sudan described previously, this was done as part of the spinning process. There are several qualities of cotton that may have made it an attractive alternative to linen or wool in the ancient world. Unlike wool or linen, cotton dries quickly and is not as heavy when wet, and compared to linen, it is easy to dye without the use of strong mordents, achieving vibrant colours.⁵⁴ The archaeological remains show that cotton was occasionally used in textiles with both wool and linen, as will be discussed, but this was rare and was likely done to achieve visual affect rather than out of necessity.⁵⁵ Like wool, and unlike linen, there are no indications that cotton production (or import, for that matter) was subject to any type of regulation, making cotton production more

⁵² Wild *et al.* 2007, 16. While there may have been variation in the ancient species, they were still water thirsty crops.

⁵³ P.Bodl.Arab.2, probably dating to the ninth century (Chris Wickham, personal communication), from Egypt mentions cotton fields (الأقطان) and a good crop, but the origin of this papyrus is unknown. Further discussion of cotton production in Egypt after the Arab conquests is discussed in chapter six.

⁵⁴ Sebesta 1994, 68.

⁵⁵ Sebesta has suggested that the term *carbasus lina* referred to a fabric of cotton woven with linen that produced a 'semi-lustrous' fabric (Sebesta 1994, 68), but as discussed in chapter one, the terms that have been interpreted as meaning cotton are often ambiguous and caution should be taken when interpreting textual references to cotton.

similar to wool and suggesting cotton was not considered a luxury fibre. This is confirmed in references in the papyri, discussed in chapter six.

Silk was an expensive fibre in late antiquity, and when its production began, it was highly regulated. The beginnings of local sericulture in the Mediterranean has generally been dated to the reign of the Byzantine emperor Justinian in the sixth century, but it may have already been present in Syria by the fifth century.⁵⁶ Silk has received more academic attention in terms of its production history than any other fibre,⁵⁷ and this has had an impact on how textiles are generally discussed; Silk has often been used as a proxy for the entire textile industry,⁵⁸ in regards to the place of textiles in both economic and social structures. However, as a high value luxury item whose wider circulation in society occurred later,⁵⁹ this has given a skewed view of the textile industry as a single entity. As shown, each fibre had its own industrial history, and consequently they cannot necessarily be used to stand in for each other; their production was happening concurrently, but also independently. The biggest distinction in terms of production seems to be between high-status ‘luxury’ textiles and their more common counterparts; while a certain degree of fibre distinction is embedded in this, it is not in itself the deciding criterion. Whereas the production processes of fibres used for luxury textiles were regulated, non-luxury textiles were more ambiguous and seem to have had multiple modes of production.⁶⁰ This will be the focus of the rest of this chapter.

Professional versus domestic production

There have been two competing theories regarding the dominant mode of textile production in the ancient world: it was either a largely domestic task undertaken by women for

⁵⁶ Parani 2008, 410; Jacoby 2004, 198; 2008, 422.

⁵⁷ Silk has been the subject of numerous studies, in particular, Jacoby 1991/1992; 2004; 2008; Muthesius 1992; 1993; 2008; Galliker 2014.

⁵⁸ See chapter one.

⁵⁹ The process of how silk became more widely available to different segments of society in the Mediterranean hinterlands was the subject of Galliker 2014.

⁶⁰ Regulations here refer to those imposed by the state, not by guilds, which will be discussed later in this chapter.

the members of the household,⁶¹ or while processing may have been done by women in the house subsequent steps in production—such as weaving—were carried out by professional men.⁶² While these theories describe different production processes, what they have in common is the relegation of women and domestic production to a ‘non-professional’ status. In this construction, both also seem to incorporate various levels of contemporary bias, examined shortly, and privilege textual evidence that confined women to the domestic sphere such as the late fourth-century church father John Chrysostom (c. 349-407) who explained:

In general, our life is composed of two spheres of activity, the public and the private. When God divided these two He assigned the management of the household to the women, but to the man He assigned all the affairs of the city, all the business of the marketplaces, courts, council-chambers, armies, and all the rest. A woman cannot throw a spear or hurl a javelin, but she can take up the distaff, weave cloth, and manage everything else well that concerns the household. She cannot give an opinion in the council, but she can give her opinion in the household.⁶³

The frequent requests for textile supplies found in personal letters from Egypt written by women have been read as confirming this,⁶⁴ as have the documents revealing the presence of professional textile workshops and guilds featuring men. What the majority of these studies do not address is the evidence of multiple modes of production, involving nearly all demographic segments of society, and in a variety of settings.

Some attempts have been made towards reconciling the differences between domestic and professional production. In their volume on women’s letters from Egypt, Roger Bagnall and Raffaella Cribiore reason that commercially produced textiles were available in cities, and

⁶¹ For example, Bagnall 1993, 34; Fulghum Heintz 2003, 140; Larsson Lovén 2007, 230; Treggiari 1979, 67.

⁶² For example, Moeller 1969; 1976; Jones 1960; Barber 1994; Fulghum 2001-2002; Poblome 2004, 492; Wild 2008; Ball 2009, 40; Gällnö 2013, 162; Gabra 2014, 239. This is also the general theme in Wipszycka 1965 but with the stipulation that the preparatory steps of textile production were not necessarily outside the conception of ‘professional’ textile work. Such gendered work distinctions have been common in scholarship of the Roman period. Dixon 2001, 121. See also Jongman 1988, 28-35; Harris 1993, 14-18; Larsson Lovén 2007.

⁶³ Chrysostom *On Marriage*, trans. Roth and Anderson 1986, 96.

⁶⁴ For example, see P.Giss.Univ. 3.32 (third to fourth century AD); P.Meyer 23 (AD 375-399); SB 14.11881 (fourth century AD); P.Oxy. 31.2599. Bagnall 1993, 34.

the letters from women in villages often included requests of finished textiles from those travelling to the cities.⁶⁵ Others have proposed that textiles produced within domestic settings were of a lesser quality than those produced by ‘specialists’ who may have been subjected to guild oversight.⁶⁶ Such a model proposes three distinct types of textile production, the first where simple everyday garments and furnishings for personal use were produced within the household, the second where textiles in a regional production centre were produced for local trade, and the third where high-quality luxury textiles were produced in specialised factory-workshops specifically for export.⁶⁷ However, the distinction between domestic/household and professional/commercial production, and who performed each, has largely remained unquestioned.⁶⁸ Despite the appearance of neat categorisation, the following section will show that the archaeological and papyrological evidence indicate a more complex system of textile production where a delineation between domestic and professional production is not borne out. Rather, the evidence highlights several fundamental areas that challenge the creations of such a dichotomy. Of these, the first is that, there is no clear definition of domestic textile production.⁶⁹ Because of this there is no way to assess the relationship between domestic and professional;⁷⁰ there is therefore no way to address how to identify the economic impact of each. To address these issues, three general aspects of textile production will be considered:

⁶⁵ Bagnall and Cribiore 2006, 78.

⁶⁶ Benda-Weber 2013, 173; Wild 2003a, 39; Jones and Brunt (ed.) 1974, 352.

⁶⁷ Poblome 2004, 493-494; Benda-Weber 2013, 173.

⁶⁸ For example, in an attempt to define what an artisan was, Brun recently wrote, ‘Personally, I think that we should consider as ‘artisanal’ any type of productive activity that is carried out in a non-domestic context and paid for by a customer or a patron in money or kind. Using such a broad definition enables a wider investigation of the entire range of urban economic activities, including the preparation of food, building activities—from the extraction of stone in the quarries to construction work—and obviously all craftsmanship. It may also include workshops in villae that were actually enterprises’. Brun 2016, 81. However, this does not address what the actual difference between domestic and non-domestic production was when there was little distinction in space.

⁶⁹ Ball 2009, 38.

⁷⁰ Bagnall 1993, 34.

who produced textiles, what constituted a workshop, and how textile production was geographically distributed.

Who produced textiles?

Implicit in the distinction between domestic and professional textile production was that there was also a gender distinction, that women produced textiles in a domestic setting while professional textile workers, weavers in particular, were male. This adheres to the organisation of ‘public’ and ‘private’ spaces in the classical world in the scholarship, vestiges of eighteenth and nineteenth century European morality that required ‘separate spheres’ for men and women;⁷¹ women, restricted to the ‘private’ sphere, therefore functioned in domestic spaces, while men as the representatives of the *domus* in the ‘public’ sphere were given entrance to professional spaces.⁷² As a result, women’s contributions to textile production have been viewed as purely informal and for household consumption rather than commercial output.

As the textile historian Mary Fulghum Heintz wrote:

Not only did spinning and weaving confine a woman to the physical space of the home, but their products, which included curtains for the windows and doorways, further circumscribed her space. While large-scale tapestries for hangings may have been produced in weaving workshops run by men, smaller, tapestry-woven textiles may have been produced by women who worked at home.⁷³

Even as evidence has accumulated that the Roman conception of space was quite different, and that the Roman conception of ‘private’ was not in fact based on space or proximity, but was instead constructed around ‘proprietary interest’ (thereby bringing all aspects of business and production within the ‘private’ sphere, regardless of where it took place),⁷⁴ the narrative of

⁷¹ Cooper 2007, 19.

⁷² There are some scattered references to women working; sources record women working as midwives, wet nurses and even seamstresses, innkeepers, dancers and prostitutes, although as Fulghum Heintz notes, such sources should be treated with caution as they often have religious or rhetorical bias, particularly in the late Roman and Byzantine texts. Fulghum Heintz 2003, 139. See passages by John Chrysostom later in this chapter.

⁷³ Fulghum Heintz 2003, 141.

⁷⁴ Cooper 2007, 20-23 argues that the line of demarcation, as much as there was one, was not in the *domus* but rather in the *forum*.

women in textile production, and gendered labour organisation, has remained largely unchanged.

This paradigm for the participation of women in textile production also has its roots in the idealized construction of ‘womanhood’ and the Roman *matrona* that began to be extensively promoted in imperial Rome under the emperor Augustus. Spinning and weaving became symbols of female virtue,⁷⁵ and one of the few ‘acceptable’ past times for women.⁷⁶ This ideal was transmitted through both literary sources and inscriptions commemorating the dutiful housewives of the time, depicting women as the organisers of the household, bearers and caretakers of children, and pursuing the tasks of spinning and weaving for the family.⁷⁷ The association between women, domesticity, and textile production persisted into the early Christian period, and women’s funerary commemorations often included references to textile production.⁷⁸ For example, a scene on the fourth-century gravestone of a woman named Pontiana from Rome depicts a woman holding a distaff in one hand, spinning with the other, and standing beside a man (presumably her husband) with some farm animals, creating a complete domestic scene [figs. 4.1 and 4.2].⁷⁹ The early Church Fathers looked to the stories from the Old Testament for the role of the ideal woman and recalled women from Greece and Rome who were expected to remain in the home spinning and wool-working while their husbands conducted business;⁸⁰ this became the church model for Christian women.⁸¹ This became reflected in Christian imagery, and the Virgin is sometimes shown weaving in scenes

⁷⁵ Cottica 2007, 220.

⁷⁶ Fulghum Heintz 2003, 140.

⁷⁷ In Rome, the association was almost exclusively with wool working, as the local fibre of choice, and women were often referred to as *lanifica*, indicating a mastery of the skills associated with wool-working. Cottica 2007, 220; Larsson Lovén 2013, 109, 113.

⁷⁸ Meyer 2009, 153; Ball 2009, 38.

⁷⁹ Meyer 2009, 153.

⁸⁰ Clark 1994, 170.

⁸¹ Even later hagiographic accounts of female saints often made a point of describing them as weavers as well, such as the accounts of Thomaïs of Lesbos (tenth century) and Theodora of Thessalonike (ninth century). Found in Talbot 1996, 304 and 200; Ball, 2009, 38.

of the Annunciation [fig. 4.3],⁸² and in the apocryphal stories of her childhood she is given purple wool to weave into the curtain separating the Holy of the Holies at the Temple of Jerusalem, a scene also depicted in the narthex mosaic at the Chora Church in Constantinople [fig. 4.4].⁸³

Since the associations between women and textile production were not explicitly framed in economic terms, the implicit characterisation of spinning and weaving as the epitome of the feminine ideal filtered into reconstructions of the textile industry made by modern scholars; non-commercial textile production was undertaken within the home by women while textiles with commercial value produced for trade were made by men in workshops and professional settings. However, such associations have a distinct class bias; the assumption that women had idle time to spend on non-economic activities as reflected in sources reflects the need for a certain level of economic attainment that would not have been reflective of the vast majority of households.⁸⁴ And it is increasingly becoming clear that women were working as professionals in a variety of artisanal trades.⁸⁵ The relative scale of the textile industry, the number of people it employed and how they were employed, and the involvement of women in the textile economy, have been debated over the years but attempts to define women's roles within the industry are relatively new and limited by the geographic dispersal of evidence.⁸⁶ The history of these attempts has been documented by Lena Larsson Lovén, but a brief summary is necessary.⁸⁷

One of the earliest studies attempting to define general textile production in the Roman Empire was by Jones, who in 1960 used Egypt and its collections of papyri, textile fragments,

⁸² Fulghum Heintz 2003, 141; Kalavrezou 2003, cat. 83, 158-159.

⁸³ Fulghum Heintz 2003, 141 fn. 19; Underwood 1966, pls. 130-34.

⁸⁴ Groen-Vallinga 2013, 295-297.

⁸⁵ Haines-Eitzen 1998, for example, details the evidence that women were working as calligraphers, scribes and even clerks. Stern 1995, 100-101; 1997 details women working as professional glass blowers, and signing their pieces. Groen-Vallinga 2013 refers to this as the 'adaptive family economy'.

⁸⁶ Larsson Lovén 2016, 208.

⁸⁷ Larsson Lovén 2013; 2016.

and artefacts related to textile production, as proxy for the rest of the Roman Empire. He categorised professional textile workers as male, writing ‘it’s only in Egypt that we have any intimate knowledge of weavers, what kind of *men* they were and how they were organized’;⁸⁸ this mirrored the claim Lopez had made fifteen years earlier in his study of the later Byzantine silk industry.⁸⁹ Jones further claimed that women working within textile production were only casually doing so in order to emphasize their roles and virtues as Roman *matronae*.⁹⁰ He argued that women living throughout the empire spun yarn in their ‘spare time’ with little in the way of a higher organizational structure, and such household work would have been of little economic importance.⁹¹ Male textile workers, on the other hand, were described as producing within organized workshops on a large scale for common consumption, as deduced from guild documents and inscriptions.⁹²

This was the commonly accepted narrative of textile production in late antiquity, despite attempts to identify women within this structure. In the 1970s, Susan Treggiari wrote about funerary inscriptions and images identifying women as professional textile workers within upper-class households, both slaves and freed-women [fig. 4.5].⁹³ Her studies concluded that while women were being commemorated as textile workers, it was at a far lower rate than men.⁹⁴ In 2001, Suzanne Dixon proposed a methodological explanation for this difference. Dixon argued that the exclusion of women, especially in the funerary inscriptions, could be explained by several constraints within Roman society—the way gender was constructed within the society itself, the social status of the individuals, the time and place in which the

⁸⁸ Jones 1960, 183, emphasis my own.

⁸⁹ Lopez argued that while women may have been involved with earlier stages of silk production, such as spinning, the later stages were performed by men. He also argued that although women were employed in the imperial factories, they were unskilled workers. Lopez 1945, 6.

⁹⁰ Jones 1960, 184.

⁹¹ Jones 1960, 190, 184.

⁹² Jones 1960, 186-188.

⁹³ Treggiari 1975; 1979.

⁹⁴ Treggiari, 1979, 69. Jobs of men are mentioned more frequently in general, regardless of occupation. Treggiari, 1979, 78.

commemorations were made—and that the absence of women in the inscriptions could have been intentional, but could also be an unconscious response to expectations within the society [fig. 4.6].⁹⁵ This was further complicated by the way in which different segments of Roman society designed their funerary commemorations; slaves and freed slaves were more likely to choose to document their occupation, but again this was more likely for men than for women, for those in urban settings, and for those holding higher positions within an industry.⁹⁶ When women have appeared, they have been interpreted as domestic employees whose production was for the upper-class household in which they worked, and on their own seem to fit into the established domestic/professional construct. However, a wider view of the evidence challenges this perception.

The Egyptian papyri demonstrate another aspect of female participation in the textile industry. Collections of documents written by women record not only personal communications, but also business transactions and disputes.⁹⁷ While mentions of textiles in these letters are not terribly common, they do appear and give a fuller picture of the late antique textile industry. The letters depict commercially produced textiles available for purchase within the urban centres, indicating clothing and furnishings being produced for multiple modes of consumption.⁹⁸ What is more interesting in the letters is that women are shown not only requesting the purchase of ready-made textiles, but also ordering supplies for their own textile production, and most significantly, conducting business to contract and sell their wares. The papyri that will be discussed here have previously been published by Sophie Gällnö (specifically those relating to spinning),⁹⁹ Roger Bagnall and Paula Cribiore,¹⁰⁰ and Jane

⁹⁵ Dixon 2001, 115.

⁹⁶ Dixon 2001, 125-127.

⁹⁷ For collections of letters written by women, see Bagnall and Cribiore 2006.

⁹⁸ Bagnall and Cribiore 2006, 78.

⁹⁹ Gällnö, 2013.

¹⁰⁰ Bagnall and Cribiore 2006.

Rowlandson.¹⁰¹ However, together these letters reveal new information on women's professional lives.

The letters mention several different stages of textile production, though these mentions are not always at the frequency one would expect given how often the activity would have occurred. For instance, there are not many mentions of spinning, which as noted earlier, was considered an 'ideal' and 'virtuous' female activity. Yet to support the Egyptian textile industry, spinning would have had to have occurred on a very large scale.¹⁰² There are only four known documents from the broader late antique period that refer specifically to spinners. One letter, from the later third century, complained that a group of tradesmen and their wives had not provided enough spun yarn to pay their tax.¹⁰³ The specific inclusion of the wives indicates that they were as important in the process as the men.¹⁰⁴ It also shows that spun yarn was a commodity that could be monetised. A second-century letter from a woman, Apollonia, to her male client, Philetos, says it was being sent along with spun yarns to be woven into an outfit, detailing which she had spun herself and which she had sent out to be spun by someone else.¹⁰⁵ The employment of an external spinner indicates that professional spinners, or at the least spinners available for hire, were a necessary workforce available to fulfil the demand for spun yarns needed for textile production. A third letter from the late second century, from a male client Achilles to a woman named Sarapias and her mother Thermouthis, acknowledged that the women had finished weaving clothing for his father and asked that they spin a weft thread to match a warp that had been purchased elsewhere.¹⁰⁶ While the reference to weaving will be returned to in a moment, this papyrus again shows that there was a market for ready spun yarns, and that the yarn for a single garment was not necessarily spun by the same person.

¹⁰¹ Rowlandson 1998.

¹⁰² Bagnall and Cribiore 2006, 78.

¹⁰³ P.Oxy.12.1414 (AD 271-272).

¹⁰⁴ Gällnö 2013, 165.

¹⁰⁵ P.Oxy.31.2593 (second century AD).

¹⁰⁶ P.Mert.3.114 (AD 175-199).

In both the previous examples, it is impossible to establish whether these women were working within a commercial enterprise or if they were servants or slaves within a household (as they have often been interpreted),¹⁰⁷ but they demonstrate a trade in female-spun yarns.

The final letter definitively demonstrates a woman spinning for commercial purposes. Dated to the fourth century, it is written by a woman in the fourth century named Allous to her ‘mother’, saying that she is unable to afford her late brother’s children and requesting flax be sent for her to spin, presumably so she could sell it.¹⁰⁸ This is the first concrete example of a woman acknowledging that she was spinning commercially for money. It has been suggested that her request was to make clothes for the children,¹⁰⁹ but that would seem unlikely, first because she explicitly says she needs money, but also because of the amount of raw material and time such an endeavour would have required,¹¹⁰ particularly for a woman in economic hardship. In addition to these letters, there are also several others requesting spun yarns to be sent, though without referencing actual spinners. These letters confirm that spun yarns were both available and not prohibitively expensive,¹¹¹ and that there was a commercial economy surrounding spinning.

¹⁰⁷ Gällnö 2013, 166-167. This raises the issue of literacy amongst slaves. It is unlikely that a slave would have been educated unless it was required for their duties; slave children would have been expected to work, even if they were only simple tasks, as soon as possible. Sigismund-Nielsen 2013, 290-291. There are cases recorded where a slave taught themselves to read to improve their situation. Gaius Suetonius Tranquillus recounts a slave named Quintus Remmius Palaemon who began as a household slave before being trained as a weaver, and then becoming a *paedagogus* (similar to a tutor) to his owner’s son despite his lack of education, but he taught himself to read while attending school with the son. When Quintus was manumitted, he became a well-known grammarian in Rome. Suetonius Tranquillus, *De Grammaticis et Rhetoribus* 23; Sigismund-Nielsen 2013, 298. If these women were working within a servile capacity, they would have been either some of the few slaves who had been taught to read, or they lower-class freeborn women who had attained at least a basic level of education.

¹⁰⁸ SB 14.11881. It is unclear if the term ‘mother’ (μητρ·ι) is referring to a familial or social relationship. Gällnö 2013, 167.

¹⁰⁹ Gällnö 2013, 167.

¹¹⁰ In PSI 6.599 (263-229 BC) a weaver in Philadelphia states that it would take three weavers and one assistant six days to weave a linen sheet, although, as Wild notes, this too may be an exaggeration of the total number of weaver days (three weavers over six days) but the total number of days seems likely. Wild 2003a, 40.

¹¹¹ Bagnall and Cribiore 2006, 78.

An attempt at quantifying the Roman textile industry demonstrates the scale of spinning that would have been required. A papyrus from Oxyrhynchos dated to sometime after the third century contains a list of clothing for export and shows nearly 2,000 pieces of clothing were exported over a period of five days.¹¹² It was extrapolated from this that in a year the Oxyrhynchite region may have exported between 80,000 and 100,000 garments, which would have required a significant labour force to provide enough spun yarn (even though these figures are likely exaggerated).¹¹³ Even if this represents a maximalist view of the scale of textile production in the Oxyrhynchite nome, it shows the widespread demand for textile labour. So, it is clear that at the very least, women were commercially participating in the primary stage of textile production, even if it was in a domestic context. The archaeological record supports this conclusion as well. Carding combs, spindle whorls and spools are frequently found in household contexts, suggesting a large industry conducted outside what have been identified as traditional workshops.

What is perhaps more surprising is that the letters also demonstrate that many women were weaving, both for members of their family and for clients. The same papyrus in which Achilles asks Sarapias and Thermouthis for a weft thread to be spun (P.Mert.3.114) also shows the women were weaving clothing, as the mother-daughter pair had just finished a garment for the client's father and were taking an order for another for the client himself. Another papyrus, SB. 18.13305, from Karanis and dating to the year 271 AD, clearly refers to a female master weaver; this text is discussed further later in relation to apprentice contracts. Many of the letters include mentions of weaving as well as requests for weaving tools, though the end use of these

¹¹² P.Oxy.Hels.40 (after the third century AD). These figures are discussed extensively in Van Minnen 1986. Although Wild questions the methodology of multiplying a single week's output by the number of weeks in a year, he agrees that the scale and capacity of the textile industry of Oxyrhynchos was likely high. Wild 2003a, 41-42.

¹¹³ Carrié 2004, 38-39; Gällnö 2013, 163. Wild has speculated that it would have taken five spinners to provide enough yarn to set up a single loom. Wild 2002b, 8-9.

textiles and the contexts in which they were being made is ambiguous.¹¹⁴ Several of the letters also refer to dyeing wool, but the women themselves are only actually described as performing the task themselves in one of these; in Pap.Choix.13 (after AD 127), Senpikos tells her son that she intends to dye some wool,¹¹⁵ though, again, the capacity in which this was being done is unknown. A few of the women's letters request dye be sent to them, and several refer to cutting fabric, implying women working as seamstresses, though none of the letters refer to the women actually stitching the cut pieces.¹¹⁶ This step in textile production appears only once, in P.Oxy.14.1679 (third century AD) when a woman, Apia, instructs the addressee to collect several items of clothing from a seamstress.¹¹⁷ While the woman who wrote the letter gives no indication that she was involved in the textile industry, she refers to another woman who is apparently working as a professional.

The letters provide a snapshot of women working within the textile industry, but the relative scarcity of references to women participating in production is not necessarily reflective of the reality of women's situations. As discussed in chapter one, preservation of papyri, even in Egypt where climate conditions have resulted in large numbers of documents being found, is not consistent throughout regions or time periods, meaning there are holes in the information we have. Further complicating what inferences can be drawn from the documents, the majority

¹¹⁴ For example, in P.Brem.63 (AD 116-117) Eudaimonis tells her daughter in law Aline that she began to weave the day after Aline left; in BGU 3.948 (fourth to fifth century AD) a mother asks her son to send linen thread so that she can make clothing, and in SB 5.7572 (early second century AD) a pregnant Thermouthas cannot do the work herself and mentions that she has set Rodina to do the work for her; in P.Oxy. 59.3991 a woman informs her brother that their mother has made a cotton tunic for him; P.Oxy.31.2599 (third to fourth century AD) a woman requests two weaver's combs; in P.Oxy.56.3860 (AD 375-399) a woman recounts what she has already received and asks for dye and yarn, amongst other things; in P.Brem.59 (AD 113-120), a woman writes of the inferior quality of dye and weaving utensils available to her. Bagnall and Cribiore 2006.

¹¹⁵ Bagnall and Cribiore 2006, 78.

¹¹⁶ In P.Rein.2.118 (AD 275-299) a daughter writes that she will cut the *kolobion* from linen cloth that her mother will send to her; in P.Tebt.2.413 (second to third century AD) Aphrodite informs the addressee that Euphroysne cut the dalmatikon; and in P.Oxy.56.3855 (c. AD 280-281), Thermouthion writes in her letter to Isidoros that she had his tunic cut. Bagnall and Cribiore, 2006.

¹¹⁷ Bagnall and Cribiore 2006, 79.

of the surviving papyri concern government administration and official judicial matters, and it has been surmised that the majority of contracts between individual citizens may have been agreed verbally with official written documents required only under certain circumstances.¹¹⁸ This would mean that standard contracts or agreements between artisans and clients would not necessarily leave a written record. This would certainly be true for women selling their wares in a market setting. So, if women were working professionally more extensively within the textile industry, it is possible that the practice of communicating verbally with customers would obscure their professional participation in the papyri, particularly if they were working outside a workshop setting or within a family business where legal communication would be carried out in the name of the head of the workshop or family, typically a male.

Letters from Egypt are not the only place where women working within the textile industry are present in the written record. Sporadic mentions by writers from across the Mediterranean indicate the presence of female textile workers throughout, and that women working in the industry was not considered unusual. The second-century geographer Pausanias wrote in his *Description of Greece* that in Patrae (Patras in Western Greece) the female population of the town was nearly double the male population and that they earned their living weaving textiles of ‘byssos’, presumably because of increased demand.¹¹⁹ Cyril of Scythopolis, in his *Lives of the Monks in Palestine*, documented female weavers working professionally in provincial Palestine in the sixth century.¹²⁰ And John Chrysostom, who claimed that spinning and weaving were the traditional and proper activities for women to pursue within the household,¹²¹ also confirms that women were producing textiles for commercial use. In his *Instruction and Refutation Directed Against those Men Cohabiting with Virgins*, he states that

¹¹⁸ Such as when property or civil law is concerned. Bagnall 1995, 13-15; Gällnö 2013, 164.

¹¹⁹ Pausanias *Periegesis Hellados* 7.21.7, trans. Frazer, 2012 (1898), 361. *Byssos* referred to either a type of fine linen or cotton; because of the region in question, *byssos* here probably refers to the former.

¹²⁰ Cyril of Scythopolis *The Lives of the Monks* 80, Price (trans.) 1991, 80; Safrai 2002 (1994), 198; Meyer 2009, 161

¹²¹ Chrysostom, *Novae Homiliae V*, CPG 68, col. 488.

many women could be found selling their textile work in the markets, either directly or through intermediaries.¹²² He further stated in *On the Necessity of Guarding Virginity* that if one purchased garments from the market, they were probably being purchased from a woman.¹²³ Again, the mentions of women working in commercial textile production do not draw comment to indicate that it was in any way an exceptional circumstance. And while Pausanias, Cyril of Scythopolis and John Chrysostom were (supposedly) recording observations of their respective locales (Western Greece, Palestine, and Constantinople) separated by several centuries, such records combined with the letters from Egypt, depict women working professionally in textile production throughout the Eastern Mediterranean. The perceived invisibility of women, as proposed by Dixon, can therefore be attributed to late antique social conventions of representation and the idiosyncrasies of document preservation, and should not be interpreted as an indication that they were excluded from professional economic participation.

Two intriguing references, particularly for the purposes of this study, of women working professionally in the textile industry come from the Western Desert of Egypt, and specifically refer to women working with cotton. The ostraka O.Douch 1.51, found in a temple in Kysis (Kharga Oasis) and dating to the second half of the fourth century, records weights of cotton next to the names of five women, interpreted as spinners and weavers.¹²⁴ The listing of the women all together seems to suggest some type of formal organisation, although the text itself does not state what that is. The *Kellis Account Book* (hereafter *KAB*), a fourth-century codex of accounts for an agricultural estate found in Kellis in the Dakhla Oasis, also contains

¹²² Chrysostom, *Instruction and Refutation* 10, trans. Clark 1982, 193-194

¹²³ Chrysostom, *On the Necessity* 5, trans. Clark 1982, 222.

¹²⁴ ‘Λόγ(ος) ἔρεοξυλα
 Ταμοῦν Παιοῦτε λίθ(οι) β
 Τεσουήρις λίθ(ος) β
 Γυνή Εὐγένης λίθ(ος) α
 Γυνή Εὐπρέπης λίθ(ος) α
 Τρεμπαμούου ἀδ(ελφή) λίθ()’;

‘Compte de coton: Tamoun fille Paoute, 2 pouds; Tesouêris, 2 pouds; la femme d'Eugénès, 1 pouds; la femme d'Euprèpès, 1 pouds; Trempamoou, sa sœur, ? pouds’. Trans. Cuvigny and Wagner 1986, 32. The issue of λίθ() as a unit of measurement is addressed in chapter six.

a reference to a woman being allocated an amount of cotton for weaving from the rents due by one of the tenants.¹²⁵ As this is an official account for an estate, and there is no indication that there is a familial relationship between the owners of the estate (who lived outside the oasis, as will be discussed later) and the woman in question, it would seem to suggest the woman was working professionally within that estate. It was common for customers to provide their own materials for weaving,¹²⁶ so it is also possible that the woman was working in the weaving workshop mentioned later in the text to produce textiles for the estate.¹²⁷ Regardless, there is nothing in the texts to suggest that women being given the cotton was any different from the other commercial interactions recorded within the codex, and they also indicate that cotton was not a special fibre.

So far, these texts have demonstrated that women were working in a professional capacity in domestic, or at least ambiguous, spaces. However, there are also texts that indicate they were present in workshops. In earlier texts from the Hellenistic period, these women have often been interpreted as slaves, an issue that will be addressed in the next section. However, there is at least one text that almost surely refers to women working within a textile workshop. SB 10.10759 (AD 33-34, from Krokodilopolis in the Arsinoite nome), is a double-sided papyrus that had been re-used in antiquity. One side contains a declaration by five brothers that they jointly own and are residents of a certain property. The other contains a list of wages for weavers, five of whom are women.¹²⁸ Because the names of the male and female workers are included in the account together, this text has been interpreted as referring to professional weavers, perhaps within a small workshop, where people's roles were fluid and the combination of weavers and assistants could perform different steps in the production of

¹²⁵ ‘παρὰ Θατ Ἰενα ἐρεοξύλ(ου)
λίθ(ος) α εἰς σύνεργα’;

‘with That daughter of Iena, of cotton 1 lith. for weaving’. *KAB* 558, trans. Bagnall 1997, 115. The *KAB* is discussed in chapter six.

¹²⁶ Parca 1999, 20.

¹²⁷ *KAB* 1266; Bagnall 1997, 153.

¹²⁸ The number of men is unknown. Litinas 2013, 119.

textiles to ‘produce the best results’.¹²⁹ The portrayal of women as active participants within a textile establishment in which they are paid alongside men indicates they were not slaves, but were considered professionals in their own right.

The presence of women in professional workshops becomes more concrete in later sources of the Middle Byzantine period. The ninth-century *Basilika* imposes a fine on any male who corrupted a woman working in a textile factory (*gynaikeion*),¹³⁰ and in the tenth-century *Book of the Eparch* female weavers are listed among the poor *katartarioi*, or silk yarn producers.¹³¹ In addition, the eleventh-century Byzantine writer Michael Psellos’ (c.1017-1078) account of the Panegyris of Agathe indicates the presence of professional female textile workers in Constantinople in the eleventh century, possibly even a guild,¹³² celebrating a festival as a cohesive group and with a dedicated sanctuary that depicted women working in the textile industry on the walls.¹³³ These texts demonstrate that by the end of the first millennium AD, what may have been largely unorganised contributions by women to the professional textile industry were being recognised on a larger scale. In none of the later texts is it suggested that the inclusion of women in these industries was new or innovative. Despite the fact that the documents discussed have been known for years, the narrative that women did not participate in the commercial economy has persisted because of the comparative paucity of evidence compared to male participation and how the evidence that does exist has been interpreted. By taking a narrow definition of what constitutes a professional and how a professional is identified, modern scholars have casually dismissed the many ways women participated in the commercial economy. Other factors, such as the role of slaves,

¹²⁹ Litinas 2013, 123.

¹³⁰ *Basilika* 54.16, 8-9; Galliker 2014, 134. Although Lopez claimed these women were unskilled, there is nothing in the text itself to indicate this. The *gynaikeion/gynaeceum* is discussed in a later section.

¹³¹ *Book of the Eparch* 7.2.

¹³² Laiou 1986, 116 referring to Psellos, *Codex Parisinus Graecus* 1182.

¹³³ Laiou 1986, 112.

apprenticeships, and guilds, as well as how workshops and production spaces have been understood in modern scholarship, will be addressed presently.

Slaves and apprentices

The jurist Florentinus is recorded in the *Digest of Justinian* as defining and justifying slavery as a consequence of war:

Slavery is an institution of the of the *jus gentium*, whereby someone is against nature made subject to the ownership of another. Slaves (*servi*) are so-called, because generals have a custom of selling their prisoners and thereby preserving rather than killing them, and indeed, they are said to be *mancipia*, because they are captives in the hand (*manus*) of their enemies.¹³⁴

While Florentinus presents a false etymology of the word,¹³⁵ it is revealing as it presents the institutions of slavery being justified as a moral choice. Slavery was presented as a necessary outcome of Roman military victories in the lands that they conquered.¹³⁶ In his book on slavery in the late antiquity, Kyle Harper categorises slavery into four distinct forms of ownership based on the wealth of the owner, the labour performed, and the physical location of the household in which the slave was working: illustrious, elite, bourgeois, and agricultural.¹³⁷ The first two categories represented the wealthiest segment of Roman society, who owned large properties in both urban and rural settings, and therefore made a distinction in the slaves they owned based on the location and specialisation of labour. The ‘bourgeois’ group consisted of the slave owners employed in ‘professions and trades’ in urban areas, independent of agricultural work and with only a handful of slaves.¹³⁸ The final type referred to the wealthier

¹³⁴ *Servitus est constitutio iuris gentium, qua quis domini alieno contra naturam subicitur. Servi ex eo appellati sunt, quod imperatores captivos vendere ac per hoc servare nec occidere solent; qui etiam mancipia dicti sunt, quod ab hostibus manu capiuntur. Digest 1.5.4 (Institutes book 9), trans. Watson 1998, 15.*

¹³⁵ Wieling 1999, 4, 42; Harper 2011, 34.

¹³⁶ Harper 2011, 34.

¹³⁷ Harper 2011, 40-42.

¹³⁸ Harper notes that this type of slave ownership was responsible for the rapid rate of urbanisation seen in late antiquity. Harper 2011, 42.

villagers in rural areas working in the agricultural fields.¹³⁹ However, the multiple steps involved in textile production, spanning rural agricultural and urban artisan contexts, means slaves in all categories were probably participating in professional textile production. Surviving documents record slaves involved in textile work within all of these contexts.¹⁴⁰

One group of women who are often acknowledged to be working in textile production at various levels, but are not recognized by modern scholars as professionals, are slaves. The early studies of funerary inscriptions from Rome, such as those conducted by Treggiari, noted that the majority of those for women that documented occupations were of slave women.¹⁴¹ As a result, in many of the instances where female textile workers, weavers in particular, are referred to in the papyri, they have been assumed to have been slaves.¹⁴² There are several reasons for this assumption. The few papyri that document women paying the weaver's tax do not include patronyms, and this has been interpreted as reflective of their status as slaves,¹⁴³ although the legal status of slaves as property would seem to preclude them from paying most taxes. Where the documents record young women being apprenticed to other women to learn the art of weaving, they all have been interpreted as slave girls,¹⁴⁴ although in at least one case

¹³⁹ Harper notes a distinction between the east, where the phenomenon of rural slavery has been accepted as an important economic aspect amongst wealthier rural families (Bagnall 1995, 125), and the west, where it has been poorly studied (Wickham 2005, 442), but seems to have been equally important. Harper 2011, 42.

¹⁴⁰ This is especially true in the Egyptian papyri. For example, SB 24.15901 (c. 299-300), shows a woman from Kellis apprenticing a slave to learn to weave (Harper, 2011, 131). P.Oxy.51.3617 (third century AD), from Oxyrhynchos, documents a runaway slave who was also a weaver. Aubert, 2001, 105. P.Oxy.41.2977 (AD 239), also from Oxyrhynchos, documents a free wool-carder with a slave apprentice. Aubert 2001, 109. And P.Lips.1.26 (AD 300-325), found in Hermopolis, records an inheritance that includes four slaves, one of whom is a weaver. Bagnall 1993, 229. Asterius of Amasea (c. 350-c. 410) characterized the rich man as one with 'a multitude of slaves weaving and houses full of clothes'; (καὶ ὁ πολλοὺς ἔχων δούλους ὑφάντας καὶ οἰκίας γεμούσας ἐσθήτος...). Asterius of Amasea *Homily* 3.13, trans. Harper 2011, 134.

¹⁴¹ However, it was also true that male slaves recorded occupations more often than other males. Treggiari 1975, 59.

¹⁴² Rowlandson 1998, 269 fn.2

¹⁴³ BGU 2.617 (AD 216); O.Mich.1.2; P.Coll.Youtie 1.36 (AD 184); PSI 9.1055 (AD 265).

¹⁴⁴ Rowlandson 1998, 267-8, 268 fn.1.

the girl is being apprenticed to a freeborn female master weaver.¹⁴⁵ Consequently, the women in the letters documenting women spinning and weaving, such as Apollonia in P.Oxy.31.2593 (second century AD), have tenuously been interpreted as slaves.¹⁴⁶ And women who are referred to as being employed in a workshop, or being hired, are interpreted as slaves who are being leased out.¹⁴⁷ There is nothing, however, in the texts themselves to indicate this is the case. Indeed, we know that women who were working in establishments for others were also being paid wages independent of transactions between slaveholders.

It could be that the lack of documents making explicit a female textile worker's status is due to the circumstances of preservation of papyri; the collections are clearly not representative of every aspect of late antique life. However, one consideration that has not been considered in these discussions is the role of the family as it would have related to a freedwoman's status and place within society and official documents. As the majority of papyri that survive deal mostly with legal matters, one reason slave women might appear more than freedwomen, if this is indeed the case, could be their legal standing within society as property. There are also indications that textile production could involve entire families. The inscription on the funeral monument of Mecia Dynata lists her mother as a wool-comber and her brother as a wool-worker,¹⁴⁸ and P.Brem.63 (AD 116-117), where a family (or at least a mother and

¹⁴⁵ In SB 18.13305 (AD 271) records Aurelia Libouke of Karanis accepting a young girl as an apprentice. Rowlandson 1998, 268.

¹⁴⁶ Bagnall and Cribiore 2006, Larsson Lovén 2013.

¹⁴⁷ By comparison, C.Pap.Jud. 11.442 explicitly refers to slave women and says, 'I am working together with your slave women to the best of my ability'. That the next section, where Eudaimonis claims more women cannot be found because they are 'working for their own mistresses. Our people have been walking around the entire *metropolis*, offering higher wages'. Rowlandson 1998, 121-122. This could refer to slave women, but then one would wonder if that was the case, why higher wages would matter- if they were already employed working for their mistress, what they were paid would not matter. It could refer to paying the 'mistresses' higher wages, but it is also possible that because they are unable to employ other slaves, they must offer higher wages to freeborn women. This text is also significant as it shows a woman managing a workshop. As will be seen, in official contracts the status of the woman is often stated. See also P.Wisc.1.5 (AD 185), which is a contract that explicitly states the woman is a slave.

¹⁴⁸ CIL 6.9493; Hawkins, 2016, 192.

daughter) seems to be sharing management of the workshop. PSI 4.341 (256 BC) from Philadelphia, documents two brothers offering their services and those of female relatives as weavers;¹⁴⁹ although this is a much earlier example, it illustrates that the intersection of family and working lives was consistent throughout antiquity. Within Roman law, the head of the *domus*, the head of the household and the property owner, was responsible for all members of the household and their economic output.¹⁵⁰ Rather than functioning as individuals, the producers within a *domus* were treated as a unit. They may also be trained by other members of a household, rather than apprenticed out, as will be seen.¹⁵¹ It therefore seems possible that free born or freed female textile workers could be obscured in texts because they were working within the family unit.¹⁵²

¹⁴⁹ Rowlandson 1998, 265-6. This is earlier than the time period in question, but there are indications of similar family relationships between male artisan guild members in Late Antiquity, so it seems likely that it was not unusual for families to all be involved in the same profession. Venticinque 2010, 273-294.

¹⁵⁰ Cooper 2007, 5.

¹⁵¹ And, as stated in both the texts of Chrysostom and Psellos, separated by many centuries, women were expected to know how to spin and weave as part of their household duties.

¹⁵² Women were also documented participating in textile production by overseeing slave labour. Chrysostom constructed the ideal Antiochene household as one where 'the mistress of the household sits in her chair with all propriety, and the slave girls weave silently'; ἐν οἰκίᾳ μὲν γὰρ πολλήν καὶ εὐταξίαν ἴδοι τις ἂν. καὶ γὰρ ἡ κυρία τῆς οἰκίας ἐπὶ τοῦ θρόνου κάθεται μετὰ εὐσχημοσύνης ἀπάσης, καὶ αἱ θεραπαινίδες μετὰ τῆς ἡσυχίας ὑφαίνουσι. Chrysostom, *I Corinthians* 36.5 (PG 61,313), trans. Harper 2011, 132. A fourth-century North African church father, preaching against drunkenness, claimed that in women it had disastrous results, 'The weaving is neglected, abandoned, or done with utter carelessness... The mistress no longer sets up the looms for the purples of weaving garments for chastity, the need for which she has long since dismissed from the household through drunkenness. The looms which she has withdrawn from the leisured slave-girls are given over to weaving — spider webs!' Lanificii vero aut negligens, aut nulla, aut abominabilis efficitur cura... Non tuendae castitatis causa telas ad texendum erigit, quae usum telae olim de domo per ebrietatem amisit; et telas quas ancillis otiantibus subtraxit, texendas araneis dedit. Pseudo-Augustine, *De sobrietate et castitate* (PL 40, 1110), trans. Harper 2011, 133. However, it is also clear there was a distinct class difference in how women of the house would relate to slave textile workers. In his letter to Demetrias, the teenage daughter of wealthy Romans who had been forced to flee the city following the sacking of the city in 410 by Alaric, Jerome advises the girl to guard her virginity by keeping 'wool always in your hands' either spinning or supervising the production going on within the house. Jerome, *Epistula* 130.15, trans. Harper 2011, 132. In both examples, the women were crucially involved in the commercial aspect of the household textile production. Harper 2011, 132-133.

There are also several references to apprentices training in the textile industry in the documents. In fact, the majority of all surviving apprentice contracts in the papyri mention work in the textile industry.¹⁵³ The documents are similar in their wording and construction; they tend to be entered into on behalf of an underage child by a third party (often a male family member or guardian), and detail the length of the apprenticeship, time off, the provision of food and clothing for the apprentice, and typically the wages to be earned, even when said apprentice was a slave.¹⁵⁴ From these documents, it seems that most apprentices began official training by around the age of twelve or thirteen, with variable lengths of contract from (possibly) as little as six months up to six years.¹⁵⁵ Even when a child was brought up in a family of artisans, it seems that at least sometimes they were still externally apprenticed to learn the trade rather than exclusively taught at home.¹⁵⁶ For example, Pausiris, a first-century weaver from Oxyrhynchos, apprenticed at least three of his sons out to other weavers (P.Mich.3.170, AD 49; P.Wisc.1.4, AD 53; and P.Mich.3.172, AD 62) while taking on the nephew of the weaver one of his sons had been sent to as an apprentice himself (P.Mich.3.171, AD 58).¹⁵⁷ The papyri also demonstrate that weavers could have several apprentices at the same time (P.Oxy.4.725, AD 183).¹⁵⁸

In *Discovering the Roman Family, Studies in Roman Social History* (1991), Keith Bradley, examined thirty such apprenticeship contracts, and made a distinction between the types of children found in the contracts, arguing:

Within the documents three categories of apprentices can be distinguished, males who were freeborn, males who were slaves, and females who were slaves. Freeborn girls do not appear at all, and that is a detail of some

¹⁵³ Bradley 1985, 320-321; Saller 2013, 77.

¹⁵⁴ Employers were responsible for feeding and clothing their workers, whether they were apprentices or hired under a free-labour contract. Hanson 1979, 80 fn. 10; Saller 2012, 76.

¹⁵⁵ The length of the term could be based on several factors, such as previous training and the age when the child began their apprenticeship. Bradley 1985, 319-322. The six-month figure is based on a reconstruction, but several contracts are only for a single year.

¹⁵⁶ The extent to which this was the case is unclear, as a child taught at home is unlikely to leave documentation.

¹⁵⁷ Bradley 1985, 320.

¹⁵⁸ McConnell 2013, 161 fn. 20.

significance, for it implies that daughters in artisanal families, like their counterparts in upper-class society at Rome, may not normally have been trained for work other than that of a traditional, domestic sort, but were instead prepared only for marriage and childbearing in the seclusive manner typical of women's life in antiquity as a whole.¹⁵⁹

He based this conclusion on the few papyri that seem to mention females being apprenticed out for textile work, while also noting that there were the same number of male slaves as female slaves listed in the documents.¹⁶⁰ Bradley lists P.Mich.5.346a (AD 12-13), Stud.Pal.22.40 (AD 150), P.Oxy.14.1647 (AD 175-199), and PSI.3.241 (third century AD) as relating to slave girls in apprenticeship contracts.¹⁶¹ It should be noted that in all of these examples, the girls were apprenticed to learn weaving. An additional document, SB 24.15901 (c. AD 299-300) is not an apprentice contract, but is a petition regarding violation of terms of a contract after a slave girl was withdrawn from the house of the weaver she had been apprenticed to.¹⁶²

To the list of apprentice contracts, Orasmus Pearl added the third century SB 18.13305 (AD 271), a fragmentary document which was initially interpreted as an apprenticeship contract between a man, Aurelius Ision, son of Nilammon, from Karanis, and a female weaver, Aurelia Libouke, in Arsinoë, to train a slave girl belonging to Ision for the period of one year.¹⁶³ This papyrus is interesting for two reasons. First, the weaver taking on the apprentice, Aurelia Libouke, was herself a freewoman, 'a weaver, acting without guardian by right of her children'.¹⁶⁴ She herself must have learned her craft somewhere. Second, Peter Van Minnen has questioned the way the fragmentary papyrus was reconstructed, and in particular, whether this was a document drawn up for a slave girl or a freeborn girl. Van Minnen points to the

¹⁵⁹ Bradley 1991, 108. This passage was first published in Bradley 1985, 319. He notes that this was also the feminine ideal, as described in Finley 1969, 129-142.

¹⁶⁰ Bradley 1991, 107-108; Saller 2012, 79-80. In contrast, Lewis made no such distinction between slave and freeborn children based on gender. Lewis 1983, 135.

¹⁶¹ Bradley 1991, 107. A final papyrus listed, P.Mich.Inv. 5196b, seems to be a misprint, as no such papyrus exists in any of the Michigan (APIS) databases. It could refer to P.Mich.Inv. 436 recto, which had a processing number of 5196, but this papyrus remains unpublished.

¹⁶² Bergamasco 1997, 7-26.

¹⁶³ Pearl 1985, 255-259.

¹⁶⁴ '...χωρίς κυρ[ίου χ]ρη(ματιζούση) τέκνων δικαίω γερδιαίνη τὴν τοῦ αὐτοῦ...' trans. Pearl 1985, 257.

reconstruction of lines eight and nine [fig. 4.7], which were highly degraded but seemed to be where the relationship between Ision and the apprentice was established. Pearl reconstructed the lines as:

Ἰσίωνος [παιδίσκη]ν [π]αρὰ
Α[ὐρ]ηλί[α Λιβου]κῆ.....

The word for ‘slave-girl’, ἡ παιδίσκη, was entirely reconstructed. This is the term used in two of the other apprentice contracts for slave girls, P.Mich. 5.346a and Stud.Pal.22.40.¹⁶⁵ However, in the rest of this text, the girl is referred to only as ἡ παῖς, ‘the girl’ or ‘the child’, the female form of the word (ὁ παῖς) often used to describe free-born males in the papyri.¹⁶⁶ Van Minnen further suggests that as it is really only the word Ἰσίωνος and the last two letters of line eight that are definitively legible (ρὰ), an alternate reconstruction that would reflect the way the girl was referred in the rest of the text might be Ἰσίωνος [... θυ]γα[τ]έρα (daughter of Ision) and as the space seems to require another word, perhaps Ἰσίωνος [ἀδελφοῦ θυ]γα[τ]έρα (daughter of Ision’s brother).¹⁶⁷ As the apprentices in such contracts are also usually named, rather than repeating Aurelia Libouke’s name in line nine, Aurelia may also be the name of the girl, a name only given to free persons.¹⁶⁸ This would make the girl either Ision’s daughter or niece, and a free-born girl apprenticed outside of the house.

This is not the only example of an apprentice contract for a free-born girl. P.Heid.4.326 (AD 98), also highly fragmentary, shows a man and woman placing their daughter with another man and woman, a contract referred to a year later in P.Heid.4.327 (AD 99) when the first couple placed a nephew with the same second couple in an apprentice contract that referred to the previous apprenticeship of their daughter.¹⁶⁹ P.Oxy.67.4596 (AD 232 or 264) documents a

¹⁶⁵ SB 24.15901 specifies the girl in question as τὴν δούλην Σενορ, the slave Senor, the same term used in PSI.3.241 (δούλην σου ὀνόματος Νίκη, your slave name Nike) and in P.Oxy.14.1647 (ἀφήλικα δούλην Θερμούθιον, the young slave Thermouthion).

¹⁶⁶ Van Minnen 1998, 202.

¹⁶⁷ Van Minnen 1998, 202-203.

¹⁶⁸ Van Minnen 1998, 203.

¹⁶⁹ Van Minnen 1998, 201-202.

father apprenticing his daughter to a weaver as well, although the terms of the contract are unusual and imply some sort of debt between the father and the weaver.¹⁷⁰ Regardless of the external circumstances of the contract, if apprenticing a free-born daughter outside the house were a particularly egregious practice, one would have expected some indication or justification noted within the text. The practice seems to have extended into the later periods as well; in an eighth-century ostrakon, KSB 1.045, a woman entrusts her daughter to another craftswoman named Maria.¹⁷¹ These few cases of free-born women in apprentice contracts corroborate the presence of female craftswomen in other documentation, challenging Bradley's selections, but also indicate that there may have been a difference in how men and women were trained. While it seems that some women were apprenticed outside of the house, the proportions of contracts for male and female apprentices compared the documentation illustrating women working suggests that many women were also being trained at home. This does not necessarily mean their outputs were purely for domestic use; there is evidence that free-born males could also learn a trade at home.¹⁷²

Van Minnen proposed that this might be because the age at which a child typically became an apprentice was also the age at which most free-born girls would have been married,¹⁷³ and the parents of free-born girls may have kept them at home to protect their virginity.¹⁷⁴ While Van Minnen reasons that this would not be a concern for free-born or slave males, applying this same logic to female slaves seems to make less economic sense. A female slave who became pregnant during an apprenticeship would be less productive and the possibility of death during childbirth would waste the investment in human capital made by

¹⁷⁰ The father is required to repay the weaver four hundred drachmas if the daughter is removed early, therefore perhaps representing a sale of labour. Huebner 2013, 77-78; Migliardi Zingale 2007, 199-208.

¹⁷¹ Van Minnen 1998, 202; Wilfong 2002, 76-77.

¹⁷² Van Minnen 1998, 201. P.Oxy.2.275 (AD 66) records Tryphon was teaching one son to weave at home while another was being apprenticed to another weaver. Rowlandson 1998, 113.

¹⁷³ This was based on census documents analysed in Bagnall and Frier 1994.

¹⁷⁴ Van Minnen 1998, 201.

both the owner and the master artisan. A more likely reason may again be to rely on the social convention of the time in which the presence of women is recorded less frequently in the documents. It is also possible that women were simply more frequently trained at home, but what is clear is that this was not necessarily a strict rule.

There is evidence of another means of training textile workers that comes from excavations of Meroitic Nubia. During excavations of the site Qasr Ibrim (discussed further in chapter four), a number of textiles were found within a re-used Pharaonic temple. Within the assemblage, the largest group consisted of forty-one cotton woven miniatures found in scattered clusters. The miniatures were incomplete, and mostly exhibited what excavators described as a low level of competency in both the spinning and weaving (although some had clearly been made by a skilled weaver); the yarns were generally unevenly spun, the weaving was loose, and many still had balls of weft yarn attached, as if they were abandoned partway through [figs. 4.8 and 4.9].¹⁷⁵ A number of loom weights for a warp weighted loom were found in one of the temple crypts, six balls of cotton yarn were found in the sanctuary, and a weaving comb was found in the sites fill. Nine non-woven miniatures consisting exclusively of openwork and fringe were also found. The excavators proposed that the combination of miniatures that appeared to be produced by both experts and novices indicated that group training of weavers may have been taking place in the temple, with the higher quality weavings acting as pattern samples and the lower quality ones as practice pieces.¹⁷⁶ The prospect of group weaving training in neither a domestic or clear workshop setting further suggests that creating distinctions between domestic and professional production is not adequate for understanding such a large industry. So far, no comparable examples of such miniatures have been discovered in Egypt, so it is impossible to determine if this was a practice unique to Qasr Ibrim or if it was also occurring elsewhere, but the placement of weaving establishments in reused temples does

¹⁷⁵ Though some of the examples were of a higher quality. Adams 1987, 93-95.

¹⁷⁶ Adams 1997, 95-96.

have parallels in early Christian monasteries in Egypt, discussed shortly, providing evidence of further modes of textile production.

The gynaeceum (gynaikeion)

The Latin *gynaeceum*, from the ancient Greek *gynaikeion* (γυναικεῖον) referring to the women's quarters within a house in which women participated in wool-working and textile production, by the fourth century AD was being used to refer to a type of imperial textile-weaving workshop (*textrinum*).¹⁷⁷ The primary purpose of these workshops was to provide clothing and necessary textile provisions for the military (*vestis militaris*); in the Roman period, every province was required to provide an established quota of textiles to the army.¹⁷⁸ The *Theodosian Code* records that the purpose of the *gynaecea* was also to provide for the *vestis militaris*,¹⁷⁹ and it is possible the institutionalised *gynaeceum* was introduced to fill the gap between the levies provided by the provinces and the actual needs of the army.¹⁸⁰ Little is known about the structure of the imperial workshops, but it seems that the purpose of the *gynaeceum* was to engage exclusively in state sponsored textile-work, non-luxury wool for the army and luxury silk for the imperial family.¹⁸¹ There have also been suggestions that within the imperial workshops there was gendered division of the work. John Peter Wild, based on a passage from Diocletian's *Edict of Maximum Prices*, proposed that men were responsible for preparing the fibres and weaving 'special' fabrics (such as the silks) and the women spun the fibres into yarn and wove the plain fabrics.¹⁸² He later wrote that men were probably

¹⁷⁷ Wild 1967, 649-650. Although the term derived from a domestic space in which women participated in the 'feminine ideal' of textile work, both men and women were employed in the imperial *gynaecea*. Wild 1967, 659.

¹⁷⁸ Prior to the 320s, the government procured textiles in exchange for some type of payment, although whether it was through purchase or requisition and reimbursement is unknown; after this point, debasement of the currency meant the fixed value of reimbursements, which had not changed since the Edict of Diocletian, meant the reimbursements were of far less value than the textile themselves and the *vestis militaris* became a straight tax. Bagnall 2000, 88.

¹⁷⁹ *Theodosian Code* VII. 6, 5.

¹⁸⁰ Wild 1967, 652.

¹⁸¹ The *gynaecea* were separate from the *linyfia* which were the linen workshops. *Notitia Dignitatum Occ.* XI, 45; XII, 26-27; *Or.* XIII, 20, 14.

¹⁸² *Edict of Diocletian on Maximum Prices* XXI, 1-4; XX, 9-3; Wild 1967, 659.

responsible for all weaving in the *gynaecium*,¹⁸³ although women were still part of the production process.

Medievalists have noted that the structure of the late antique *gynaecea* were also adopted for textile production in the Merovingian and Carolingian courts, but that these were largely populated by women.¹⁸⁴ David Herlihy argued that the later medieval diversified textile industry was established after the workshops on these estates began attracting fewer and fewer women to work in them, resulting in an industry that was male dominated in dispersed workshops.¹⁸⁵ To demonstrate the place of women in the late antique *gynaecea*, Herlihy describes several passages in the ancient texts where the association between women, textile work, and the *gynaecea* are used to emasculate and ‘shame’ a man. For example, in an edict ending the persecution of Christians, Constantine referenced those who had been thrown into the *gynaecea* and ‘condemned to perform ‘women’s work’’ as punishment.¹⁸⁶ However, the number of documents detailing male participation in textile production (particularly guild documents, discussed in this chapter) would seem to indicate that this is more of a rhetorical device to emphasise the injustice of their persecution rather than a reflection of occupational gender difference within the imperial workshops. I believe the more interesting detail regarding the labour organisation within the *gynaecea* is that the documents indicate large segments of the workforce were not participating voluntarily.

¹⁸³ Wild 1976, 52. For example, the laws governing the *gynaecearii*, the workers within the imperial workshops, always use the masculine gender. Herlihy 1990, 10.

¹⁸⁴ Herlihy 1990.

¹⁸⁵ Herlihy 1990, 87-88. Berman attributes some of these changes to the introduction of the heavier horizontal treadle loom often associated with male weavers, and that Herlihy was not distinguishing between the different steps in the production process; instead, she argues that women continued to be involved in the preparation of fibres, and that the introduction of the watermill resulted in more time to undertake these time-consuming tasks. Berman 2007, 15. Øye 2016 notes that there are depictions of women using the treadle loom, and that women probably continued to participate in all stages of textile production throughout the Middle Ages.

¹⁸⁶ Eusebius, *Life of Constantine II*, 34; Herlihy 1990, 7-8.

In addition to Eusabius, Lactantius, Sozomen and the *Theodosian Code* record Christians being sent to the *gynaecea* as convicts.¹⁸⁷ Slaves and those contracted to work for independent workshops who ran away were also sent to the *gynaecea*.¹⁸⁸ These records show both men and women being forced to work in them. The reality is that the *gynaecea* were likely populated by slaves, convicts, and possibly members of the lower classes who were hired in, regardless of gender. The references to the workers themselves, like those referring to the textile industry in general, are often contradictory in terms of any occupation gender difference. As with the commemorations discussed previously, this likely has more to do with societal norms of documentation and rhetoric than realistic representations of labour organisation. So far, no *gynaecea* have been identified in the archaeological record;¹⁸⁹ until this happens, identification of women in private textile workshops may provide parallels for female participation in production of the *gynaeceum*.

Defining and identifying workshops and guilds

Wipszycka noted that although tools associated with textile production were typically found in great quantities in a variety of archaeological contexts and the word for weaver occurred frequently in the papyri, weaving workshops were mentioned fairly infrequently, leading her to conclude that textile production was likely on a small-scale and done within the houses of the artisans.¹⁹⁰ The archaeology is increasingly confirming this, highlighting the importance of the family and domestic structures in the creation of workshops. Archives within the collections of papyri from Egypt show that artisans were usually part of extended families

¹⁸⁷ Lactantius, *De Mortibus Persecutorum* XXI, 4; Sozomen, *Historia Ecclesiastica* I, 8; *Theodosian Code* IV, 6.3; Wild 1967, 657; 1976, 53.

¹⁸⁸ Wild 1967, 658.

¹⁸⁹ Medieval textile weaving workshops have been discovered in northern Europe. At Tilleda in the district of a Sangerhausen, the ancillary buildings of a royal Saxon palace (tenth century) included two large structures with pits in the middle for vertical looms and multiple finds of loom weights were excavated. Grimm 1968, 97-98; Herlihy 1990, 78. A similar early medieval structure was identified at Talhof in southern Württemberg-Hohenzollern, West Germany. Kimmig and Gersbach 1966, 121-122.

¹⁹⁰ Wipszycka 1965, 56.

all working within the same industry, if not the same specialty. For example, the archive of Tryphon, son of Dionysios, who was teaching one son to weave at home while another was apprenticed elsewhere,¹⁹¹ documents a large extended family of weavers.¹⁹² The papyri often also show weavers apprenticing their children within the same craft, and that families of weavers occasionally lived together, blurring the lines between occupation and household.¹⁹³ These archives suggest that textile production in this time period was largely dominated by small local workshops which provided for both local and regional economies.¹⁹⁴ They appear often in the papyri, but in ways that shed limited light on the business practices within the industry; for example business accounts, such as SB 16.12314 (after AD 130), records both employees and owners of the workshop receiving and making payments, and indicates the employer was responsible for both clothing and feeding their employees,¹⁹⁵ as they were for their apprentices. However, identifying the physical remains of these workshops can be difficult.

The belief that there was a regimented use of gendered space in late antiquity has impacted on how scholars defined ‘professional’ versus ‘non-professional’ spaces, as well as professional artisans. As it was assumed that economic enterprise should take place in the ‘public’ sphere, commercial production was abstractly determined to have been conducted outside of the household and in a professional workshop setting, despite widespread identification of production spaces within domestic settings; an insistence that ‘work’ took place outside the house amplified associations between professional production and men. This is a very modern conception of the use of space. Archaeological evidence is increasingly showing that the form or location of a room in a building did not always determine the function

¹⁹¹ See 143 fn. 172.

¹⁹² Wipszycka 1965, 65. For a history of the family of Tryphon, see Rowlandson 1998, 112-114.

¹⁹³ P.Lond.2.257 (AD 94-95) and BGU 7.1615 (AD 84). Wipszycka 1965, 65.

¹⁹⁴ Poblome 2004, 499.

¹⁹⁵ Hanson 1979, 77, 79 fn. 10.

or functions of that room,¹⁹⁶ and that archaeological assemblages found within certain spaces do not necessarily indicate where they were used.¹⁹⁷ Nor does it indicate how the function of a space may have changed over time. This is also true in houses. The organization of houses was flexible,¹⁹⁸ and it is therefore difficult to definitively categorise rooms and their uses.¹⁹⁹

Until the seventh century, many cities in the eastern Mediterranean featured multi-purpose built block units lining streets—termed *tabernae*—which included structural features seen to indicate that they were shop spaces: open fronts, benches, counters, or production units such as vats and ovens.²⁰⁰ However, in the ancient sources, the term *taberna* did not strictly refer to a shop, but to a more generalised construction which Ulpian described as ‘every building fit for habitation, because it is closed by doors’.²⁰¹ These same spaces are also referred to as residences in sources spanning several centuries, including in Horace’s first-century poem *Carmina*, where the *taberna* is juxtaposed to a palace.²⁰² This has led some scholars to refer to these spaces as “shop houses” rather than strictly shops,²⁰³ and it demonstrates that there was not such a clear differentiation between domestic and public spaces. In his *Treatise of Construction and Design Rules*, Julian of Ascalon lays out guidelines for the location of workshops that could prove a danger or nuisance to the general public such bakeries or glass-blowing workshops, but even in his idealised situation he acknowledges the placement of these workshops both within and near domestic structures.²⁰⁴ This of course does not mean that all artisans and traders were also living in their shops or production spaces, but it does mean that

¹⁹⁶ Allison 2007, 345-347; Putzeys 2007, 49.

¹⁹⁷ Ellis 2000, 159; Putzeys 2007, 49.

¹⁹⁸ Putzeys 2007, 49.

¹⁹⁹ Wallace-Hadrill 1988, 56-58; Clark 1994, 95; cf. Clarke 1993, which argues for more static function, but largely based on decorative schemes.

²⁰⁰ Dixon 2001, 123; Putzeys and Lavan 2007, 83.

²⁰¹ Ulpianus, *Edict, book 28* in *Digest*, vol. 4 50.16.18, trans. Watson 2011, 463.

²⁰² Putzeys and Lavan 2007, 83; Horace, *Carmina* 1.4 13-14.

²⁰³ Ellis 2000, 78-80; 2004, 47; MacMahon 2003, 70-77; Putzeys and Lavan 2007, 83.

²⁰⁴ Julian only makes reference to the aspects of textile production that involve the use of strong smelling materials, such as fullers burning sulfur and dyers using various mordants to affix dye. Hakim 2001, 10-13.

classifying textile production by women as a domestic task does not also disqualify them from being professional textile workers. In Egypt, the shared use of space is reflected in both the archaeology and the documents. For example, at the site of El Kab (known as Eileithyia), between Luxor and Thebes, there is evidence that houses not only held multiple families at once, but also workshops and storage areas.²⁰⁵ The papyri often refer to leases of workshops within houses, or for entire houses that include workshop spaces.²⁰⁶ This included weaving workshops as well.

Weaving workshops in the papyri are generally small operations, occupying a room or rooms in a house. Looms and their associated tools came in a variety of forms, were highly mobile, and could be set up anywhere,²⁰⁷ allowing for greater flexibility and little practical distinction in production space in the home or workshop. For example, in Stud.Pal.20.53 (AD 246) a weaver rents two-thirds of a house in Herakleopolis in order to set up three looms.²⁰⁸ P.Dubl.31 (AD 355) also records a lease for a linen workshop within a house in Panopolis for two looms,²⁰⁹ while in P.Neph.48 (AD 323), a house is sold in Phathor that also includes a linen workshop.²¹⁰ The presence of weaving workshops within houses is realized in the archaeological record. Excavation of House One at Kellis in the Dakhla Oasis (dating to the fourth century) uncovered placements for two vertical looms in room four as well as a warping frame and a letter stating that one of the occupants of the house was to be sent to a monastery

²⁰⁵ Huebner 2017, 165. In house B at the modern site of El Kab, known as Eileithyia, between Luxor and Thebes, four of the rooms contain potter's basins. Hendrickx 1998, 1363. An archive found within the house also suggest that a weaver moved in after the family of potters left. Huebner 2017, 166; Bingen and Clarysse 1989.

²⁰⁶ For example, SB 26.16580 (AD 362-363) from Herakleopolis records the lease of a part of a house with a workshop. Rabinowitz 2001. P.Oxy.50.3595, from the third century and found in Oxyrhynchus, documents the lease of a pottery workshop which is attached to a farmstead. Cockle 1981.

²⁰⁷ McGing 1990, 118.

²⁰⁸ Wipszycka 1965, 55; McGing 1990, 119.

²⁰⁹ This agreement is interesting because part of the rent is to be paid in woven items with the material to be supplied by the house's owner. Aubert 2001, 104; McGing 1990.

²¹⁰ McGing 1990, 118.

to be instructed in linen weaving.²¹¹ The house was clearly a domestic residence, but the presence of the loom mounts and reference to professional training indicates that the weaving being carried out in this house was more than casual. Similar archaeological artefacts were found in several other houses, including worked-wood, which excavator Gillian Bowen suggests strongly resemble horizontal ground looms.²¹²

While the majority of written evidence for workshops comes from Egypt, excavations from elsewhere in the Mediterranean suggest that incorporating workshops into domestic buildings was not uncommon, in either urban or rural settings. At Pompeii, most workshops identified in the city were located within *tabernae*,²¹³ blurring the line between the domestic and professional spheres of the lower-class, and many of the large houses both with and without *atria* clearly had workshops incorporated into them as well.²¹⁴ While this was initially seen as a result of the reconstruction the city underwent after the earthquake of AD 62, indicating a loss of wealth and living standards,²¹⁵ there is little evidence of this chronology; the workshops within these homes tended to be larger than those found in the *tabernae*, but again showed that flexibility in the use of space within the domestic structures in relation to production.²¹⁶ While only a few of these workshops could be positively identified as part of the textile industry,²¹⁷ it is clear that production was carried out in a variety of settings. Excavation of the Villa dels Antigons in Reus, Spain, revealed the presence of a textile workshop as well,²¹⁸ demonstrating that production of textiles was both an urban and rural endeavour throughout the different

²¹¹ Bowen 2002 97; P.Kell.1.12.

²¹² Bowen 2001, 24.

²¹³ Flohr 2012, 1.

²¹⁴ Flohr 2011b, 89.

²¹⁵ Maiuri 1942, 161-164.

²¹⁶ Flohr 2011b, 101-102. This was likely not unusual because although the inhabitants of these houses were not taking part in production themselves, as many depended on trade for their livelihoods, it was an integral part of their daily lives. Wallace-Hadrill 1988, 56-58; Flohr 2011b, 88-89.

²¹⁷ Workshops identified as part of the textile industry were classified as either dyeing or fulling workshops.

²¹⁸ Prevosti 2014.

regions of the empire, confirming perhaps more ambiguous evidence of textile production on larger estates in the provinces.²¹⁹ As in Egypt, the evidence therefore suggests it was common for textile workshops, including weaving workshops, to be set up in extra rooms of houses and villas, regardless of class, and suggesting that there was not a clear distinction between domestic and professional production.

The connections between family life and business were further reinforced by the guild system. Largely due to the relative scarcity of documents illustrating the functioning of guilds in the Roman period, most scholars have assumed that they functioned similarly to medieval guilds, and that the medieval guild system derived from the Roman *collegia*,²²⁰ or business associations.²²¹ These associations were seen as having little economic impact on the lives of their members, but were instead a means for the local administration to exert control over craft production, prices, quality, and taxation.²²² Some seem to have had primarily religious functions, and were not related to trade or craft at all.²²³ However, the documents relating to guild associations reveal occupational links and 'that groups met regularly, feasted together, marked major life events, celebrated religious rituals with colleagues, and relied on each other for financial assistance and support in their professional and personal lives'.²²⁴ Therefore such associations were serving a variety of overlapping functions in Roman society, in both a social

²¹⁹ Drinkwater 1982; 2001 discuss images of rural estate textile production on the third-century Igel Column of the Gallo-Roman Secundinii family, while analysis of artefacts related to textile production in Roman Britain (Wild 2002b, 27-29) suggests that there was a large rural industry while urban production is more difficult to identify.

²²⁰ As the sources themselves do not specify what a *collegia* was, Liu has enumerated three central features that appear to define them in the surviving documentation: they had a structured governing system, could take on patrons, and would survive changes in membership. Liu 2009, 10. In the past the *collegia* was described as a social or religious club, and the occupational aspects of these associations have only been a recent point of interest. See Verboven 2016 and Liu 2016 for discussions on the changing interpretations of the Roman *collegia* and its role.

²²¹ For a discussion of past scholarship on the formation of these associations, see Maniatis 2006, 482, 531; Liu 2009, 4-11; Venticinque 2010.

²²² Lewis 1983, 145 on guilds in Egypt; Alston 2002, 209 on the role of guilds in setting price controls; Venticinque 2016, 5.

²²³ Alston 2002, 209.

²²⁴ Venticinque 2016, 10.

and economic capacity.²²⁵ Several guild constitutions survive, detailing the obligations and benefits of membership. For example, P.Mich.5.243 (c. AD 14-37), from Tebtynis in the Fayyum, is a contract between a guild president and its members, detailing dues owed to the guild (twelve *drachmas*), and a host of other fees and obligations for members relating to family and property,²²⁶ showing how intertwined guild associations and family structures were.

Surviving membership lists also demonstrate that many members of the same guild associations were also linked through kinship.²²⁷ This adds an additional dynamic to guild participation beyond economic control and enforcement;²²⁸ guilds were also used to reinforce social, familial, and business ties between its members.²²⁹ The names on these lists are generally of freeborn men, but there are some indications that women also belonged to these associations, or participated in associations in which family were members.²³⁰ For example, P.Oxy. 12.1414 refers to women and children as participating in the production of items requisitioned from an association of linen weavers by the local administration in Oxyrhynchos.²³¹ It is therefore possible that women were participating in the production of items under the auspices of guilds in which they had family who were members, or that families would be members of associations as a unit.

²²⁵ For example, Alston 2002; Liu 2009; Perry 2011; Venticinque 2010 and 2016.

²²⁶ This included fines for missing the meeting (one *drachma* if in the village, four if in the city), dues owed for various life events (two *drachmas* for marriage, two for the birth of a son, one for the birth of a daughter, four for the purchase of sheep, one for cattle), fines for not helping other guild members (eight *drachmas*), agreement to stand security of one hundred *drachmas* for thirty days if one member is imprisoned for debt, and agreement on funerary customs (all members must shave their head and must attend the feast with two loaves and one *drachma*- failure to do so results in more fines). P.Mich.5.244 (AD 43) records similar stipulations. Alston 2002, 208-209.

²²⁷ Venticinque 2010, 278-279.

²²⁸ Liu 2009, 20-21 points out that these are impossible to test, but the surviving guild constitutions indicate that there was an element of self-enforcement through social sanctioning with both economic and status implications.

²²⁹ Venticinque 2010, 275-277.

²³⁰ Venticinque 2016, 15.

²³¹ Venticinque 2016, 16.

Monasteries, a new type of workshop

Textile production was not only a secular task, and there is limited evidence that textile production took place in religious temples in the pre-Christian period throughout the Mediterranean region.²³² Excavations in Egypt suggest this continued into the Christian period, and there is evidence that organised weaving establishments were being set up in monasteries from approximately the sixth century, particularly in reused temples and necropoleis. The conversion of pagan temples and funerary structures into churches and dwellings respectively during the Christian period was common, and is considered one of the most reliable indicators of cultural transformation and landscape adaptation in late antique Egypt.²³³ Numerous excavations of such sites have recorded the various alterations made of the older funerary structures, such as the plastering and painting of walls, installation of cooking facilities, and the creation of workspaces for production of goods needed for both internal consumption and external commerce.²³⁴ Features found at several such sites have led investigators to suggest communal textile production as one of these activities. This has led to the conclusion that textile production was an important source of income for monasteries, and seems to have been conducted on a professionally organised scale.²³⁵

The first of these features that suggested textile production was found at the Monastery of Epiphanius at Thebes in excavations conducted by Herbert Winlock (1884-1950) and Walter Crum (1865-1944) for the Metropolitan Museum of Art in the 1920s. Eight brick-lined pits with built-up ledges on one side near the top were situated throughout the site, generally near

²³² Distribution of textile production artefacts at Etruscan temples has led to the conclusion that textile production was commonly taking place. Gleba 2008. It also seems clear that textile production was taking place in Nubian temples, as discussed earlier in this chapter.

²³³ O'Connell 2007, 239. Some of Egypt's best preserved late antique monasteries were initially necropoleis from the Dynastic period that were inhabited by famous ascetics, such as the Monastery of Apa Jeremias at Saqqara and Deir Anba Hadra at Aswan, and were then expanded as followers flocked to the sites and began building purpose-built structures recognizable from other monasteries, churches, cells, refectories, work spaces, etc. O'Connell 2007, 240. See Quibell 1912.

²³⁴ O'Connell 2007, 240-141.

²³⁵ Wipszycka 2011, 175.

doorways.²³⁶ Items associated with textile production were also found in the vicinity of these pits, and they were subsequently interpreted as loom pits.²³⁷ Similar structures were found in a room of the monastery at Abydos at Sohag, where eight similar pits had been set up, two against each wall [figs. 4.10 and 4.11]. The exact date of the features is unknown, but reused capitals dating to the fifth and sixth centuries found nearby led excavators to date the structure to the seventh or eighth centuries.²³⁸ The pits were stepped, with masonry creating ledges over the highest step, long wooden bars protecting the front edges of the pit, late Roman jars sunk into the floor to the right, and the circular granite slabs to the left. Unlike at the Monastery of Epiphanius, there were no other objects associated with textile production found, but holes carved in the centre of the front ledge of each pit and into the stone blocks on the wall approximately twenty centimetres above the floor level have been interpreted as accommodation for the wooden fixings of a vertical loom; rectangular shaped corbels found in the debris may have also been fixed to the walls for ropes to act as loom supports.²³⁹

At the Monastery of Deir el-Bachit on the western banks of the Nile, the largest of the monasteries in Thebes-West and in use between the sixth and tenth centuries, a storage room was uncovered during the 2004 excavation season that had two similar loom pit structures dug into the floor.²⁴⁰ They have also been identified, both by excavators and after the fact, in tomb-cells at Tell el-Amarna [fig. 4.12], Deir el-Qarabin/Kom el Ahmar/Sharuna, Cyriacus, Gournet Murrai, Deir el-Bachit,²⁴¹ and possibly Naqlun and Medinet Habu (Jeme).²⁴² At Deir el-Bachit,

²³⁶ Winlock and Crum 1926, 68-69.

²³⁷ Carroll 1985, 169.

²³⁸ Farag 1983, 54.

²³⁹ Farag 1983, 53-57.

²⁴⁰ Lösch *et al.* 2012, 28.

²⁴¹ Sigl 2007; 2008; 2011; Wipszycka 2011; Eichner 2015; Eichner *et al.* 2009; Huber 2006.

²⁴² Godlewski 2007 reported similar structures at Naqlun without coming to a conclusion regarding their function, but later reported to Wipszycka his determination that they were, in fact, loom pits. Wipszycka 2011, 174 fn. 28. Re-examination of the excavation reports at Medinet Habu (Hölscher 1954) revealed a structure next to the church with a room possibly containing three loom pits. Bechtold 2007, 7; Wipszycka 2011, 174. It is possible there were more monasteries that had loom-pit structures, but as Sigl has pointed out, publication of Coptic

two bowls sunk into the floor near the loom pits, like those found at Abydos, contained spindle whorls and raw unspun fibres, likely flax.²⁴³ In each of the monasteries, the loom pits appeared during the period of Christian reoccupation.²⁴⁴ There has been some scepticism that the pits from the Monastery of Epiphany and Abydos in particular were in fact for looms as they are very narrow and seem to lack the required support fittings.²⁴⁵ The original interpretation at Epiphany was that the loom pits were for actually for a horizontal loom, not a vertical one, and were intended for the weaving of narrow tapes or ribbons, accounting for the size of the pits.²⁴⁶ However, such textiles were probably tablet woven without the use of a loom.²⁴⁷ A more probable explanation for the width of the pits at Epiphany and Abydos, and the variety of sizes found throughout the sites, can be found again in the anthropological studies of Grace Crowfoot, this time from her studies of the Near East in the 1930s. Crowfoot recorded the practice of using vertical looms set above a pit with the loom frame leaning up against the wall in Syria and Palestine [fig. 4.13].²⁴⁸ If the structures found in the monasteries are indeed loom pits, the examples from Syria offer a suggestion of how they may have been used, and point to a wide-scale development of textile production facilities within monasteries.

Additional evidence from the documents supports the argument that weaving was an important aspect of monastic life.²⁴⁹ For example, in the surviving corpus of monastic rules by Shenoute several refer to textile production or products. Rule 211, directed to the nuns, refers to the ‘wool that you work on’;²⁵⁰ rule 316 discusses how products from the monastery should

material in Pharaonic contexts is often slow, and it is also possible they were destroyed in excavation without being recognized. Sigl 2007, 358.

²⁴³ Sigl 2011, 386

²⁴⁴ Sigl 2011, 377. At the necropolis of Dra’ Abu el-Naga in Thebes, three rooms of the later Christian monastery had features which had been interpreted as loom pits, but were later determined to have been part of the original use of the rooms. Polz and Eichner 2005, 301-303.

²⁴⁵ Wild 1987, 459; Ball 2009, 43.

²⁴⁶ Carroll 1985, 169.

²⁴⁷ Bechtold 2007, 5. For an overview of weaving technology and looms, see appendix 4.

²⁴⁸ Crowfoot 1941.

²⁴⁹ Lösch *et al.* 2012, 28-29.

²⁵⁰ ‘And just as it is done in our (men’s) domain so too shall you (women) do, not to let girls go in pair to light the lamp for the morning gathering or to make arrangement for the gathering

be sold and the setting of prices;²⁵¹ and rule 429 directs the laying out of reeds to be woven into baskets (often linked with weaving).²⁵² Shenoute's preserved writings to the nuns of his monastic community also contain frequent mentions of spinning and weaving.²⁵³ The previously mentioned papyrus from Kellis, P.Kell.1.12 (fourth century AD), refers to a young man being sent to a monastery to learn the art of weaving.²⁵⁴ And a Coptic inscription on a re-used Pharaonic temple at Deir el-Medina contained instructions for weavers on a wall constructed in association with the monastery, although the date of the inscription is unknown.²⁵⁵ It seems the monastic communities, like the secular communities in Egypt, were participating in textile production and training as well, possibly in makeshift 'workshop' settings.

An eighth-century monk named Frange, living in the Theban region, who left behind a considerable record of private correspondence in his tomb (TT 29), documented on an ostrakon (O.TT 29.61) receipt of payment of three *artabae* of grain (approximately ninety kilograms) for four pairs of *keiriai*, the tapes or bandages used for wrapping the external shroud to the body.²⁵⁶ At such a price, it is clear the monasteries were capable of producing high-quality

at the time of evening by laying out the wool that you (plur.) work on, unless the house leader is present—or the second or a great woman who is perfect in propriety and the fear of the Lord.' Codex XS 353-54, trans. Layton 2014, 175.

²⁵¹ 'As for all things of every craft that are for sale, whether linen, hair cloth, rope, basket, book, or any other thing that they are learning how to make, they shall keep them for their own use at any time in these abodes (*topos*). And they shall not sell any of them until they are of good quality, and until those who construct them show clearly that those to whom we sell them shall not despise the name of God on our account, and that we are not going to charge a reduced or bad price for them. And if we happen to sell some things that have only partially been finished, we shall sell them for what they are worth, and shall inform the buyers that they come from siblings who are learning.' Codex BV 39, trans. Layton 2014, 223.

²⁵² 'When it is time to spread out the soaked reeds for the gathering in the early morning or at evening, they shall go in fives or sixes, or on occasion fours and even threes. I am referring to this house or this church (*ekklesia*) here. And also those in the village (the nuns) shall...' Codex ZA 224, trans. Layton 2014, 275.

²⁵³ Wipszycka 2011, 173.

²⁵⁴ Bowen 2002, 97.

²⁵⁵ Heurtel 2004, 20-23; Wipszycka 2011, 179; Winlock and Crum 1926, 9 for the translation into English.

²⁵⁶ Boud'hors and Heurtel 2010, 75.

goods for commercial markets. The collection of ostraka from TT 29 also reveal that the monks were often trained in multiple crafts, unlike lay people; in addition to being a weaver, Frange was a scribe.²⁵⁷ Monasteries were also invested in the cultivation of the raw materials. In exchange for cash loans before the planting season, monks would collect flax from peasants after the harvest, showing that the monasteries may have been integral parts of the rural economy.²⁵⁸

The widespread production of textiles in such a variety of settings further speaks to the conception of space within late antique society; these monasteries were initially set up for the seclusion from the concerns of the world, but in their economic activities were actively participating in it, expanding the areas that would be considered commercial production zones, from urban to rural zones and at least sometimes isolated monasteries. The terminology used for regions and installations highlights the ambiguity of spatial delineation in late antique society. The Greek and Coptic words which are commonly used to refer to the desert borderlands, the frontier of the cultivated and ‘habitable’ land, ὄρος and ʿooṣ respectively, can also at various times mean mountain, desert, cemetery or monastery.²⁵⁹ The meaning, rather than referring to a specific type of place of built landscape, referred to anywhere that was outside the Nile’s cultivation zone, typically where Pharaonic necropoleis would have been located,²⁶⁰ allowing for a wide variety of social and economic roles to be ascribed to such spaces. This fluidity in conceptions of space should be kept in mind when discussing such a seemingly deterministic phrase as ‘domestic production’.

²⁵⁷ Wipszycka 2011, 182.

²⁵⁸ P.Mon.Epiph. 85 records such an exchange, where for two *solidi*, two *arurae* of flax will be sown, suggesting large-scale production. P.Köln. 3.151 (AD 423) records a similar agreement. Wipszycka 2011, 182, fn. 41.

²⁵⁹ O’Connell 2007, 242-243.

²⁶⁰ O’Connell 2007, 242.

Urban versus rural centres

The other major distinction used to categorise textile production in modern scholarship is the divided roles between urban and rural production. Traditionally, the relationship is constructed so that the preparation of raw materials took place in rural settings, near cultivation or animal husbandry, while artisanal production took place in the city.²⁶¹ Both literary and documentary texts name several cities as textile production centres, and reveal the networks of connection between wealthy landowners in urban areas and their tenant farmers in the towns and villages. These relationships, along with their legal and economic implications, have been studied in depth in a series of volumes by Dennis Kehoe,²⁶² who has emphasised the importance of agriculture within the Egyptian economy:

Agriculture employed the vast majority of the empire's population, and it played a crucial role in the Roman government's effort to govern the empire. Agriculture constituted the basis for the wealth of the Roman upper classes, who dominated the government both in Rome and in the cities of the empire, and whose social and political privileges it was the imperial government's policy to foster. Many upper-class Romans derived their fortunes from estates cultivated by small-scale tenants.²⁶³

Landowners used tenancy and lease contracts to keep their own capital investment and managerial costs low.²⁶⁴ They were therefore able to largely transfer management responsibilities and decision making to others, evidenced in remaining contracts, business letters and accounts which survive in papyri and ostraka.²⁶⁵ Such arrangements were common throughout the ancient world, and several writers described the responsibilities of landowners and tenant farmers, as well as the imperatives of good management.²⁶⁶ The divisions between what happened in the city and what happened in the country have been seen as extending into

²⁶¹ Putzeys and Lavan 2007, 81. This is similar to the argument put forward in Bagnall and Cribiore 2006, 78.

²⁶² In particular, Kehoe 1992; 1997; 2007.

²⁶³ Kehoe, 2007, 1-2.

²⁶⁴ Kehoe, 1992, 130-139.

²⁶⁵ Aubert 2001, 95.

²⁶⁶ Aubert 2001, 95, 97. For example, Palladius' fourth- to fifth-century AD *The Work of Farming*.

production; rural craft production was to supply the rural communities,²⁶⁷ and raw materials were sent to the cities for commercial production.²⁶⁸ However, studies which have looked at the interactions between the rural and urban economies have not looked at the scale and complexities of the textile industry which complicate such linear process models. This chapter has so far examined production within the framework of domestic structures, workshops, and monasteries. This final section will contextualise these modes of production in terms of their geographic location.

Textile production centres

In some ways, the distinctions between what constituted urban and rural can be ambiguous, as towns and cities were often surrounded by areas of agricultural lands, and these areas could continue to expand as economic buying power within the cities grew.²⁶⁹ There is also increasing evidence that rural areas were growing in both population and wealth across the Eastern Mediterranean in conjunction with growing consumption of certain products from their areas, both natural and manufactured, in the first several centuries of the first millennium.²⁷⁰ Textiles were one such product. Few studies of textile production have looked specifically at the evidence of urban versus rural production, usually privileging urban over rural due to the concentration of evidence, and there has often been the assumption that the bulk of textile production was urban. Bagnall has suggested that the cities of Egypt remained the centres of textile production, and that the industry was likely employing a significant amount of the urban population.²⁷¹ However, there is evidence to suggest that circumstances were more ambiguous. Ewa Wipszycka's review of the papyri recorded significant textile production activity at every habitation site where documentary papyri were found, which

²⁶⁷ Erdkamp 2001, 350. As Erdkamp also points out, the model of a consumer city is dependent on the vicinity of the rural population providing agricultural goods and their capacity of surplus production. Erdkamp 2001, 352.

²⁶⁸ This was prominently advanced by Finley and Jones.

²⁶⁹ Erdkamp 2001, 346, 351; Bagnall 2009.

²⁷⁰ Ward-Perkins 2001, 168.

²⁷¹ Bagnall 1993, 82.

included cities, towns and smaller villages.²⁷² Texts analysed since her 1965 study have continued to confirm this, showing the textile industry to be highly diversified between larger imperial factories and ‘workshops’ of varying sizes.²⁷³

Certain regions were well-known for their production of specific types of textiles. For example, in Egypt, Panopolis seems to have been highly regarded for its linen production,²⁷⁴ and the regions of Oxyrhynchos and the Fayyum have revealed evidence of extensive textile production, as have many of the urban centres throughout the upper and middle Egypt.²⁷⁵ Similarly, wool textile production centres have been identified throughout the Eastern Mediterranean. In Asia Minor, these were Miletos, Sardeis, Thyateira, Saittai, Laodikea and the Lykos Valley.²⁷⁶ In Italy large textile centres identified as centres of commercial wool production for export have included Pompeii, Tarentum, Altinum, Canosa, Mutina, Patavium, and the region of Latium around Rome.²⁷⁷ Such concentration of textile production seems to also be reflected in the official documents setting prices for different types of textiles; in Diocletian’s Edict of Prices, textiles are often referred to in terms of particular geographic regions or even towns.²⁷⁸ For example, woollen garments from Phrygia, the Pontis, Cappadocia and cities in the Lykos Valley were priced higher, while the same was true for linen from Tarsos and general textiles from Antinoöpolis and Alexandria in Egypt.²⁷⁹ However, it is

²⁷² Wipszycka 1965.

²⁷³ Thomas 2007, 154.

²⁷⁴ Bagnall 1993, 83.

²⁷⁵ Bagnall 1993, 82-85; Van Minnen 1986. Though there are references to textile production through the Oxyrhynchite nome, the heaviest concentration is within the city of Oxyrhynchos itself.

²⁷⁶ Benda-Weber 2013, 173-178. Miletos: Gleba and Cutler, 2012. Sardis: Crawford 1990, 15-18. Thyateira: Zimmermann 2002, 175-176; Sanidas 2011. Saittai: Sanidas 2011. Lykos Valley: Drexhage 2007, 246.

²⁷⁷ Jongman 2000; Flohr 2016a, 38; 2016b.

²⁷⁸ *The Edict of Diocletian on Maximum Prices* in Frank 1940.

²⁷⁹ Poblome 2004, 493.

unclear from the texts what such references actually mean,²⁸⁰ and how they match the archaeological evidence of production.

The textile production *chaîne opératoire* has been a central theme in the work of Miko Flohr, who has been re-examining the evidence from Roman Pompeii, referenced previously as a centre of export based textile production. He has pointed out that in the past, if there seemed to be an unusually large amount of remains related to a certain type of product, it was generally interpreted as evidence of a centre of manufacture.²⁸¹ This was also true in Pompeii. During the excavations of the late nineteenth and early twentieth century, the ‘unusually large number of workshops, artefacts, iconographic representations and texts that point to the existence of a variety of textile crafts in the town’ were used as evidence that Pompeii had a large ‘export-oriented’ textile industry.²⁸² The emphasis on production specifically for export was quickly attacked by Finley and his followers whose models for agriculture-fuelled economic growth did not have a place for the inclusion of urban economies centred on surplus artisanal production.²⁸³ Jongman also highlighted one of the biggest problems with reconstructing Pompeii as a centre of the textile export industry: the fact that there was little evidence of large-scale spinning and weaving.²⁸⁴ There have been recent attempts to bolster the place of textile production in Pompeii,²⁸⁵ but as Flohr has pointed out, these attempts have

²⁸⁰ It is sometimes unclear if geographic descriptions refer to the place of origin of a product, or if it meant a type of product that is characteristic of a region, but produced more widely throughout the empire. The Edict of Diocletian also mentions Tarsian fabric from Alexandria, produced by *ταρσικάριοι*, almost certainly referring to immigrant weavers into Egypt producing textiles in the Tarsian manner, perhaps on a warp-weighted loom. Wild 1969.

²⁸¹ Flohr 2014, 2.

²⁸² Flohr 2013, 53. For example, see Moeller 1976.

²⁸³ See chapter 2 for a review of Finley’s model for ancient economies.

²⁸⁴ Jongman 1988, 162-165.

²⁸⁵ Allison 2004, 146-148, synthesised evidence of weaving and spinning in Pompeii, including the finds of spindles, spindle whorls and loom weights, noting that the majority of these were found in domestic settings. Monteix 2010 argues for market-oriented production in Herculaneum (and Pompeii), but also notes that the lack of clustering of the loom weights indicates that they were being re-used rather than indicating the presence of a loom. He calculates that from the loom weights, only sixteen looms can be definitively identified. Monteix 2010, 180. I find several methodological problems with this calculation. First, by the time Pompeii and Herculaneum were destroyed in AD 79, the two-beam vertical loom was also

relied on the post-Industrial Revolution paradigm that manufacturing and industry can be indicated by extensive evidence of a single phase in the production process, as set forth by Tenney Frank in 1918.²⁸⁶ As later studies have shown, there are three issues in identifying textile production centres that have typically been overlooked: first, as discussed in chapter one, there is typically little evidence for the scale of textile production;²⁸⁷ second, it does not consider the long life cycle of a textile which included production, retail, use and repair, and finally reuse; and third, such production centres are typically identified on an individual basis without acknowledging larger regional networks and patterns of production and consumption.²⁸⁸

To the question of production and how to interpret evidence of textile centres, there are two basic process reconstructions. One, prominent in the arguments of Jongman,²⁸⁹ contends that weaving and spinning took place near consumption centres (Finley's 'consumer city'),²⁹⁰ and that trade to these areas was mainly in raw materials rather than finished textile products.²⁹¹ In this model, textiles were largely confined to their local economies, thereby negating evidence of an export based industry, and the 'textile centres' served as local manufacturing centres. In the second model, production was more dispersed and took place near the source of the raw materials, before being transported to 'textile centres' for further distribution.²⁹² This

in use throughout Roman Italy, and therefore many looms would not have required loom weights. Wild 1992, 17. For a discussion of looms, see appendix 4. Second, drawing such conclusions from the clustering of loom weights relies on the assumption that all looms would have been strung with warp threads when the city was destroyed, which is possible but seems unlikely. The distribution of the loom weight finds merely indicates they were not in use on a loom at the moment they were buried, not that they were being re-used for another purpose. The peculiar circumstances under which Pompeii has been preserved need to be considered as well.

²⁸⁶ In Frank's work, this was the identification of fulleries (Frank 1918, 234-235). Flohr 2013, 56.

²⁸⁷ The papyri in Egypt give some indication of scale, but a full understanding is hindered by the geographic and temporal gaps in document preservation.

²⁸⁸ Flohr 2013, 56-57.

²⁸⁹ Especially Jongman 2000.

²⁹⁰ See also Erdkamp 2001.

²⁹¹ Flohr 2016a, 36.

²⁹² Flohr 2016a, 36.

would account for many of the textile related products found in Diocletian's *Edict of Maximum Prices* which documents prices for spun yarns and garments as well as raw materials, and mirrored in the fourth-century *Expositio totius mundi et gentium* which highlighted the specialty products and exports of each region of the Roman Empire; this also accounts for some of the more remote locations of cities identified as textile centres.²⁹³ Although the majority of the textile items described in the *Edict of Maximum Prices* would have been considered costly high-status items,²⁹⁴ the fact that they were recorded in a document with such wide distribution probably indicates that by this point regional products were being consumed outside their regional networks.²⁹⁵ As Flohr points out, one of the distinguishing features between these two models is the role of the city, static and self-contained on the one hand, flexible and dependent on variable factors of its surrounding environs on the other. As discussed in chapter three, economic historians have increasingly come to focus on the role of exchange in economic networks, emphasizing intra-regional networks over the formerly favoured long-distance connections, in which cities performed a variety of functions individual to their particular circumstances.²⁹⁶

The role of the city within a trade network was largely dictated by the resources of the hinterlands near and far and their ability to produce surpluses to support a trade economy.²⁹⁷

²⁹³ Poblome notes there is little correspondence in the location of textile centres in Asia Minor and geography or apparent transport costs; rather, the determining factor seems to have been the proximity of raw materials. Poblome 2004, 494. This is confirmed by Flohr to mirror the situation in Roman Italy, where major centres of wool production such as Mutina, Patavium, Canosa and Tarentum were situated in what would be considered more marginal areas, perhaps because there would be less agricultural pressure for foodstuffs, allowing for greater investment in animal husbandry and agriculture for fibres. Flohr 2016a, 38.

²⁹⁴ Jongman 2000, 188.

²⁹⁵ Pleket 1998, 123; Flohr 2014, 3.

²⁹⁶ In particular, this idea is taken up by Horden and Purcell 2000; Mattingly 2002; Wilson 2001 (specifically in relation to the textile industry); 2002; and on a widespread scale in Wickham 2005; 2009. Diocletian's *Edict* and the *Expositio totius mundi et gentium* generally match what both Pliny and Strabo say regarding the textile of specific areas, and according to Flohr lend credence to the validity of the earlier texts. Flohr 2016a, 27. For a discussion of the *Exposito*, see Grüll 2014.

²⁹⁷ Flohr 2016a, 37-38.

This, however, does not mean every step of production would have been conducted in the same place. Despite the prevailing notion of the textile industry as a process of cohesive chain production, where an entire industry would be centred in a single city, there is actually little evidence that this was the case. As will be seen in the discussion of cotton in the coming chapters, each step in the production and distribution chain was a separate transaction that did not necessarily correspond to the previous transactions. For example, in Pompeii there were a large number of fulleries and dyeing workshops identified in support of the conclusion that the city had been a centre of export-oriented textile production. However, these represent steps at either end of the production process; dyeing was typically done before the fibre was spun into yarn, and fulling was done after a garment was complete, sometimes several times over the course of a garment's life.²⁹⁸ This does not necessarily mean there was also a large industry for the steps in between, and textile production may have been highly dispersed. Therefore, while it is probable that there were centres for varying types of production, cities should not be given outsized consideration in discussions of the textile industry. As Flohr states, 'In the decentralised manufacturing economy...the role of an urban centre was basically that of an aggregator.'²⁹⁹

Conclusions

While in the past, many studies of textile production have used evidence from a single region, and therefore often a single fibre, to discuss the textile industry as a whole, the histories of the fibres were actually quite different. While it is not yet possible, with current evidence, to create complete production narratives for every fibre, there does seem to be one significant distinction that shaped the way certain fibres were treated; whether they were used for luxury textiles or not. Those that were, linen and silk, were subject to greater regulation of their production and trade than those that were not, wool and cotton. Despite the fact that such

²⁹⁸ Flohr suggests that fulling could actually be seen as a service rather than as a step in production. Flohr 2011a, 209.

²⁹⁹ Flohr 2016a, 37.

distinctions in the textile industry are still not clear, what this chapter has shown is that there were multiple modes of production that were not strictly defined as they have been described in the past. First, there was not a clear division between domestic and professional production, just as there were not clear divisions between houses and workshops. The preparatory steps of textile production likewise could not be classified as strictly non-professional. There is evidence that spinning, for example, was being done commercially, though perhaps not in a way that would be recognised as professional organisation. The reason the initial steps of textile production have often been deemed non-professional is because they were also often seen as the work of women, done in the house as part of their household duties, but the reality is that the gender distinctions that has been characterised as part of the textile industry were actually the result of social structures within the society, as reflected in the documentation, and not because women were not participating professionally or commercially. Finally, in past studies of the textile industry, too much emphasis has been placed on cities as centres of textile production. This is perhaps why cotton, which was largely produced in what have been considered regions peripheral to the Roman empire, is not discussed more in terms of its local cultivation and production. While it has become more common for urban economies to be studied in the context of regional and intra-regional networks, connected by both roads and seas,³⁰⁰ the same considerations should be given to the areas of rural production and the regions that would be considered on the margins of the producing economy. This demonstrates the flexible relationships between the urban and rural economies, as well as the mechanisms that were driving connectivity.

³⁰⁰ Flohr 2016a, 37.



Figures 4.1 and 4.2 The funerary inscription of Pontiana, and detail of Pontinana holding a distaff in her hand. Vatican Museum, Vatican City. Reproduced from Caillaud 2013, 94.



Figure 4.3 Painting of The Annunciation on parchment, with the virgin holding a distaff, tenth century, Fayyum, Egypt. The Pierpont Morgan Library, New York. Reproduced from Kalavrezou 2003, 159.



Figure 4.4 Mosaic of the Virgin Mary receiving a skein of wool at the temple from the inner narthex of the Chora Church, Istanbul. © Chora Museum, Istanbul.



Figure 4.5 Funerary stela for Trosia Hilaria commemorated as a lanifica (wool worker), probably of the late Roman period, in the Museo Archeologico di Aquileia, Aquileia. Reproduced from Larsson Lovén 2013, 114.



Figure 4.6 Funerary commemoration of Cafurnius Antiochus and his wife Veturia Deutera, both former slaves. Antiochus is named as a lanarius, but no separate occupation is named for Deutera. It is possible she was also employed in textile production with her husband. From the courtyard of Palazzon di Fide Propaganda, Rome. Reproduced from Larsson Lovén 2013, 120.



Figure 4.7 Image of the highly fragmented SB 18.13305. © University of Michigan, Advanced Papyrological Information System (APIS).



Figures 4.8 and 4.9 Nearly complete miniatures from the temple area of Qasr Ibrim. Reproduced from Adams 1987, 120, 118.

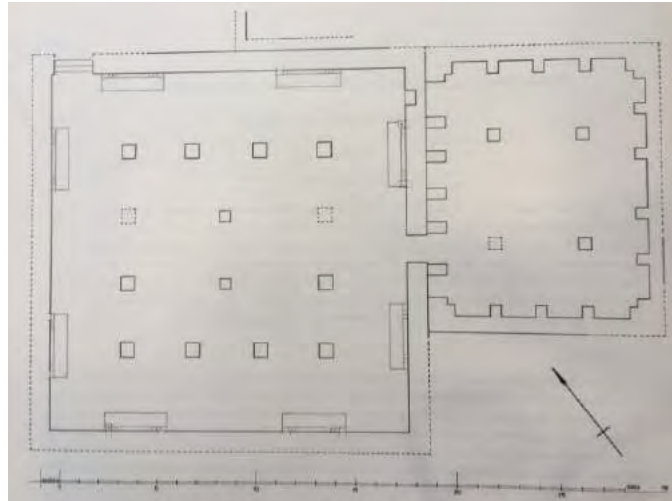


Figure 4.10 Plan of the weaving 'factory' at Abydos with the eight loom pits against the walls. Reproduced from Farag 1983, 52.

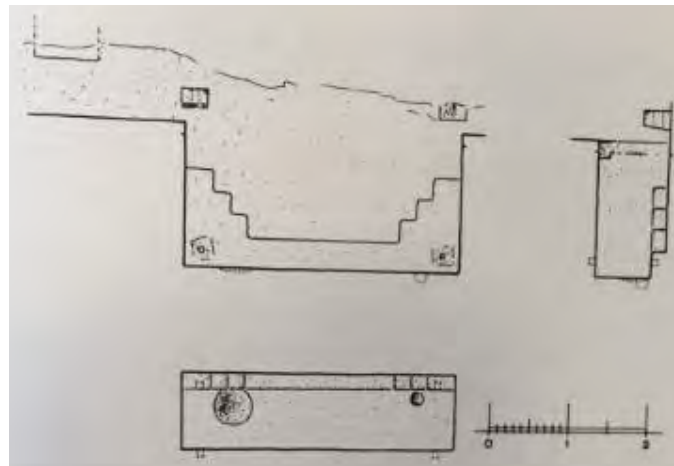


Figure 4.11 Cross-section and overhead view of the loom pits at Abydos. Reproduced from Farag 1983, 53.



Figure 4.12 Loom pit from Amarna, with hole in the ceiling possibly indicating a loom attachment. Reproduced from Sigl 2011, table 35.



Figure 4.13 Image of a man weaving on a two-beam vertical loom in Syria, c. 1940. The bottom of the loom is in the pit as the man sits on the edge and the loom rests against the wall. Reproduced from Crowfoot 1941, pl. XII.I

Chapter Five:

Nubia and the Earliest Evidence of African Cotton

Introduction: Nubia and the Kingdoms of Kush

As discussed in chapter one, both Pollox and Pliny described cotton being grown in the Roman province of Egypt, and in discussions of early cotton use in the Mediterranean, Egypt is often at the centre. However, the earliest evidence of cotton use and cultivation does not come from Egypt, but from Nubia. The first evidence of cotton was identified at Afyeh in Lower Nubia, from a mixed context of plant and animal remains which included several charred cotton seeds, and from animal coprolites which contained seeds with the lint still attached, leading researchers to conclude that semi-domesticated cotton was being used for animal feed.¹ These finds had been dated to the third millennium BC based on radiocarbon dating of associated charcoal finds at the site,² but this is a misreading of the BP ages and the samples are probably from the fourth millennium BC.³ As detailed in chapter two, it is not known where domestication of cotton in Africa took place, as large regions of sub-Saharan Africa have not been subject to even cursory archaeological survey. But the potential presence

¹ Chowdhury and Buth 1970, 85-86; 1971, 86. However, it has been suggested that there is reason to suspect this evidence is the result of site contamination. Yvanez, 2015, 104-105. This fact is irrelevant to the larger argument of the nature of the adoption of cotton in Nubia, but could be relevant in discussions of the original domestication of *Gossypium herbaceum*.

² Ghosh 1964, 67 reported a calibrated date range from 2600-2400 BC, but this seems to have been arrived at by subtracting the BP date from 1950 and taking an approximate range; therefore the first sample, which was dated to 4540 ± 120 BP was stated as c. 2600 BC ($1950 - 4540 = -2590$) and the second sample which was dated to 4445 ± 125 BP was stated as c. 2400 BC ($1950 - 4445 = -2495$). This range has been repeated in subsequent publications.

³ Calculating the calibrated date ranges for each sample in OxCal with the IntCal13 calibrated curve returns dates for cal. 3626-2917 BC (4540 ± 120 BP) and cal. 3518-2873 BC (4445 ± 125 BP). OxCal 4.3 available at c14.arch.ox.ac.uk. Accessed 28 January 2019.

of cotton in Nubia in the fourth millennium BC demonstrates a long history of interaction between the civilisations of Nubia and sub-Saharan Africa, and Nubia's integral place in the diffusion history of cotton throughout the continent and beyond. The fact that cotton cultivation first appears in Nubia and inland sites throughout the African continent that are removed from Roman trade centres on the Mediterranean, including the Western Desert of Egypt, is significant not only for our understanding of the communication networks functioning throughout the first millennium, but also for contextualising Nubia as an entity separate from Egypt and important in its own right. This chapter will begin by looking at the history of the study of Nubia before examining the evidence of cotton in the Nubian world and its significance to our understanding of Nubia's place in the ancient economy.

The kingdoms of Nubia, rising in the first millennium BC, have broadly been grouped into the Kingdom of Kush, from the term used for Upper Nubia in Middle Egyptian (*Kš*),⁴ though the exact location of Kush at this time (and whether the term referred to a geographic entity or a polity) remains unclear.⁵ However, the Kingdom of Kush in modern parlance is now used as a broad characterisation of the civilisations of Nubia from the early first millennium BC to the middle fourth century AD, centred on three successive urban power bases: Kerma, Napata, and Meroë (with an intervening period of Egyptian colonial rule in the New Kingdom that followed the decline of Kerma) [fig. 5.1].⁶ The Kerma Culture (roughly from 3000-1500 BC) from the city of Kerma, near the Third Cataract in the fertile Dongola Reach, grew to become political and economic rivals to their Egyptian neighbours to the north.⁷ While the

⁴ Posener 1958.

⁵ Lower Nubia was also referred to as *Wawat* (*W3w3t*), a term from Old Kingdom Egyptian that was adopted in Middle Egyptian. Cooper 2017, 201. This divide between upper and lower Nubia was used by Adams 1977. Posener proposed that Kush could broadly refer to the region below *Wawat* (Posener 1958, 60-62), but it has also been proposed that references to Kush were geographically ambiguous (Kemp 1983, 134). A critique of both views can be found in O'Conner 1986, 39-50. The debate has yet to be fully resolved. Cooper 2017.

⁶ Edwards 1998, 175.

⁷ Trigger 1976, 21; Minor 2012, 19-23.

origins of ‘Kush’ are obscure,⁸ the appearance of the Middle Egyptian term *Kš* concurrent with the rise of Kerma indicates the migration of a new ethno-linguistic group to the region.⁹ At its greatest extent, the borders of Kush extended over more than 1,000 kilometres of the Nile Valley, from Lower Nubia, south of the First Cataract to Sennar on the Blue Nile, far south of the Sixth Cataract,¹⁰ and though the capital cities may have changed, reflecting shifting power bases, the Kingdom of Kush represented a significant economic area. However, the early histories of Nubia were still written in relation to Egypt, with Nubia as a ‘secondary state’ on the margins of a great civilization, unique within, and effectively unconnected with, other regions of sub-Saharan Africa,¹¹ the implications of which are still felt in modern scholarship. While this is partly a consequence of the written record (with few exceptions, the earliest references to the peoples of Nubia are Egyptian)¹², its roots ultimately lie in the early explorations of Nubia under British colonial rule.

The Egyptocentric development of Nubian studies

In 1904, increasing numbers of archaeological finds prompted the colonial British Sudanese government to establish an antiquities service, and they placed John Winter Crowfoot, husband of Grace Crowfoot whose anthropological study of Nubian cotton weaving was discussed in chapter two, in charge of the care of archaeological finds. Although John Crowfoot was himself an academic, the administration of the antiquities service mirrored that of other artefact-rich countries under colonial control—archaeological finds were routinely transferred out of the country to museums across Europe and America, and foreign

⁸ Edwards 1998, 175.

⁹ Cooper 2017, 201. Although the Kingdom of Kush is sometimes used to refer only to the period of Napatan and Meroitic power (such as Welsby 2002), the Kerma culture is also often included in recognition of both the Egyptian conception of the people of Nubia as well as the continuities between the cultures as archaeological research in the area progresses (for example Edwards 1998; Hafaas-Tsakos 2009; Boozer 2017). Egypt’s Twenty-Fifth Dynasty is also sometimes referred to as the Kushite Dynasty.

¹⁰ Edwards 1998, 175.

¹¹ Edwards 1998, 175.

¹² Williams 2013, 1.

archaeologists and treasure hunters were drawn to the region.¹³ As was the case with early twentieth-century archaeology in Egypt, many excavations took place in a haphazard fashion, and results were often not published until many years after the fact, if ever. One of the more important examples are the excavations conducted by John Garstang from 1910 to 1914 at the city of Meroë. Prior to his work at Meroë, Garstang had conducted excavations at Abydos, which likely swayed his own interpretations of the site and the emphasis he placed on identifying Egyptian and Hellenistic influences there.¹⁴ Although Garstang went on to publish five interim reports on his excavations of Meroë,¹⁵ all work ceased with the outbreak of World War I, and a full report of the excavation was not published until 1997, written by Laszlo Török who studied photographic archives, artefacts, and field notes to reconstruct the excavation.¹⁶ Later excavations of Nubia continued to be conducted with a similar lack of academic rigour.

The American archaeologist George Andres Reisner travelled to Sudan to excavate after the end of World War I, continuing to uncover the royal cemeteries from the Kerma culture through the Meroitic period into the 1920s. In this endeavour, Reisner managed to accomplish the impressive feat of excavating all of the known royal cemeteries within the Kingdom of Kush dating from the ninth century BC through the fourth century AD, establishing the sequence for what became the accepted chronology of the Nubian kingdoms.¹⁷ While Reisner's work on the chronology of Nubian cemeteries remains influential,¹⁸ it has been noted that these excavations irreversibly damaged many sites by destroying subsidiary structures and giving only cursory descriptions of what was found, without drawings or

¹³ Boozer 2017, 226.

¹⁴ Török 1997 vol.2, 1. For example, Garstang's description of the necropolis notes the similarities to both Egyptian and Roman structures. Garstang 1911, 29-33. However, he also notes that the pottery seems to be entirely Meroitic. Garstang 1911, 37.

¹⁵ See, Garstang 1910; 1912; 1913; 1914; and 1916.

¹⁶ Török 1997 vol. 2: 2 vols.

¹⁷ Boozer 2017, 231.

¹⁸ These excavations were reported in Reisner 1918; 1921; and 1923d. The chronology was established in Reisner 1923c.

photographs, and leaving many questions regarding Nubian burial practice unanswered.¹⁹ Reisner also ascribed to the so-called ‘Hamitic Hypothesis’, described by Bruce Trigger as ‘insidious speculation that attempted to establish a prehistoric counterpart for the modern Western European colonization of Africa...’.²⁰ Based on racial stereotypes of the time, the core of this theory was that native African peoples would have lacked the organization and ability to create complex societies, so that whenever it was clear that a society was not a result of Phoenician, Greek or Egyptian colonisation, it was ascribed to the light-skinned ‘Hamites’ from northeast Africa, north of sub-Saharan Africa.²¹ Therefore, any periods of progress in Nubia were seen as due to the influence of the ‘Hamitic’ peoples and the imitation of superior Egyptian culture, while periods of decline were due to the influence of sub-Saharan Africans to the south.²² For his part, Reisner wrote:

‘Wretched Nubia’, as the Egyptians called it, was at first part of Egypt. After the First Dynasty, it was only an appendage of the greater country, and its history is hardly more than an account of its use or neglect by Egypt, its enrichment or impoverishment by changes of the Nile and the climate. Its very race appears to be a product of its poverty and its isolation—a negroid Egyptian mixture fused together on a desert river bank too far away and too poor to attract a stronger and a better race.²³

While such views were subsequently discredited in academia, the placement of Nubia as a subsidiary state to Egypt remained, and even entered popular perceptions of Egypt and its relationship with its southern neighbours. In a 1911 article on Reisner’s excavations published in *The New York Times*, Reisner was quoted as stating:

From the first dynasty [sic] on there is visible in Egypt a development in which Nubia did not share. The Nubia portion of Egypt held on to its old arts and customs, lost perhaps the best elements in its population to Egypt, and absorbed a certain amount of negroid population from the south and from wandering tribes to the east or west.²⁴

¹⁹ Boozer 2017, 232-233; Yellin 2014, 78, 86-87 fn. 6.

²⁰ Trigger 1994, 328.

²¹ Trigger 1994, 328. For the place of Egyptians in this theory, see Trigger 1994, 329-330.

²² Boozer 2017, 233.

²³ Reisner 1910, 348.

²⁴ *The New York Times* 12 March 1911, 4.

Even after the acknowledgement the role such blatant racism played in shaping the field, many scholars have continued to emphasise the role of Egypt in shaping the development of Nubian cultures and their material remains.²⁵ As will be seen, the development of cotton cultivation and its rapid ascent to dominant fibre use within the later Meroitic kingdom provides evidence that challenges this view, instead demonstrating an instance when Nubia was exerting influence on parts of Egypt. And while studies of the relationship between Nubia and Egypt have been well studied despite an implicit Egyptian centric bias, the interactions between Nubia and sub-Saharan Africa remain relatively unknown.²⁶

Interactions between Nubia and Egypt

From the third to mid second century BC, the Kingdom of Kush was centred around the city of Kerma. In this early period, it is difficult to define the political status of Kerma and when it became an entity that might be recognised as a state, particularly because of the lack of textual resources,²⁷ but there is evidence that organised trade was being carried out between Nubia and Egypt. The Old Kingdom tomb 34 from Qubbet el-Hawa, across the Nile from Aswan, contains the famous biographical inscription of Harkhuf, which details several expeditions to Nubia. Harkhuf was a native of Elephantine and an official who served two Sixth Dynasty kings, Merenre I (r. c. 2287-2278BC) and Pepi II (r. c. 2278- probably c. 2216). His tomb recounts three trips to ‘Yam’.²⁸ On his first journey, he travelled with his father, on the second, he travelled through other districts of Lower Nubia on his way home from Yam,²⁹ and, on his third journey, he travelled along what was called ‘the oasis road’ (*w3t wh3t*) instead of one that followed the Nile, referring to the oases of the Western Desert.³⁰ The significance

²⁵ Edwards 2004, 7-9; Boozer 2017, 226, 235. Boozer points out that Adams, 1977 is a notable exception, but there are other issues with the construction of Nubia in this work, which will be addressed later.

²⁶ Edwards 2007, 212.

²⁷ Flammioni 2008, 51.

²⁸ For a discussion of the exact geographic location of Yam (another term used to refer to a region of Nubia) see Cooper 2017.

²⁹ Kadish 1966, 23-24.

³⁰ Förster 2013, 312-313; Gourdon 2014, 201.

of this early reference to connections between the Egyptian oases of the Western Desert will be returned to in the next chapter, but for now what is important is the reflection of a sustained trading relationship between Nubia and Egypt at an early period.

However, at other times the relationship between the two was also defined by an ebb and flow of military conflict and power struggles. Dating to the Old Kingdom, the Palermo stone (one of the remaining seven stele that make up the Royal Annals) records a slave raid conducted by Pharaoh Sneferu (c. 2613-2589) into Nubia, and an Egyptian settlement, Buhen, that was constructed at the Second Cataract.³¹ It was not until after the First Intermediate Period, at the beginning of the Middle Kingdom, that the Egyptians made their first full-scale incursion into Lower Nubia initiating a period of colonial occupation. A chain of fortresses were constructed from Elephantine to Semna South in the Twelfth Dynasty, creating a fortified frontier south of the Second Cataract, and these were maintained until the late Thirteenth Dynasty (approximately 2050-1750 BC).³² The purpose of these fortifications was laid out in an early stela from year eight in the reign of Sesostri III (or Senusret III, r. 1878-1839 BC) found in Semna:

In order to prevent all *nehesyw* passing it in traveling downstream by water or by land with a ship or with all cattle of the *nehesyw*; except when a *nehesy* will come in order that trading might be done in Iqen (Mirgissa) on or a commission. Any good thing may be done with them; but without allowing a boat of the *nehesyw* to pass in traveling downstream by *Heh*, forever.³³

In other words, they were used as a means of controlling the interactions with Nubians. As the power of the Egyptians waned leading into the Second Intermediate Period, Kerma was able to exert greater power and reconquer Lower Nubia, even going so far as to stage their own

³¹ Flammini 2008, 53; Adams 1977, 41. The Royal Annals record the names and reigns of the kings of Egypt from the First through early Fifth Dynasties, as well as significant events that occurred.

³² Edwards 2007, 281; Flammini 2008, 53.

³³ Smith 1995, 40. *Nehešyw* refers to a culture known as the C-group that inhabited the area of Lower Nubia between the First Cataract and just south of the Second Cataract. Flammini 2008, 53-54.

incursions into Egypt, recorded in the tomb of Governor Sobeknakht at Elkab near Edfu.³⁴ Egyptian colonial rule was re-established in Lower Nubia during the New Kingdom (1550-1070 BC),³⁵ but this too ended during the upheaval of the Third Intermediate Period. Little is known of the end of Egyptian rule in Nubia, or the move of the power base from Kerma to Napata,³⁶ but by the eighth century BC, the new Kingdom of Kush centred on Napata was powerful enough to stage a full invasion of Egypt, establishing the Nubian Twenty-fifth Dynasty (744-656 BC) at the end of the Third Intermediate Period.³⁷ During this time, the Nubian rulers adopted some of the archaic symbols of the royal Egyptians, such as pyramid burials which they constructed at the royal cemetery at Napata [fig. 5.2], as well as certain aspects of Egyptian iconography [fig. 5.3].

There were two main kingdoms following the decline of Kerma, named after the two cities that served as their successive capitals: the Napata and the Meroë. Napata remained the capital of the Nubian kingdom after the fall of the Twenty-fifth Dynasty until sometime in the fourth century. By this time Egypt had been invaded by the Persians, and a Persian raid in 591 BC seems to have negatively impacted the economic fortunes of Napata and paved the way for the rise of Meroë as the new economic centre, though the actual transition to the royal capital seems to have not taken place until sometime around 300 BC.³⁸ In this period, the royal cemetery of Napata was replaced by a new royal cemetery to the east of Meroë city, and there was a distinct change in the cultural iconography of the tombs constructed there to one that was

³⁴ Davies 2003, 52.

³⁵ For discussions of Egyptian colonialism in Nubia, see Morkot 1991; Smith 1995; 2003, especially chapter four.

³⁶ Minor 2012, 1.

³⁷ Some have sought to link the rulers of Napata, and the Twenty-fifth Dynasty with Egypt, but there is little evidence of such a connection. Edwards 2007, 219. For a summary of various theories, see Buzon *et al.* 2016.

³⁸ Manning and Ruffini 2013, 4822.

less Egyptian [fig. 5.4].³⁹ It also resulted in a distinctive material culture which has helped archaeologists identify Meroitic settlements as far south as Semnar on the Blue Nile.⁴⁰

The Meroitic period saw an expansion of trade throughout Nubia, but not only with Ptolemaic and later Roman Egypt. The introduction and growth of camel use (thought to be present in Lower Nubia by at least the seventh BC)⁴¹ resulted in some power shifting away from the centres of the Nile Valley to the desert regions further west.⁴² Increasing use of the camel and land caravans meant Libya could be reached via three routes [fig. 5.5]. One was direct through the Tibesti area, another a more southern route around Lake Chad, and up to the Fazzān, both routes used in the Medieval period and very likely used in the later Meroitic period as well,⁴³ if not earlier. The other was via the oases of Egypt's Western Desert, where the Darb el-Arbain, which connected Nubia to the Kharga Oasis, branched off and met up with east-west routes leading to the Dakhla Oasis and further into the Western Desert.⁴⁴ The use of these routes is increasingly being attested to by growing collections of artefacts as further excavations are carried out.⁴⁵ While the largest number of imports found in Meroitic sites have been, unsurprisingly, Egyptian, and Aswani in particular,⁴⁶ both amphora and other trading vessels from the Maghreb have also been found in Meroitic contexts.⁴⁷ The additional possibility of trade in organic materials through the deserts will be discussed in the next chapter.

³⁹ It has been suggested that this perhaps reflected a shift away from the Egyptian pantheon of gods towards local deities. Burstein 2008, 47.

⁴⁰ Connah 2015, 88.

⁴¹ Rowley-Conwy 1988.

⁴² Alexander 1988, 79-81. Finds of camel bones in Meroitic tombs and a bronze camel figuring in the tomb of Prince Arikhankharor in the royal cemetery confirm the use of camels in the Roman period, c. the late first century BC to the early first century AD. Welsby 2002, 155; Vincentelli 2003, 85.

⁴³ Vincentelli 2003, 84.

⁴⁴ Rossi and Ikram 2013, 265.

⁴⁵ Vincentelli 2003, 83-85.

⁴⁶ Edwards 1998, 189

⁴⁷ Edwards 1998, 189.

The evidence, though fragmentary, illustrates a continuous and at times contentious trade relationship between Egypt and Nubia that continued up until the Roman occupation of Egypt, the time period in which cotton begins to spread throughout the Saharan regions of Africa. Rome's approach to Nubia, after it gained control over all of Egypt in 30 BC was similar to previous Egyptian administrations; although there was not necessarily the desire to colonise Lower Nubia, there was an attempt to make the kingdom of Meroë a subsidiary 'client kingdom' where Meroitic interests would be constructed to align with and serve those of Rome.⁴⁸ While Rome initially dispatched their military south, the venture was short lived, as the campaigns in Arabia in 24 BC forced the Roman armies to leave the Nubian border unguarded. Unrest in Aswan, perhaps encouraged by the kings of Meroë, and the lack of a Roman military presence enabled Meroë to stage an incursion into Egypt and sack Aswan;⁴⁹ the results of this conflict were recorded by Strabo, and referenced in the *Res Gestae Divi Augusti*.⁵⁰ In response the Prefect of Egypt, Gaius Petronius (c. 75 BC- after 20 BC), led an attack against Meroë, pushing the Nubians back to Pselchis (Dakka), destroying the city of Napata, and establishing military fortifications in Lower Nubia, including at Qasr Ibrim on the Nile between the First and Second Cataract. Rome maintained marginal control over Lower Nubia and the trade routes between Nubia and Egypt from their fortified garrisons for approximately another one hundred years, but the evidence suggests only occasional official contact with the rulers of Meroë; both Pliny and Seneca record missions sent by Nero, perhaps in preparation for staging another conquest into Nubia.⁵¹ The descriptions of these missions have raised questions as to whether they are discussing the same event, or even the same place,⁵² but regardless Nero died in AD 68 before any potential further military action could

⁴⁸ Boozer 2017, 212.

⁴⁹ Boozer 2017, 212.

⁵⁰ Strabo *Geography* 17.1.53-54; *Res Gestae Divi Augusti* 26.5.

⁵¹ Pliny *Natural History* 6.35.181; Seneca *Natural Questions* 6.8.3.

⁵² As Pliny describes the mission meeting a queen while Seneca describes a king, Hintze suggested that they were actually describing two different missions, while to Welsby, Seneca's

be taken.⁵³ Lower Nubia, therefore, was left largely undisturbed by the Romans after the garrisons were abandoned in the early second century AD, and Meroë was able to bring the area under its control.

Despite the complex history of interaction between Egypt and Nubia, the historiography of Nubia has tended to describe it as a ‘lesser’ state that served little other function than to provide Egypt with luxury goods from further south,⁵⁴ influenced by the contemporary culture in which these works were being written. In chapter three, the historiography of all of Africa in the Roman period was examined, depicting a situation in which the agency, and often the very presence, of African civilisations were rendered invisible in favour of theories of colonisation and subsidiary states. Here I have attempted to trace this back further specifically in Nubia, a region that saw a succession of powerful cultures rise and fall within the context of fluctuating relations with Egypt, but which still largely remained independent. While it is true that there were clearly close trade relations that saw the Nubian states providing goods to the Egyptian Nile Valley, it also seems that the extent of actual political control the polities of Egypt exerted over Nubia never extended past the closest borderlands between the First and Second Cataracts, and even then was intermittent. The nomadic tribes that inhabited the deserts between served as a vexation and buffer for both, and as will be discussed, the archaeology shows that the civilisations of Nubia had their own distinct material culture, especially in the Meroitic period, of which cotton was a part. How cotton developed and then spread from Nubia will show that while the Nile River was an important trade route linking Nubia with its neighbours, Nubia maintained dynamic relationships along other trade routes and was a polity distinct from Egypt.

description of the landscape more closely matches that of the White Nile over 1,000 miles south, rather than Meroë. Hintze 1973, 131; Welsby 2002, 70; Boozer 2017, 213 fn. 11.

⁵³ Boozer 2017, 213.

⁵⁴ For example, Adams 1977; Edwards 1998, 179.

Excavations of Meroitic sites

Compared to Egypt, excavations in Nubia began relatively late, and under more unusual circumstances. Some of the early excavations have already been detailed, but from the beginning the archaeological investigation of Nubia has been characterised by rescue operations and political uncertainty. When construction of the first Aswan Dam commenced in 1898, archaeologists were able to influence the design enough to ensure that the temple of Philae would be spared, and it was deemed that no archaeological intervention was needed to limit damage to local sites.⁵⁵ However, plans to increase the height of the dam nine years later meant that the entire Nile Valley between Shellal and Wadi es-Sebua would flood, and resulted in a rescue operation of sites in the areas threatened by rising water levels. The First Archaeological Survey of Nubia, conducted from 1907 to 1911, was charged with two separate missions. The first was to create a series of drawings of plans, elevations, inscriptions, and carvings on all of the threatened temples; the second was to survey of the entire area that would be flooded and excavate as many sites as possible.⁵⁶ The archaeological digs, headed by Reisner in the first season and thereafter by British Egyptologist Cecil Mallaby Firth (1878-1931), were focused almost entirely on cemeteries; all other sites, including settlements, were not only not examined, they were often not even recorded.⁵⁷ However, the artefacts recovered from the cemeteries did allow for the creation of a chronological framework of material culture that augmented the information collected during Reisner's earlier excavations of the royal cemeteries.⁵⁸ They also inspired a number of further expeditions,⁵⁹ and when it was determined that the dam would need to be enlarged again, the Second Archaeological Survey of Nubia was

⁵⁵ Adams 2014, 49.

⁵⁶ Adams 2014, 49.

⁵⁷ Adams 2014, 49.

⁵⁸ The results of these excavations were published in Reisner 1910; Firth 1912; 1915; 1927.

⁵⁹ Following the initial season of the First Archaeological Survey of Nubia, the University of Chicago began a survey of northern Sudan and excavations at Kerma; the University of Pennsylvania at Karanog, Oxford University at Faras, the University of Liverpool at Meroë, and Reisner's excavations for Harvard and the Boston Museum of Fine Art.

carried out from 1929 to 1934. As with the first survey, the focus was on mortuary sites rather than settlements, with the exception of a pharaonic fortress and a single Meroitic village called Wadi el-Arab.⁶⁰

The consequences of the focus of these early excavations on cemeteries will be discussed later, but the loss of information on the settlements of Nubia should not be understated, and highlights the stark contrast to how later rescue operations in Nubia were conducted. After World War II, survey began again in 1959 in anticipation of construction of the Aswan High Dam, several kilometres upstream from the old Aswan Dam, which would flood the area from Aswan to south of the Second Cataract. UNESCO's subsequent campaigns in the 1960s and 1970s led to the relocation of several temples, most famously the temples of Ramesses II and Nefertari at Abu Simbel, and the Temple of Philae, as well as numerous excavations. In the intervening years between the Second Archaeological Survey of Nubia and the UNESCO operations, the focus had shifted from trying to create a chronological 'sequence of cultures', as advanced by Reisner, to a recognition of a cultural continuity of the peoples of Nubia.⁶¹ However, the limited time frame available for the rescue excavations and the amount of ground to cover resulted in many sites being overlooked or incompletely excavated, including the elite centres of Faras, Gebel Adda and Qasr Ibrim.⁶² The overall impact of the subsequent constructions of dams and consequent rescue operations has been the restriction of archaeological investigations of Nubia to the areas threatened, at the expense of both settlements and sites further afield from the flood zone.⁶³ Since the UNESCO campaigns, additional excavations have sought to remedy some of the shortcomings of these early

⁶⁰ The results of these excavations were published in Emery and Kirwan, 1935.

⁶¹ Boozer, 2017, 234.

⁶² Adams, 2014, 55.

⁶³ Boozer, 2017, 209.

investigations, though occasionally interrupted by the unstable political situation in the region.⁶⁴

Textile history of Nubia

The results of these excavations have prompted scholars to create a broad picture of the economic development of Nubia dependent on a model of periphery to centre trade. Nubia's importance as an economic centre was constructed around the theory that it was the only route through the Sahara that connected the Egyptian Nile Delta and Mediterranean regions with the African interior.⁶⁵ Since William Adams' 1977 monograph *Nubia: Corridor to Africa*, Nubia has been conceived as something of a bridge between sub-Saharan Africa and the civilisations of Egypt and beyond. As a result, scholars in the past held the view that it did not have much influence on other civilisations of the African continent or the regions outside the Roman centres that formed the markets for most of its goods.⁶⁶ However, new archaeological excavations have increasingly called this into question,⁶⁷ and examination of textile finds indicates that it may have actually been very influential across northern Africa, including in the Egyptian Western Desert, in the period of late antiquity irrespective of its role in providing the Mediterranean with goods from the African interior.

As described, the final centuries of the Kingdom of Kush were dominated by the city of Meroë, creating a kingdom that spread over the length of the Nubian Nile Valley [fig. 5.6]. Evidence suggests there were three main areas of Meroitic settlement that formed administrative provinces: the Southern Province (which contained the city of Meroë and the traditional Meroitic homelands); the Napatan Province in the middle; and the Lower Nubian

⁶⁴ For example, Peter Shinnie's excavations of Meroë city, first conducted between 1965 to 1976 and resurrected in 1983, were abruptly ended in 1984 due to political conflict. Boozer, 2017, 239.

⁶⁵ Connah 2015, 69.

⁶⁶ For example, see Shinnie 1967, 168-170; Trigger 1969; Adams 1977, 20; 23-50; Connah 1987, esp. chapters three and five; Alexander 1988, 73-90.

⁶⁷ Edwards, 2004, esp. 10-20; Connah 2015, 70.

Province, bordering Egypt.⁶⁸ The development of the desert Korosko Road (possibly a result of the introduction of the camel in the first millennium BC), which began at the Nile at Abu Hamed and led northwards, connected the Southern Province with Lower Nubia,⁶⁹ although structurally, the two provinces were very different. Whereas the Southern Province was characterized by large urban centres, such settlements were largely absent from Lower Nubia which instead contained several small administrative centres connected by farming villages located on the banks of the Nile.⁷⁰ Lower Nubia is also where the most compelling evidence of cotton cultivation comes from.

The evidence from Kerma and sites of the Napatan period suggests that clothing prior to the rise of Meroë was generally made from either leather or linen. Reisner's excavations of Kerma period graves revealed the use of leather kilts, similar to those found in 'Pan-Grave' burials of Nubian mercenaries found in Egypt near Edfu, as well as the remnants of linen cloth.⁷¹ Linen was also found in the graves excavated at the cemetery of Gammai.⁷² Later analysis of finds from the University of Geneva's excavations at Kerma from 1979 to 1981 confirmed the use of both leather and linen, with the use of linen seen as a sign of Egyptian contact.⁷³ While linen was most often found in burials as shrouds, this was not necessarily reflective of everyday use of textiles. Regardless, the lack of evidence of the use of other types

⁶⁸ Connah 2015, 88.

⁶⁹ Rowley-Conwy 1988, 245-248.

⁷⁰ Connah 2015, 89.

⁷¹ Reisner 1923b, 303-308; Vogelsang-Eastwood 1993, 16-31; Minor 2012, 160-161. The 'Pan-Grave' culture refers to a nomadic group of the Eastern Desert that likely had its origins in Nubia.

⁷² Bates and Dunham 1927, 1-21.

⁷³ Ryder 1984, 477-478; Minor 2012, 179. Flax was not native to Nubia (Bianchi 2004, 44) and there is a noticeable increase in the proportion of linen found from Napatan cemeteries compared to Kerma cemeteries. This is also partially due to the general ubiquity of linen in Egypt, and the fact that it was an Egyptian trade good throughout the Dynastic periods. Morkot 2001, 249. Archaeobotanic evidence shows that flax was being cultivated in Lower Nubia in the Napatan and Roman periods. Clapham and Rowley-Conwy 2007, 159.

of textile fibres suggests the widespread use of linen, which continued in the Napatan period as well.⁷⁴

Wool was introduced to Nubia on a wider scale after the Roman conquest of Egypt, but never attained the level of use it did in parts of Egypt. As previously mentioned, after Rome conquered Egypt in 30 BC, it established a military presence along the southern border with Nubia, building a full garrison at Qasr Ibrim in Lower Nubia which remained functioning for approximately 125 years.⁷⁵ During this period, there was a marked increase in wool use, largely consistent with textiles found at Roman military installations elsewhere,⁷⁶ but despite such a dramatic increase, linen remained the dominant textile type for both clothing and furnishing.⁷⁷

Archaeological cotton in Nubia

A dramatic shift in textile fibre usage occurred at the turn of the first millennium AD with the introduction of cotton. Cotton was first identified by Reisner and the botanist R. E. Massey in the textile assemblage from the tombs of the western cemetery at Meroë (Begrabiya), published in 1923 as being of the ‘Greco-Roman period’,⁷⁸ later determined to have had a significantly longer period of use, from the eighth century BC to the third century AD.⁷⁹ After this discovery, the few textile remains that had been collected from a previous excavation at the similarly dated cemetery of Karanog in Lower Nubia, in use from the first to fourth centuries AD, which had been described as linen in the original publication,⁸⁰ were re-

⁷⁴ Wild and Wild 2008, 3; 2014, 72-73; Yvanez 2015, 119-120.

⁷⁵ Wild and Wild 2006, 18; Wild *et. al.* 2007, 17.

⁷⁶ Adams and Crowfoot 2001, 30-31.

⁷⁷ While wool had been used in Egypt in the dynastic period, it was not common and only became more widely used after the arrival of the Romans. Adams 2007, 203.

⁷⁸ Massey 1923, 231. The presence of cotton in the western cemetery of Meroë was confirmed by Dunham 1963, 143, 146, 227.

⁷⁹ Dunham 1963, 1. Dunham, in the course of revisiting Reisner’s excavations of the royal cemeteries in Nubia (Dunham 1950; 1955; 1957; 1963; Chapman and Dunham 1952), re-examined a selection of the tombs in the cemeteries of Meroë, and identified three that contained textiles, two with cotton and one with flax. However, his dating chronology is based on generations of rulers so is therefore based on his understanding of the royal chronology, and explanations of the dating chronology changes somewhat in each of the five publications. He dated the cotton finds to the first century AD through fourth centuries AD.

⁸⁰ Woolley and Randall-Maciver 1910, 27.

examined and also determined to be cotton.⁸¹ Finds from the two cemeteries represent the oldest fragments of cotton textiles from Nubia that have been discovered [fig. 5.7].⁸² These early examples of cotton were initially interpreted as imports from either India or Egypt,⁸³ but further excavation of sites in Nubia continued to uncover large amounts of cotton textiles, as well as evidence of local cultivation, creating a very different picture of textile production in the kingdom of Meroë.

The earliest evidence of domesticated cotton and local cultivation, comes from the city of Qasr Ibrim in Lower Nubia, which lies along the Nile on the modern Egyptian Sudanese border, now partially covered by Lake Nasser. Qasr Ibrim has had a long history of occupation, from the eleventh century BC to the end of the Ottoman occupation in 1811;⁸⁴ its importance stems from its position along the Nile which allowed it to function as the meeting point of Egypt and Nubia. During the Nubian Twenty-Fifth Dynasty when Egypt was ruled from the city of Napata, Qasr Ibrim served as the border of the Napatan home regions and Upper Egypt. The city was called Premes or Pedeme after the Romans built their garrison there between 25/24 and 22 BC, and its fortification marked the southern extent of Roman rule until the end of the first century AD.⁸⁵ However, during the Meroitic period, Qasr Ibrim increasingly became a wealthy and powerful centre in its own right. The evidence also suggests that it may have had a substantial cotton industry.

At Qasr Ibrim, fragments of cotton textiles, yarns, wads of fibre, seeds, and capsules, have been found in no less than eighty contexts ranging in date from at least the first century BC to the nineteenth century AD when the site was abandoned. During the Roman occupation, until roughly AD 100, the finds of cotton consist of only a few seeds and capsules, but after

⁸¹ Griffith and Crowfoot 1934, 5-6.

⁸² Gevers 1990, 14; Clapham and Rowley-Conwy 2009, 247.

⁸³ For example, Arkell 1961, 166; Shinnie 1967, 129; Adams 1977, 371. This theory persisted, despite the lack of similar cotton assemblages being found in Egypt, even with increasingly intensive and extensive archaeological investigation throughout Egypt.

⁸⁴ Wild and Wild 2006, 16.

⁸⁵ Alexander 1988, 77-78; Wild and Wild 2006 18; Wild *et. al.* 2007, 17.

the Roman abandonment of the garrison, finds of seeds, capsules, wads of cotton with seeds still attached, and even complete bolls, all increase suggesting an intensification in local cultivation.⁸⁶ Nearly every Meroitic occupation layer of the houses on the acropolis contained wads of cotton lint, seeds with the lint still attached, spun yarns and occasionally complete bolls, with wads of cotton and seeds still attached.⁸⁷ However, the agricultural fields and irrigation systems that would shed light on the methods of ancient cotton cultivation have not been identified.⁸⁸ Cotton seeds and seed fragments have also been identified at the Meroitic (late first to fourth century AD) site of Hamadab, located approximately three kilometres south of Meroë,⁸⁹ and at Muweis, fifty kilometres south of Meroë, dating to the first to second centuries AD.⁹⁰ At both Qasr Ibrim and Hamadab, many of the seeds were found crushed, leading to two possibilities;⁹¹ that the seeds were processed using something heavy for ginning, or that the seeds were being put to secondary use and were being pressed for oil.⁹² If it is the former, this would contradict the observations Grace Crowfoot made regarding spinning practices in the 1920s discussed in chapter one, but it is also possible that cotton fibres were being spun both with and without that initial step in preparation, depending on the quality of the fibre and what the end-use function was.

Local cultivation for textile production is confirmed by the overwhelming textile evidence. In addition to the cemeteries of west Meroë and Karanog, cotton textiles have been recovered from sites throughout Meroitic Nubia. At the Meroitic cemeteries on the Island of Sai, located approximately half-way between the Second and Third Cataracts, cotton was the

⁸⁶ Clapham and Rowley-Conwy 2009, 249.

⁸⁷ Wild *et al.* 2007, 17.

⁸⁸ It seems likely that Lake Nasser now covers the high-level river terraces where the cotton fields were probably located Wild *et al.* 2007, 17-8.

⁸⁹ Fuller 2014, 173.

⁹⁰ Bouchaud *et al.* 2018, 395-396. The site is wetter than others where cotton has been found, and as a result no textile remains have been uncovered, but seeds and seed fragments were found in seventy-five percent of the samples.

⁹¹ Wild *et al.* 2007, 17; Yvanez 2015, 107.

⁹² Yvanez 2015, 111. Yvanez does point out that evidence of the use of cotton oil in antiquity has yet to be found.

most common textile fibre type identified.⁹³ This was also true at the cemetery site of Jebel Adda, in use from the second to fifteenth centuries, where approximately seventy-five percent of the textiles recovered were either cotton or cotton mixes.⁹⁴ At the cemetery of Aksha, in use between the end of the first century BC and first century AD, located between the Dal Cataract and the Third Cataract, roughly half of the textiles found were wool while the other half were wool and plant fibre mixes, or entirely plant fibre (most likely cotton); some cotton textiles were also definitively identified.⁹⁵ Similar proportions of textiles were discovered in the Meroitic and the post-Meroitic Christian periods of the cemetery of Semna South, just to the north of Aksha and south of the Second Cataract.⁹⁶ About a third of the shrouds from the third- to fifth-century AD tombs at Wadi Qitna and Kalabsha South in Lower Nubia were identified as cotton, with a few more examples of cotton wool mixes.⁹⁷ Likewise, excavations at Ballana and Qustul in Lower Nubia near Qasr Ibrim, with occupation periods from the second to seventh centuries AD, revealed nineteen fragments of cotton amidst an assemblage mostly characterized by animal hair, although in the Meroitic period the proportion of cotton to hair textiles was closer to that found in Aksha, about half.⁹⁸ Smaller amounts of cotton textiles were further identified at Abka, Ashkeit, Gabati, Sahaba, Sedeinga, Serra and Serra East, and Shablul.⁹⁹ However, alone these sites do not reveal the extent of cotton use in Meroitic Nubia. As the majority of archaeological attention in Nubia was focused on cemeteries during the

⁹³ Yvanez 2011/2012, 340; Yvanez 2015, 112. The cemeteries examined were established around the first century AD, and were interpreted as elite necropolises. Francigny 2009; 2010; 2014. The Island of Sai had previously been excavated by Francis Geus and published in Geus 1995; 2002; 2003; 2006 (published posthumously).

⁹⁴ Watson 1977, 357, 364; Wild *et al.* 2008, 145.

⁹⁵ Vila 1967, 332-333; Yvanez 2015, 112. In the original site report, while the presence of textiles were noted for the individual burials, the fibres of the individual finds were not reported, so it is not possible to assign definitive dates.

⁹⁶ Žabkar and Žabkar 1982, 24. The authors do not make distinctions in their text between cotton and linen, but the lack of linen in this time period at other sites strongly suggests that the vast majority of vegetal fibre textiles found at Semna South are cotton. Yvanez 2015, 115, 124.

⁹⁷ Strouhal 1984, 250, 309 tab. 48; Clapham and Rowley-Conwy 2009, 247.

⁹⁸ Williams 1979b, 17; Mayer Thurman 1979, 36-7.

⁹⁹ Yvanez 2015, 114; Bergman 1975, 12-13.

early rescue operations, most of the evidence mentioned of cotton textiles has come from cemetery sites, and are therefore reflective of textile use in funerary customs, not necessarily in everyday life. The overwhelming exception is again, the site of Qasr Ibrim, which suggests extensive cotton use.

As one of the only settlements that underwent systematic excavation, Qasr Ibrim helps to clarify the use of cotton exhibited in the cemetery contexts from other sites. Owing to its long occupation history, the city continued to be built on top of its own rubbish, and the finds from Qasr Ibrim therefore tend to be fragmentary, showing signs of both use and repair; they were also incidentally discarded rather than intentionally deposited.¹⁰⁰ Massive amounts of textile remains have been recovered in each excavation season; in the 1980 field season alone, 23,432 textiles fragments were collected, standard numbers for both previous and subsequent fields seasons.¹⁰¹ The excavations revealed that in the first five centuries of the first millennium, cotton made up over eighty percent of the total textile assemblage [fig. 5.8].¹⁰² The use of both linen and wool dropped dramatically in a relatively short period of time, though wool overtook cotton in the sixth century to become the dominant textile fibre in the region.¹⁰³ For the linen in particular, it has been suggested that the fragments found at Qasr Ibrim were survivals from the Napatan period, and not representative of contemporary textile production in the Meroitic kingdom,¹⁰⁴ which if true would mean the adoption of cotton was a sudden and significant cultural change. Combined with the archaeobotanic evidence, the textiles indicate that not only was cotton being used, it was being cultivated and processed locally in significant

¹⁰⁰ Adams 2000, 50.

¹⁰¹ Adams 2000, 50.

¹⁰² Wild *et. al.* 2007, 17; Adams 2000, 54.

¹⁰³ Adams 2000, 51. John Peter and Felicity Wild note that there is a discrepancy between the low levels of wool found at Qasr Ibrim and the relatively higher proportion of wool found in the cemetery sites of a similar time period, attributing the reason for the difference to the peculiarity of burial customs within a culture. Wild and Wild 2009, 17.

¹⁰⁴ Wild and Wild 2006, 18; 2008, 3. This possibility was raised because so few linen fragments were found in the Meroitic contexts.

amounts after the declining presence of the Romans, suggesting that it was not Roman demand that spurred the expansion of cotton cultivation.

The fragments of cotton found at Qasr Ibrim were of varying qualities, but tend to exhibit production features commonly found in Mediterranean wool production, such as reinforced selvedge edges or a flat starting border,¹⁰⁵ and there seems to be progressive experimentation incorporating wool into cotton fabrics and spinning wool and cotton together to be used in either the warp or weft.¹⁰⁶ This is perhaps because of the resemblance of raw cotton to wool. Many of these mixed textiles were made of warps of one fibre and wefts of another.¹⁰⁷ Cotton was also spun in the same way as wool, rather than spliced as flax fibres were,¹⁰⁸ again, possibly because of the resemblance shared between wool and cotton, especially compared to linen.¹⁰⁹ There were also some examples of incredibly fine cotton tapestry-woven textiles found in a temple and interpreted as temple furnishings rather than garments. According to Nettie K. Adams, these textiles are much finer than anything else found at Qasr Ibrim, and raises the possibility that they were imported; Adams cites the city of Meroë as a possible place of origin, given the similar fineness of the yarn and weaving illustrated by the few textiles from the cemeteries of Meroë that have been recovered.¹¹⁰ This would be evidence that there was an extensive commercial textile industry in Nubia that extended from the province of Lower Nubia to at least the city of Meroë, and that, as suggested by the DNA testing on fragments of cotton from Qasr Ibrim, referenced in chapter two, cotton use and

¹⁰⁵ Wild and Wild 2008, 4; Wild and Wild 2009, 16.

¹⁰⁶ Clapham and Rowley-Conwy 2009, 247.

¹⁰⁷ Wild and Wild, 2009, 16.

¹⁰⁸ Wild and Wild 2014b, 75.

¹⁰⁹ As a bast (plant stem) fibre, linen threads were produced by stripping the stem of the flax plant, resulting in long flat strips. Splicing means overlapping strips were twisted together to form one long continuous yarn.

¹¹⁰ Adams 1997, 265.

cultivation in Lower Nubia was an expansion of an earlier tradition of cotton cultivation and production.¹¹¹

The textile history of Nubia is complex, incorporating several introductions of new fibres, but reflects a progression that closely matches socio-political changes. From the period of the Kerma culture (c. 3000-1500 BC) to the Napatan and early Meroitic periods (c. 700-100 BC), linen was the dominant textile fibre being used for clothing and furnishing, along with leather, and its use gradually increased over the course of the centuries. The arrival of the Romans on Nubia's borders after the conquest of Egypt in 30 BC saw the introduction of wool as a textile fibre. While the exact time of introduction of cotton into Upper Nubia is not known, the evidence shows that it was being used there by the first century BC, and was later introduced into Lower Nubia to the north as the Roman presence there began to decrease from the first century AD, until it became the dominant textile fibre used. The techniques of cotton production were probably transmitted into Lower Nubia as the Romans retreated as well, and cities such as Qasr Ibrim increasingly came under the influence of Meroë. This suggestion is borne out in the evidence of textile production from elsewhere in Nubia in the Meroitic period, and in changes to the technology of textile production used.

Cotton production and technological change

The development of the cotton industry not only represented a change in the dominant fibre used in textile production, it also seems to have represented a shift in the fundamental weaving process, as traditional Egyptian means of yarn production and weaving that had been adopted in Nubia were abandoned. Prior to the Meroitic period and the rise of cotton, the fibre most commonly used in Nubia was linen. As in Egypt, flax was not spun to make linen yarns, but instead the individual fibres were spliced together and then twisted with

¹¹¹ Fuller 2014, 173. This somewhat contradicts Clapham and Rowley Conwy, who speculated that cotton was introduced and adopted rapidly throughout all of Nubia. Clapham and Rowley-Conwy 2009, 251.

other spliced threads to create a stronger yarn.¹¹² This had been the traditional way linen had been treated in Egypt until the Ptolemaic period,¹¹³ but in Nubia it continued to be practiced well into the medieval period.¹¹⁴ How these threads were woven into a textile is still an open question. Despite the number of textile production tools found throughout the excavations, there is very little evidence of the types of looms that were being used. In Egypt, there is evidence of the use of the horizontal ground loom,¹¹⁵ which was easily portable, from the Neolithic period; such looms continue to be used by some of the nomadic peoples in Egypt's Eastern Desert, North Africa, and the Middle East.¹¹⁶ By the time of the New Kingdom, Egypt seems to have switched to using a vertical two-beam loom, which had a rigid frame and had to have fixed supports.¹¹⁷ These looms required the weaver to weave from the bottom up, as described by Herodotos,¹¹⁸ a distinctive feature of Egyptian weaving until the first century AD.¹¹⁹

Fittings for such looms have not been found in any Nubian context, and as the horizontal ground loom is still used in parts of Sudan today, it has been suggested that, unlike Egypt, Nubia never adopted the vertical two-beam loom, despite sharing a common linen

¹¹² Wild and Wild, 2014, 73.

¹¹³ Cooke *et al.* 1991; Kemp and Vogelsang-Eastwood 2001; 68-88.

¹¹⁴ Crowfoot 2011, 20-21; Adams and Crowfoot 2001, 31; Wild and Wild 2014b, 74.

¹¹⁵ Barber 1991, 83-84; Kemp and Vogelsang-Eastwood 2001, 324-335; Ciszuk and Hammarlund 2008, 121; Wild and Wild 2014b, 74.

¹¹⁶ Pickton and Mack 1989, 55-59; Crocker-Jones 1989, 34-53; Ciszuk and Hammarlund 2008, 121; Wild and Wild 2014b, 74.

¹¹⁷ Kemp and Vogelsang-Eastwood 2001, 335-36; Ciszuk and Hammarlund 2008, 125; Wild and Wild 2014b, 74. The earliest evidence of these types of looms come from tomb paintings, but their fittings have also been found in habitations sites.

¹¹⁸ Crowfoot 1937, 36 in relation to the vertical loom, but she misidentifies the Egyptian vertical loom as a warp-weighted loom. Also, Ciszuk and Hammarlund 2008, 125, although the phrasing is somewhat confusing.

¹¹⁹ Trying to create a chronology of loom typologies is difficult because of the fact that there was not a single linear progression in the technologies; loom types were adopted at different times in different areas, and occasionally in different orders, meaning that such developments need to be examined on a regional level: we cannot make generalisations regarding the ancient world as a whole. For a description and images of looms, see appendix 4.

culture prior to the Meroitic period.¹²⁰ However, with the rise of the Meroitic kingdom and the arrival of cotton in Nubia, there is evidence that that horizontal ground loom was replaced by a vertical warp-weighted loom, where, as the name suggests, weights are attached to the warp threads to maintain tension while weaving [fig. 5.9]. The earliest evidence of the warp-weighted loom comes from Europe and parts of the Middle East in the Neolithic period, and it remained the most common loom type for much of the Roman period.¹²¹ Yet the warp-weighted loom was rarely used in Egypt except by non-native communities,¹²² and after Egypt became part of the Roman empire, the vertical two-beam loom began to spread to the rest of the empire so that by the first or second century AD, it was rapidly replacing the warp-weighted loom in the Mediterranean.¹²³ As in Nubia, there are few archaeological remains of looms surviving from Roman Europe, but representations of Roman looms in wall paintings and references in tomb inscriptions, as well as in classical texts, document this shift.¹²⁴ Nevertheless, the evidence from Nubia shows that the use of the warp-weighted loom persisted there throughout the Meroitic period. The warp-weighted loom could be propped up against a wall, and did not require the same stable fittings as the two-beam loom, so the looms themselves would be unlikely to leave behind any physical evidence. But numerous mud loom-weights have been found throughout the region. At Qasr Ibrim, multiple loom weights have been found, some even with the string that affixed them to the warp thread still attached.¹²⁵ Some of the textiles from Qasr Ibrim also preserve the flat woven starting border typical of the

¹²⁰ Yvanez 2015, 183. It is also possible that the intense focus on the excavation of cemeteries in Nubia rather than settlements means we are missing crucial evidence.

¹²¹ Wild 1970, 136-137; Barber 1991, 91-113; Ciszuk and Hammarlund 2008, 122; Ball 2009, 39; Wild and Wild 2014b, 76.

¹²² Wild and Wild 2014b, 76.

¹²³ Crowfoot 1941, 148; Wild 1992, 17; Granger-Taylor 1992, 29; Sheffer and Granger-Taylor 1994, 231. Ciszuk and Hammarlund 2008, 126. Use of the warp-weighted loom persisted in northern Europe into the ninth century, or at least there is a depiction of one, in the Utrecht Psalter (fol. 84r), and to the east in Anatolia to the Middle Byzantine period, attested to by loom weights found in the Byzantine layers of Amorium. Lightfoot 1999, 344; Ball 2009, 39.

¹²⁴ Summarised in both Wild 1987, 460; Ciszuk and Hammarlund 2008, 125.

¹²⁵ Wild *et. al.* 2007, 17; Wild and Wild 2006, 19; Wild 2011, 111.

warp-weighted loom, where weaving was done from the top-down.¹²⁶ Similar loom weights have also been found at other sites where cotton was found, including Ballana, Hamadab, Karanog, and Meroë.¹²⁷

It is unknown where this loom type was introduced from, but there are numerous possibilities. It could have been introduced along with cotton cultivation from sub-Saharan Africa, although there is no archaeological evidence for textile production in sub-Saharan Africa from this time period.¹²⁸ It is also possible the war-weighted loom was introduced through trade with other Saharan communities, such as the Garamantes in the Fazzān (discussed in the next chapter), which was also using the warp-weighted loom, perhaps introduced from the northern Mediterranean. This is an area that required further research. The connection between the use of the warp-weighted loom and cotton production will also be explored in the next chapter, but what the technology of textile production in Nubia shows is that while the pre-Meroitic textiles themselves may indicate strong cultural ties between Egypt and Nubia, Meroitic culture was a dynamic mix of influences and interactions, and does not display the same strong links with Egypt. And what will become clear in the following chapters is that Nubia was the instrumental central starting point for the diffusion of African cotton throughout the Mediterranean and Red Sea regions of Africa and the Middle East.

Post-Meroitic textiles

The kingdom of Meroë ultimately fell sometime between 300 and 350 AD, though the exact reason for this state collapse is not yet understood. Various suggestions have ranged from barbarian invasions of the nomadic tribes that inhabited the Eastern and Western Desert of

¹²⁶ Hoffmann 1964, 151-161; Gleba and Mannering 2012, 14-16; Wild and Wild 2014b, 76.

¹²⁷ Yvanez 2015, 184-185 has compiled a list of all of the sites where loom weights have been found. Sites named by Yvanez where loom weights have been found, but where cotton has not, are Argin, Arminna West, Kedurma, Meili Island, Mouweis, Moussawarat, Saras, Tila Island, Umm Muri, and Ouad ben Naga.

¹²⁸ This is not to say that there was no textile production, just that it has not yet been identified. My own inclination is to believe there was some kind of production tradition that was related to the domestication and cultivation of the cotton plant.

Egypt, to the Meroitic heartlands being conquered by Aksum, although there is little evidence of this kind of disruption in the outer provinces.¹²⁹ However, the evidence suggests that the Meroitic writing system had completely gone out of use by the fifth century, and there was a demographic shift away from the urban centres, suggesting a break down in central authority that eventually resulted in the emergence of three smaller successor states: Nobadia/Noubadia in Lower Nubia, Makuria in the Dongola Reach, and Alodia/Alwa in Central Sudan.¹³⁰ Declining trade with Egypt and the Roman Empire due to increasing interactions with Aksum has also been proposed as a cause for the decline of Meroë,¹³¹ but again, this is highly speculative and the evidence suggests that Roman items continued to enter Nubia.¹³² Dorian Fuller has proposed an alternate theory of the collapse of the Meroitic state, one based on economic competition between the three different provinces. He singles out Lower Nubia in particular as participating in intensive agricultural exploitation and innovation in the cultivation of summer crops, such as cotton, resulting in the wealthy province being able to exert a level of economic and military independence from the central authority of Meroë city.¹³³ He goes on to argue that the evidence suggests that the summer crops being grown in Nubia were not grown for significant local consumption, but were instead being grown on a limited scale as ‘a risk-buffering cash crop’, an extra source of income to supplement established winter crops and provide some surety in case of a bad crop year.¹³⁴

This is based on the fact that no evidence of extensive irrigation systems has been found in Nubia, and these are considered necessary for largescale cultivation of summer crops. Sites

¹²⁹ Edwards 2007, 220. The barbarian incursions have been attributed to the 'Noba tribes' from south and west by Kirwan 1957a; 1957b; 1958; Williams 1991b, 158-161; and to the Blemmyes from the east by Williams 1991b, 158-160. The Aksum theory has been written about by Kirwan 1957a; 1960; Shinnie 1967, 52-55; Török 1988, 33.

¹³⁰ Edwards 2007, 220-221; Fuller 2015, 33.

¹³¹ Adams 1977, 383-385; Török 1988, 41; Edwards 1998, 188.

¹³² Fuller 2015, 33.

¹³³ Fuller 2015, 33.

¹³⁴ Fuller 2015, 41. The spread of summer crops and how they relate to the spread of cotton will be discussed in the next chapter.

where cultivation was traditionally reliant on the proximity of the Nile, such as those where the majority of cotton finds in Nubia have been made,¹³⁵ would have required a different type of irrigation from those where water was stored in underground aquifers and artesian wells, like the sites in the Egyptian and Libyan oases discussed in the next chapter. The *saqia*, or waterwheel, first appeared in Egypt in the second century BC,¹³⁶ but there is no evidence of its use in Nubia until the fourth century AD.¹³⁷ To Fuller, this suggests that while the summer crops, including cotton, were introduced during the Meroitic period, it was not until the post-Meroitic period when their consumption increased following the introduction of the *saqia*.¹³⁸ However, it is not clear that the *saqia* was necessary for cotton cultivation in Nubia. Edwards suggested that the importance of the *saqia* in Nubian cotton cultivation has been over-emphasised, and that the *shaduf* well, which required manual labour to lift water powered by a weighted beam, would have sufficed, although he also adheres to the view that cotton was not common in the Meroitic period.¹³⁹ The use of wells for irrigation of cotton is also found in the Dakhla Oasis in Egypt, discussed in the next chapter, so is not without parallels elsewhere.

Both Fuller and Edwards rely on later dates for the cotton finds in Nubia, and on the finds from cemetery sites where the proportion of cotton was less than other fibres. However, this is not reflective of the evidence of cotton use as a whole. As the textiles from Qasr Ibrim show, cotton was already being produced and used in Lower Nubia by the first century AD, and on a substantial scale by the second century AD.¹⁴⁰ While it is true that the means of irrigating and managing water supply to fields of cotton in Nubia, is not known,¹⁴¹ it is also the case that the circumstances of many of the excavations during the early rescue missions have

¹³⁵ Although cultivation may have taken place elsewhere, further removed from the Nile's banks.

¹³⁶ Venit 1989, 219-222; Eyre 1994, 64; Fuller 2014, 172.

¹³⁷ Wild and Wild 2006, 18; Wild *et al.* 2007, 17; Clapham and Rowley-Conwy 2007, 163.

¹³⁸ Fuller 2014, 172; 2015, 41.

¹³⁹ Edwards 1998, 184.

¹⁴⁰ Wild *et al.* 2007, 17.

¹⁴¹ Wild and Wild 2006, 18.

left many questions unanswered. The privileging of burial contexts over settlement sites, or the fields surrounding them, means much information has been lost. Additionally, there are still areas that have not been subject to archaeological survey. This raises an additional possibility for the geography of its production. When cotton cultivation spread into Egypt and the Libyan Desert, it spread to the arid oases rather than fertile riverbanks. It is possible that while cotton textiles were produced in cities like Qasr Ibrim, cotton cultivation may have taken place in more rural areas which were using similar irrigation technologies. Ultimately, this an issue that will only be answered with more archaeological investigation, but what can be said definitively is that cotton had a significant presence in the Meroitic period.

The second part of Fuller's theory is that while cultivation increased in the post-Meroitic period as a result of the adoption of the *saqia*, local consumption actually decreased. As evidence of this point, he looks to the cemeteries of Qustul and Ballana, excavated by Keith Seele and the University of Chicago in the early 1960s as part of the UNESCO salvage operations. Examining the report on the textile finds and subsequent exhibition catalogue,¹⁴² Fuller writes that in the post-Meroitic period '...wool textiles predominate and cotton is quite rare. When cotton occurs, it is almost always in male graves, and a perusal of the finds register suggest these are all relatively wealthy burials, i.e. cotton seems to be restricted to high status males'.¹⁴³ He therefore postulates that the growth of the cotton industry in Nubia, and its spread into the peripheral regions of Egypt's Western Desert and the Libyan Desert, was in response to Roman demand, and that these areas were augmenting their own agricultural output to cater to the Roman market further north.¹⁴⁴ The finds within the graves, he claims, prove that cotton

¹⁴² Mayer Thurman and Williams (eds.) 1979.

¹⁴³ Fuller 2015, 46-47. This is also perhaps too much of a generalisation of the evidence; many of the burials contained the remains of more than a single individual, and reports do not make clear which textiles were associated with which body. For example, the post-Meroitic grave from Qustul Q230, in which thirty-four fragments of cotton were found, contained the bodies of five individuals, tentatively identified as four males and one female. Mayer Thurman and Williams (eds.) 1979, 108, cat. no. 106. In Qustul grave Q594, cotton was found alongside two bodies, one an adult male and the other undetermined. Mayer Thurman 1979, 126, cat. no. 145.

¹⁴⁴ Fuller 2015, 44.

cultivation in Nubia was produced as a luxury product specifically for an export market, and that the incidence of cotton in Lower Nubia from the earlier Meroitic period was the result of ‘regular gifts that trickled down from the Meroitic state’.¹⁴⁵ As discussed in previous chapters, the argument that Roman demand caused the spread of cotton cultivation has been widespread in studies of late antique cotton, and will be further critiqued in the subsequent chapters. But in Nubia, the chronology of the spread of cotton itself disputes this claim. Cotton use increased after the Romans left. This position also does not reconcile with the overwhelming evidence of a large scale cotton culture at Qasr Ibrim, which would seem to transcend class. Rather, it highlights the discrepancies between the different sites in Nubia that have been used in discussions of scale of the cotton industry, which need to be further explored.

It is true that no other site displays as high of proportions of cotton use in both the Meroitic and post-Meroitic periods as Qasr Ibrim, with the exception of Meroë city, although only a selection of the textiles found in the cemeteries of Meroë have been subject to re-investigation.¹⁴⁶ However, what really sets Qasr Ibrim apart is the fact that it is a settlement, not a cemetery, and the function of the site is important in the interpretation of the finds. Clothing, shrouds, and grave goods used in cemeteries are deliberate deposits, chosen specifically as part of the cultural rituals surrounding death and interment. In contrast, Qasr Ibrim was a bustling urban centre that was built up on its own rubbish, and the textiles found there were incidental deposits, the leftover refuse of daily life discarded after it had lived out its usefulness. To render the sheer amount of data from the textile fragments from Qasr Ibrim useable, Nettie Adams used quantitative methods usually reserved for ceramics studies to look at the fluctuations in use of the three major fibre types (wool, linen, and cotton), and she found that after the departure of the Romans from Qasr Ibrim c. AD 100, the presence of cotton increased dramatically, indicating an increased influence of Meroë, and it continued through

¹⁴⁵ Fuller 2015, 47.

¹⁴⁶ See Dunham 1963.

the collapse of Meroë in the mid fourth century, before finally rapidly declining in the mid sixth century, during the period of Christian conversion in Nubia.¹⁴⁷ This means cotton was still the dominant fibre being used in Qasr Ibrim during the time Qustul and Ballana were being used as cemeteries just to the south.

Qustul and Ballana were also elite cemeteries, and they did show changes from the Meroitic to the post-Meroitic period. Whereas the Meroitic graves had been covered by large funerary monuments, in the post-Meroitic period smaller, simpler burial monuments became more common.¹⁴⁸ The graves also contained large numbers of imported goods, mostly from Egypt.¹⁴⁹ This may have been the result of increasing contacts between the two, which ultimately led to the spread of Christianity from Egypt; the finely woven linen and wool in the later graves at Qustul and Ballana could likewise be Egyptian imports.¹⁵⁰ However, as noted before, differences in textile finds between settlement sites and their cemeteries is not uncommon, and has been frequently observed in Roman Egypt.¹⁵¹ The evidence from elsewhere in Nubia shows that cotton was not exclusively a Meroitic crop, and its use continued past the demise of the single Meroitic state and subsequent political fragmentation. This suggests that cotton's cultivation and use was neither closely linked with central state authority, nor with a larger economic strategy; instead it appears more closely associated with local agricultural practice. Cotton use really decreases only after the post-Meroitic kingdoms, when it seems to be replaced by various types of animal hair, such as sheep and some camel.¹⁵² The reasons for its plummeting use in the sixth century will therefore be explored in the next chapter in terms of wider cotton networks rather than political shifts, and in particular in relation to

¹⁴⁷ Adams 2000, 51. Whether there was a correlation of the decline of cotton as Christianity was taking hold in Nubia, or if there were other factors, will be examined in the next chapter.

¹⁴⁸ Williams 1979a, 33.

¹⁴⁹ Edwards 2007, 221.

¹⁵⁰ Wild and Wild 2009, 17.

¹⁵¹ Wild and Wild 2009, 17.

¹⁵² Gevers 1990, 14; Adams 2000, 51; Kriger 2005, 91.

what is now known about climatic events and long-term changes throughout Africa and the Mediterranean.

Conclusions

While the history books have long framed Nubia as a satellite state of Egypt, sometimes partially under its control, whose existence was owed to trade with its northern neighbour, it is increasingly becoming clear that this construct owes much to the modern colonial history of Africa and the ancient documentary sources that have largely been used to write the history of the continent. In regard to the former, the impact of racism on the nineteenth- and twentieth-century narratives cannot be escaped. To the latter, as most of the texts are Egyptian (until the Meroitic period) all that is known of the history of Nubia is how its interactions with Egypt were viewed by the Egyptians. While contacts between the two states fluctuated, as did the political affiliations, there was undoubtedly interaction between Nubia and its other neighbours. The rise of cotton in Meroitic Nubia clearly illustrates cultural influences that did not originate in Egypt, and opened a new economic front to the region. However, our understanding of the transmission of cotton into the area, and its means of cultivation, is hampered by the circumstances of much of the archaeological investigation (or lack thereof) that has taken place in Nubia, as well as most of sub-Saharan Africa. A focus on cemeteries during salvage operations at the expense of settlements or rural areas has skewed the surviving material evidence. Further investigation is needed, though some general conclusions can be drawn.

During the Meroitic period, cotton was undoubtedly an important fibre, probably being cultivated throughout the entire kingdom. However, the rise of the cotton industry has been described as a reaction to rising demand for cotton in Egypt and the rest of the Roman world. The timeline of the spread of cotton throughout Nubia, particularly from the southern provinces north into Lower Nubia, contradicts this claim. While cotton begins to appear in the sites of Lower Nubia, such as Qasr Ibrim, in contexts from the first century AD, it was not until the

Romans abandoned their garrisons (which had supposedly been built to protect their trade interests) that there was a boom in cotton cultivation and use.

The presence of cotton in Egypt is also sometimes used to support the argument that cotton in Nubia was being grown to feed Roman demand; in this reasoning, as cotton became more sought after in Roman urban centres, new regions began to cultivate it to supplement the supply from India (via the Red Sea) and later Nubia (traded along the Nile). The next chapter will examine the evidence of cotton in Egypt, the networks it was being traded through, and it will evaluate the evidence Egypt supplies regarding the scale of the demand for cotton throughout the Roman empire. Ultimately, it will reinforce the trade connections and cotton diffusion between Egypt and Nubia, and ultimately further into North and West Africa, but not in the way (or regions) commonly cited. Combined with the information provided in the previous chapter on the scale and economic participation in the textile industry, it is clear that the shift in fibre use in Nubia that occurred in the Meroitic period was both culturally and economically significant. Looking at the evidence of cotton elsewhere in Africa and the networks it was transmitted through will allow us to evaluate that significance



Figure 5.1 Map of the ruling cities of Kush.



Figure 5.2 Royal pyramids of Napata. Reproduced from Wikimedia Commons.



Figure 5.3 Hathor-headed crystal pendant, from el-Kurru Nubia, 743-712 BC (Napatan period). Accession number 21.321. © Museum of Fine Arts, Boston.

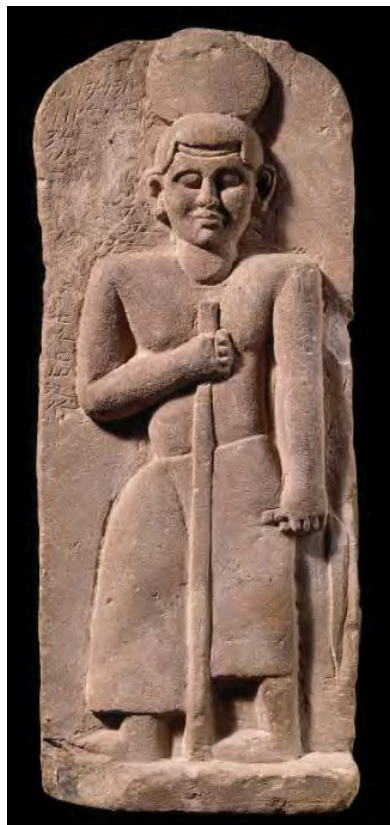


Figure 5.4 Meroitic sandstone funerary stela, c. AD 100-299. Accession number 1992.257. © Museum of Fine Arts, Boston.

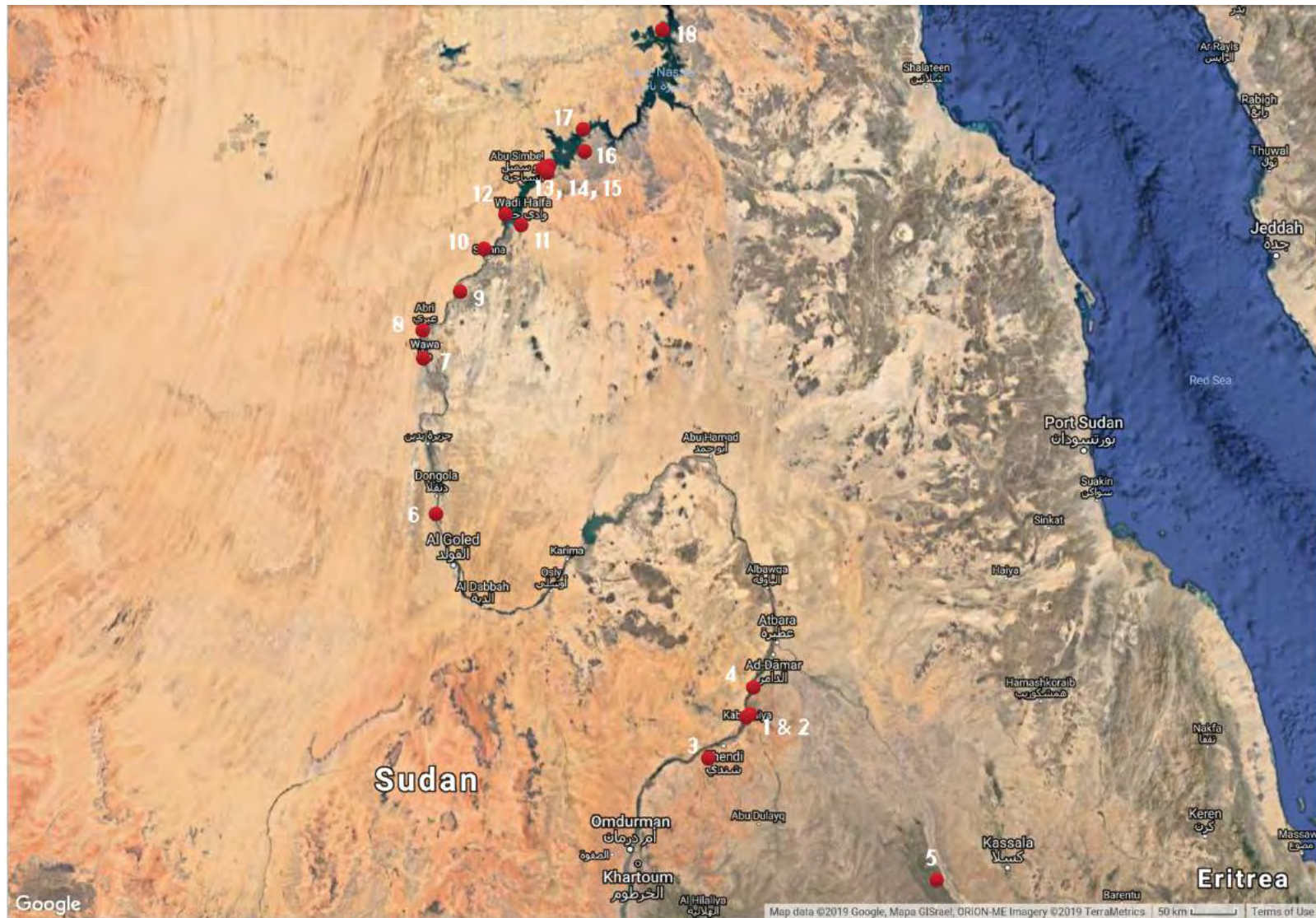


Figure 5.7 Map of the sites with cotton finds in Nubia. 1. Meroë 2. Hamadab 3. Muweis 4. Gabati 5. Ashkeit 6. Sahaba 7. Sedeinga 8. Sai 9. Aksha 10. Semna 11. Serra 12. Abka 13. Qustul 14. Ballana 15. Gebel Adda 16. Karanog 17. Qasr Ibrim 18. Kalabsha and Wadi Kitna



Figure 5.8 Cotton fragment from Qasr Ibrim. Reproduced from Wild and Wild 2008, 4.



Figure 5.9 Spindle whorls excavated from Nubia. Reproduced from Yvanez 2016, 167.

Chapter Six:

Early Cotton Networks in Africa

Introduction: Sources of cotton, Africa or the Indian Ocean?

Discussions of cotton in Africa have tended to start in Egypt, although, as we have seen, the story of cotton really begins further to the south in Nubia. The reason Egypt has played such a prominent role in the discourse of cotton has little to do with the evidence itself, and more to do with a persistent narrative of large-scale Indian Ocean trade, in Egypt's Red Sea ports played an important role. This has created two connected, though somewhat divergent, theories of cotton use and production in Egypt. One, largely favoured by textile historians such as Wild, argues that cotton was in demand in the Roman world after its introduction from India and though there is some evidence that it was grown in Egypt at an early period, this had little economic impact; the bulk of cotton in the Roman world entered the markets via trade with India along the Indian Ocean and Red Sea trade routes.¹ In contrast, scholars of Roman Egypt such as Roger Bagnall have sought to portray the cotton being grown in Roman Egypt as fulfilling a huge demand in the Nile Valley and beyond that had been spurred by trade with India, and which had a significant, though diffused, economic impact.² The growing evidence of cotton cultivation in Nubia has augmented each of these theories somewhat, but the reliance of each on a concept of Roman demand has remained.

The main conflict in these two constructions of Egyptian cotton cultivation concerns the relative economic impact it had; Wild sees it as largely irrelevant, while to Bagnall it was

¹ For example, Wild 1997, 291; 2006 (although Wild *et al.* 2008 shifts perspective); Parthasarathi and Riello 2009, 2-4; Riello 2013, 17; Beckert 2014, 10; Watson 1974; 1983.

² Bagnall 2008, 21-30; 2016, 155-156; Gradel *et al.* 2012; Bouchaud *et al.* 2018.

an integral part of expansion into the Western Desert. However, both view cultivation in relation to Roman consumption. I will argue that privileging Rome in this fashion gives a very narrow picture of how cotton was actually functioning in Egypt, and, as will be seen, North Africa and the Horn of Africa, in this early period. By expanding the areas considered, comparing textual and archaeological evidence from Egypt, along with archaeological remains from sites throughout Africa, it becomes clear that the spread of cotton was far more diffuse than previously thought. This new evidence has widespread implications for our understanding of early trade connections.

As seen in chapter three, the early role of the British East India company in bringing Indian cotton to British factories, as well as imperialist narratives of India as a source for raw materials to be exploited, created an implicit association between India and cotton that persisted for early twentieth-century scholars.³ Much of the current scholarship contends that it was not until the widespread development of Indian Ocean trade networks in the eighth century that cotton became widely available as a trade good outside the subcontinent and south east Asia, although it was being traded on a limited scale in earlier periods.⁴ In the first century BC, Malay sailors, pioneers in traversing the Indian Ocean, had reached the shores of East Africa and established trade routes from India to Africa and the Red Sea.⁵ While the archaeology indicates that during the next two centuries merchants travelling to and from India were supplying the Mediterranean with goods, including a variety of spices and textiles (silk and cotton),⁶ there

³ For example, see King 1909; Massey 1923; Warmington 1928, 210-212; Gulati and Turner 1929; Wilson 1933, 50; Lamm 1937, 1-6. Griffith and Crowfoot, writing of the cotton finds from Nubia, are the only ones to stress a likely Sudanese origin of the cotton, although it is unclear if they are referring to the textile fragments themselves or the cotton plants. Griffith and Crowfoot 1934, 7.

⁴ This has its beginnings in Watson 1974 and 1983, but continues to shape the discussion, as will be discussed in chapter seven. For example, see, Schaffer 1994, 4; Riello 2013, 17.

⁵ Schaffer 1994, 4.

⁶ It has also been argued that raw materials, technologies and, eventually, plants and seeds for agriculture were also travelling along the trade routes. Parthasarathi and Riello 2009, 2. While probably true, there is little evidence for the scale of this trade.

have been few attempts to quantify the scale of this trade, or the scale of particular goods.⁷ A general assumption that it was large-scale and economically significant has led scholars to over-emphasise the importance of trade with India in introducing cotton and cotton cultivation via Red Sea trade routes.⁸ Darley, on the other hand, suggests that such trade was not as economically important as previously thought, based on a re-examination of the written sources concerning Indo-Roman and Indo-Byzantine exchange and quantitative analysis of artefacts of Mediterranean origin in India.⁹ While it is not the intention of this thesis to stake a position in the scale or economics of Indian Ocean trade, synthetic examination of the evidence of cotton in Egypt suggests that cotton from India was somewhat limited, both in quantity and wider geographic reach. Discoveries from Nubia, detailed in the last chapter, as well as from sites in Egypt's Western Desert, the Libyan Fazzān, and Horn of Africa all suggest that while cotton was being imported from India via the Red Sea, there was an alternate, independent network that African cotton (*G. herbaceum*) was being transmitted along. While trade with India may have been fiscally significant, this chapter will argue that the evidence of cotton suggests that trade along the Sahara was culturally significant.

The Indian network, cotton on the Red Sea

While Pliny described Egyptian cotton as being grown on the 'Arabian side' of the Nile Valley,¹⁰ in the Eastern Desert, there are only three sites where cotton remains have been definitively identified in archaeological excavations from the region: two along the Red Sea coast, Berenike and Myos Hormos (Quseir al-Qadim), and one slightly inland, Abu Sha'ar

⁷ Darley 2013, one of the most comprehensive studies to look at scale, using numismatic evidence, concluded that trade along the Indian Ocean was relatively small compared to the total trade activities of the Roman Empire. However, studies that have attempted to calculate the fiscal impact of Indian Ocean trade based on P.Vindob.G.40822 and accounts by Strabo of the number of ships sailing to India each year argue for a potentially significant economic impact. For example, see Wilson 2015.

⁸ For example, Gevers 1990, 15; Wild 1997, 287-298; Schörle 2012, 65; Albaladejo Vivero 2013, 144-145; Droß-Krüpe 2013, 150; Riello 2013, 17; amongst others.

⁹ Darley 2013.

¹⁰ Pliny *Natural History* 19.1.3.

[fig.6.1]. Berenike was established as a Ptolemaic trading post in 275 BC. The city went through periods of fluctuating economic activity, peaking from the first century BC to the first century AD, and then again in the late fourth century until its final abandonment in the early sixth century.¹¹ Excavation of the site began in 1994 and in the first two seasons over 400 textile fragments were uncovered, mostly from midden (rubbish heaps) contexts, of which approximately half were determined to be cotton.¹² Subsequent excavation seasons recovered equally high proportions of cotton textiles.¹³

The majority of these textiles were plain undecorated scraps, though there were some fragments with a characteristic blue check pattern, and a few fragments of a single blue resist-dye cotton fabric.¹⁴ Cottons with s-spun threads were determined to probably be Nubian in origin, or produced locally.¹⁵ The recovered textiles fell into roughly two dating groups: those from contexts deemed ‘early Roman’, from the first and second centuries, and those from ‘late Roman’ contexts dating to the late fourth to early sixth centuries.¹⁶ There were relatively few s-spun textiles from the early Roman contexts,¹⁷ but z-spun cottons made up between eighteen and thirty-eight percent of the total textile assemblages from those contexts; in the late Roman period, z-spun cotton represented twenty-five percent of the total textiles found.¹⁸ This indicates that the cotton trade at Berenike in the early Roman period was dominated by trade with India, and s-spun cottons only became widely available much later.

¹¹ Wild and Wild 2004, 10.

¹² Wild 1997, 287. Reports of the excavations found in Sidebotham and Wendrich (eds.) 1995; 1996; 1998; 1999; 2000; 2007; Sidebotham and Zych (eds.) 2011. Wild and Wild further attempted to break down the assemblage of cotton from Berenike based on whether it was Indian or African cotton. Wild and Wild 2014a, 101. Due to the high salt content of the site, organic material tended to be preserved only in certain locations. Wild and Wild 2000, 251.

¹³ Wild and Wild 2004, 11.

¹⁴ Wild and Wild 2004, 13.

¹⁵ Wild and Wild 2007, 227; Wild *et al.* 2008, 145-146;

¹⁶ Wild and Wild 2000, 251-252.

¹⁷ Wild and Wild 1998, 235; 2000, 270; 2007, 227.

¹⁸ Wild and Wild 2014a, 101.

Myos Hormos, north of Berenike, was also constructed during the third century BC, and in the first century AD it became the second main port city on the Red Sea after Berenike,¹⁹ with caravan routes leading to Coptos (modern Quft) on the Nile River.²⁰ It lay largely abandoned from the mid third century to the early Islamic period, when it was renamed Quseir al-Qadim and went through second phase of use as a port city.²¹ Excavation of the Roman levels took place from 1978 to 1982, and further excavations on both the Roman and Islamic occupation levels were carried out from 1999 to 2003.²² Most of the textiles found at the site were small scraps that either came from general packaging (sacking, covers, etc.) or clothing from the rubbish dumps adjacent to the domestic structures, though the fragmentary nature made it impossible to identify what type of garment they might have come from.²³ In total, over 2,000 textile fragments were recovered from the Roman contexts (first century to mid-third century AD), and while the majority were wool, a sizable proportion were cotton of coarse, low quality.²⁴ Additionally, only five Roman spinning whorls were recovered from the site, suggesting that there was not a great amount of local textile production occurring at the site, and most textiles had to have been brought in from elsewhere.²⁵

Abu Sha'ar, farther north and very slightly inland from the Red Sea, was a Roman fort constructed between 309 and 311 as a satellite military installation to the main legionary fort at Luxor; military occupation seems to have ended sometime in the late fourth century and in the early fifth century the site was taken over by either Christian monks or hermits.²⁶ The site

¹⁹ Wild 1997, 290.

²⁰ Cardon *et al.* 2010, 2.

²¹ Sidebotham 2011, 354; Thomas 2012, 174.

²² Whitcomb and Johnson (eds.) 1979; 1982; Peacock and Blue (eds.) 2006; Whitewright *et al.* (eds.) 2011.

²³ Handley 2011, 321-323.

²⁴ Eastwood 1982, 300-317; Handley 2011, 323; Droß-Krüpe 2013, 151. The excavation report did not categorise bulk textile types by fibre, so it was not possible to quantify the presence of cotton at Myos Hormos. See Handley 2011, 321-328.

²⁵ Handley 2011, 322.

²⁶ Bender Jørgensen 2006, 161. Similar patterns of reoccupation occurred at military outposts in Judaea, Palestine and the Roman East. Sidebotham 1993, 7.

was ultimately abandoned in the seventh century.²⁷ Most of the recovered textiles could be firmly attributed to either the earlier military installation or the later Christian community, creating two chronological periods useful for comparison. However, due to the high salinity levels of the textiles and unfamiliarity of excavators with cotton fibres, identification was difficult and in most cases a distinction was not made in textiles created of plant fibres (cotton and linen).²⁸ Wool was the most common fibre type during the military occupation, but in the later Christian period use of textiles made of vegetable fibres increased and became the more common.²⁹ Despite excavators' reluctance to assign a fibre type to the majority of the plant fibre textiles at Abu Sha'ar, some cotton was definitively identified. Relevant fragments included several decorated with blue checks,³⁰ and fragments from one white on blue resist-dyed textile,³¹ both similar to finds from Berenike, and all were identified as probably being of Indian origin. More cotton was identified in the second phase of the site than the first.³²

The later adoption of plant fibres corresponds to the second period of high activity at the port site of Berenike, where cotton continued to be used, and confirms the placement of Abu Sha'ar on the route to the port cities on the coast, as well as a change to the textile culture after the departure of the military. As at Qasr Ibrim, the change in fibre usage after the departure of the Roman military suggests local led adoption rather than a reaction to state intervention, a point that will be returned to later. Finds of cotton at these sites contrasts to finds at sites located farther inland (Mons Claudianus, Maximianon, Xeron, etc.) where large assemblages of textiles were recovered in which wool was the most common fibre type throughout their

²⁷ Excavations were conducted alongside the other Red Sea excavations, summarized in Sidebotham 1996a.

²⁸ Bender Jørgensen 2007, 27.

²⁹ Bender Jørgensen 2007, 27.

³⁰ Bender Jørgensen 2007, 33

³¹ Bender Jørgensen 2006, 171.

³² Bender Jørgensen 2018, 475.

occupation, with the proportion of vegetable fibres comparatively low, and none of which were determined to be cotton.³³

Cotton has additionally been identified in Lower Egypt, at Karanis in the Fayyum (technically one of the oases of the Western Desert but closer to the valley than the other oases and culturally considered part of the Nile Valley), where a single skein of red dyed cotton dated to the fourth or early fifth century was found and attributed to India,³⁴ and three other fragments (from two textiles) dating to the second to early third century were recently identified on re-examination.³⁵ It is likely that other cotton fragments from the Nile Valley were uncovered but misidentified in the past when all textiles from Egypt were assumed to be linen or wool and analytical tools were less precise. However, re-examination of collections as well as contemporary excavations continue to yield few examples of cotton from the Nile Valley.³⁶ Collectively, the archaeological evidence of cotton in the Eastern Desert between the first and roughly seventh centuries AD indicates that there was limited cotton use along the Red Sea, and that it was largely restricted to the port cities;³⁷ the written sources which have been used to argue for the scale of this trade will be returned to shortly. Additionally, there is no archaeobotanic evidence, such as cotton seeds or capsules,³⁸ to suggest that cultivation was taking place nor any evidence of widespread textile production at the sites where cotton was found, such as spinning or weaving tools. Cotton was clearly being imported, the scale and

³³ Bender Jørgensen and Mannering 2001; Bender Jørgensen 2007; Cardon *et. al.* 2010; Cardon 2011.

³⁴ Wilson 1933, 50.

³⁵ These fragments were originally misidentified as linen and wool. Batcheller 2002, cat. nos. 164-165, 181. As Batcheller notes, it is possible there are other fragments that have been misidentified in the Karanis collection, though the sample size of the collection re-examined indicates that the presence of cotton at Karanis was small. Batcheller 2002, 107.

³⁶ In addition to Batcheller's study of the textiles of Karanis at the Bolton Museum, analysis of 468 late antique textiles also from the Fayyum at the Museum für Spätantike und Byzantinische Kunst, Staatliche Museen zu Berlin-Preussischer Kulturbesitz found no examples of cotton, even in those described as 'suspicious'. Linscheid 2001, 75.

³⁷ See the discussion of sails in chapter one, 20.

³⁸ Two seeds of cotton were identified in the Islamic period re-occupation (eleventh to twelfth century) of Myos Hormos, when the site was known as Quseir al Qadim. Van der Veen *et al.* 2011, 89-90.

significance of which will be addressed later in this chapter, but the only evidence of cotton cultivation, and the transmission of cotton as a crop, comes from the oases of Egypt's Western Desert.³⁹

The African network, cotton in the Western Desert

The oases of the Western Desert consist of five basins that run parallel to the Nile: the Kharga Oasis, the Dakhla Oasis (which together form the Great Oases), the Siwa Oasis, the Bahariya Oasis (the Little Oases), and the Fayyum, which as mentioned, is geographically removed from the other four and is closest to the Nile Valley [fig. 6.1]. Because of the position of the oases within the Saharan Desert, the ground tends to be wetter with a higher salt content than in other areas of Egypt, resulting in less preservation of organic materials than commonly found in other, drier, regions.⁴⁰ However, both textile and archaeobotanical remains attest to the presence of cotton and its cultivation.

The Kharga Oasis had the largest population, the most routes to the Nile Valley from its two main centres of Kysis and Hibis, and was also on the Darb el-Arba'in (Forty Days Road), the land route that connected Egypt and Nubia to the south.⁴¹ As noted previously, a papyrus from Kysis (Douch) specifically refers to the farming of cotton in the Kharga Oasis,⁴² and systematic excavations have uncovered additional evidence of cotton production and use. Seeds, capsules, and twigs were found from a fourth century burial, the only time cotton wood has been found at any of the sites discussed,⁴³ as were desiccated cotton textile fragments.⁴⁴ Of the over fifty textiles collected from funerary contexts by the North Kharga Oasis Survey in the seasons from 2001 to 2005 at Ayn Umm Dabadib (dated to the third to fourth centuries and

³⁹ Wagner 1987, 292.

⁴⁰ The use of irrigation wells to bring underground water to the surface means areas will be intensively farmed until the accumulation of salt and minerals in the soil renders the soil unusable. Thanheiser 2002, 299.

⁴¹ Adams 2007, 30.

⁴² P.Iand.7.142 (AD 164-165).

⁴³ Gradel *et al.* 2012, 126.

⁴⁴ Dunand *et al.* 1992, 232; Gradel *et al.* 2012, 126.

examined under the microscope), four were cotton tabbies and a further three were mixed cotton and linen; the remaining textiles were all linen.⁴⁵ The survey also uncovered desiccated cotton seeds inside mud bricks used to construct a Roman building in the third to fourth century, indicating local cultivation.⁴⁶ At El-Deir, seeds and bolls were recovered from the temple, perhaps indicating processing,⁴⁷ and cotton textiles have also been identified in mummy wrappings from the nearby cemetery, in use from the third to fifth centuries.⁴⁸ Cotton seeds were also identified at Qasr el-Sumayra, broadly dated from the first to fourth centuries AD.⁴⁹ However, it is from the Dakhla Oasis, and the cities of Kellis (now known as Ismant el-Kharab) and Trimithis (Amheida) in particular, that the most significant evidence for the cultivation of cotton has been found.

The Dakhla Oasis lies to the north of the Kharga Oasis. Kellis' residential areas were only developed in the third and fourth centuries; the entire site was abandoned at the end of the fourth century, and the site was never resettled.⁵⁰ At Kellis, capsules, seeds and complete bolls of cotton from the first to fourth centuries have been identified,⁵¹ as well as fragments of decorated cotton textiles from the second to fourth centuries, recovered from several domestic structures within the city.⁵² Excavation of the cemetery uncovered many linen coverings being

⁴⁵ Jones and Oldfield 2006, 27.

⁴⁶ Jones and Oldfield 2006, 30.

⁴⁷ Gradel *et al.* 2012, 127.

⁴⁸ Letellier-Willemin 2011; Gradel *et al.* 2012, 127; Clapham and Rowley Conwy 2009, 249. The inclusion of cotton in funerary contexts at such an early date is interesting because it is generally thought linen was exclusively used for mummies as a matter of religious tradition. For the religious significance of linen, see Riggs 2014, 130-140 for pre-Roman Egypt and Raheel 1993, 124 for its continuation into the Roman period.

⁴⁹ Ikram and Rossi 2007, 181.

⁵⁰ Hope 1997, 13. Possible reasons for such abandonment are explored later in this chapter.

⁵¹ Thanheiser and Bagnall 1997, 39; Thanheiser 2002, 304; Clapham and Rowley Conwy 2009, 249-250.

⁵² Cotton was more frequent than either wool or linen. Livingstone 2009 documents numerous finds of cotton textiles, mostly undyed with dyed wool decoration. There were two pieces (in multiple fragments) that were dyed; one blue with the resist-dyed technique, and one pink, both found in House 3. Livingstone attributes both to a non-Egyptian origin because they have z-spun threads (Livingstone 2009, 77-78), but there was another textile found that had a plain undyed s-spun cotton ground with z-spun dyed wool bands (Livingstone 2009, 80), which

held together with cotton cordage.⁵³ At Trimithis, approximately twenty kilometres northwest of Kellis, seeds dating to the third century were recovered from a house located in a mixed residential and industrial sector.⁵⁴ There were only two textile fragments found at the site (which is wetter than Kellis owing to local agriculture, leading to fewer finds of organic materials), one of them a fragment of light blue cotton.⁵⁵

There are documentary references to cotton from the oases as well, all of which use the word ἐριόξυλον (ἐρεόξυλον). From Kharga, the previously mentioned P.Iand.7.142 (AD 164-165) from Kysis lists the cotton plant amongst a list of agricultural trees.⁵⁶ There are four ostraka, also from Kysis that mention cotton: the previously discussed O.Douch.1.51 in which cotton is provided to five women;⁵⁷ O.Douch.5.537 which contains an accounting reference to cotton;⁵⁸ O.Douch.5.634, a letter requesting cotton be given to a third party;⁵⁹ and finally O.Douch.4.381, another letter in which cotton seems to be requisitioned by the army.⁶⁰ This

received no comment. I believe this indicates caution should be taken when attributing origin based on spin-direction, discussed further in appendix 3.

⁵³ Livingstone 2007, 20.

⁵⁴ A total of 56 desiccated and 45 charred seeds were found in rooms one, two, three, four, seven, eight, and the courtyard. Thanheiser and Walter 2015, 381, 389, 391. The highest concentrations of seeds, and all of the charred samples, were from the first four rooms. These rooms corresponded to storage rooms (room four, beneath the stairs, and possibly room three, although the presence of weaving materials found in this room also indicates it may have been a textile production room) and rooms of non-dedicated occupational use (rooms one and two). Boozer 2015a; 2015c.

⁵⁵ Boozer 2015d, 397-398.

⁵⁶ Winter and Youtie 1944, 250.

⁵⁷ Cuvigny and Wagner 1986, 32.

⁵⁸ Wagner 2001, 19.

⁵⁹ Wagner 2001, 75.

⁶⁰ 'Κυρίοις μου ἀδελφοῖς
ἐν Πινῶρ Ἀν... () καὶ Μου()
..... ου Ἀτρῆς χαίρειν).
'Αξιωθείς παράσχου
ἀδελφῶ Ἠλίας ἀννόν(ας)
ἐρεοξ(ύλον) λι(θ-) γ (ῆμισυ) μόνους.
[Φλ(αούιος)] Πλῆνις ὀπτίων
σεσ(ημείωμαι). Ἐρρῶσθαι';

'À mes seigneurs et frères, à Pinhôr, An...() et Mou(), fils deos, Hatrès, salut. Vous êtes requis de fournir à notre frère Elias 3 1/2 lith() seulement d'annonnes de coton. Signé par moi Flavius Plênis, [optio]. Bonne santé'. Trans. Wagner 1999, 22.

has been interpreted as payment of the *annona militaris*,⁶¹ but it is likely for a local garrison given that the request is made on an ostrakon,⁶² the familiarity between the parties, and mention of Pinhor, a local village known from other ostraka.⁶³

There are text references to cotton in the Dakhla Oasis as well. The previously mentioned *KAB* details the dues and expenditures of the tenants and storehouses of a single estate over a period of three years, and was found at the floor level of one of the houses in Kellis.⁶⁴ In it, two tenants (out of approximately twenty) are recorded as growing and owing dues in cotton (ἐριόζυλον). The *KAB* also includes an entry stating that some of the cotton was to be given to a woman for weaving.⁶⁵ P.Kell.1.61 (fourth century AD, and actually a wooden board), from the fourth century, is a list of money in arrears that includes cotton as one of the entries.⁶⁶ Two third-century ostraka, O.Kell.68 and O.Kell.69, receipts for cotton, are discussed below, as are the (as yet) only two mentions of cotton from texts from Amheida, O.Trim.38 and O.Trim.44, also receipts for cotton from the fourth century. The accumulation of evidence from both Kellis and Trimithis indicates that not only was cotton being cultivated there, it was being processed and woven as well, perhaps on a large scale.

Measures for amounts of cotton produced in the oases

The *KAB* [fig. 6.2] records commodities in which tenants of a single estate owed rent, listing the name of the tenant, the amount of a given crop expected and the amount actually paid, over the period of several years. These were likely the years from AD 361 to 364, but could also have been from AD 376 to 379, near the end of the occupation period of Kellis.⁶⁷ A

⁶¹ Wagner writes: ‘Un document rare: un ordre de paiement de coton, au titre de l’annone militaire à un soldat, contresigné par un officier. Il s’agit à coup sûr de la taxe en nature du vêtement militaire, la vestis militaris, l’ἐσθής’. Wagner 1999, 22.

⁶² As Bagnall argues, ostraka were likely used for ‘everyday’ writing rather than official communications due to the necessary brevity of the text and the fact that ostraka are not meant for long-term recording. Bagnall 2011, 132-133.

⁶³ It also appears in O.Waqfa.66.2. See Wagner 1999, 22-23.

⁶⁴ A critical edition and translation of the text by Roger Bagnall was published in 1997.

⁶⁵ *KAB* 558. This passage was previously discussed in chapter three.

⁶⁶ Worp 1995, 162-164.

⁶⁷ Bagnall 2008a, 115.

smaller section of the codex is devoted to expenditure accounts, also organized by commodity. Analysis indicated that the major crops of the estate were wheat and barley, with wine grapes, chaff, hay, figs, jujubes, olives for oil, chickens, cotton, turnips and an as yet unidentified crop referred to as ‘τιφάγιον’ also being grown; occasionally substitutions were made for the amounts due in other crops, or even in coin.⁶⁸ The most important tenants appear to have paid in most of the crop categories.⁶⁹

Cotton in the *KAB* was measured in a unit that appears to have been unique to the oases called a *lith* (λίθ).⁷⁰ There were two tenants listed for each of the three years as owing dues in cotton (compared to the twenty who owed in wheat) Nobs (Νόβς) and Louia (Λούια). For all three years covered in the *KAB* neither tenant paid the full amount owed in cotton, requiring them to make up the difference with a mixture of other crops and cash.⁷¹ The reasons for this are unclear, but the text reveals it was not uncommon for dues to be paid in such combinations. This could indicate that for a period cotton was not thriving, especially as the *KAB* dates to the period directly preceding the abandonment of Kellis during a period of large scale depopulation in the Great Oases (discussed later in this chapter), or it could simply be an innocuous substitution. Yet calculations for the unit of a *lith*, combined with measurements on various *ostraka* found at the site, indicate that at least during certain periods, significant amounts of cotton were being grown.

O.Trim.1.44 records the largest amount of cotton of any document from the oases.⁷² Interpreted as a receipt, it records a payment of twenty-six *lith* of cotton. Bagnall has argued

⁶⁸ Bagnall 2008a, 115; Bagnall 1997, for examples from the text.

⁶⁹ Bagnall 2008a, 116.

⁷⁰ For a discussion of a λίθ as a unit of measure, see Bagnall 1997, 50-1.

⁷¹ In the first year, neither tenant delivers any cotton at all, but a mixture of cash, sesame, dates, butter and ἀράκιον, possibly carob or vetch; in the second year Nobs delivers three of the three and a half λίθοι of cotton needed while Louia delivers one λίθος and 200 talents for his one and three quarters λίθοι owed; finally, in the third year, Nobs delivers two λίθοι of cotton and 900 talents, while Louia delivered just 484 talents, equivalent to about four-fifths of a λίθος. *KAB*, trans. Bagnall 1997, 547-554, 720-726, 1484-1491.

⁷² Bagnall 2008b, 25; Bagnall and Ruffini 2012, 98-99.

that based on the fractions found on existing papyri and *ostraka*, a *lith* must be the equivalent to at least 3.23 kg,⁷³ meaning twenty-six *lithoi* would represent just under eighty-four kg, a relatively large amount of raw cotton. The next two highest measures recorded on the same *ostrakon* were of twelve *lith* and eleven *lith*, both still quite high amounts. The only other mention of cotton from Trimithis, O.Trim.38, contains smaller quantities.⁷⁴ Two other *ostraka* from Kellis refer to cotton in similar amounts to Trimithis; O.Kell.68 and O.Kell.69, both receipts for cotton payments over successive years record twenty, twelve, twelve, twelve and twenty *lith* between them.⁷⁵ So it would seem that at least in certain areas of the oases large amounts of cotton were being produced. However, the text on these *ostraka* does not specify for what or where this cotton was intended.

Cotton as an agricultural crop

The environmental situation of the oases made them particularly suited to cotton cultivation. Water is accessed through a series of underground aquifers, brought to the surface either by utilising *qanats* (or *foggaras* in the studies of North Africa, referred to below) [fig. 6.3] in which channels were dug to access higher water tables on the edges of the escarpment or, in the case of the Dakhla Oasis, wells.⁷⁶ The *qanat* was an old Persian system of water supply where deep vertical shafts connected by tunnels were constructed to bring subterranean water to lower surface areas using gravity. As noted earlier, cotton has specific water requirements to thrive.⁷⁷ In the Nile Valley, agriculture continued to be centred on the inundation cycle of the Nile River, and there seems to have been little incentive to alter agricultural practices to suit the cultivation of cotton.⁷⁸ In contrast, the established irrigation

⁷³ Bagnall 1997, 50-1; Bagnall 2008b, 25.

⁷⁴ Bagnall and Ruffini 2012, 94-95.

⁷⁵ Worp 2004, 73-74.

⁷⁶ Thanheiser 2002, 302. There is little evidence of *qanats* in the Dakhla Oasis.

⁷⁷ Wild *et al.* 2007, 16; Thanheiser 2002, 302.

⁷⁸ Cotton cultivation is possible in the Valley, but does not occur until the later medieval period.

system in the oases made them well suited to a year-round growing season.⁷⁹ The need for irrigation systems explains why cotton cultivation seems to have occurred only in the oases, but evidence of cotton use and cultivation has not been found in all of the oases. For example, there is no evidence of widespread cotton use in the Fayyum (the few instances of cotton from Karanis could hardly be described as evidence of common use) or cultivation, despite an extensive irrigation system located at the Roman levels.⁸⁰ Nor has evidence been uncovered from the Siwa or Bahariya oases (although there is a text that perhaps refers to it in the latter, discussed later). The implications of this regional variation will be discussed shortly.

The evidence makes clear that cotton cultivation was taking place in a limited region of Egypt. It is also clear that cotton cultivation was transmitted to the oases from within an African network, possibly Nubia, the only other region where evidence of substantial cotton cultivation has been found, rather than from contact with India on the Red Sea where there is no evidence that cotton as an agricultural crop was being traded.⁸¹ For cotton to have reached the oases from India, the cotton seeds and cultivation techniques would have had to make the journey to the oases on the overland caravan routes from the eastern port cities. This is possible, but seems unlikely for three reasons: there have been no cotton seeds found at any of the port sites on the Red Sea where cotton textiles have been identified; there is little evidence of cotton in any form from the Nile Valley in this period; and the Fayyum shows no evidence of cotton cultivation, despite its irrigation system and its location closer to the Nile Valley (and therefore the coast where cotton would have been introduced from).

This suggests that there were two different networks that cotton was travelling along, one African based on cotton as an agricultural crop (and textile fibre), and one Indian based on finished textile goods. When factoring in issues of terminology, as discussed in chapter one, it

⁷⁹ Thanheiser and Bagnall 1997, 40.

⁸⁰ Wild *et. al.* 2007, 16.

⁸¹ This is gradually becoming the consensus, but with the caveat that trade with India generated demand that resulted in African cultivation.

raises the question of whether there was the recognition that the textile fibres of the products exchanged along these two networks were the same thing. This will be returned to shortly, but the fact that cotton was functioning simultaneously within two separate exchange networks within Roman Egypt requires an examination of how cotton from each of these networks was interacting with its immediate and wider socio-economic environment. The argument that cotton in both of these networks was the result of wider Roman demand, and in the case of Nubia and Egypt (an as will be discussed later, the Fazzān) was driven by a growing demand not met by the Indian network, relies on the assumption that the introduction of cotton into the Roman world spurred a rapidly growing market for it.⁸² But a re-appraisal of the evidence for such demand suggests that the scale and reach of the cotton market was not necessarily as wide as previously thought. It also indicates that there was sustained contact between the two between Nubia and the oases of the Western Desert that was consequential enough to facilitate the relatively rapid transfer of agricultural practices.

Identifying market demand

Archaeological excavations have uncovered a number of small settlements in both the Kharga and the Dakhla oases dating to the dynastic periods in Egypt,⁸³ but it seems that both the number of settlements and the size of the populations of the oases did not increase until the beginning of the first century AD.⁸⁴ The reasons for this development are still not fully understood, but it was initially speculated that it was the result of state sponsored investment programmes intended to increase agricultural output.⁸⁵ This period of agricultural expansion may have corresponded to a period of decline in the Fayyum, and it was theorised that the two

⁸² For example, Bagnall 2008b, 29; Pelling 2005, 405; Wilson 2012, 425; Wild et. al. 2007, 18; Bagnall 2016, 31, 156; Droß-Krüpe 2013, 151; Riello 2013, 17.

⁸³ Kuper 2001, 801-2.

⁸⁴ Kaper 1998, 152. Such settlements may have been made less remote by the arrival of the camel from at least the fifth century BC, although they may have been introduced even earlier. Bagnall 2016, 151.

⁸⁵ Kaper 1998, 152; Roe 2005/2006, 128.

could have been related,⁸⁶ though the distance between the Great Oases and the Nile Valley would have made them less ideal agricultural centres than the Fayyum. Another possibility raised by Bagnall, who has led numerous excavations in the Dakhla Oasis, was that the oases were developed specifically to exploit the land for export production of high value trade goods back to the Nile Valley. He argues that the significant capital investment, as well as trade infrastructure and irrigation systems which would have been required, indicate that only high value goods would have made such a venture profitable.⁸⁷ The fact that the wells around which the irrigation systems in Dakhla were based were privately owned, rather than being dug through a state initiative, suggests that there was private investment that developed the oases possibly initiated by a number of wealthy individual families and landowners in the Nile Valley seeking to profit from future revenue streams.⁸⁸

Amongst the high value items Bagnall suggests as being cultivated in the oases specifically for a market in the Nile Valley are grapes and olives (as well as wine and olive oil produced from them respectively), date palms, and cotton.⁸⁹ The introduction of millet into the oases at about the same time as cotton, a cereal previously unused in Egypt and evidently not grown elsewhere, both of which were summer crops, is also taken as evidence of a desire by landowners to exploit the resources of the oases by introducing crop rotation.⁹⁰ As Bagnall points out, the ability to produce two crops per year within the same fields could have helped to offset the costs of transport to the remote oases which, along with increasing olive oil consumption, may have increased the attractiveness of the oases to agricultural investors.⁹¹ For Bagnall, cotton was one of the most important crops in this development. But this argument

⁸⁶ Jackson 2002, 201.

⁸⁷ Bagnall 2016, 31.

⁸⁸ Bagnall 2016, 30.

⁸⁹ Bagnall 2016, 31, 156.

⁹⁰ Bagnall 2016, 155.

⁹¹ Bagnall 2016, 155-6.

requires there to be high enough demand for cotton in the Nile Valley to warrant investment in its cultivation.

Cotton was clearly being produced in large amounts in late antiquity, but on the peripheries of the Roman world. In addition to the evidence of widespread cultivation in Nubia, Kharga, and Dakhla, the recovery of the *KAB* has been significant in giving clues of the scale of cotton production in the Western Desert. Papyri found throughout Egypt that mention cotton have been used to suggest where such large amounts of cotton were going to. But these mentions of cotton have generally been found in private letters, rather than business documents, and that fact should be taken into account in their interpretation.

As previously mentioned, archaeological excavations have yet to recover more than the very occasional fragment of cotton in the Egyptian Nile Valley prior to the spread of Islam. The primary evidence of its use there comes in the form of personal letters from the second to third centuries, and a single list of goods. One, P.Oxy.59.3991 (second to third century AD), was penned by a woman writing to her brother that their mother had made him a cotton tunic.⁹² While the letter was found in Oxyrhynchus, its origin is unknown and could have been anywhere with connections to that city.⁹³ The second, SB 6.9026 (second century AD) was written by another woman to her brother requesting that he send twenty drachmas worth of cotton to be made into tunics for their other brothers to wear in the fields, as their previous tunics had worn out.⁹⁴ The exact origin of this letter, as well as where it was found, is also

⁹² ‘...τὸν χιτῶνά σοι τὸν

ἐριό[ξ]υλον ἢ μήτηρ

σου κ[α]τεσκεύασε.

ἐζητ[ο]ῦμεν [σοι] τὸν

δυνάμενον κομίσαι

ἀσφαλὴν...’ ‘Your mother made you the cotton tunic. We were looking for someone reliable to deliver it.’ P.Oxy.59.3991 trans. Bagnall and Cribiore 2006, 355 .

⁹³ Bagnall and Cribiore 2006, 355; Bagnall 2008b, 23.

⁹⁴ ‘...πά[ν]τη πάντως μοι πέμψης τῷ ἀγωγίῳ

τούτῳ ἐριοξύλου δραχμὰς εἴκοσι σπουδαίας κρό-

κης. ἀλλ’ ὅρα μὴ ἀμελήσης ἐπεὶ οἱ ἀδελφοί σου ἐπεν-

δύτην οὐκ ἔχουσι ἐκτριβέντων τῶν ἐριοξύ-

λων αὐτῶν, καὶ χρεῖαν ἔχουσι ὡς οἶδας καθὰ

unknown, but it was also likely found somewhere in the Oxyrhynchite or Arsinoite nomes.⁹⁵ Familial and business connections between the oases and cities of the Nile Valley, particularly in these nomes, will be discussed shortly, and the small-scale nature of the request, rather than indicating cotton is readily available, suggests that these were special requests and cotton was, in fact, not widely available. It is also possible that while the first letter was written somewhere in the oases, the second was intended to be sent there. This is only speculation, but as the oases are the only regions in Egypt with clear evidence of extensive cotton cultivation and use, it should be considered.

Another letter seems to be more business oriented. SB 6.9025 (second century AD) is a letter between two business associates, Herakleides and Horion, which contains a postscript in the margins saying that Herakleides was not able to acquire a cotton *chiton* which Horion had requested, and suggests that Horion send him warp thread and his measurements to have one woven.⁹⁶ This letter mentions the village of *Psobthis* (Ψῶβθις), which was initially thought to refer to one of four villages in the Oxyrhynchite nome bearing that name,⁹⁷ but it has recently been suggested that this was really a reference to another village of the same name located in the Bahariya Oasis.⁹⁸ In the text Herakleides makes reference to importing lentils, wheat and fish, frequent imports into the oases, while exporting dates and wine;⁹⁹ the reference to wheat

πάντοτε ἐν ἀγρῷ διατρεῖβουσι...’ ‘By all means send me by this shipment twenty drachma’s worth of good cotton thread. See that you do not neglect it, since your brothers have no outer garments, now that their cotton ones are worn out, and they need them, as you know, inasmuch as they spend all their time in the field.’ SB 6.9026 trans. Bagnall and Cribiore 2006.

⁹⁵ Though there is no specific information in the letter that would support such an attribution, most examples of personal correspondence from the second century have been found in these nomes, with the exception of the Apollonios archive from Hermopolis. Bagnall 2008b, 22; Bagnall and Cribiore 2006, 356.

⁹⁶ ‘...ἐν τάχει οὐχ εὔρον τὸν χιτῶνα τὸν ἐρεόζυλον ὥς ἤθελον. εἰ δὲ θέλεις ὑφανθῆ-

ναί σοι ἐνθάδε, πέμψον στήμονα καὶ τὰ μέτρα...’ ‘In a hurry I did not find the cotton *chiton* as I should have liked. If you want to have one woven for you here, send warp thread and the measurements.’ SB 6.9025 trans. in Bagnall 2008b.

⁹⁷ Winter and Youtie 1944, 251.

⁹⁸ Bagnall 2008b, 22.

⁹⁹ Bagnall 2008b, 22.

and lentils in particular suggest Bahariya.¹⁰⁰ In turn the oases were important sources for wine, dates, figs, olives and olive oil, all high value commodities; in the *KAB* these items account for forty percent of the total value of the estate's agricultural output.¹⁰¹ As of yet, this is the only papyrus possibly mentioning cotton in one of the small oases, and there have not been any finds of cotton in the Bahariya Oasis, but the other small oasis of Siwa is a location on a historic caravan route leading into Libya described by Herodotos.¹⁰² Finds of cotton in the Libyan oases are discussed later in this chapter, but the prospect of cotton in the small oases, along an established caravan route, presents a means of transmission; however this letter does not give any indication of the scale of its presence in Bahariya. While this was a letter between two business associates discussing the exchange of various goods, Horion's request for cotton is for personal use, and only for a single garment, not for materials or finished items which could be sold to others. Again, this papyrus seems to suggest that cotton was not widely available outside the oases.

The final letter is the only one that refers to cotton outside of Egypt. P.Mich.8.500 (c. AD 100-147), part of the Ioulios Apollinaris archive, is a letter between two brothers and appears to be the clearest evidence for cotton being transported to Rome, though it too could be relating to family matters rather than business. The letter was addressed to Apollinaris from a friend Roullios and was found as part of an archive in Karanis.¹⁰³ The text on this faded and worn papyrus seems to be a request for cotton goods to be sent from Rome, reading 'Send the white cottons, as I requested of you when I was with you, to Menon. 'If there are soft ones,' he said when he was with you, 'let them be sent from Rome.''¹⁰⁴ What this exactly refers to is

¹⁰⁰ Bagnall 2008b, 22. The *KAB* suggests there was more subsistence agriculture occurring in the Dakhla Oasis.

¹⁰¹ Adams 2007, 235; Bagnall 2008a, 116.

¹⁰² Liverani argues that in constructing his description of North Africa, Herodotos seems to be using a caravan itinerary which begins in Thebes and passes through Siwa, the Augila oasis, and the Fazzān [fig. 6.4]. Liverani 2000b.

¹⁰³ Bagnall 2008b, 24.

¹⁰⁴ '...τὰ ἐρει[ό]ξυλα τὰ λευκά, καθώς σε παρὼν παρεκάλασα πέμψον Μ[έ]νονι. ἄ[ν μ]αλακὰ

debatable.¹⁰⁵ It could just be a request sent between family members, as with the other letters, or it could refer to a business transaction involving cotton. However, there are no amounts listed, and Apollinaris was a soldier, not a merchant. This letter is undated, but Apollinaris was stationed at several different locations throughout the empire during his career. In AD 108 he was a *principalis* in Bosra, in Arabia, and in AD 119, he was appointed to the position of *frumentarius*, acting as a liaison between Rome and the provinces, and he was therefore stationed in Rome.; it is possible it is during this period that P.Mich.8.500 was written.¹⁰⁶ The other letters in the archive likewise record family correspondence, although in P.Mich.8.487 (c. AD 100-147), Apollinaris requests an escort for a cargo; this papyrus is also very damaged and what the shipment was or where it was going have been lost.¹⁰⁷ However, the family was apparently well off and the letters record items being sent great distance between members. For example, in P.Mich.8.465, written in Bosra, Apollinaris states that he would like to send his mother a gift, and mentions pearls or perfume as possibilities; he also requests linen garments be sent as they are not available.¹⁰⁸ There are several possibilities for what this papyri is referring to, but if cotton is being sent from Rome, it is unlikely to be cotton that was grown in Egypt or Nubia, and may be cotton that was coming from Arabia (either being grown there, as detailed in chapter seven, or the result of land routes to India).¹⁰⁹

The possibly most compelling document for the importation of cotton to the Nile Valley comes from P.Lond.3.928 (third century AD), which has been described as a payment of a customs toll or a list of taxable goods,¹¹⁰ and contains cotton listed as one of the goods, although

ἦν, εἶπε πα[ρώ]ν σοι, πεμφθῆ ἀπὸ Ῥώμης...’ P.Mich.8.500 trans. in Winter and Youtie 1944.

¹⁰⁵ Bagnall 2008b, 24.

¹⁰⁶ Husselman 1963-1964, 4.

¹⁰⁷ Youtie and Winter (eds.) 1951.

¹⁰⁸ P.Mich.8.466 (AD 107) records similar requests.

¹⁰⁹ All models of cotton consumption in the Roman world feature Egypt as the point of diffusion, either as the point of import from India, or production, from the Western Desert. If cotton needs to be sent from Rome, it implies that cotton was not a regular trade good passing through Egypt.

¹¹⁰ Johnson 1936, 608 and Winter and Youtie 1944, 250 identify the list as a customs schedule, while Bouchaud *et al.* 2018, 404 calls it a ‘list of taxable goods.’

without any quantities. Peter Sijpesteijn, however, argues that it is unlikely to be a record of taxed goods due to the seemingly miscellaneous nature of the goods listed, and instead might merely be a list of expenses.¹¹¹ If that is the case, rather than reading the document as an official accounting, P.Lond.3.928 should be viewed as personal record keeping. The provenance of the papyrus is also a problem. There is no record of where this document was found, and there are no clues in the papyrus itself to suggest where it was written, where it was going, or perhaps more importantly, what the origin of the cotton was.¹¹² In the end, this document contains no actual evidence that cotton was being imported into the Nile Valley from the oases.

Links between the oases and the Nile Valley

The textual evidence of cotton use is far from comprehensive, and in none of the surviving letters is cotton discussed as a trade commodity. Nor do they support the claim that cotton was sometimes available in the Nile Valley, either in the Oxyrhynchite or Arsinoite nomes (which had the closest administrative ties to the oases) for commercial purposes.¹¹³ In fact the letters are perhaps suggesting the opposite. By requesting items be sent for personal use, the letters imply that cotton was something that was not commonly available in the valley and therefore it had to be specially sent when other business matters allowed. Yet cotton was known in the Nile Valley and beyond. Additionally, the writer of SB 6.9026, stating that the cotton tunics would be worn in the field, indicates that its appeal was not as a luxury or high-status item. It is therefore unlikely that the cotton being produced in the oases, would have been viewed as suitable alternatives to the finely woven cottons produced in India. Therefore, the letters should not be read within a narrative of an overall demand for cotton in the Roman world, but rather as reflective of an absence of readily available cotton outside the oases themselves. The only other places in Egypt where archaeological finds of cotton indicate

¹¹¹ Sijpesteijn 1987, 25 fn. 58. He notes the inclusion of paints as an indication that this is not, in fact, a customs list.

¹¹² Bagnall 2008b, 23.

¹¹³ Bagnall uses the evidence from these documents when coming to the conclusion that cotton was widely available in the Lower Nile Valley. Bagnall 2008b, 24.

widespread use are the port cities of the Red Sea (Myos Hormos and Berenike) but unlike the oases, they contain no evidence that would suggest that cultivation and processing were taking place. It seems more probably, then, that rather than cotton being grown to fulfil the demand of people native to the Nile Valley, cotton was being sent on a limited basis to people who may have been from the oases and familiar with its use. I would suggest that the knowledge of cotton and requests found in the documents do not reflect the movement of cotton and the beginning of its adoption in the Nile Valley, but rather the migration of people from the oases into the Nile Valley. There is evidence of close familial connections between the oases and the Nile Valley, particularly in the Oxyrhynchite and Arsinoite nomes where these papyri may have originated.

Although the travel time between the Nile Valley and oases has been estimated to have been approximately eight days in antiquity,¹¹⁴ people frequently relocated between the oases and the Nile Valley, and it was not uncommon for people living in one oasis to not only own property in another, but also the Nile Valley and vice versa.¹¹⁵ For example, surviving documents show that several people from Kellis lived in Aphrodite in the Antaiopolite nome, and that they owned and rented property there; they also owned property in Akhmim (Panopolis) in the Chemmite nome.¹¹⁶ It was not uncommon for landowners to live away from their holdings; even the landlord for the *KAB*, Faustianos son of Aquila and his wife lived in Hibis in Kharga rather than Dakhla where they had extensive landholdings, likely administered through agents.¹¹⁷ Coptic papyri dating to the fourth century recovered from Kellis show frequent correspondence with immediate family members living in the Nile Valley and an active Manichaean community there.¹¹⁸ It is clear that there was a certain level of mobility of people between the oases and the Nile Valley cementing familial and business ties.

¹¹⁴ Thanheiser 2002, 299.

¹¹⁵ Thanheiser 2002, 299.

¹¹⁶ Hope 1997, 14.

¹¹⁷ Bagnall 2008a, 116; Hope 1997, 13.

¹¹⁸ Gardner *et al.* 1999, 5, 9.

Given the lack of evidence of any kind of movement of cotton in quantities suggesting commercial sale to the Nile Valley, that all references to cotton being used outside of the oases related to (probable) personal use, that the correspondence in which these references are found are often letters between family members, and finally that there continue to be so few archaeological remains of cotton in the Nile Valley, it seems unlikely that cotton was a sought after good being cultivated in large quantities for export to the Nile Valley. The discussion of terminology from chapter one suggests the same is true for most of the empire; while cotton is clearly something that is vaguely known, it is not available on a wide enough scale for a demonstrated understanding of what it actually was. It was not until the medieval period that there is evidence of a wider adoption of cotton use in the Egypt, again indicating that the rise of cotton being grown in Nubia and elsewhere in Africa was the result of alternate interactions.

The Periplous Maris Erythraei and other mentions of cotton

There is one text that has been repeatedly used by scholars to prove a demand for cotton, specifically Indian cotton, in the Roman world: the *PME* described as a manual or handbook of Indian Ocean trade. The *PME*, most commonly dated to between c.AD 40-70,¹¹⁹ details a trade voyage from the Egyptian Red Sea port of Myos Hormos to the various ports on the coasts of India and Africa along the Red Sea, Arabian Sea and Indian Ocean. It also includes accounts of the trade goods that were travelling along these routes, including textiles, and has therefore been used to show that there was knowledge and demand for cotton within the Roman world. But such conclusions also rely on accepting the veracity of the text without question. The issue of terminology, and the terms that have been interpreted as meaning cotton, has already been addressed in chapter one, and shown that such terms should not be read as a description of fibre so much as a type of cloth. And as Darley has demonstrated, the wider text

¹¹⁹ Proposed dates for the text vary between the first and third centuries AD, but a reference in the text to ‘Malichas, the king of the Nabataeans’ (19,6, 28-29 δι' ἧς ἐστὶν εἰς Πέτραν πρὸς Μαλίχαν, βασιλέα Ναβαταίων < ἀνάβασις >) which overlaps with Nabataean regnal sequences in the years between AD 40-70. Bowersock 1971, 223-5; Darley 2013, 127, FN 212

should be approached within the context of the popular genres of report and travel writing rather than as an instructive text.¹²⁰

In the first English critical edition of the text, Lionel Casson referred to the text as a ‘handbook’ written by a merchant who had travelled the sea routes between Africa and India, and decided to create a guide for others.¹²¹ As laid out by Darley, this was a final step in a long history of assumptions made by scholars regarding the production of the *PME* that had little to do with the text itself,¹²² and all of which ignored the fact that the text did not fit within the genre exemplified by other surviving navigational texts.¹²³ The arguments for its accuracy rest on three points: that a merchant’s handbook would by necessity be accurate, that many details included in the text have been confirmed in scholarship, and that the language and grammar used was poor, reflecting little understanding of rhetorical strategy.¹²⁴ To the first point, as stated, this is based purely on the assumption that the *PME* is in fact a handbook, and in itself is not confirmation of veracity. There is also no evidence that the text was ever used, or was intended to be used, as a guide or navigational handbook.¹²⁵ To the second point, while it is clear that the text is based on a historical reflection of the trade situation in the first century, to use it to recreate the scale of an entire trade network relies on many assumptions not supported by the archaeological data. The final question of the grammar and rhetoric of the text leads to the question of genre.¹²⁶

When compared to other *periploi*, the *PME* contains little actual navigational information, seeming far more concerned with the commercial aspects of the regions

¹²⁰ Darley 2013, 125-157.

¹²¹ Casson 1989, 8.

¹²² This included the conclusion that the merchant who wrote the text was not only Egyptian, but that he was from Alexandria and was concerned with both the navigation and trade of routes between Africa and India. Darley 2013, 129-131.

¹²³ For example, see the *Periplous of the Euxine Sea* (Περίπλους τοῦ Εὐξείνου Πόντου, *Periplus Ponti Euxini*) written by Arrian of Nikomedia in AD 130-131 describing the author’s travel throughout the Black Sea.

¹²⁴ Darley 2013, 149.

¹²⁵ Darley 2013, 145.

¹²⁶ Darley 2013, 145.

discussed.¹²⁷ One possibility, first raised by Gervase Mathew in 1975,¹²⁸ is that rather than a merchant's handbook the text was meant to be a government report intended for the Roman prefect of Egypt.¹²⁹ This explanation was used to justify the focus on taxable goods rather than the mechanics of trade or geographic features that would have been necessary for navigation.¹³⁰

An alternate explanation, advanced by Darley, is that, the 'report' like structure combined with a lack of navigational directions make the text of the *Periplous* more reminiscent of an attempt at a work of geography by a member of the merchant class.¹³¹ Darley has demonstrated that viewing the work as a piece of literature, rather than as a 'handbook', can explain many of the idiosyncrasies that seem to prevent the text from fitting into the genre of either a *periplous* or governmental report,¹³² and that the text should not be relied on as an accurate guide to reconstruct the scale or mechanisms of trade on the Indian Ocean. As Darley concluded:

If the *Periplous* is considered to be a work within a genre of informative writing, including classical geography, then its interpretation must also be reconsidered. First, reframing the text as a work of synthetic data collection and presentation means that information must be considered selectively: that one section of the text is verifiable does not necessarily mean the other sections of the text can be considered accurate by extension.¹³³

If the *PME* is considered a piece of literature rather than a merchant's handbook, and removed from reconstructions of the textile trade throughout the Red Sea (and the Roman Empire in general) other than showing the types of textiles that were moving, there is little reason to rely

¹²⁷ Darley 2013, 137; Casson 1989, 8. For a critique of the genre of *periploi*, see Darley 2013, 135-147.

¹²⁸ Mathew 1975, 147-163.

¹²⁹ Mathew 1975, 153-154; Darley 2013, 132.

¹³⁰ The apparent absence of non-luxury items, which are known to have been travelling along these routes, within the discussion of trade goods the text of the *Periplous* has been noted, but largely dismissed, by scholars. Sidebotham 1990, 6.

¹³¹ Darley 2013, 149-152.

¹³² Literature defined 'as work intended to be read – whether for enjoyment or edification – and which therefore deploys rhetorical choices, however mundane, to engage its reader'. Darley 2013, 152. The idiosyncrasies include the lack of practical navigational information, the focus on luxury goods, the use of complete sentences, lack of administrative details, etc.

¹³³ Darley 2013, 153-154.

on it as an accurate reflection of the scale of trade. The accumulation of evidence from elsewhere in Egypt indicates that demand for cotton was probably much smaller than has been previously projected, and that while Indian cloth, possibly much of it cotton, was being imported, there is no evidence that it created enough demand to warrant largescale investment in its production on the peripheries of the empire.

There are very few other classical writers who have described items that were made of cotton in various parts of the empire. The possibility of a mention of cotton in Caecilius Statius' *Pausimachus* has been discussed in the terminology section of chapter one. Strabo first mentions cotton, the 'wool blossoms' from trees, being used for pillows and saddle padding in Macedonia.¹³⁴ He cites Nearchos as his source, an officer who accompanied Alexander the Great on his campaigns, and who wrote a description of India on his return. The reference therefore is probably to cotton that was brought back with the army, rather than resulting from sustained trade or adoption of cultivation. As cotton dries more quickly than either wool or linen when wet, it may have been a desirable 'souvenir' to the returning army. As stated previously, there are no mentions of cotton in Diocletian's *Edict of Maximum Prices*, although wool, linen, and silk all appear frequently.¹³⁵ The bulk of possible written evidence comes from the papyri, discussed previously.

¹³⁴ 'διὸ καὶ τοὺς κλάδους φησὶν εὐκατμπεῖς εἶναι τῶν δένδρων, ἐξ ὧν οἱ τροχοί· ἐκ δὲ τῆς αὐτίας ἐνίοις καὶ ἐπανθεῖν ἔριον. ἐκ τούτου δὲ Νέαρχός φησι τὰς εὐητρίους ὑφαίνεσθαι σινδόνας, τοὺς δὲ Μακεδόνας ἀντι κναφάλων αὐτοῖς χρῆσθαι καὶ τοῖς σάγμασι σάγης'; 'For this reason also, he adds, the branches of the trees from which the wheels of carriages are made are flexible; and for the same reason even wool blossoms on some. From this wool, Nearchus says, finely threaded clothes are woven, and the Macedonians use them for pillows and as padding for their saddles'. Strabo, *Geography* 15.693. trans. Jones 1966, 33-32.

¹³⁵ Warmington mentions mattresses and pillows stuffed with Indian cotton (Warmington 1928, 212), from Tralles, Damascus and Antinoöpolis, and although he does not refer directly to the lines in the text, he might be referring to 28.46 ('τύλη μετὰ προσκεθαλαίου Τραλλιανῆ ἤτοι Ἀντινοησία / Δαμασκηνῆ ἤτοι Κυπρία καὶ / αἱ λοιπαί', 'bedtick and pillowtick from Tralles or Antinoe / From Damascus or Cyprus / and other places', trans. Frank 1940, 404), but there is no word in this section that could reasonably mean cotton. He may also be referring to the use of the word σινδόνων in 28.16 (σινδόνων κοιταρίων) and 28.31 (ἄπερ ἀπὸ φώπ. γ' τῆς ποιεργμένης καταδεέστερα εἶεν σινδόνων κοιταρίων), but it is clear for the context (including lists of sites of production) that this is not a reference to a type of fibre, but instead of cloth as a bed furnishing. Frank translates these line as 'bed linens' and 'bed linens which are inferior

The literary evidence combined with a lack of archaeological evidence suggests that there was not a cotton culture in the Nile Valley that would have made it economically advantageous to invest in the oases for its production and export to the Nile Valley, nor was there a wider market for it in the Roman world. What is commonly taken to be evidence of the presence of cotton in the Valley is purely a matter of interpretation of a limited number of texts, not currently supported by archaeological evidence. This is not to say that there were not high value goods going to the Nile Valley from the oases that could have driven investment – production of wine and olive oil for the Nile Valley were key drivers of the oasis economies.¹³⁶ But the adoption of cotton and native African cereals for cultivation do not seem to be a part of this tradition. Why, then, were such large quantities of cotton being produced? In 2012 Coralie Gradel, Fleur Letellier-Willemin and Gaëlle Tallet tentatively proposed that rather than being seen as part of the Nile Valley, and consequently Roman, trade networks, the cotton from the oases could be seen as indicative of interactions between the oases and the other civilizations of Africa, although they restricted their analysis to interactions with Nubia.¹³⁷ This theory warrants further consideration, and proposes a new and more complicated view of the investment and exploitation occurring within the oases of the Western Desert, and North Africa as a whole.

Contacts across the Sahara

The previous chapter suggested that cotton was being cultivated and used by at least the first century AD, at approximately the same time as the introduction of sorghum and millet;¹³⁸ this chapter shows that it had arrived in the Western Desert by at least the second century AD.¹³⁹ The chronology of crop introduction confirms that there was prior and sustained

to the aforesaid third quality'. Trans. Frank 1940, 401-403. The Latin for these sections is not preserved.

¹³⁶ Bagnall 2016, 152-153.

¹³⁷ Gradel *et al.* 2012.

¹³⁸ Rowley-Conwy 1989, 134-135.

¹³⁹ P.Iand.7.142 and the finds from Kellis.

contact between the two regions via desert caravan routes along which trade and cultural exchange were occurring. This is further reinforced by evidence of shared textile production technology. At Trimithis, loom weights were found in House B2, where cotton seeds and the cotton textile were also found.¹⁴⁰ Loom weights were also found at Kellis.¹⁴¹ As mentioned, the warp weighted loom was rare in Egypt, indicating that it may have been introduced along with cotton from Nubia as part of a single production process. Excavations further west, in the Fazzān area of the Libyan Desert, show that these connections were even more extensive and that contact between peripheral areas of the Roman world had a substantial impact on the development of northern Africa.

The Fazzān consists of a series of oases in southwest Libya along several medieval and modern trans-Saharan trade routes [fig. 6.5]. The Garamanteian culture, centred on the Wādī al-Ajā but present throughout the oases, became an increasingly dominant power in the central Sahara from 900 BC to AD 500. Multiple archaeological surveys indicate that at their peak, the Garamantes controlled an area spread over approximately 250,000km².¹⁴² Preservation levels at Garamantian sites are varied, some still with standing monuments and some barely visible because of high levels of sustained cultivation in the modern period;¹⁴³ of these sites, only a small portion have been excavated. Texts from classical authors seem to have little to say on the Garamantes, but they were known to Greco-Roman writers and were described as a kingdom outside civilisation¹⁴⁴ However, archaeological excavation has demonstrated an

¹⁴⁰ Davoli 2015, 281, 286-288.

¹⁴¹ Hope and Bowen 2002, 157; Bowen 2002, 97.

¹⁴² Mattingly and Sterry 2013, 504.

¹⁴³ Mattingly 2005, 391.

¹⁴⁴ Pelling 2005, 397. The name ‘Garamantes’ derives from Herodotos (*Histories* 4.174; 4.183) writing in the fifth century BC, but both Pliny the Elder (*Natural History* 5.4) and Pomponius Mela (1.22; 1.47) both refer to the ‘Gamphasantes’ in the first century AD, probably an issue of transcription. For a discussion of this discrepancy, see McCall 1999. Herodotos’ two descriptions of the Garamantes seem to contradict each other. In the first, they are described as defenseless and isolated, while in the second they are described as having horse-drawn chariots with which they conduct slave raids. It is possible he was using different source material for the two accounts. Pomponius Mela follows Herodotos’ first passage, claiming the Garamantes

advanced agricultural civilisation that had adapted to its desert environs through the use of significant irrigation systems.¹⁴⁵

For much of the twentieth century, scholarship on trade in North Africa was dominated by the theory that there was occasional but insignificant contact with sub-Saharan Africa through Lower Nubia and the Fazzān, trading for luxury items and resulting in the scattered Roman archaeological finds along the purported routes; that fact that few Roman objects have been found in sub-Saharan Africa was pointed to as proof.¹⁴⁶ This contributed to a consensus that significant trade through the Saharan did not occur until after the Arab conquest of North Africa,¹⁴⁷ which has proven surprisingly resilient amongst some scholars despite new archaeological evidence indicating connections between the Mediterranean, the African interior, and the regions in between.¹⁴⁸ The discovery of a series of thirty staging stations marking a 350km route from southwest Dakhla to the cliffs of the Gilf Kebir suggests that land expeditions were being carried out into sub-Saharan Africa from as early as the Old Kingdom in Egypt.¹⁴⁹ And classical writers referred to trans-Saharan trade routes as well; both Pliny and Strabo described the trade in semi-precious stones between Carthage and Garamantian traders in the first century AD,¹⁵⁰ implying trade with sub-Saharan Africa (descriptions of these routes

‘go naked and have no knowledge of any weapons’. Mela 1.47, trans. Romer 1998, 48. Other mentions by classical authors, such as Pliny, are incidental.

¹⁴⁵ This included use of *shaduf* wells and, later, *qanats*, both likely technologies transmitted via Egypt. Wilson 2003; 2006; Mattingly and Sterry 2013, 504.

¹⁴⁶ Swanson 1975; Salama 1981, 525. Law 1967 disagreed with some evidence commonly used to show trans-Saharan trade, but concluded that the archaeology showed networks leading from sub-Saharan Africa to the coasts and regular trade.

¹⁴⁷ Levzion 1980 (1973), 124-126, with a focus on the gold trade (Garrard 1982 argues that the trans-Saharan gold trade intensified contacts prior to the spread of Islam, but still not before the fourth century); Bulliet 1975, 138-140 (arguing that Berber hostility and the Roman use of camels as farm animals kept trans-Saharan trade from developing).

¹⁴⁸ For example, Wright 2007, 12-17 argues that interactions were focused on occasional trade in luxuries; Lydon 2009, 9-10, 52-59; Austen 2010, 11-19; as recorded by both Wilson 2012, 410 and Connah 2015, 48. Also Magnavita 2009, 95.

¹⁴⁹ Kuper 2001, 801-802; Roe 2005/2006, 121.

¹⁵⁰ Pliny *Natural History* 5.5; Strabo *Geography* 17.3.19.

in classical texts will be returned to shortly). However, some of the most compelling evidence for trans-Saharan trade in antiquity has come from the Fazzān in Libya.

Evidence of early Garamantian culture indicates that its people started out as nomadic pastoralists, but by the first millennium they had adopted a largely settled lifestyle that revolved around intensive agriculture.¹⁵¹ The capital of Jarma expanded and became an urban centre at the intersection of several regional trade systems and caravan routes, providing links to the Mediterranean world.¹⁵² Extensive archaeological excavation and survey has uncovered evidence of a vast number of urban centres, as well as evidence of Roman trade wares, technologies, and even public works,¹⁵³ implying a diversified economy beyond subsistence agriculture that included merchants and artisans.¹⁵⁴ The finds Roman produced goods, including ceramics and glass (typically as grave goods) in the Garamantes has conclusively demonstrated the occurrence of trans-Saharan trade, with the Garamantes at the centre of routes between sub-Saharan Africa and the Mediterranean.¹⁵⁵ The reason for the lack of Roman material at sites in sub-Saharan Africa is not because of a lack of a network, but because, similar to Horden and Purcell conclusions in the Mediterranean, the Sahara was not a single network. As Wilson argued:

While a part of the trade was truly trans-Saharan in the sense that some goods crossed the Sahara from one side to the other (usually from south to north), much of it was carried out by a series of interlocking subsystems of short- to medium-range trade, and the reason why Roman goods are scarcely found south of the Sahara is that the Garamantes imported them from the Mediterranean for their own use and consumption, but did not trade them on southwards; they were thus filtered out in the Fazzān.¹⁵⁶

¹⁵¹ Pelling 2005, 398. Mario Liverani has suggested that this may have been an adaption to the increasing aridification occurring in the desert in the final centuries BC, which prompted both an increase in local cultivation and trade. Liverani 2000a, 17-28.

¹⁵² Liverani 2000a, fn. 3.

¹⁵³ Mattingly and Wilson 2010, 523-527; Wilson 2018, 603.

¹⁵⁴ Mattingly and Sterry 2013, 506.

¹⁵⁵ Mattingly (ed.) 2003; 2007; 2010; 2013; Mattingly *et al.* 2007; 2008; 2009; Mattingly and Abduli *et al.* 2010; Mattingly and Sterry 2013, 506; Wilson 2012; Wilson 2018, 600-603.

¹⁵⁶ Wilson 2018, 604. The development of short- to medium- distance trade networks was the subject of Wilson 2012.

I propose that the connections between the communities peripheral to the Roman Mediterranean were equally important to the trade economy. By looking at the evidence of cotton, in terms of the development of agriculture in the Fazzān and the technologies used, we begin to see the indications of a far more extensive series of networks spanning the Saharan desert to the regions south and west that included Lower Nubia and the Egyptian oases.

Changes in agriculture

The earliest botanical remains of cultivated plants from a Garamantian settlement come from Zinkekra, a hill fort near Jarma. They suggest that agriculture in the Fazzān was initially developed from cultivation of Near Eastern cereals found throughout the Mediterranean and Egypt in the early first millennium BC.¹⁵⁷ Similar finds were recorded from slightly later periods at Jarma itself and a first millennium promontory site known as Tinda B.¹⁵⁸ These finds are significant for the complete lack of indigenous African cereals in this time period, such as pearl millet and sorghum, indicating that agricultural practices were introduced to the Garamantes from somewhere with close ties to the Mediterranean, rather than rising from a natural exploitation of local flora or from contact with sub-Saharan Africa.¹⁵⁹

In the last few centuries BC and earliest centuries AD, there was a clear change in the crops being cultivated by the Garamantes. The first shift was when the hulled emmer wheat that had been used began to be replaced by free threshing wheat that had gained prominence in the Mediterranean in the first millennium BC.¹⁶⁰ This change corresponds to a similar shift in Egyptian agriculture, indicating a strong connection between the two.¹⁶¹ The subsequent adoption of summer crops brought about the beginnings of a biannual harvest, which may have

¹⁵⁷ These included emmer wheat (*Triticum dicoccum*) and barley (*Hordeum vulgare*), both staples in Egypt, as well as some perennial fruits such as grape (*Vitis vinifera*), fig (*Ficus carica*) and date (*Phoenix dactylifera*). Van der Veen, 1992, 7-39; Pelling 2005, 401; Pelling 2014, 206.

¹⁵⁸ Pelling 2014, 206.

¹⁵⁹ Pelling 2005, 401.

¹⁶⁰ Schörle 2012, 65.

¹⁶¹ Pelling 2008, 57.

added to surpluses and an increase in trade.¹⁶² Pearl millet and sorghum, have been identified in the archaeobotanical assemblages from Jarma dating to the final centuries of the first millennium BC,¹⁶³ as well cotton, detailed below. The origin of the pearl millet and sorghum cultivation found in the Fazzān, as in Nubia, is probably from contact with sub-Saharan Africa,¹⁶⁴ but it is adopted in the Fazzān slightly earlier.¹⁶⁵

Key to this development was the adoption of irrigations networks, principally the *shaduf* well and later the *foggara* (essentially the same technology as a *qanat*). The *shaduf* was used in the Fazzān from the first millennium BC and was likely transmitted from Egypt.¹⁶⁶ Likewise, *foggaras*, described earlier in relation to the Egyptian oases, were being used in Egypt by the fifth to fourth centuries BC,¹⁶⁷ before their first appearance in the Fazzān. The *foggara* was in use in the Fazzān between the first and fourth centuries AD, but may have appeared as early as the second century BC as indicated by the Taglit *foggaras* in southwest Libya.¹⁶⁸ It therefore seems that these technologies were transferred to the Garamantes via the oases of the Western Desert of Egypt.¹⁶⁹ Ruth Pelling posits that it was the adoption of the *foggara* system that allowed for the efficient cultivation of summer crops, and of cotton in particular, by allowing for effective supply and control of subterranean water.¹⁷⁰ Again, the introduction of new irrigation technologies across the desert is indicative of a certain level of interaction among the Saharan desert communities.

¹⁶² Schörle 2012, 65.

¹⁶³ Schörle 2012, 65.

¹⁶⁴ Schörle 2012, 65; Mattingly and Wilson 2010, 528.

¹⁶⁵ At the Meroitic site of Umm Muri, near the Fourth Cataract, radiocarbon dating shows that they were growing a variant of sorghum by cal. 350-150 BC (2180 ± 40 BP), reaching Qasr Ibrim by approximately 100 BC. Fuller 2015, 39-40.

¹⁶⁶ Wilson 2003, 126; Mattingly and Sterry 2013, 504.

¹⁶⁷ Wilson 2006, 211.

¹⁶⁸ For discussion of possible dating see Wilson 2005, 228-229; 2006, 209-10.

¹⁶⁹ Wilson 2006, 211.

¹⁷⁰ Pelling 2005, 404.

Evidence of cotton in the Fazzān

Garamantian textiles that do survive largely come from funerary settings, and in the few instances where fibre identification has been published, the textiles have been wool.¹⁷¹ The earliest archaeobotanic evidence of cotton in the Fazzān comes from two seeds found in a deposit in Jarma from contexts dating to the fourth to second centuries BC;¹⁷² such an early find indicates it is possible cotton cultivation spread into the Western Desert from the Fazzān as well, though the bulk of cotton evidence comes from after the second century AD. These finds included seeds and seed fragments, a sample of which was radiocarbon dated to cal. AD 140-380 (1770 ± 40 BP) [fig. 6.6].¹⁷³ It is not known whether these seeds were originally still attached to bolls that were imported as a raw material or if they represent local cultivation;¹⁷⁴ further excavation needs to be carried out to identify agricultural fields but what evidence does exist suggests there was widespread textile production among the Garamantes.¹⁷⁵ It is possible both were occurring – small scale cultivation and the importation of raw cotton. However, a total of eighty-three cotton seeds were recovered from domestic contexts in Jarma, the majority from contexts corresponding to the second to ninth centuries AD.¹⁷⁶ And although never present in particularly high densities, they appeared in at least fifty percent of the archaeobotanical samples recovered, suggesting consistent (though perhaps small-scale) processing of the raw material.¹⁷⁷ Either way, this indicates a level of interaction along the

¹⁷¹ Wild 2010, 487 identifies two fragments from site of Zinkekrā as wool. In other publications, textile finds are not given fibre identification. For example, see Mattingly *et al.* 2007; 2008; 2009; Edwards *et al.* 2010; Cole 2013, 467-468, although in this case, it is noted that there is evidence of both plant and animal hair fibres.

¹⁷² Pelling 2014, 482.

¹⁷³ Pelling 2005, 402; Pelling 2014, 206.

¹⁷⁴ Pelling makes the comparison to the trade in finished cotton material between Egypt and Nubia (Pelling 2005, 402), but there is no evidence that cotton was being traded in the Nile Valley, and cotton was being cultivated in the oases of the Western Desert.

¹⁷⁵ This includes finds of warp weights and spindle whorls, which will be discussed further shortly. Wild 2010; Cole 2013. The two wool fragments Wild discussed were z-spun, suggesting a textile production culture independent of linen production (see the discussion of spin-direction in appendix 3). Wild 2010, 488.

¹⁷⁶ Pelling 2008, 55; 2013, 482.

¹⁷⁷ Pelling 2007, 191; 2008, 63; 2013, 482.

Sahara from the oases of the Egyptian Western Desert to the Fazzān resulting in the exchange of irrigation technologies, crops, and possibly also textile production technologies, though we as yet do not have enough evidence to make claims on directionality or time-scales.

Fifty-four loom-weights were recovered from the site of Sāniat Jibrīl (a ‘satellite village approximately three-hundred metres from Jarma) from contexts dating to the first to fourth centuries AD,¹⁷⁸ and a further sixty were recovered from Jarma from contexts dating approximately from c. 150 BC to AD 1200;¹⁷⁹ a much smaller number, only six, were recovered from Aghram Nadharif dating from c. 50 BC to AD 250.¹⁸⁰ These finds, along with recovered spindle whorls,¹⁸¹ suggest widespread textile production in the Fazzān using the warp-weighted loom. As discussed previously, this type of loom was largely going out of use in the Mediterranean by the first century AD, except for in the regions of Africa where cotton cultivation and textile production were also taking place.¹⁸² The warp weighted loom may have been transmitted to the Fazzān from the northern/Punic Mediterranean, and from there into the Western Desert and Nubia as part of a larger system of exchange.

If the argument that the development of cotton cultivation in the Fazzān was encouraged by Roman demand is abandoned, the question of a market for the large amounts of cotton being produced in Nubia and the Western Desert remains (at present, there is not enough information to determine the scale of cotton production in the Fazzān). Some cotton was being transported to the Egyptian Nile and the Roman world, both from India and possibly from Africa (either Nubia or the East African Coast; this will be discussed shortly). But in the absence of substantiation for largescale demand, the evidence of a shared cotton culture in the Sahara perhaps presents a more logical market for cotton; they were trading with each other, and perhaps into sub-Saharan and west Africa. It appears that the Saharan routes were crucial

¹⁷⁸ Mattingly *et al.* 2010, 194

¹⁷⁹ Cole 2013, 467.

¹⁸⁰ Mori 2006, 319-321 for the catalogue of loom weights.

¹⁸¹ Mattingly *et al.* 2007, 480; 2010, 197; Cole 2013, 467.

¹⁸² Wild *et al.* 2007, 17; Cole 2013, 467.

to the development of the Fazzān and the oases, as the introduction of irrigation technology, summer crops and the resulting biannual harvest allowed for crop diversification and surplus to support non-agricultural endeavours such as trade and the provision of caravans.¹⁸³ Additionally, the cultivation of a crop as labour intensive as cotton (ensuring proper water levels, harvesting, and processing) that held no sustenance value indicates the cities of the Fazzān and the oases had achieved a level of prosperity that allowed them to pursue economic activities additional to food production.¹⁸⁴

The transmission of cotton and summer crops is not the only indicator of interaction between the oases and the Fazzān; the presence of Egyptian Sigillata (although noted to be limited)¹⁸⁵ at Jarma and colourless glass similar to that found in several regions of Egypt, including the Western Desert,¹⁸⁶ confirm a trade relationship. Fragments of a gilded blue glass vessel depicting an Egyptian scene were determined to probably be from a cylindrical goblet, typical of a type produced in Egypt, and similar to examples from Meroitic cemeteries at Meroë city and Sedeinga, as well as Ain et-Turba in the Kharga Oasis.¹⁸⁷ Several burials in the ‘Royal Cemetery’ of Jarma contained imported material that likely originated in the Egyptian oases, including vessels with Greek inscriptions on them.¹⁸⁸ Other glass fragments from Jarma have been noted as similar to material found in the Western Desert of Egypt,¹⁸⁹ particularly after the third century AD.¹⁹⁰ Trade across the Sahara was likely based on the reciprocal trade of goods such as olive oil (produced extensively in the oases for export), bronze, pottery,¹⁹¹ and glass as

¹⁸³ Schörle 2012, 66; Mattingly and Sterry 2013, 516.

¹⁸⁴ Pelling, 2005, 405.

¹⁸⁵ Leone *et al.* 2013, 406.

¹⁸⁶ Leone *et al.* 2013, 411 makes the comparison to items from the Kharga Oasis (Ain-et-Turba and Bagawat) and Kellis in the Dakhla Oasis, in Nenna 2003, 94.

¹⁸⁷ Leone *et al.* 2013, 411-412.

¹⁸⁸ Edwards *et al.* 2010, 360-366; Mattingly and Wilson 2010, 530

¹⁸⁹ Leone *et al.* 2013, 412-414

¹⁹⁰ Leone *et al.* 2013, 417.

¹⁹¹ Pottery of North African origin has been found in the Dakhla Oasis, although it could have been transported from the Nile. Caputo 2014, 173.

well as other goods in exchange for salts,¹⁹² animals, skins, and other products,¹⁹³ similar to the trade occurring between cities throughout the Mediterranean region. It is possible that trade in other organic materials was occurring but does not leave any physical remains.

Systematic analysis of the botanical finds supports the close relations of these regions. Plotting the flora compositions of sites in the Garamantes, Mediterranean regions of North Africa, Egypt and the Egyptian oases, indicated that while there were noticeable differences between the Garamantes and the Mediterranean and Egyptian sites, there was a marked closeness to the finds from the oases.¹⁹⁴ Of the sites in the Garamantes, Zinkekra was the most comparable to the oases, with Jarma and Tinda B slightly more divergent, perhaps indicating the chronological development of the flora in the area.¹⁹⁵

Similar periods of agricultural innovation are seen at roughly contemporaneous moments at other sites along this Saharan route. The shift to cultivation of native African cereals such as sorghum and pearl millet occurs earlier in the Fazzān than it does in either the Egyptian oases or Lower Nubia.¹⁹⁶ These crops are rarely found elsewhere in Roman North Africa or Egypt in the time period. It is possible that these crops, the practices of their cultivation, and in the case of cotton possibly processed products, were being transmitted along an alternative trans-Saharan route, and that this network did not involve the urban Mediterranean Roman centres of Africa; this is supported by the fact that there is little evidence of that cotton produced in these areas entered Roman markets.¹⁹⁷ Rather, they indicate a relationship maintained with sub-Saharan agriculture and sustained trade.

¹⁹² Two specialised salts of note that passed through the Garamantes were natron, used in glass making, from the Dawada lakes in Dahan Ubari, and alum (used as a mordant in dyeing and leather curing), from the Ghat and Serdeles areas further east. Mattingly *et. al.* 2003, 359.

¹⁹³ Mattingly *et. al.* 2003, 359; Pelling 2005, 398.

¹⁹⁴ Pelling 2014, 216-17, fig. 18.4.

¹⁹⁵ Pelling 2014, 217.

¹⁹⁶ Fuller 2004; Clapham and Rowley-Conwy, 2007.

¹⁹⁷ An exception is the s-spun cotton found in Berenike, Myos Hormos and Abu Sha'ar. See appendix 3. However, there is little evidence cotton ever made it further than these ports.

Trans-Saharan Trade

There is evidence that this network extended into West Africa and Aksum to the east, at least in the later centuries. There is as yet no evidence of textile production in sub-Saharan West Africa before approximately the seventh to ninth centuries, when spindle whorls and distaffs begin to appear in the archaeological record, indicating both spinning and weaving,¹⁹⁸ though textile finds in fourth- to sixth-century AD graves from Kissi in Burkina Faso show that textiles were being used.¹⁹⁹ These textiles were made of wool, but there was no evidence of either textile production (spindle whorls, distaffs, weaving tools) or sheep found at the site.²⁰⁰ So, although it is impossible to say definitely one way or the other, it is probably that the textiles found in the burials were imported from regions to the north; cotton may have been part of this trade.²⁰¹ Finds of cotton west of the Fazzān tend to date to later periods. Cotton textiles have been found in graves from Mammanet in Niger dating to the seventh to eighth centuries,²⁰² and in the Tellem cave dwellings of the Bandiagara escarpment from eleventh- to twelfth-century contexts.²⁰³ A single cotton textile with silk stitching was found at Essouk in Mali from a context dating to c. 950-1100, and seeds appeared in the assemblage from the twelfth century.²⁰⁴ Seeds have been found at Volubilis in Morocco from the ninth century,²⁰⁵ from Dia in the settlement mounds of Shoma and Mara in Mali in the eleventh century,²⁰⁶ although possibly as early as the sixth.²⁰⁷ Spindle whorls were also found. Cotton pollen has also

¹⁹⁸ Kriger 2005, 96-97.

¹⁹⁹ Magnavita 2008, 244; 2009, 90.

²⁰⁰ Magnavita 2008, 250; 2009, 90-91.

²⁰¹ Kriger 2005.

²⁰² Paris 1996, 231, 348.

²⁰³ Eighty-four percent of the textiles recovered were cotton, the rest were wool. Bedaux and Bolland 1980, 10; Bolland 1991.

²⁰⁴ Nixon 2009, 241-242.

²⁰⁵ Pelling 2014, 206.

²⁰⁶ Schmidt and Bedaux 2006, 287; Murray 2005, 156-157. In these contexts, cotton was the most numerous archaeobotanical find.

²⁰⁷ Cotton seeds were found in the Horizon III samples from Shona, but one of these seeds was radiocarbon dated to the fifteenth century (cal. 1402-1459, 480 ± 33 BP), raising the possibility that all of the seeds were later intrusions. However, a light spindle whorl, such as would be required to spin short fibred cotton, was also found in the earlier context, raising the possibility

potentially been identified in eleventh-century contexts at Ogo in the Middle Senegal Valley.²⁰⁸ More archaeological investigation of these areas is needed to establish transmission, cultivation, and production patterns, and to examine gaps in the data;²⁰⁹ for example, it has also been speculated that the Garamantes had direct contact with urban centres in Algeria, but there has been very little excavation there.²¹⁰ The finds from these sites all date to the period after the spread of Islam, which has traditionally been proposed as the cause for the spread of cotton. But given the evidence from Fazzān, it is possible that the spread of cotton into these areas is part of an older process of diffusion.

There is also evidence of cotton being transmitted east, to the Horn of Africa, from Nubia [fig. 6.7]. At Aksum, in modern day Ethiopia and Eritrea, organic material is rarely preserved, but several fragments from the same heavily charred fabric from a domestic structure at Kidane Mehret were identified as cotton, dating to the late fifth to early sixth centuries.²¹¹ Seeds have also been discovered in the same area, in deposits dating from the fifth century to at least the ninth centuries, peaking in the late seventh.²¹² A mix of seeds, including cotton, were discovered inside vessels in a funerary context at Aksum city; radiocarbon dating of closely associated charcoal artefacts within the tomb statistically combined resulted in a date range of cal. AD 250-400 (1714 ± 17 BP), although the seed deposits were likely accidental.²¹³ Aksum was also responsible for one of the more interesting references to cotton in text. An

of cotton processing and spinning. Murray 2005, 155, 258. An additional seed found in Horizon IV was dated between the thirteenth and fourteenth centuries (cal. 1276-1398, 655 ± 38 BP). Murray 2005, 268.

²⁰⁸ Chavane 1985, 109-112; Arazi 2005, 282. Al-Bakri describes cotton production by a people called the Diakhanké, possibly from the states of Tekur and Silla in Senegal, in the eleventh century in *Kitāb al-Masālik wa'l-Mamālik*. Levitzion and Hopkins 2000, 77-78; Arazi 2005, 352.

²⁰⁹ Haour 2013, 73-78 details the difficulty in identifying trade activities in African archaeology.

²¹⁰ Mattingly and Sterry 2013, 517.

²¹¹ Phillipson 2000, 267.

²¹² Phillipson 2000, 366-367. One of the seeds from this site was radiocarbon dated to cal. 681-881 (1240 ± 35 BP). Higham *et al.* 2007, S45.

²¹³ Phillipson 2000, 127-129; 129 fig. 109 provides a full chart of all radiocarbon testing results.

inscription written in Ge'ez (an ancient Ethiopian language, but written in South Arabian script) from around 350 AD during the reign of King Ezana records a raid into the area of Senar that destroyed the corn and cotton of the Noba.²¹⁴ The Aksumites were clearly familiar with cotton by this point. Despite the proximity of the settlement of Aksum to Adulis, the Red Sea port of the Aksumite empire, the presence of seeds indicates interaction with the African cotton network along which cultivation was diffusing, rather than India which was trading finished products. It is also possible Aksum was providing the Egyptian Red Sea ports with non-Indian cotton as well, either locally produced or from Nubia.²¹⁵ Aksum will be returned to in the next chapter in terms of its relationship with Arabia.

One of the chief arguments against trans-Saharan trade in the Late Antique period is that few Roman items are found in sub-Saharan contexts and vice versa, while objects that may have been traversing the Saharan desert along its length are infrequently identified.²¹⁶ There are several possible reasons for this lack of evidence. One is that the goods travelling along these routes were organic materials that simply do not survive in the archaeological record. But another is that the goods that travelled across the Sahara in all directions were not meant to travel the full extent of the route, as argued by Wilson.²¹⁷ In the later medieval period, it was more common for camel caravans to travel short distances, break up upon reaching a middle destination, and then reform at various points along the trans-Saharan routes.²¹⁸ There is little

²¹⁴ Clapham and Rowley-Conwy 2009, 245.

²¹⁵ Particularly at Berenike, it has been noted that there are roughly equal numbers of z-spun and s-spun cottons represented in the assemblages, and it has been proposed that the s-spun cotton may have come from Nubia (Wild *et al.* 2008). This a parity not seen in other sites and Egypt, and would seem to indicate two origins for the cotton finds (see appendix 3 for a discussion of caution in using spin-direction diagnostically). While the Nile is typically viewed as the avenue for these textiles, the aforementioned lack of cotton evidence at intermediary sites on this route may mean that African cotton was entering the Egyptian ports from ships that were trading goods from the port of Adulis as well.

²¹⁶ Specifically, Roman coins are not found in sub-Saharan contexts, though there seems to be no argument for their use as they would have had little significance as coins in societies unfamiliar with monetary systems, and their value would have been in their metal content. Connah 2015, 66.

²¹⁷ Wilson 2012; 2018.

²¹⁸ Wilson 2012, 413-14.

reason to think that trade in the late antique period would have been different; it is a pattern that seems distinctly suited to desert caravans. This would explain why the majority of Mediterranean goods seem to stay in the Saharan communities; rather than representing a single network in which goods moved from beginning to end, the trans-Saharan trade routes were series of overlapping networks in which goods could change hands many times and have different intended end destinations, or people could transport different items over different legs of a journey.²¹⁹ Evidence of direct contact between non-neighbouring populations across the Sahara may simply not exist as the pattern of trade was more indirect, with the transfer of agricultural practices and technologies the clearest indicator of sustained cultural contact. The Saharan populations relied on trade with their neighbours,²²⁰ and the roles of these sites where the caravans would break up, exchange goods and reform created a local sub-economy directed towards servicing the caravans and the people who were travelling along them.²²¹ While the gaps in the areas excavated in North Africa make deciphering these networks difficult, it is possible that cotton use quickly spread the entire length of the trade routes.

Possible collapse along a trade route

In addition to shared agricultural practices, crop use and investment patterns, a further connection between the peripheral regions of the trans-Saharan trade is that they all went through a period of collapse or profound cultural change in the late fifth to sixth centuries. In the oases of the Western Desert, entire settlements were abandoned and the oases went through a fairly rapid period of depopulation.²²² As found at Qasr Ibrim, in Lower Nubia, the Meroitic state gave way to a new culture called the X-group in the fourth century.²²³ By the late fifth century, the culture of Lower Nubia also seems to have changed dramatically and the textiles from Qasr Ibrim quickly switch from predominantly cotton to animal hair (mostly wool) with

²¹⁹ Wilson 2012, 419.

²²⁰ Crawley Quinn 2009; Schörle 2012, 58.

²²¹ Wilson 2012, 414.

²²² Bagnall 2016, 172; Hope 1997, 13.

²²³ Fuller 2014, 174-175.

few examples of cotton by the mid-sixth century.²²⁴ In the Fazzān, there is a decline in the agricultural output and population, and the *foggara* irrigation system likewise seems to have declined.²²⁵ Recent analysis of tombs in North Africa, combined with modern linguistic analysis, has shown that there appears to have been a migration event of Saharan peoples into the pre-desert area of North Africa in the late fifth century.²²⁶ And late in the fifth century through to the sixth, the Aksumite Empire began to disintegrate, with several references to internal territorial revolts.²²⁷

There have been many theories put forth by scholars to explain these changes, but discussing each as a regionally distinct event. They have ranged from political instability across the Roman world,²²⁸ over-exploitation of resources (both water and soil),²²⁹ and sand movement (particularly in the Egyptian oases).²³⁰ None of these explanations are particularly convincing on their own, nor do they address the changes occurring amongst areas that clearly shared cultural aspects but were politically unrelated. Increasingly, archaeological evidence has shown that political changes that were occurring in the Mediterranean regions of North Africa and Egypt had little effect on the everyday lives of the people who lived in them, or on their economies.²³¹

²²⁴ Gevers 1990, 14; Kriger 2005, 91. Fuller 2014 places this change earlier, but looks only at the cemetery sites of Qustul and Ballana.

²²⁵ Mattingly 2002, 393; Fentress and Wilson 2016, 56 notes that the chronology of this based on imports of Roman (which had begun to decline in the third century) and Byzantine material which are rarely found after the seventh century. This resulted in a shift from *foggara* irrigation to wells in this period. Mattingly 2002, 393; Wilson and Mattingly 2003, 273-275; Fentress and Wilson 2016, 57.

²²⁶ Fentress and Wilson 2016.

²²⁷ Munro-Hay 1991, 260-4; Phillips 1997, 455

²²⁸ Discussed in Bagnall 2016; Fuller 2015.

²²⁹ For example, there is some debate as to whether the declining water table was due to over-exploitation (as proposed in Mattingly 2002, 393) or climate change, addressed in this section. Fentress and Wilson 2016, 57-58 proposes a combination of factors, including the possibility that the aquifers feeding the Saharan oases were 'leaky' and therefore utilisation was always going to be time-limited.

²³⁰ Bagnall 2016, 172-173; Hope 1997, 13.

²³¹ For example, Foss 2003 showed that the Sasanian occupation of Egypt had little impact on the everyday lives of Egyptians as the Sasanians relied heavily on the established Byzantine infrastructure.

It has been noted that the Sahara was frequently characterised by ecological instability,²³² defined by Horden and Purcell as one of the key drivers in the creation and eventual abandonment of exchange networks throughout history.²³³ Research in Wadi Tanezzuft, south of Fazzān, on cypress tree rings used to indicate annual rain fall, has shown that there were a series of short dry periods throughout the Sahara starting in c. 1570 BC, with the onset of a final hyper-arid conditions in the southern Sahara beginning around AD 450, seeming roughly to coincide with the beginnings of the collapse of the Garamantes civilisation,²³⁴ and the change in textile use in Nubia. This is based on very limited data, but may be part of a wider pattern. Throughout the third and fourth centuries, increasing periods of aridity spread over East Africa and the Sahara was already affecting the agricultural output in Nubia and may have accelerated the growing regionalism that was developing between the Meroitic heartland and the Lower Nubian province,²³⁵ leading to various successor states. It has also been suggested that the decline in Ethiopia was also connected to the decreasing rainfall in the area of Sudan.²³⁶ And it is also possible such aridification was responsible for the struggling cotton harvests recorded in the *KAB* in the period immediately prior to the abandonment of Kellis.

As mentioned, in this time period the archaeological remains show that in Lower Nubia, cotton was largely abandoned in favour of animal hair in textile production. The change in fibre from plant to hair would seem to indicate a wider shift in agricultural practice within the region of Lower Nubia; changing precipitation patterns may have made cotton cultivation untenable, and to the extent that irrigation systems were being used outside of the Nile floodplains, they may have been suffering from declining water tables as well.²³⁷ The decline of the *foggara*

²³² Schörle 2012, 63.

²³³ Horden and Purcell 2000.

²³⁴ Liverani 2003; Cremaschi *et al.* 2006; Schörle 2012, 63.

²³⁵ Fuller 2014, 174-5.

²³⁶ Fuller 2014, 174.

²³⁷ As noted, these regions have received limited archaeological investigation.

system in the post-Garamantian Fazzān signals that there was a similar decrease in agricultural output there, though water in these areas was provided by underground aquifers, so is unlikely to be related to short-term changing aridity in the area. It is difficult to assign the consequences of climatic events within various geographic regions, as the knock-on effects are not always immediate. However, if part of what made these desert communities profitable and sustainable was a shared trade network that did not rely on Roman and later Byzantine centres, disruption of a part of that network that affected crops that were traded along the network, such as cotton, could have had consequences for the network as a whole.

It seems probable that both the Egyptian oases and the region of Lower Nubia around Qasr Ibrim were producing large amounts of cotton that made up a vital component of their economy, as speculated by Bagnall.²³⁸ However, this cotton was not necessarily intended for the regions Bagnall assumed. Rather than being traded along the Nile to the cities of the valley, it was moving west along the Saharan desert routes into the Garamantes, and perhaps even into the areas of West Africa and the sub-Sahara, where archaeologists have yet to uncover evidence of any kind of widespread textile production. If it was being traded along with other agricultural commodities in exchange for semi-precious gems, salts and other goods from West Africa and the interior, it would have been part of a highly consequential trade network that would have contributed greatly to the development and wealth of the civilisations participating in it. If the onset of a prolonged dry period caused the agricultural commodities being traded along this route, such as cotton, to fail it could explain the concurrent disruptions and abandonment found throughout the Saharan areas of North Africa. While the theory of climate impact may have only been a contributing factor that combined with other events in the fifth and sixth centuries to interfere with these communities, it provides a framework for explaining why these

²³⁸ To this we may add the Fazzān, although the limited evidence of cotton should be used as only an indication of the presence of cotton; there is much less evidence than in the Egyptian oases or Nubia to provide indications of the scale of cultivation or use.

communities were no longer sustainable on a large scale. Further research needs to be done in this area, looking at these communities together rather than as independent entities.

After the Roman period

Following the abandonment of the Red Sea ports in the fourth to sixth centuries as Red Sea trade decreased, and the largescale desertion of towns in the Western Desert in the fifth century, definitive finds of cotton in Egypt become more rare, only beginning to reappear in the archaeological record after Egypt was incorporated into the Islamic world. When large assemblages are found, they again suggest that there were multiple cotton networks functioning in Egypt. For example, excavations at one of the cemeteries of Fustat, ‘Ayn al-Sira, dating to the second half of the eighth century to the early ninth century, yielded a number of bodies, all of which had raw cotton around the neck and pelvis areas; the rest of the textiles found were linen.²³⁹ The excavators proposed that the sheer amount of raw cotton present in the cemetery indicated local cultivation rather than the import of foreign material.²⁴⁰ While there is no archaeological evidence for cotton cultivation in this time period P.Bodl.Arab.2, probably from the ninth century, does refer to cotton fields, although the origin of this papyrus is unknown. P.MargoliouthMonneret 4 refers to the purchase of cotton seeds in Qus in southern Egypt, but this papyrus, found in Aswan, probably dates to the eleventh century.²⁴¹ If cotton was being cultivated in the Egyptian Nile Valley in this time period, it was probably rare.

This conclusion diverges from the assertions that cotton in Egypt in the early Islamic period evidenced increased trade with India, first proposed in the 1930s when Rodolphe Pfister noted similarities between ‘printed’ cottons found in Egypt and Indian art, specifically architectural features seen in Gujarati motifs from both Hindu and Jain manuscripts.²⁴² There are several large collections of such textiles held in museums throughout the world, the largest

²³⁹ Gayraud *et al.* 1994, 11-12

²⁴⁰ Gayraud *et al.* 1994, 12.

²⁴¹ I would like to thank Chris Wickham for bringing these documents to my attention, and providing probable dates.

²⁴² Pfister 1936, 161-164; 1938; Barnes 2017, 22.

of which is at the Ashmolean Museum in Oxford, with over 1,200 fragments.²⁴³ At first the printed cottons were dated based on stylistic comparison to the twelfth/thirteenth centuries and later, the period when there seemed to have been a resurgence of trade between India and Egypt along Red Sea routes under the Mamluks.²⁴⁴ However, radiocarbon dating on a selection of the textiles from the Ashmolean Museum has indicated that some of these were actually produced in the tenth and eleventh centuries,²⁴⁵ and one was as early as the eighth or ninth century.²⁴⁶ The tenth and eleventh century dates also correspond to an intensification of Red Sea trade undertaken by the Fatimids in Egypt,²⁴⁷ suggesting that it is possible these textiles were either the result of direct trade between Red Sea and Indian Ocean communities (including those of East Africa and Yemen, discussed shortly) or imitation. The earlier examples could represent an initial phase of this trade expansion, but could also be from Central Asia or potentially even in Egypt. Indian trade goods were travelling west through the Persian Gulf and to the Abbasid capital of Baghdad,²⁴⁸ and imitation cannot be ruled out. Studies of medieval textile assemblages elsewhere in the world have demonstrated that the movement of textiles and frequency of motif imitation throughout Mediterranean, Middle Eastern and Central Asian regions makes attribution of origin based on iconography alone problematic, as has been

²⁴³ This collection was the subject of an in-depth study by Ruth Barnes in the early 1990s. Barnes 1997.

²⁴⁴ Excavations of the second period of occupation of Quseir al-Qadim (Myos Hormos) by the University of Chicago in the 1970s and 1980s recovered thirteenth-fifteenth-century coins and a further sixty-nine fragments of 'Indian printed' cotton fragments, taken to indicate an expansion of trade links with India by way of Red Sea routes. Vogelsang-Eastwood 1990; Burke and Whitcomb, 2004, 82-97. Two cotton seeds from the eleventh to twelfth centuries were also found. Van der Veen *et al.* 2011, 89-90.

²⁴⁵ Barnes 1997, 33-34, 39-40; Higham *et al.* 2007, S41-S44. Three samples returned date ranges in tenth to eleventh centuries: OX-10445 cal. 770-991 (1128 ± 36 BP, 82.5 % 854-991), OX-10447 cal. 895-1118 (1037 ± 37 BP, 84.9% 939-1043), OX-10453 cal. 880-1020 (1097 ± 35 BP). Calibrated dates were calculated using the OxCal 4.3 program available at c14.arch.ox.ac.uk. Accessed 28 January 2019.

²⁴⁶ This sample was tested twice; OX-10448 cal. 609-765 (1360 ± 37, 88.8% 609-713) and OX-10854 cal. 692-891 (1214 ± 32, 78.5% 762-891).

²⁴⁷ Power 2012, 146-174, esp. 152-154 for the importance of textiles.

²⁴⁸ Higham *et al.* 2007, S43.

conclusively demonstrated by several studies of silk textiles.²⁴⁹ While to date there has not been any evidence of block-printing in Egypt in this time-period, resist-dye was a technique used in Egypt from at least the fourth century, demonstrated by a group of resist-dyed linen textiles from burial grounds across Egypt held in the Victoria and Albert Museum in London.²⁵⁰ Further analysis on decorated textiles in institutional collections may clarify this point.

One of the most comprehensive sources scholars have detailing mercantile activity in early Islamic Egypt is the Cairo Genizah, a collection of several hundred thousand letters, wills, dowry lists, legal complaints, etc., from the Jewish community of Fustat (Old Cairo). These documents had been deposited in the storeroom (*genizah*) of the Ben Ezra Synagogue in Cairo from the early ninth to mid-nineteenth centuries. In these texts, many relating to the merchants within the community, there were several references cotton, and to a certain type of textile being imported from India, referred to as *mihbas* (plural *mahabis*) which Goitein translated as ‘wrapper’ and has been assumed to be some type of cotton.²⁵¹ However, India is not the only location recorded as exporting cotton to Egypt. The documents show raw cotton being imported from Tunisia and Syria in the later periods,²⁵² as well as *Balad al-Rūm*, the land of the Romans, thought to refer to Sicily.²⁵³ These other cotton centres have received less attention than the Indian Ocean, but are increasingly being corroborated by archaeological excavation. As discussed previously, there is increasing evidence of cotton cultivation and use from at least the ninth century, perhaps earlier, in West Africa.

There is also evidence that these areas had become hubs of trade by the ninth or tenth centuries. Arab geographers frequently refer to West and sub-Saharan Africa as *Balad al-*

²⁴⁹ Galliker 2014; Thomas 2012, 125, 127-129; Jacoby 2004, 214. It is reasonable that the same would be true with other fibre types.

²⁵⁰ References are also made to smaller collections held by the Louvre, Cluny Museum, Abegg Foundation and Royal Museums in Brussels. Woolley 2001, 106-113. However, the two samples that were not block-printed in the group tested returned much later dates: OX-10357 cal. 1438-1634 (387 ± 39 BP) and OX-10446 cal. 1401-1464 (479 ± 34).

²⁵¹ Goitein, 1983, 171.

²⁵² Goitein, 1961, 179.

²⁵³ Goitein, 1961, 404.

Sudan (the Land of the Blacks) in accounts collected from traders, emphasising the commercial trade in gold and slaves.²⁵⁴ At Gao in western Sudan collections of copper objects from the eighth to tenth centuries were determined to be made from ore mined near Tunisia (similar to the copper objects found at Kissi in Burkina Faso, Essouk in Mali, and Marandet in Niger);²⁵⁵ the chemical composition of glass beads at the site suggested they originated in the Syria-Palestine area and the Middle East.²⁵⁶ Other imported goods included carnelian beads possibly from India or the Fazzān, and cowry shells from India.²⁵⁷ At Marandet in central Niger, ceramics from North Africa and glass beads from Egypt or the Middle East were found in deposits broadly dated to between the sixth and ninth centuries.²⁵⁸ And at Essouk, where cotton seeds and cloth were discovered,²⁵⁹ pottery and copper from North Africa and imported glass and cowry shell have been found beginning in eighth century contexts.²⁶⁰ It is therefore possible that cotton being grown in West Africa was also moving along trade routes connecting the area to other parts of the Islamic world. Regardless, while cotton use seems to increase in the period after the eighth century, it does not represent a large-scale change in the textiles of Egypt due to external introduction and diffusion by a central entity, but rather a gradual incorporation based on prior tradition along multiple networks.

Conclusions

There are several important points to note from this study of the early cotton networks across the African continent. First, as discussed in chapter two, the species of cotton being grown in Africa in this time period was the native African domesticate *G. herbaceum*, not the species from the Indian subcontinent. This will be explored further in the next chapter, especially in how this might reshape our understanding of the development of cotton

²⁵⁴ Magnavita *et al.* 2007, 147; Haour 2012, 444; Cissé *et al.* 2013, 10.

²⁵⁵ Cissé *et al.* 2013, 27.

²⁵⁶ Cissé *et al.* 2013, 27-29.

²⁵⁷ Cissé *et al.* 2013, 29.

²⁵⁸ Magnavita *et al.* 2007, 158-160.

²⁵⁹ This chapter, 249.

²⁶⁰ Nixon 2009, 239-248.

cultivation on the Arabian Peninsula, and ultimately, the Middle East. However, it indicates that, as is beginning to be suggested by studies of other materials,²⁶¹ there has been a historical over-emphasis on the role of India in discussions of the introduction of various types of trade goods and trade, particularly in discussions of textiles. Although many studies of cotton continue to rely on the *PME* as proof that there was an extensive cotton trade with India, and that this trade stimulated Roman demand resulting in cultivation in parts of Africa,²⁶² the evidence of the temporal and geographic spread of cotton, combined with the evidence of the diffusion of irrigation technology and other African crops, indicates a network independent of India, though with an intersection in east Africa and Arabia. While the evidence from Berenike and Myos Hormos shows that there was some trade in Indian cotton, it does not appear to have been extensive and may have been focused on the more utilitarian needs of seafaring communities with occasional trade of more high-quality garments for trade, particularly if the evidence from the *PME* is taken out of formulations of scale. This suggests that there needs to be a shift in both how economic historians, and also textile historians, model evidence of interaction. As discussed in chapter two, the movements of goods and the movements of people do not necessarily match, and textile networks need to be examined in aggregate, not as specific case studies.

A second point is that, as demonstrated by looking at cotton as a commodity, there has been too much focus on discussions of trade centred on the urban Mediterranean cities in late antiquity, at the expense of regions that were only marginally considered part of the Roman trading zone. Despite the repetition by scholars, there is little evidence of a demand for cotton in the wider Roman world, and even less that there was a demand in the Nile Valley. Rather, the cotton being grown in the areas discussed seems to be functioning within an independent network, suggesting the need for a more nuanced view of how trade networks were formed.

²⁶¹ Darley 2013.

²⁶² Most recently Bouchaud *et al.* 2018.

While it is true that certain items were being transported from the oases to the Nile Valley, it is also true that items were travelling across the Saharan desert, bypassing the traditional Roman urban centres all together. Rather than a single long-distance trade network, the area seems instead to be made up of a series of smaller regional networks that were linked and overlapping, but not necessarily working as a single unit. Likewise, the cotton found in two disparate regions of Egypt indicate that there were multiple networks that cotton moved along. A secondary implication of this is that it seems cotton was a much more diffuse commodity, and at an earlier period, than was previously thought. The consequences to our historic understanding of the development of the cotton trade, and in particular Andrew Watson's theory of an 'agricultural revolution' (which, in light of the evidence above, should be re-examined) will be explored in the following chapter.

Finally, the evidence of cotton use throughout the Saharan regions, several centuries before the Arab conquests of Egypt and North Africa, shows that there were routes going across the desert towards West Africa. While further excavation is needed to fully understand these routes and their scale, the transmission of cotton use and cultivation indicates that the societies on the African continent had more active interactions with each other than simply functioning as middlemen between sub-Saharan Africa and the Roman Empire. Their growth and prosperity was due to a combination of factors and a mediation of relationships between themselves as well as the Mediterranean centres. The possible links between these areas and changing climatic conditions are something that should be explored further, but initial findings indicate this network was an important aspect of the prosperity of the regions peripheral to the Roman trade zones, and that changes to the agricultural output of one of the communities may have had a knock-on effect on the others. It is clear that we need to re-examine the history of trans-Saharan trade and the role of Africa in the development of global trade networks.



Figure 6.1 Sites of Egypt with cotton finds.



Figure 6.2 The Kellis Agricultural Account Book. Photo reproduced from the Royal Ontario Museum.

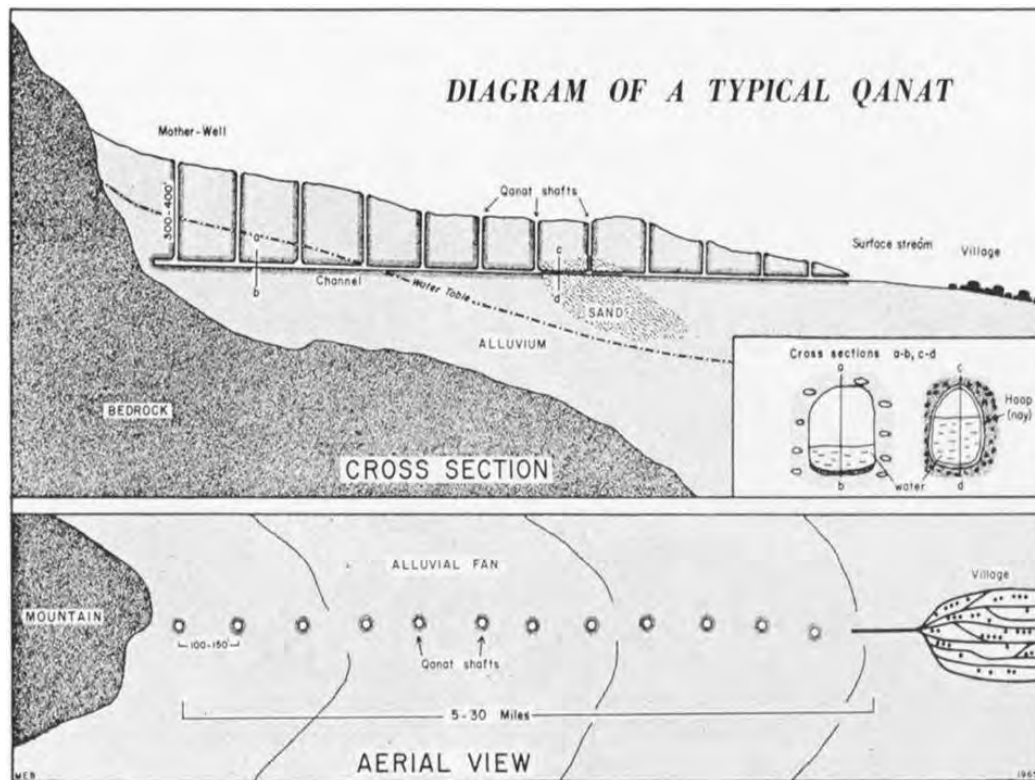


Figure 6.3 Cross section diagram of a qanat. Reproduced from English 1968, 171.

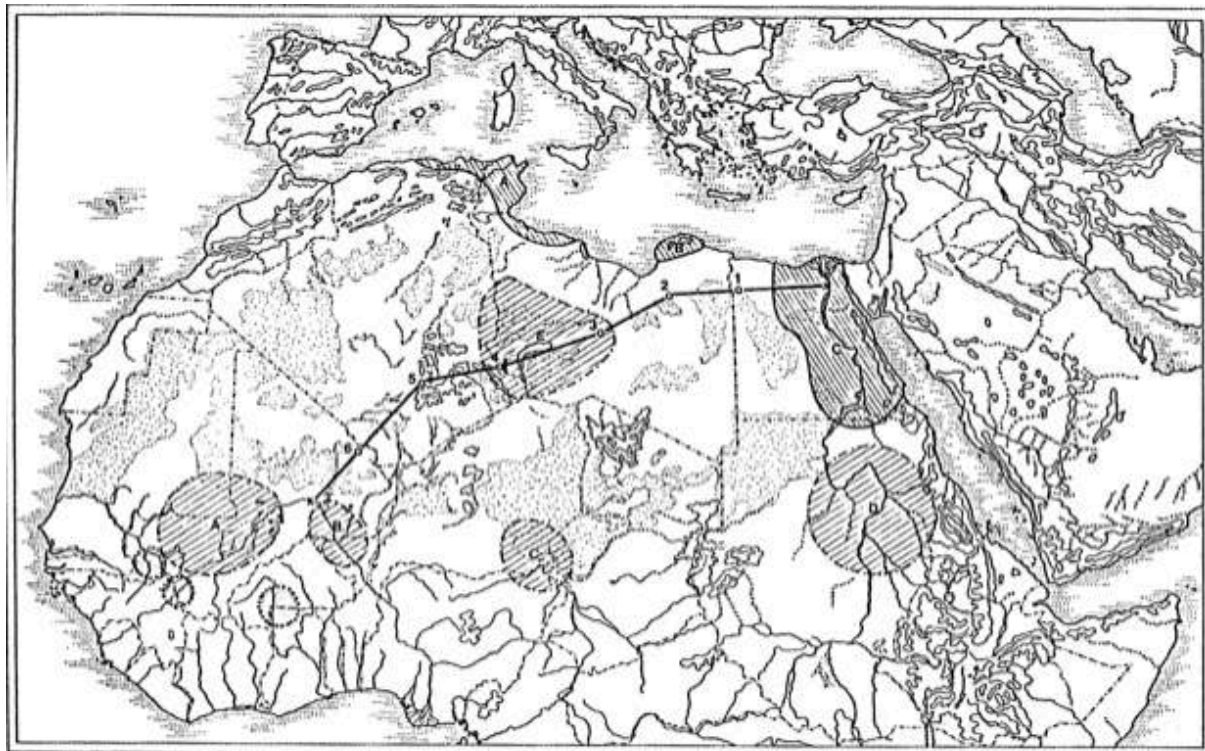


Figure 6.4 The desert caravan route of Herodotos, proposed by Liverani. Reproduced from Liverani 2000b 519.



Figure 6.5 Map of Jarma and the sites in Egypt with cotton.

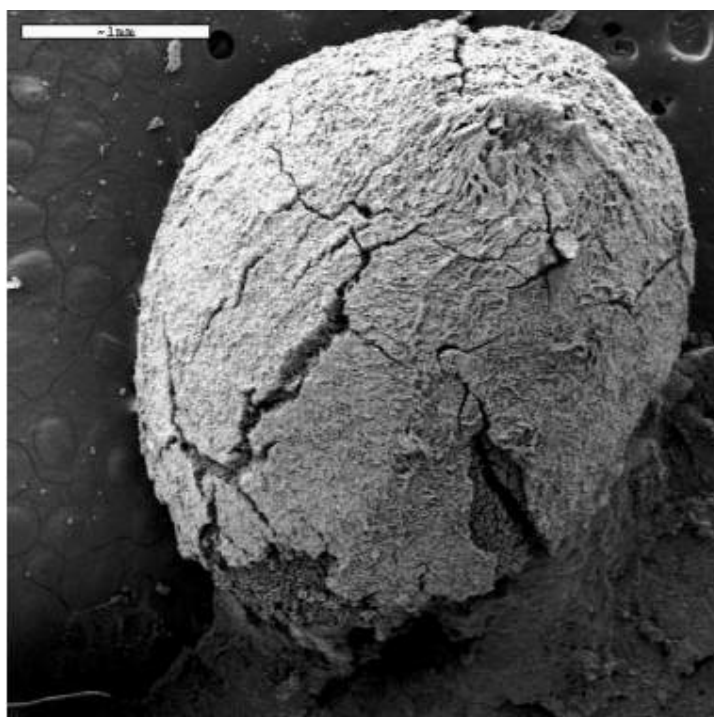


Figure 6.6 Archaeobotanic cotton seed from Jarma. Reproduced from Pelling 2005, 404.



Figure 6.7 Sites with cotton finds in Africa (not chronological). Later sites marked purple. 1. Central Sudan: Meroë, Hamadab, Gabati and Muweis 2. Sahaba 3. Upper Nubia: Sedeinga, Saï, Aksha, Semana 4. Lower Nubia: Serra, Abka, Qustul, Ballana, Gebel Adda, Karanog and Shablul, Qasr Ibrim 5. Kalabsha and Wadi Kitna 6. Ashkeit 7. Berenike 8. Myos Hormos 9. Abu Sha'ar 10. Kharga Oasis: Kysis, El-Deir, Ain Umm el-Dabadib 11. Dakhla Oasis: Trimithis, Kellis 12. Karanis 13. Jarma 14. Aksum 15. Mammanet 16. Essouk 17. Fustat 18. Tellem 19. Dia (Shoma and Mara) 20. Volubilis

Chapter Seven: An ‘Agricultural Revolution’? The Spread of Cotton in Central Asia and the Middle East

Introduction: Cotton outside of Africa

While evidence for the cultivation and use of cotton from the Gulf side of Arabia has been known for some time, evidence from the Red Sea side has only recently been discovered. As has been the case for cotton in Africa, its presence in Arabia has been seen as a consequence of the importation of Indian cotton through maritime trade connections.¹ The last chapter proposed two networks of cotton in late antiquity that were largely independent from each other, one African and one Indian, and overlapped at the Red Sea coasts. This chapter will argue that the same was true for Arabia, and consequently the rest of the Middle East, and suggest that the cotton found in Western Arabia should be considered part of the African network rather than the Indian. It will also fully address Watson’s ‘agricultural revolution’ and the mechanisms of cotton diffusion prior to and after the rise of Islam by examining the earliest evidence of cotton throughout Central Asia and the Middle East [fig. 7.1]. The archaeological evidence and (comparatively) few references to cotton in textual sources throughout the region will be examined, from surprise finds in Central Asia nearly contemporaneous with some of the earliest evidence from India, through the seemingly large-scale adoption in the Levant after the seventh century AD, and the implications of a ‘cotton boom’ in the eighth- and ninth-

¹ See Bouchaud *et al.* 2011; 2015; 2018; Bouchaud 2015a; 2015b.

century Iranian Plateau. Through a close re-contextualisation of the evidence, within the framework of both wider textile use and agricultural developments, a new theory of cotton networks will be proposed that will emphasise the importance of land trade and interaction with Africa, in addition to the well-studied exchange routes through the Mediterranean and Indian Oceans. This will also be situated within the wider structural changes that occurred in the early Islamic period as the Abbasid caliphs sought to expand their economic advantage throughout the Middle East, North Africa, and rest of the Mediterranean.

Watson's 'Agricultural Revolution', Decker and Squatriti

It was in 1974 that Watson first proposed that the spread of Islam in the seventh and eighth centuries was responsible for a dramatic change in agricultural practices (the 'agricultural revolution') in its new territories. He theorised that it was this revolution, based on an influx of new crops introduced from the tropical climate of the Indian subcontinent, which ultimately transformed the global medieval economy in a multifaceted process that continued through the twelfth century and would eventually be felt in European economies as well. Watson identified seventeen crops which he said demonstrated the significance of this agricultural revolution: rice, sorghum, durum wheat, sugar cane, watermelons, aubergine (eggplant), spinach, artichokes, taro (colocasia), sour oranges, lemons, limes, bananas, plantains, mangoes, coconut palms, and cotton (the only non-foodstuff).² The premise of his argument was that these crops were largely unknown throughout the ancient world prior to this point, were summer crops requiring warmer temperatures to grow, and their spread resulted in the adoption of new irrigation technologies which allowed crop rotation. The ensuing growth in agricultural output drove increases in surplus and urbanisation, and had an impact on economic structures such as labour organisation, production, demography, and ultimately cultural and social organisation.³ For example throughout the Roman empire, the traditional

² Watson 1974, 9.

³ Watson 1974, 8. These principals were later expanded in Watson 1983.

growing season had been winter, with crops sown in the autumn and harvested in the spring. The introduction of tropical crops, which required heat to grow and were thereby ideally suited to the summer seasons, resulted in a widespread adoption of crop rotation which ultimately increased agricultural surplus and allowed rapid population and economic growth.⁴ However, this would have required increasing use of irrigation technology as there was not enough rainfall in the summer months through the Middle East and Mediterranean.⁵ Watson claims that the new Muslim conquerors facilitated this by reviving irrigation systems which had largely fallen into disrepair by the late Roman and early Byzantine periods, and introduced both the *qanat* and *saqia* from Persia.⁶

Watson's theory became highly influential in discussions of economic change in the regions encompassing the Middle East to the Mediterranean, stimulated by the political transformations that occurred with the spread of Islam and accelerated development of exchange networks. While reviewers occasionally pointed to problems within the framework of Watson's arguments, the theory of an Islamic agricultural revolution was not critically challenged, despite an influx of archaeological evidence, until Michael Decker's 2009 'Plants and Progress, Rethinking the Islamic Agricultural Revolution' in *Journal of World History*.⁷ Decker looked at four of the crops which Watson had highlighted as crucial to the agricultural revolution: durum wheat, rice, artichokes and cotton.⁸ Decker definitively proved that all were known outside of India prior to the spread of Islam, and that any structural changes due to crop introduction would have been limited anyway. Increasingly evidence has pointed to the use of

⁴ This is the subject of Watson 1983, part four.

⁵ Watson 1974, 11; 1983, 103-111.

⁶ Watson 1974, 12-13, 24-25; 1983, 107-110.

⁷ Rowley-Conwy 1989 discussed earlier evidence of some of these crops in Nubia, but did not go so far as to challenge the underlying principle of an 'agricultural revolution' throughout the Mediterranean.

⁸ Decker 2009, 187-206. The presence of durum wheat in Egypt and North Africa is discussed in chapters four and five. Although sorghum was a native African cereal and, as also discussed in chapters four and five, was being cultivated in Africa from at least the first millennium BC, it was not included in Decker's argument.

crop rotation in the late Roman world, as detailed in the *Geoponica*, a farming manual compiled in the tenth century from a collection of late antique Syrian sources, which indicates that planting crops for a summer season was actually common.⁹

Geoffery Kron has also conducted a detailed analysis of technical terminology in the farming texts written by ancient authors such as Columella, Varro and Pliny, which seem to indicate various forms of fallowing.¹⁰ And crop rotation to maximise crop yields has been suggested as one of the primary reasons for the development of the oases in Egypt's Western Desert. Likewise, the irrigation technologies cited by Watson, specifically the *qanat* and *saqia*, had spread centuries before and were being used widely in the Middle East, Africa and even Spain (in the case of the *saqia*) by the seventh century.¹¹ Rather than introducing these new technologies, what seems to have been occurring was the widespread refurbishment and expansion of the ancient systems under Muslim control, such as was determined to have been carried out in Mesopotamian irrigation systems.¹² Decker's overall conclusion is that 'the resultant Green Revolution thesis is therefore a simplistic, linear model of the movement of ideas and goods that fails to acknowledge the complexities of these transmissions, the correct range of their diffusion, and the real limits of their significance.'¹³

Despite such convincing arguments, Watson's theory continues to have defenders, most recently in Paolo Squatriti's 2014 'Of Seeds, Seasons, and Seas, Andrew Watson's Medieval Agrarian Revolution Forty Years Later' in *The Journal of Economic History*. Squatriti argues that the fundamental theme of Watson's argument is that of crop diffusion—not introduction—and technological advancement as the driving force behind the changes to agricultural practices

⁹ Decker 2009, 189. For example, the section on artichokes by Varro, which documents their sowing in both autumn and spring. *Geoponica*, 12.39, trans. Dalby 2011, 266.

¹⁰ Kron 2000, 277-287.

¹¹ Watson mentions the *shaduf* well as present in pre-Islamic Arabia, but not in Egypt or elsewhere in Africa. Watson 1983, 104-105. For summaries of the diffusions of ancient irrigation technologies, see Wilson 2003; 2006. The use of these technologies in cotton cultivation in Africa is detailed in chapters five and six.

¹² Christensen 1993, 73-116.

¹³ Decker 2009, 191.

and ultimately a new kind of economic growth.¹⁴ Watson's theory has also continued to be highly influential in textile histories, which tend to place India at the centre of an expansion of 'eastern' textiles, such as cotton and silk, emphasising its importance in the production and spread of use and cultivation as the centuries progressed. Watson's argument—that India played an especially important role in global development through expanded trade networks that introduced new crops and practices—only reinforced the narrative of India's central role as a global textile source, fulfilling a demand for luxury cotton and silks.¹⁵

However, as has been demonstrated in chapters five and six, cotton was already highly diffused in Africa, with cultivation and use spreading after the first century AD in Nubia, Egypt, North Africa, and the Horn of Africa, and eventually into West Africa. As demonstrated, while Indian cotton was reaching Egypt and East Africa via the Indian Ocean trade routes and Red Sea ports, it was cultivation of the African species that led to transmission throughout the region, not the Indian. Additionally, as discussed in chapter one, the terminology used in the Egyptian documents to refer to cotton and imported Indian textiles seem to indicate that there was not necessarily a recognition that Indian cotton and African cotton were technically the same fibre type. Expanding this study outward reinforces the fact that cotton was already a highly diffuse crop prior to the spread of Islam and that the process of transmission, contrary to the linear depiction in Watson, was more complex and involved several overlapping exchange networks.

The Caucasus, Mesopotamia and Persia- early and scattered evidence

Some of the earliest examples of cotton from outside the Indian subcontinent come from an unexpected location in terms of textile preservation, the Caucasus. At the site of Majkop in the North Caucasus, in present day Russia, a skeleton was found in a stone burial chamber, dating to the mid fourth millennium BC, along with the remains of garments.

¹⁴ Squatriti 2014, 1210.

¹⁵ A comprehensive re-contextualisation of the medieval silk industry can be found in Galliker 2014.

Although the majority of the textile fragments examined were wool, several included threads that were described by excavators as ‘ribbon-like plant-fibre’¹⁶ with a ‘cellulosic structure’.¹⁷ Although the authors claimed the fibres were cotton-like, without making the determination they were cotton, the accompanying photographs (fig. 7.2) show the clear inverted structure of a cotton thread. The question of the origin of these threads, whether they were from cotton grown locally or imported from elsewhere, is left open. However, several sites further south, in Georgia, have revealed what seems to be sustained cotton use, though not necessarily on a large scale. At the site of Vani in western Georgia, dating from the eighth to first centuries BC, a hoard of objects revealed cotton fibres associated with bronze lamps, indicating they had likely been used for the wicks.¹⁸ Although the dates of the objects have not been determined, finds from other sites suggest early cotton use.

In the fifteenth- to fourteenth-century BC burials from Saphar-Kharaba in southern Georgia, remains of cotton fibres made up fifty-five percent of the total textile fibre finds,¹⁹ and the excavators noted that cotton was also reported to have been found in Tetrtskaro in southern Georgia.²⁰ It was speculated that cotton and linen were being used for the burial shrouds at the site, though there was no evidence that local cultivation was taking place.²¹ At the palace of Dedoplist Gora (Aradetis Orgora) in central Georgia, which had been destroyed in the last quarter of the first century AD, remains of carbonized yarn, ropes and balls of yarn were found in one room, which was interpreted as a weaving workshop.²² Of all the fibres found, cotton accounted for fifty-eight percent of the total, with linen following at twenty-

¹⁶ Shishlina *et al.* 2003, 333.

¹⁷ Shishlina *et al.* 2003, 334.

¹⁸ Chichinadze and Kvavadze 2013, 2252.

¹⁹ Kvavadze *et al.* 2010, 489. Many linen fibres were also found, but very little wool, likely because of preservation conditions.

²⁰ Kvavadze *et al.* 2010, 489.

²¹ Kvavadze *et al.* 2010, 492.

²² Kvavadze and Gagoshidze 2008, S212. Other than these finds of threads, it is unclear why this has been determined to be a weaving workshop rather than just a store room, as no other artefacts relating to textile production are recorded, but that is irrelevant to its use here.

eight; the rest was made up of silk and other vegetal fibres.²³ Textile fibres were also found in a mouse hole in a room used as a storehouse for foodstuffs, in similar proportions.²⁴ Finally, cotton has also been identified in the garments used to dress the bodies from fourth- to sixth-century AD burials at Tsitamuri, approximately twenty-five kilometres north-west from the Georgian capital of Tbilisi. It was determined that the bodies were first clothed in garments that included cotton, and then wrapped in a linen shroud.²⁵

In all cases, these fibres were found devoid of evidence of local cultivation, and the excavators at Saphar-Kharaba note that the climate in Georgia was likely not appropriate for the growing of cotton,²⁶ speculating that cotton was being imported from elsewhere. If cotton was being cultivated locally, it would have had to have been an early photoperiod-neutral species. All known wild and primitive cultivated species of *Gossypium* are characterised by photoperiodism, meaning their growth cycles are dictated by periods of sunlight and darkness; they depend on shorter days in winter in order to develop the boll, but are also not frost tolerant, so the winter months cannot be too cold.²⁷ They are also perennial plants. This restricted the wild and early cultivated plants to the tropic and sub-tropic zones. Photoperiod-neutral cotton does not rely on day length to trigger flowering, and is therefore able to flower before the winter frost sets in, developing an annual form able to grow in more temperate zones. How the selection for photoperiod-neutral *Gossypium* occurred is not known, but may have involved human intervention.²⁸ Regardless, if there was local cultivation in Georgia, it would have had to have been of an already photoperiod-neutral species, meaning the region is could not have been a site of parallel domestication.

²³ Kvavadze and Gagoshidze 2008, S213-214. Again, little wool was preserved.

²⁴ Kvavadze and Gagoshidze 2008, S214.

²⁵ Kvavadze *et al.* 2008, S222.

²⁶ Kvavadze *et al.* 2010, 492.

²⁷ Brite and Marston 2013, 41.

²⁸ Brite and Marston 2013, 41-42.

Although in two of the sites discussed cotton was the most common fibre found, it is likely that wool was actually the dominant fibre, but the wool fibres were more susceptible to degradation in the cool, wet conditions of the site.²⁹ There are several conclusions that can be drawn from these finds. First, the wide geographic and temporal spread of the cotton finds indicate that cotton was widely known in the Caucasus, and for a long period of time. In general, the evidence of cotton is too minuscule to determine the quality of the textile, its function, or social significance, but its apparent use in lamp wicks at the site of Vani indicates that it may have been used for garments as well as utilitarian items. Finally, the finds of cotton fibres in some cases predating those found in most other places other than India (though the few exceptions will be discussed shortly), and the complete lack of signs of local cultivation would seem to suggest that there were early trade connections between the Caucasus and another cotton cultivation centre, perhaps not yet identified.³⁰ If genomic analysis of the samples could show whether the cotton from sites in Georgia was photoperiod-neutral or not, it could indicate that local cultivation was a possibility, but would raise new questions of where cotton cultivation was introduced from.

Though not as early as the evidence from the Caucasus, there is evidence of early cotton use at various times in the area of Mesopotamia, both in the archaeological record and in surviving texts. At the Assyrian palace of Assurnasirpal II (883-859 BC) at Nimrud, approximately thirty kilometres south of Mosul, a stone sarcophagus discovered below the floor level of room forty-nine was found to contain the remains of two women, thought to be the Assyrian queens Yabâ, the wife of Tiglath-Pileser III (744-727 BC), and Ataliâ, the wife

²⁹ Kvavadze and Gagoshidze 2008, S214.

³⁰ Bouchaud 2015b, 323 suggests that the presence of cotton in the ‘weaving workshop’ at Dedopoli Gora could indicate that Georgia was a centre of cotton textile production, though the evidence seems too flimsy to make such a claim, especially without any evidence of cultivation or the textile production technology in use in the area. One fact not addressed is the cost associated with importing a material to be used in lamp wicks, but it may be that in the absence of either linen or cotton cultivation, all material used for wicks had to be imported.

of Sargon II (721-705 BC).³¹ Within the sarcophagus were the remains of several textiles, which, though initially classified as linen, actually comprised six linen textiles and one cotton.³² This could confirm an inscription purportedly by the Assyrian king Sennacherib (705-681 BC) describing the gardens around the palace at Nineveh with ‘trees bearing wool’ (*iše naš šipati*) which ‘the people pluck and weave into clothing’.³³ There seems to be no other reference to cotton in Assyria, nor have other cotton textiles been identified, so it has been speculated that the cotton plants in the royal gardens were of limited use and that they failed to survive beyond the destruction of Nineveh in 612 BC;³⁴ it is also possible that there is a word in inscriptions referring either to cotton or cotton textiles that is poorly understood.³⁵ In absence of evidence of cultivation and processing for fibre, it is likely this was also imported from India.

Another early example of cotton comes from a late seventh- to early sixth-century BC Elamite tomb containing a bronze coffin found near Arjan (ancient Arrajân) in southwestern Iran. Inside the coffin, the body was clothed in garments with gold rosettes and disks sewn onto it, alongside many other high-value items and numerous textiles, all of which were found to be cotton.³⁶ The burial also included a gold ‘ring’ which had the emblem of Elamite power on it,³⁷ so the burial was clearly of a high-status and important individual. An inscription in the tomb identifies the occupant as Kiddin Hutrân, son of Kurlush. The name Kurlush appears in several administrative tables found at nearby Susa, situated in the Zagros Mountains, either as a merchant or emissary associated with the name Unsak, though who (or what) this refers to is unknown.³⁸ Kurlush is also recorded as providing wool and a garment known as a *kuktum* to

³¹ Oates and Oates 2001, 83-84; Alvarez-Mon 2015, 47.

³² TORAY Industries 1996, 199.

³³ Alvarez-Mon 2015, 45; Betts *et al.* 1994, 497; Oppenheim 1967, 245. Translation by Oppenheim.

³⁴ Watson 1983, 38.

³⁵ Alvarez-Mon 2015, 45.

³⁶ Alvarez-Mon 2015, 41-42.

³⁷ Alvarez-Mon 2015, 41.

³⁸ Alvarez-Mon 2015, 47. The name *Unsak* occurs at least twenty times in inscriptions on tablets from Acropolis as both a personal name and a toponym, and on objects from the hoard of the Kalmakarra Cave. Khosravi *et al.* 2010, 48; Vallat 1996. Vallat has theorised that the

the court at Susa.³⁹ The word *kuktum* may derive from the Akkadian word kitû/kititu,⁴⁰ which *The Chicago Assyrian Dictionary* defines as a finely woven linen or wool,⁴¹ though the incidence of words being applied to both finely woven linen and cotton in both Greek and Latin in later periods, as detailed in chapter one, has led to the suggestion, though admittedly tenuous, that it could be a reference to cotton.⁴² Further Neo-Elamite texts from Susa include many mentions of *kuktum*, sometimes even with the descriptions ‘classified as blue, white, of quality and streaked,’ coming from a range of locales including Aiapir (in Izeh/Malamir) and Rakan/Raga (around Persepolis).⁴³ There is not enough evidence to say definitively how common cotton, like that found in the tomb, was in Elamite culture, but these descriptions of *kuktum* as being dyed blue, and potentially several different colours (streaked could possibly either refer to stripes or a design similar to the ikat textiles later known to be produced in Yemen), could indicate that the material used was something easier to dye than linen, such as wool or cotton. Until further evidence is revealed, this will have to remain an intriguing possibility, but these finds again indicate elite trade with India.

The limited use of cotton in Mesopotamia and Persia continued with successive changes of political power. At the At-Tar Caves in southern Mesopotamia, approximately eighty kilometres west of Babylon in present day Iraq, a series of four-hundred and eighty caves artificially dug around 1200 BC were found, which had been reused as a cemetery in the Parthian period from the third century BC to the third century AD; cotton fragments were found

name could be associated with the Samati kingdom based in the Lorestan Province in the Zagros Mountains. Vallat 2000, 30; Vallat 2002, 4.

³⁹ In their lexicon of the Elamite language, Hinz and Koch describe the *kuktum* as a shirt-like garment worn over a sleeveless robe, similar to a cape, ‘Nach den Darstellungen von Elamern auf den achämenidischen Flachbildern wurde dieses Kleidungsstück über dem ärmellosen Gewand (tuk-li) getragen als eine Art kurzes Cape, das jedoch hinten am Hals zugeknöpft war, also einen Teil des Rückens freiließ, umgekehrt wie unser Begriff von Cape’. Hinz and Koch 1987, 559.

⁴⁰ Alvarez-Mon 2015, 48.

⁴¹ CAD 9 466.

⁴² Alvarez-Mon 2015, 48.

⁴³ Alvarez-Mon 2015, 47-48.

amongst the burials, in addition wool and linen.⁴⁴ At the site of Shahr-I Qumis in northern Iran, an undyed black-brown felted garment was found with a section of shoulder and neckline lined in cotton, dating from the first half of the first century AD.⁴⁵ The Armenian geographer Ananias of Širak (AD 610-685), when describing the area around the Araxes river in the eastern Armenian province of Paytakaran (in present day Azerbaijan), wrote ‘cotton is found in great abundance here and wild barley’, although no note on terminology is included by the translator.⁴⁶ This is the first attestation of cotton cultivation in Persia, though there have been no archaeological finds of cotton in the area Ananias describes.

The most extensive evidence of cotton use, and the earliest archaeological evidence of cultivation in the Sassanian Empire, comes from Central Asia, from Merv in modern day Turkmenistan, which has been the subject of a multi-decade survey and excavation. There, cotton seeds, some carbonised from hearths, have been found in multiple contexts dating from the fourth through seventh centuries AD, roughly the Middle to Late Sassanian period.⁴⁷ The evidence of cotton seeds led excavators to conclude that cultivation was taking place nearby.⁴⁸ Climate conditions at Merv have meant that no actual textiles have themselves been preserved,⁴⁹ but analysis of spindle whorls found at the site and their weights indicates that they were not being used for wool, which required a heavier spindle whorl, and were instead probably used for spinning cotton threads.⁵⁰ The finds from Merv are the earliest indication of cotton cultivation in the region, corresponding to what Ananias of Širak claimed was occurring farther east.

⁴⁴ Fujii *et al.* 1989, 109-112; Fujii and Sakamoto 1990, 45; Matsumoto 1997, 302.

⁴⁵ Kawami 1992, 14.

⁴⁶ Ananias of Širak, trans. Hewson 1992, 65a. The text was composed in medieval Armenian.

⁴⁷ Herrmann *et al.* 1993; Herrmann and Kurbansakhatov 1994; 1995; Herrmann *et al.* 1996; 1997; 1998; 1999.

⁴⁸ Herrmann *et al.* 1993, 57; 1996, 20.

⁴⁹ Herrmann *et al.* 1998, 63.

⁵⁰ Kossowska-Janik 2016, 110.

The implications of the evidence of early cotton use throughout such a large geographic region are difficult to fully define because of the large gaps between archaeological finds and the overall lack of textile evidence of any kind in the area, regardless of fibre type. However, some general conclusions can be drawn that create a picture of differing patterns of cotton use and spread. The earliest evidence of cotton use, in the Caucasus, which is much earlier than evidence of domesticated cotton use in Africa, may be the result of trade with India,⁵¹ expanding to other areas as cotton cultivation within India expanded.⁵² Local cultivation at this point is improbable; the Caucasus were likely too cold to cultivate non-photoperiod-neutral cotton. Likewise, the finds from the royal tombs of Yabâ and Atanliâ at Nimrud in the eighth century BC, and the Elamite tomb at Arrajân from the seventh to sixth century BC, are probably the result of some form of elite trade.

The finds at the At-Tar Caves, from the third century BC to the third century AD, and Shahr-I Qumis, from the first century AD, could be more ambiguous. The time period and networks the region was connected to, as will be seen, could mean multiple origins for the cotton. This possibility is highlighted by the finds from Merv. While the species of cotton being grown from the seeds found in Merv has not been determined, it has been suggested that the prevailing climate conditions would be more favourable to *G. herbaceum*,⁵³ while India is much closer and a more probable source of the cotton found in Merv, if there was an earlier diffusion of *G. herbaceum* through the Arabian Peninsula, which has not yet been identified in

⁵¹ Trade between India and the Central Asia, particularly in the first millennium BC, was beyond the scope of this study, but the finds of cotton suggests further exploration may be due.

⁵² It is interesting to note that in Iran and Central Asia, there are two species of Old World cotton cultivated that have been traced through cultivation, both subspecies of *G. herbaceum*, *G. herbaceum* ssp. *persicum* and *G. herbaceum* ssp. *kuljianum*, although there is still not enough evidence to determine when this took place. Kulkarni *et al.* 2009, 72. The authors speculate that it was *G. herbaceum* from Africa that was later spread into Europe as well, although they argue that domestication first took place in Arabia and spread from there. Kulkarni *et al.* 2009, 71. Genomic analysis of archaeological samples would help to significantly clarify these points.

⁵³ In particular, its resistance to dryer and colder climate conditions. Kossowska-Janik 2016, 113.

the archaeological record, this expands the number of networks cotton was moving on. At the same time, the earlier cotton from Assyrian and Elamite contexts was likely the result of trade, either with India or the coastal regions of the Persian Gulf, which will be discussed presently. What becomes apparent is that in the case of the diffusion of both use and cultivation, the Arabian Peninsula plays an important role, and is key to understanding the reach of both Indian and African cotton networks.

Arabia, the centre of cotton diffusion

As is the case with the study of Africa, the history of scholarship focused on the Arabian Peninsula has been influenced by the Western colonial experience of its landscape. In the 1930 *The Geographical Journal*, Eldon Rutter, the author of *Holy Cities of Arabia* (1928) wrote:

the Arabian Desert is a waste of naked yellow plains, composed of limestone, gravel flats, or shifting sand, among which are certain volcanic tracts covered with the black debris of lava and basalt. The horizons of this great wilderness are as unbroken as the horizons of the open sea. Like them, they are pierced by infrequent pinnacles of rock. These stand up like huge bared fangs, symbolizing the eternal hunger which obtains in this sterile country.⁵⁴

The geography of the desert was both a barrier to human occupation and to Western exploration. As with Africa, attention was paid mainly to the coasts, particularly as the archaeology of trade connections increased the visibility and assumed pre-eminence of sites along the Indian Ocean. This has resulted in a degree of regionalisation in the study of the Arabian sea,⁵⁵ and by extension, the entire Arabian Peninsula.

To an extent, the focus on sites along the coasts has been reinforced by evidence of early trade interactions between Arabia and Mesopotamia with the fourth- to third-millennium BC Harappan culture of the Indus Valley.⁵⁶ The earliest finds of cotton in the Middle East do not come from Arabia, but from a site further north in eastern Jordan known as Dhuweila. There, nine plaster fragments were found with textile impressions in them, some with trace cotton

⁵⁴ Rutter 1930, 512-513.

⁵⁵ Boivin and Fuller 2009, 114.

⁵⁶ These interactions have been seen as equally important in the archaeology of the Indian subcontinent and was a factor in increasing urbanisation. Betts *et al.* 1994, 497.

fibres still attached, dating from the Levantine Chalcolithic period (approximately 4300 – 3300 BC) or the Early Bronze Age (approximately 3300 – 2000 BC).⁵⁷ The finds were dated to after the Late Neolithic period of occupation of the site, and it was therefore determined that the plaster fragments and embedded cotton had been deposited at the site when they were no longer functionally useful by nomadic tribes that had sought shelter in the ancient ruins of the site.⁵⁸ As a result, it was concluded that the presence of cotton was the result of trade rather than local cultivation, either from India, or the region of Arabia that had the closest trade connections with the subcontinent, the area of Bahrain and the Persian Gulf.⁵⁹

The regions of Bahrain (Dilmoun, then Tylos) and the Persian Gulf exhibit the earliest evidence of cotton on the Arabian Peninsula. Theophrastos (c. 371- c. 287 BC), repeating the fourth-century BC admiral Androstenes of Thasos, reported that by the time of Alexander the Great's naval expedition in 325 BC, cotton was being grown on the island of Bharain:

... the island also produces the 'wool-bearing' tree in abundance. This has a leaf like that of the vine but small, and bears no fruit; but the vessel in which the 'wool' is contained is as large as a spring apple, and closed, but when it is ripe, it unfolds and puts forth the 'wool' of which they weave their fabrics, some of which are cheap and some very expensive.⁶⁰

This passage was taken up by Pliny, and have possibly been corroborated by the archaeological evidence. At the site of Qal'at al-Bahrain, in the north of the island, seven carbonized cotton seeds were discovered amongst the archaeobotanic remains from the Achaemenid period (c.

⁵⁷ Betts *et al.* 1994, 489; Betts 1998, 140-142. Initially it was thought the threads were Z-spun, but further analysis indicated that this could not be determined and it was more likely that the yarns had instead been Z-plied. Betts *et al.* 1994, 491; Betts 1998, 140.

⁵⁸ Betts 1998, 142.

⁵⁹ Initially excavators claimed it was possible the example of cotton came from Egypt or Africa (Betts *et al.* 1997, 497) based on evidence of connections between Egypt and the area of Syria and Palestine in the pre-dynastic period (for example, Ben-Tor 1991 and Harrison 1993, although the intensity of these connections is debated). However, there is no evidence for cotton in Egypt at such an early date.

⁶⁰ Φέρειν δὲ τὴν νῆσον καὶ τὰ δέδρα [καὶ] τὰ ἐριοφόρα πολλά· ταῦτα δὲ φύλλον μὲν ἔχειν παρόμοιον τῇ ἀμπέλῳ πλὴν μικρόν, καρπὸν δὲ οὐδένα φέρειν, ἐν ᾧ δὲ τὸ ἔριον, ἡλικὸν μῆλον ἑαρινόν, συμμεμυκός· ὅταν δὲ ὠραῖον ᾖ, ἐκπετάννυσθαι καὶ ἐξείρειν τὸ ἔριον, ἐξ οὗ τὰς σινδόνας ὑφαίνουσι τὰς μὲν εὐτελεῖς, τὰς δὲ πολυτελεστάτας. Theophrastos, *Enquiry into Plants*, 4.7.7., ed. Amigues 1989 86-87. English translation in Bouchaud *et al.* 2011, 411.

600-400 BC), although this represented less than half of one percent of the total cultivated seed remains from the site.⁶¹ While it is not possible to determine whether these seeds were *G. arboreum* or *G. herbaceum*, it has been suggested that due to the geographic proximity and timeline of known cultivation of *G. arboreum*, and it is more probable that the cotton being grown in Bahrain was the Indian species.⁶² Additionally, an Achaemenid period bathtub coffin, similar to the Elamite coffin from Arrajân in Iran discussed previously, from Qal'at al-Bahrain was found to contain several textile fragments that were tentatively identified as cotton,⁶³ though this is so far the only find of an actual cotton textile from the area.

The similarity between this burial and the Elamite burial in Arjan, in form and the textile remains found, is interesting in its suggestion of exchange connections, but should also be approached with caution as these isolated examples do not reveal any information regarding scale of either cotton production and use, or the nature of any trade connections that may have existed between the two areas. However, some connections may be cautiously suggested. Alavarez-Mon presents three circumstantial points for the cotton found in the Elamite burial coming from Bahrain rather than India: geographic proximity, history of interaction, and the presence of evidence of cultivation from Qal'at al-Bahrain.⁶⁴ However, cotton cultivation in Bahrain was likely the result of transmission from India, so the finds from Arjan can be seen as an extension of that network.

Cotton has also been discovered in western Arabia, but even the earliest evidence there dates to several centuries later than that found in Bahrain, during the late Nabatean and early Roman periods (from the first century AD). The Nabataeans had long been thought to have been mainly nomadic peoples, based primarily on two descriptions from the ancient sources. Both Diodoros of Sicily and Strabo describe the Nabateans as nomadic/pastoralists engaging

⁶¹ Bouchaud *et al.* 2011, 410; Tengberg and Lombard 2001, 176. This site was unusual for the scale of seed finds throughout.

⁶² Tengberg and Lombard 2001, 176.

⁶³ Højlund and Hellmuth 1994, 415; Haerinck 2002, 246.

⁶⁴ Alvarez-Mon 2015, 49.

and long-distance trade of spices and incense between Arabia and the Mediterranean.⁶⁵ However, examination of the archaeobotanical evidence shows that the Nabateans were actually a mix of nomadic and sedentary communities, though neither necessarily permanently, and that settlement patterns were changeable based on circumstances.⁶⁶ Cotton does not appear in the archaeobotanic record until later, but it can be assumed that established irrigation practices are a requisite to the development of cotton cultivation due to its water requirements. Cotton seeds have been discovered at two sites in the region, at Bosra in southern Syria and Hegra (Madâ'in Salih) in Saudi Arabia, though significantly more seeds have been discovered at Hegra.⁶⁷ There, cotton appears from the first century AD, after the Nabatean kingdoms had come under Roman control, in many residential areas, mainly from domestic fireplaces.⁶⁸ Excavation of the monumental tombs at Hegra further revealed a number of preserved textiles, some of which were cotton of varying qualities, though the majority were linen.⁶⁹ These finds are significant because so few textiles have been found at Nabatean sites.⁷⁰ At both Bosra and Hegra, cotton seeds were found along with evidence of the cultivation of a number of different plant species, including cereals, pulses and fruit seeds, suggesting an established irrigation systems which would have made cotton cultivation possible. It is also worth noting that while cotton does not appear until after the establishment of Roman rule, there was never a large Roman population at Hegra. Excavators have taken this to mean that cotton cultivation represented a local adoption rather than practice imported by the Romans,⁷¹ although introduction by the Romans, or adoption by a new Roman population are also possible.

⁶⁵ Bouchaud 2015a, 104, 106.

⁶⁶ Tholbecq 2013, 3-4; Bouchaud, 2015a, 104, 114.

⁶⁷ Bouchaud 2015a, 108

⁶⁸ Bouchaud *et al.* 2011, 412. The seeds were preserved by the process of carbonization, and their presence in fireplaces could be the result of disposal of waste by-products by fire or the result of oil extraction.

⁶⁹ Bouchaud *et al.* 2011, 412; Mathe *et al.* 2009, 627.

⁷⁰ Mathe *et al.* 2009, 627. One exception is the site of Khirbat Qazone, which was a late Roman Nabatean site in Jordan, which will be discussed later in relation to finds in the Levant.

⁷¹ Bouchaud 2015a, 120.

There is an additional site contemporaneous with Hegra and Bosra at the northern coast of the Gulf of Aqaba (Gulf of Eilat) of the Red Sea, the ancient port of Aila. There, cotton seeds have been discovered in stratified deposits from the late Roman, early Byzantine, Umayyad, and Abbasid periods.⁷² It was initially thought that all crop material was imported into Aila due to the lack of agricultural by-products found at the site during early excavations (such as weeds), but more recent analysis has shown evidence that cultivation of a wide variety of plants was in fact taking place at Aila, including cereals such as wheat and millet, indicating that the cotton seeds found could be the result of local cultivation.⁷³ While excavators have yet to find evidence of irrigations systems in the area, there is evidence of runoff agricultural irrigation elsewhere in Jordan.⁷⁴ If local cultivation of cotton was taking place, the means of cultivation in such an arid environment would have had more in common with the means of cultivation in Nubia and the oases of Egypt and North Africa than in the humid and tropical environs of India, which in itself is not indicative of a means of transmission, but is a comparison that should be kept in mind.

A final site, which has revealed extensive amounts of cotton, is Palmyra, where textiles have been recovered from a number of funerary contexts.⁷⁵ However, there are several factors that set these finds apart. First, Palmyra was a one end of the so-called ‘Silk Road’ and was an entrepot for trade goods from the east. There were also no archaeobotanical finds of cotton,

⁷² Ramsay and Parker 2016, 105. Only single seeds were found for the Umayyad and Abbasid periods, but there were an additional fifty seeds that were either modern or were from mixed context strata and were therefore unable to be dated. Four were from late Roman contexts, and three were from the Byzantine.

⁷³ Ramsay and Parker 2016, 105, 108-109.

⁷⁴ Ramsay and Parker 2016, 113-114, 117. Such irrigation systems have been identified at Petra and Khirbet ed-Dharh in Jordan and Bosra in Syria, which may have been used for local agricultural irrigation). It has also been proposed that irrigation canals could have been dug in the Arabian and Middle Eastern sites which would not have necessarily been discernible in the archaeological record. Bouchaud 2015a, 114.

⁷⁵ Stauffer 2000. Both s-spun and z-spun fibres have been reported, indicating the cottons in Palmyra were the consequence of a confluence of interaction. These textiles came from tombs dated to the first to second century, but Wild 2002a, 677 notes this is a *terminus ante quem* and individual pieces cannot be dated.

unlike at the other sites. So while it is possible that some of the cotton found in Palmyra was locally produced, there is not enough evidence to definitively place it within a model of Indian or African cotton networks; it was perhaps a meeting place of both.

The southwestern-most point of the Arabian Peninsula, the area closest to the Horn of Africa through which it has been speculated many cultivars were transmitted between Arabia and Africa, is Yemen. The evidence from Yemen presents a problem. While it is thought to have one of the oldest traditions of crop cultivation in Arabia, where ‘monsoon rains have supported an indigenous system of rain fed terraces, spate irrigated fields along wadis and recharge for irrigation from wells and highland springs’,⁷⁶ there is little archaeological evidence of agricultural practice that has been uncovered. Likewise, sources discussing local agriculture in Yemen prior to the Rasulid period (1229-1454) are fairly rare. However, the tenth-century Yemeni geographer Abu Muhammad al-Hasan al-Hamdānī wrote in *Sifat Jazirat al-'Arab*, a geographic survey of the Arabian Peninsula:

There are wonderful varieties of grains in Yemen. For wheat there is *'Arabī*, which is not like usual wheat (*hintā*). If the dough is taken hold of and you want to cut off part of it, the piece is taken and the result is that it lengthens like a piece of sweet meat (*kubbayt*). [The wheat varieties] *maysānī*, *nusūl* and *halbā'* are only found in Najran. There are [also varieties which are] black-headed and smooth, red and coarse, as well as cowpeas, peas, cotton, teff, colours of white, yellow, red and dust of sorghum, and sesame, of which no other overtakes it, especially the *Ma'ribī* and *Jawfī* which are very shiny, pure and of excellent quality. Also grown in Yemen are chick peas, fava beans, cumin, and the like.⁷⁷

There is also evidence of Yemeni cotton from a similar time period, though not found in Yemen. A group of ikat cotton textiles held in the Textile Museum in Washington, DC, ranging from the ninth to tenth centuries, contain inscriptions attributing them to the city of Sana'a; these textiles had been acquired by dealers throughout Egypt and Europe, though were supposedly originally from Egypt.⁷⁸ The ikat textiles from Yemen seem to have been well-known in the

⁷⁶ Varisco 2009, 382-383.

⁷⁷ Trans. Varisco 2009, 386.

⁷⁸ Bier 2014, 33.

Islamic world, and are recorded by both Persian and Arab geographers listing the goods traded in cities throughout the region.⁷⁹ While the lack of inscriptions on many of the ikat fragments held in museum collections precludes a definitive identification of origin,⁸⁰ it is nevertheless possible that at least some of them originated in Yemen. This evidence points to the presence of cotton cultivation several centuries later than the earliest evidence of cotton from elsewhere on the Arabian Peninsula, but combined with the history of agricultural transfer in the area still makes it a likely contender for the point at which cotton cultivation diffused through western Arabia.

Most domesticated plants and animals in Arabia are not native, originating elsewhere and introduced as a result of external contact.⁸¹ However, understanding the process of transmission is difficult due to gaps in the archaeological investigation of the littoral regions of the Red Sea, the Horn of Africa and the Arabian Coasts, though some regions have been more thoroughly explored than others; this has created a series of specialized studies outside a larger framework of synthesis for understanding interaction and exchange in the area.⁸² However, the evidence that is available indicates a long history of waxing and waning contact between the civilisations of these regions. For the evidence of cotton in Arabia, there are two possible origins,⁸³ either that it came from India through the Persian Gulf,⁸⁴ or from Africa via trade routes across the Red Sea in the Nabataean period. It also opens the possibility that some of the cotton found on the coasts of the Egyptian Red Sea was from Arabia. These possibilities will

⁷⁹ See Serjeant 1972, 123, 133.

⁸⁰ Bier 2004, 188.

⁸¹ Boivin and Fuller 2009, 133.

⁸² Boivin *et al.* 2009, 251.

⁸³ Bouchaud 2015a, 120.

⁸⁴ This is the most commonly cited theory, and in many of the discussions of early domesticates on the Arabian Peninsula, evidence of cotton is described as *Gossypium arboreum* rather than *Gossypium herbaceum*, even though the remains have not been genetically sequenced, the only way to determine between the seeds of the two species. For example, Varisco 2009, 407; Boivin *et al.* 2009, 267. This would follow a pattern of goods similar to that described in Durand and Gerber 2014.

be examined within the larger patterns of interaction and crop transfer between India, the Arabian Peninsula and Africa.

It is likely that at least some of the domesticated plant and animals in Arabia were introduced via maritime routes, from Africa and India, while others were transmitted along overland routes, from Mesopotamia and the Levant.⁸⁵ The geography of the region played a crucial role in dictating such interactions. In general, the coastal regions around the Red Sea are separated from their respective interiors by deserts and mountains, without the river-ways that would have provided a route through them; as a result, the major early maritime civilisations of the region are only found in Ethiopia and Eritrea in Africa and Yemen on the Arabian side.⁸⁶ The earliest evidence of a mercantile system along the Neolithic Red Sea comes from obsidian, likely originally from the highlands of Ethiopia or Eritrea and found at sixth-millennium Tihama sites in the highlands of Yemen,⁸⁷ suggesting contact between the two.⁸⁸ Egypt seems to also have been participating in the obsidian trade in this period, in the Predynastic period, during which goods such as silver, lapis, turquoise, and malachite were also circulating around the Mediterranean.⁸⁹ This may have been the beginning of the pre-classical ‘incense road’ that connected Egypt, the Levant and Yemen.⁹⁰ The later expeditions into the Kingdom of Punt recorded during the time of Egypt’s Pharaohs likely built upon the Neolithic routes previously established.⁹¹

⁸⁵ It is also clear that plants of African origin became established in the agricultural practices of India as well from c. 2000 BC, although the means of introduction and early use were not documented. Blench 2003; Boivin and Fuller 2009, 115. These included sorghum, pearl millet and finger millet. Fuller *et al.* 2011, 546.

⁸⁶ Boivin and Fuller 2009, 118. The Egyptian ports were established later, during the Ptolemaic period.

⁸⁷ Francaviglia 1990a, 48; 1990b, 133-134; Zarins 1989; 1990; 1996; Khalidi 2010, 288-289

⁸⁸ Boivin *et al.* 2009, 260; Boivin and Fuller 2009, 130-131.

⁸⁹ Boivin and Fuller 2009, 131.

⁹⁰ Boivin *et al.* 2009, 252. On the Persian Gulf side, the series of major river systems along the coasts may have been responsible for more integrated interaction with both the Mesopotamians and Harappans. Boivin and Fuller 2009, 118. For example, Ubaid pottery from Mesopotamia has been found at over sixty Neolithic sites on the Arabian Peninsula, including Bahrain. Carter 2006; Parker and Kennedy 2010.

⁹¹ Fuller *et al.*, 2011, 545.

The exact location of Punt has been a source of debate for Egyptologists for years. Various locations proposed have included Syria, different parts of Arabia, Ethiopia, and Sudan.⁹² The Egyptians referred to mining taking place in Punt, and seem to have imported a variety of exotic goods including incense, ivory, ebony, perfume, animals and skins.⁹³ It has been noted that none of these items were actually related to mining, and it is currently believed that the location of Punt is likely in eastern Sudan or the regions of Ethiopia and Eritrea making up the northern Horn of Africa, possibly both.⁹⁴ Because of the intense interest in Egyptian archaeology from the nineteenth century onwards, resulting in heightened visibility of the inscriptions and iconography associated with the trade between Egypt and Punt, these two powers have traditionally been seen as the major players in pre-classical trade on the Red Sea. But it is possible this paradigm has over-emphasised the role of Egypt in the early mercantile system of this region. Despite the accounts of royal trade expeditions into the land of Punt recorded in inscriptions, such as those on the second-millennium temple of the Eighteenth dynasty Pharaoh Hatshepsut at Deir el Bahari near the Valley of the Kings, the lack of evidence of early port cities on the Red Sea and clear details of the routes to Punt seem to indicate that Egypt was not highly active on the Red Sea in this time period, and that there was more intensive trade interaction between smaller scale societies in the coastal regions, with goods moving along local networks.⁹⁵ It has been suggested that the increasing exchange witnessed ‘may have increased in scale not only to meet the demands of increasingly powerful elites of Egypt, but also the needs of the increasingly hierarchical societies emerging in the hilly interior of Yemen...’.⁹⁶ This is not to say that there was not inter-regional trade occurring on the Red Sea,

⁹² Fattovich 1990, 259. There had also been the suggestion by Bard and Fattovich that Punt referred to areas of both Africa and Arabia, but they revised this after further excavation and have concluded Punt was strictly on the African side of the Red Sea. Bard and Fattovich 2007.

⁹³ Kitchen 1993, 606; Phillips 1997, 429-340.

⁹⁴ Fattovich 2012, 2.

⁹⁵ Kitchen 2002; Boivin *et al.* 2009, 262. An example of goods moving on local networks would be obsidian. Zarins 1989; Khalidi 2010.

⁹⁶ Boivin *et al.* 2009, 262.

but rather that instead of Egypt being a driving force in these interactions, it was the exchange between other regions on either side of the Red Sea that had a larger effect on trade networks, into which Egypt was able to tap.

These connections are reflected in the history of crop adoption as well. The earliest agricultural crops in Arabia, as in Egypt, seem to have originated in the Near East and South Asia,⁹⁷ reaching Yemen by at least the fourth millennium BC when the first evidence of terraced agriculture appears.⁹⁸ However, there were geographic differences in the crops being grown. While the dominant cereal in both the east and west of the Arabian peninsula was wheat, on the Persian Gulf side the most common variety was the free-threshing type (*Triticum aestivum*) which dominated the Indus Valley region while on the west, centred on Yemen, hulled emmer wheat (*Triticum dicoccum*) was dominant, the same variety found throughout Egypt, Nubia, Ethiopia, and Eritrea.⁹⁹ As both types of wheat have been found in Mesopotamia and the Levant, it has been proposed that the distribution of wheat species suggests agricultural zones of influence.¹⁰⁰ There are also several crops that are known to have originated in Africa that are also found in Arabia including sorghum from the eastern savannah regions and finger millet (*Eleusine coracana*) from the Ethiopian highlands, as well as the Ethiopian cereal tef (*Eragrostis tef*), which appears around the end of the first millennium BC.¹⁰¹ These connections continued through to late antiquity, and spread to the rest of the western Arabian peninsula. Hundreds of items with Nabataean graffiti have been found in the Eastern Desert of Egypt along the established trade routes leading from the Red Sea to the Nile.¹⁰² Besides the graffiti, a few sherds of Nabataean fine-ware were also identified at Myos Hormos and Berenike, although

⁹⁷ Zohary and Hopf 2000.

⁹⁸ Harrower 2008; Wilkinson 2006.

⁹⁹ Boivin and Fuller 2009, 146.

¹⁰⁰ Boivin and Fuller 2009, 146.

¹⁰¹ Boivin and Fuller 2009, 146. Sorghum, finger millet and pearl millet also seem to have begun to be cultivated in India at some point in prehistory. Fuller *et al.* 2011, 546.

¹⁰² Durand 2012, 85.

none are later than the first century AD.¹⁰³ While this study has so far focused on Yemen as a point of entry, because of its proximity to trading communities in Africa, but it is also possible that the point of introduction was further north.¹⁰⁴

The evidence of cotton use in Arabia and the patterns of interaction evidenced through agricultural practices and artefact finds point to the possibility of two distinct networks of interaction and exchange, and, for cotton specifically, two distinct diffusion processes. On the western Arabian Peninsula, the appearance of evidence for cotton cultivation in the first century AD at the sites of Hegra, Bosra, Aila and, to a certain extent, Palmyra, corresponds to the evidence of the spread of cotton cultivation from Nubia into the Western Desert of Egypt and North Africa. While it is possible, and even likely, that some cotton was transported from the eastern Arabian side to the west, especially after the domestication of the dromedary camel at the end of the second millennium BC in south eastern Arabia,¹⁰⁵ it is also possible that the transmission of cotton cultivation occurred along the route with an established tradition of shared agricultural practices, especially as there is little evidence of crop cultivation diffusing from the eastern side of Arabia to the western side.¹⁰⁶

The evidence points to an African origin of cotton cultivation on the western side of Arabia; at the same time, evidence of cotton and cotton cultivation found in Bahrain and the early sites in Mesopotamia, the Caucasus and Central Asia was likely the result of trade with the Indian subcontinent. And while Indian cotton was being traded along the coasts of the Red Sea into the period of late antiquity (although, as discussed in chapter five, not on the scale that

¹⁰³ Durand 2012, 86. In the Nabataean kingdom, Strabo described the port city of Leuke Kome as the main Nabataean port city on the Red Sea in the first century BC (Strabo, *Geography* 16.4.24); the exact location of Leuke Kome has still not been identified.

¹⁰⁴ Bouchaud *et al.* 2018 has little to say on Yemen or its shared agricultural practices with east Africa, but concludes that the point of entry may be closer to where archaeological cotton has been found. The ports of Qana and Moscha are also possibilities, although both seem to have been active in Indian Ocean networks.

¹⁰⁵ Almathen *et al.* 2016.

¹⁰⁶ This is perhaps because of geography. As mentioned, the arid regions of the western Arabian Peninsula are more similar to the pre-desert and desert regions of North Africa and Egypt than to the western side with its islands, river basins and silt-rich soils. Boivin and Fuller 2009, 118.

has been traditionally cited), it is also possible some of the cotton found in Berenike and Myos Hormos was from Arabia, particularly in light of Nabataean pottery found there. This confirms the presence of at least two separate but overlapping cotton networks functioning in the Mediterranean, North Africa, Middle East, Central Asia, and Indian subcontinent, potentially more, that were centred on different local inter-regional exchange networks. This is highly significant. The suggestion of an early diffusion of a fibre crop out Africa reshapes the entire paradigm of cultural diffusion that has been used to describe the interactions of the societies of the first millennium in the above regions. Africa now has an important place in this narrative, with wide-reaching implications.

The Levant

Though Levantine merchants participated in trade along the networks through which cotton was being transmitted, most notably through the eponymous ‘incense road’, cotton does not appear in textile assemblage there until relatively late, and evidence of cultivation is even later. Throughout the Roman period, wool was the most common textile fibre used, though increasing flax cultivation from the second century AD resulted in an economically significant linen industry.¹⁰⁷ The adoption of cotton in the Levant, therefore, represents a significant change prior to the Arab conquests [fig. 7.3]. The earliest cotton textile comes from the cemetery of Khirbet Qazone in modern Jordan, used from the first to third centuries AD; wool accounted for the majority of garments excavated but there was a single child’s tunic made of

¹⁰⁷ The linen industry in the Levant continued until the Arab conquests, and then steadily declined into the early Middle Ages as it became more economical to import linen from Egypt, which by the ninth and tenth centuries had become the centre of linen production in the Islamic world. Amar 1998, 114. For example, Ibn Hawqal wrote ‘On y fabrique des objets de commerce ourt l’exportation, que leur juste réputation nous dispenserait d’énumérer. Il en est ainsi de Bahnasa, où l’on confectionne des tentures, des soieries brochées d’or, des voiles de navire, des tentes, des manteaux, des rideaux, des tapis, des pavillons et des tentes grandes dimensions en laine et en lin...’ Ibn Hawqal *Kitāb surat al-Ard* 159, trans. Kramers and Wiet 1964, 157. One of the earliest of the sites with notable textile assemblages is an urban dwelling and workshop at Masada in modern Jordan. Dating from the first century BC to first century AD, excavations showed the predominance of wool within the region, with proportionally very few linen or goat-hair textiles and only a single cotton fragment that excavators determined was likely a modern intrusion. Sheffer and Granger-Taylor 1994, 160.

cotton.¹⁰⁸ At the Cave of Letters, again in Jordan, which contained nineteen tombs from the first to second century, most of the textiles were wool without a single cotton fragment.¹⁰⁹ At the fourth-century site of Rogem Zafir in modern Israel, only one fragment was identified as cotton, with wool slightly outnumbering linen fragments in the remaining assemblage.¹¹⁰ At all of these sites, wool was the dominant fibre type with a notable presence of linen and only a rare inclusion of cotton. This began to shift in the seventh and eighth centuries. There have been early sporadic finds in Syria as well. There were the finds of cotton seeds from Bosra in southern Syria from the first century discussed earlier in relation to the finds on the Arabian Peninsula, though finds from northern Syria appear later. At Dura-Europos, several fragments likely dating to the third century AD, which were interpreted as part of a tent, including one that had a wool warp and cotton wefts,¹¹¹ and at the site of Halabiyah (the ancient city of Zenobia), on the banks of the Euphrates, a sixth-century cotton tunic was found.¹¹²

At En-Boqeq in Israel excavations under a destruction layer of a Byzantine fort, dated to the first half of the seventh century, showed that while wool was still the dominant textile type, with eighty fragments recovered, fourteen cotton fragments indicated a greater use of cotton compared to pre-seventh-century sites.¹¹³ At Nessana in modern Palestine, the textiles recovered from the ruins of a seventh-century Byzantine house revealed linen as the dominant fibre type, with a smaller proportion of cotton, and even less wool.¹¹⁴ Finds at later sites confirm that cotton use continued to increase through the seventh century. At Deir ‘Ain ‘Abata, a late seventh- to early eighth-century monastic outpost, cotton was the principal fibre type identified followed closely by linen; wool made up only a small proportion of the assemblage, with an

¹⁰⁸ Granger-Taylor 2006, 121-127.

¹⁰⁹ Granger-Taylor 2006, 127.

¹¹⁰ Shamir 2001, 93; Shamir 2007, 1

¹¹¹ Pfister and Bellinger 1945, 53.

¹¹² Pfister 1951, 55.

¹¹³ Sheffer and Tidhar 1991.

¹¹⁴ Bellinger 1962, 92.

additional few examples of goat and camel hair textiles.¹¹⁵ The middens of the habitation site Nahal ‘Omer in modern Israel, approximately forty kilometres northwest of Petra and dating from the mid seventh to early ninth century, also revealed a large shift to cotton, making up over half of the assemblage with linen and wool making up just over a third combined.¹¹⁶ This is a particularly significant find as Nahal ‘Omer was located on the overland routes that led to Petra and down into the Arabian peninsula and Yemen, and in the other direction on the route that connected Petra to the ports of the Mediterranean Sea.¹¹⁷ Of the cotton fragments found at the site, eight were decorated with the ikat technique, similar to those known to have come from Yemen (discussed earlier in this chapter),¹¹⁸ emphasising the trade connection between the two and the possible role of Yemen in the diffusion of cotton and cotton use throughout the Middle East. The use of cotton continued into the early Islamic period.

At the small farming outpost ‘En Marzev in the Jordan Valley, dating from the seventh to ninth centuries, cotton fragments were identified amongst the textiles found in one of the buildings, although they were a relatively small percentage.¹¹⁹ One of the fragments appears to have bands of silk wrapped in silver metallic thread woven into it,¹²⁰ which would have been a valuable luxury good at the time. At the nearly contemporaneous site of ‘En ‘Avrona further south, another farm dating to the seventh to ninth centuries, cotton was found in the textile assemblage, also at a relatively low rate.¹²¹ Omir Shamir notes that cotton was absent from the nearby contemporary sites of Nahal ‘Amram, Nahal Shahaq, and Yotvata,¹²² indicating that while cotton was present at the time, it does not seem to have been adopted as thoroughly by the local inhabitants as in some of the other areas discussed. The Qarantal Cave 38, a storage

¹¹⁵ Granger-Taylor 2012.

¹¹⁶ Shamir and Baginski 2014, 66.

¹¹⁷ Shamir and Baginski 2014, 66.

¹¹⁸ Shamir and Baginski 2014, 71.

¹¹⁹ Shamir 2016a, 11, 15-16.

¹²⁰ Shamir 2016a, 16. A second fragment found at the site is plain, and was stitched to another fragment, perhaps indicating a mend or re-use of the textile.

¹²¹ Shamir 2016b, 3.

¹²² Shamir 2016b, 8.

cave from Israel from the ninth to thirteenth centuries,¹²³ also contained a large number of textiles, of which cotton was the largest single fibre type (282 fragments out of 483), followed by line and finally wool, which made up less than five percentage the total assemblage.¹²⁴ There was also a large group for textiles (133 of 483) which had linen warp threads and cotton weft threads, as well as five with linen warps and wefts of linen and cotton, and two textiles with wool warps and cotton wefts;¹²⁵ Similar features that have been documented in the finds from Egypt and Nubia, but not in the earlier finds from the Levant (other than the example of the tent from Dura-Europos of cotton with wool).

There is also a site that appears to confirm a diffused use of cotton in this time period. Qasr el-Yahud is an eighth- to ninth-century mass gravesite near the monastery of John the Baptist near the Jordan River. According to Christian tradition it was the site where the ‘washing of the lepers’ took place, and the skeletons recovered from the site all show signs of leprosy and tuberculosis.¹²⁶ While there is no record of a hospital associated with the monastery, the high incidence of disease exhibited by the bodies suggests that the individuals were seeking healing in the Jordan River.¹²⁷ Of the 250 that were recovered, 176 were linen and eighty-four were cotton; there was no wool identified.¹²⁸ The high incidence of linen and cotton, as well as the concentration of ill individuals indicated to excavators that many were

¹²³ Baginski has suggested that the cave was used by local people as a refuge during periods of conflict that resulted from numerous invasions into the area that occurred during the tenth to thirteenth centuries by the Tulunids, Fatimids, Seljuks, and finally the Crusaders. Baginski wrote, ‘Why was such a large quantity of used textiles stored in the cave? It can be assumed that the people who stored them there were rag collectors or merchants who collected them for the paper industry, which was introduced by the Arabs from China through Central Asia in the eighth century A.D., and became popular in the region using mainly linen and cotton as its raw material... The carried their goods with them when they escaped to their refuge in the cave.’ Baginski 2001, 82. This is highly speculative, and such an interpretation has implications for how the textile evidence is deciphered, implying that rather than being reflective of ever-day textile use, the assemblage reflects a deliberate deposition and is therefore the result of biased selection. This may have been the case, but there is no way to tell one way or another.

¹²⁴ Baginski 2001, 82; Shamir and Baginski 2012, 1-11.

¹²⁵ Baginski 2001, 82-83.

¹²⁶ Shamir 2015, 49.

¹²⁷ Shamir 2001, 100.

¹²⁸ Shamir 2015, 52-54.

not local,¹²⁹ and suggests a wider distribution of cotton throughout the Mediterranean and surrounding area.

Other than the seeds found in Bosra, there is little evidence of cotton cultivation in the Levant prior to the spread of Islam, although its use was clearly adopted earlier. There is disagreement about when cultivation in the area clearly began. Cotton is not recorded in the Old Testament, but does appear in Rabbinic sources. The *Mishnah*, the first collection of Jewish oral traditions, dating to the first to second century AD, mentions *tsemer gefen* literally translated as ‘wool vine’, growing in Palestine, and this has been taken to mean cotton.¹³⁰ However, this appears in a section regarding grape cultivation, which very clearly grow on vines, and though Shamir speculates this phrase is used because the shape of the leaves of a cotton tree resembles that of vine leaves,¹³¹ the lack of knowledge of the form of the plant (very clearly a shrub, often referred to as a ‘tree’ in ancient sources and not a vine) makes this identification somewhat suspect. Further, the references clearly state that planting of the ‘wool vines’ are prohibited.¹³² This reference to cotton is also repeated in the early fifth-century Jerusalem Talmud and the early sixth-century Babylonian Talmud, but both texts used the *Mishnah* as source material.¹³³ A final early source that seems to depict cotton growing in the earlier centuries in the Levant is a sixth-century hagiographic account written by Gregory of Tours, who wrote that:

Near Jericho there are trees which produce wool. On these trees grow fruits similar to gourds that have tough shells around them but inside are full of wool. Some say that clothing used to be made from this wool for Joshua

¹²⁹ Shamir 2001, 100-101; Shamir 2015, 58.

¹³⁰ This translation first appears in *Kilaim* 7,2, trans. Danby 1933, 36, who translated the phrase as ‘cotton-tree’. This was also adopted in the translation by Mandelbaum 1982, 63, who elaborated ‘cotton [tree]’. The translation of cotton been repeated in Gevers 1990, 16; Wild *et al.* 2008, 144; Decker 2009, 201; Brite and Marston 2013, 43; Shamir 2016c, 235. The translation of *tsemer gefen* and *cutnah* is from Shamir 2016c, 235.

¹³¹ Shamir 2016c, 235.

¹³² The line as translated reads ‘R. Mier says, moreover it is forbidden to plant the cotton-tree, but it does not render [the adjacent vines] forfeit.’ in Danby 1933, 36; and ‘R. Mier says, ‘Also, [the] cotton [tree] is prohibited, [it is prohibited to sow near it], but it does not sanctify [the seeds sown above it].’ in Mandelbaum 1988, 63.

¹³³ Shamir 2016c, 232.

the son of Nun. But still today [these trees] produce such fine wool; I have seen some that people gathered, and I marvelled at its whiteness and fineness.¹³⁴

What is clear from the passage is that Gregory himself claims to have come into contact with cotton at some point, though he himself did not witness its cultivation. This passage differs from that in the Mishnah in one significant way: the description of cotton is taxonomically correct, and though Gregory himself was not there to observe it in the fields, he was basing his account on someone who had. Whether this was actually on the banks of the River Jordan near Jericho, or was perhaps something that was witnessed elsewhere and transplanted, either by the source Gregory used or Gregory himself, cannot be known. As yet there is no archaeological evidence to verify Gregory's account. There is, however, evidence of cotton cultivation further north, in the valley around the Euphrates River.

In Delwen Samuel's summary of archaeobotanical sampling from excavations of the medieval Euphrates valley, a single cotton seed was found in an eighth- to ninth-century floor context from the site of Shheil, and a further seven seeds were found from the same period in a fill context from the site of Dībā.¹³⁵ Three further seeds were found from the end of the tenth- to eleventh-century midden contexts in Tell Guftān.¹³⁶ This indicates that there was local cultivation occurring in the Euphrates valley of Syria by at least the ninth century, though its scale seems to dramatically increase by the twelfth century. At Tell Guftān, 277 seeds were uncovered in hearths from the end of the twelfth century to the first half of the thirteenth century; a single cotton boll capsule and a further seventy-two seeds were also found in or near a jar.¹³⁷ A hearth from Qasr Medād from the same time period contained a further 189 seeds and forty-one cotton boll capsules.¹³⁸ Because this study was based on sampling of remains

¹³⁴ Gregory of Tours, *Glory of the Martyrs*, trans. Van Dam 1988, 18.

¹³⁵ Samuel 2001, 362, 365. Bouchaud *et al.* 2011, 415 uses these finds to claim cotton was being cultivated in the region of the Euphrates river, in a slight distortion of the actual dating of the finds.

¹³⁶ Samuel 2001, 366-367.

¹³⁷ Samuel 2001, 369.

¹³⁸ Samuel 2001, 368.

from excavations conducted in some cases over a decade earlier (in the 1980s) rather than a complete accounting of the archaeobotanical remains, it is difficult to make determinations of scale or how important the crop was, but the study nonetheless indicates a chronology of development of cotton cultivation that roughly corresponds to descriptions offered by Arab geographers. For example, Ibn Hawqal described cotton plants replacing fruit trees in Northern Mesopotamia, east of the Euphrates, and noted that cotton from the region was being exported into Syria and beyond.¹³⁹

By the twelfth century, cotton was circulating the Mediterranean and Middle Eastern regions. In addition to the Cairo Geniza documents and finds of seeds across Africa from the ninth century, discussed in chapter five, there is archaeological corroboration of its spread. On the island of Jasirat Fara'un (the Coral Island or Pharaoh's Island) in the Gulf of Aqaba, approximately two-hundred metres off the Sinai Peninsula, over 1,500 textile fragments were recovered, along with approximately seven-hundred basketry and seven-hundred cordage fragments dating to the late Ayyubid or early Mamluk period (late twelfth to early thirteenth centuries).¹⁴⁰ Most of the textiles were recovered from middens, unlike the basketry and cordage fragments which were found in structures, and the majority were cotton.¹⁴¹ No objects associated with spinning or weaving were found, and nearly all of the other items found were determined to have been imported from elsewhere.¹⁴² The island is small and rocky,¹⁴³ with only the fort at the northern end, and therefore local cultivation is unlikely; the cotton was being grown and manufactured elsewhere, and imported into the island. In analysing the material, Baginski and Shamir suggested that the quantity of cotton fragments and the variety of types and qualities of the fabrics were tangible artefacts of the commercial exchange

¹³⁹ Ibn Hawqal *Kitāb surat al-Ard* 213.

¹⁴⁰ Baginski 2001, 85.

¹⁴¹ Baginski and Shamir 1998, 39.

¹⁴² Baginski 2001, 85.

¹⁴³ Approximately 350 metres by 170 metres.

occurring on the Indian Ocean between India, South Arabia, Syria, Egypt and Nubia,¹⁴⁴ although Amar cited Israel and Syria as the sources of the cotton found on the Coral Island, he also stated that the weaving may have actually been done in Egypt.¹⁴⁵ However, with its position near the port of Aqaba (earlier called Aila and discussed previously in this chapter), which itself displayed evidence of cotton cultivation in earlier periods, it is possible that at least some of the cotton was being produced ‘locally’ on the mainland.

There are several possible reasons for cotton’s increasing use throughout the Middle East into the Early Islamic period. First, and particularly in the Levant, it has been suggested the rise in cotton represented a shift in attitudes towards wool, which was closely associated with the nomadic and pastoral communities throughout the Arabian Peninsula,¹⁴⁶ although the evidence from early Egyptian papyri and later Byzantine texts seem to indicate that cotton was not necessarily a high-status textile.¹⁴⁷ The relative ease with which cotton could be dyed may have also made cotton a more attractive fibre choice, especially when compared to linen which was difficult to dye, and even with the use of strong mordants to affix pigment, could not achieve the range and saturation of colour that wool or cotton could.¹⁴⁸ Finally, the clothing preferences of the Arabs, who in certain areas had been growing cotton as a textile fibre for centuries, could have impacted the clothing choices as people sought to emulate the Arab émigrés,¹⁴⁹ further encouraged by Muslim *hadith* against luxurious fabrics such as silk.¹⁵⁰ However, such explanations do not address the question of why cotton appears to have had a greater impact on the Levant and Middle East particularly after the spread of Islam, when Arab traders have been seen as spreading the use and cultivation of cotton throughout their newly

¹⁴⁴ Baginski and Shamir 1998, 44.

¹⁴⁵ Amar 1998, 115.

¹⁴⁶ Bulliet 2009, 46.

¹⁴⁷ In the late ninth-tenth-century *Book of the Eparch*, 9.1.423-424 records that linen merchants were allowed to produce linings possibly made from cotton (βαμβακίνων from the Persian *pambas*). 9.1.423-424.

¹⁴⁸ Kirstein 1999, 14.

¹⁴⁹ Bulliet 2009, 51.

¹⁵⁰ Brite and Marston 2013, 43.

acquired lands. As discussed in chapter five, finds of cotton in the Nile Valley region remained rare for the period up to the tenth century, and it seems cultivation in the oases decreased dramatically after the period of depopulation in the fifth century. However, in the same period there is evidence of rising cotton use throughout the rest of Africa and the Middle East. There is also increasing evidence of cotton use in areas further removed from areas of cultivation, which in the past was closely associated with textile finds.

These shifting patterns will be examined in the next section. Two complementary forces will be proposed. First, that part of the saturation of cotton use had to do with proximity to regions that relied heavily on cotton cultivation for economic prosperity, and correlated to this, that rather than cotton use and cultivation being driven by Arab traders introducing the material to new areas and pushing for its adoption, Abbasid economic policies resulted in wide reaching consolidation of economic relationships, and allowed for certain regions to ‘specialise’ in products that would not be produced in others but would be available. The Levant, in particular, ceased much of its own textile production in the immediate aftermath of the spread of Islam, and began to rely more on the textiles being manufactured in neighbouring regions. Egypt, on the other hand, became one of the primary linen production centres for all the regions under the Islamic Caliphate, and therefore had less need to import non-luxury textiles or change fields used for flax cultivation to fields for cotton. And while the Levant does seem to have had some amount of cotton cultivation by the eighth or ninth centuries, the scale of this cultivation is unclear. However, the Levant was geographically near a region that was revolutionising its own economy with intensive cotton cultivation, the Iranian plateau.

A ‘cotton boom’ on the Iranian plateau

Richard Bulliet was the first to identify what he termed a ‘cotton boom’ on the Iranian plateau, part of a restructuring of agricultural output beginning in the eighth century and reaching its apex in the ninth and tenth centuries. By looking at a combination of tax documents, works by contemporary geographers, personal notices and archaeological

excavation, Bulliet determined that an influx of immigrants in the period directly following the collapse of Sasanian rule and the incorporation of their lands into the new Islamic empire resulted in a redevelopment of agricultural land for the purpose of creating an export market. Cotton, as a cash crop, was a primary factor in this restructuring, and led the Iranian plateau to become one of the most productive regions within the Middle East.¹⁵¹ Climatic cooling in the eleventh century and the incursion of Turkic nomadic immigrants that followed meant the cotton boom was short lived.¹⁵² But while it lasted there was a source of cotton that was closer to the Levant than India, and it is worth exploring this possible connection further.

As previously discussed, before the Islamic period, cotton was grown in Central Asia, primarily in the urban centres east of the Iranian plateau, such as Merv, that were near rivers which could provide the irrigation necessary for cotton cultivation. However, this was of limited external commercial importance, and the evidence does not indicate that there was the infrastructure for large-scale production or trade.¹⁵³ In the plateau, there is little evidence of cotton cultivation prior to the seventh century, with wheat and barley being the primary agricultural crops, and excavation has revealed few cotton textile remains.¹⁵⁴ According to Bulliet, after the seventh century, increased immigration from the Arabian Peninsula led to increasing investment in *qanats*, in areas of uncultivated land specifically for cotton cultivation.¹⁵⁵ The existing irrigation systems were greatly expanded in the early Islamic period,¹⁵⁶ corresponding to an increase in documented textile merchants specialising in cotton.¹⁵⁷ Ninth-century geographers also list Nishapur, Rayy and Isfahan, the three largest cities of northern Iran, as cotton production centres.¹⁵⁸ Tax schedules and documents also

¹⁵¹ Bulliet 2009, 1.

¹⁵² Bulliet 2009, 1.

¹⁵³ Bouchaud *et al.* 2011, 415; Allsen 1997, 68.

¹⁵⁴ Kawami 1992, 7-18; Bulliet 2009, 5-6.

¹⁵⁵ Bulliet 2009, 37-40.

¹⁵⁶ Decker 2009, 190-191.

¹⁵⁷ Bulliet 2009, 4-5.

¹⁵⁸ Bulliet 2009, 42.

indicate that cotton had higher returns for export, taxed at two and a half times the rate of wheat.¹⁵⁹ So it was financially advantageous to develop previously unused land for cotton cultivation specifically to take advantage of the export market.

Cotton production in Yemen was closely linked to this development. Bulliet speculates that it was immigrants from Yemen who began the push for cotton cultivation in the Iranian plateau in a push to derive profits from previously uncultivated lands.¹⁶⁰ So while the development of cotton cultivation in these areas fits the timeline of Watson's argument, the evidence suggests that India was at best playing a secondary role in the increasing use and cultivation of cotton across the regions, a later step in a process that was already well under way. As cotton had been grown in the areas around the plateau in the pre-Islamic period, the new immigrants were not responsible so much for the diffusion of the crop into Central Asia, but for aggressive exploitation of land. None of this is to say that cotton was never exported from India through long-distance trade networks. But what becomes clear from a re-analysis of the evidence of cotton use and cultivation from the first millennium is that cotton was already being widely distributed through a series of overlapping regional trade networks.¹⁶¹ Therefore, while Indian cotton was almost certainly being traded along established routes into the newly Islamised lands, it does not appear to have been a driving force in the increased use of cotton from the seventh and eighth centuries on. Nor does it appear to be the result of new or expanded Indian Ocean trade networks. Instead, the cotton boom was fed by increased local production and Yemeni immigrants seeking to capitalise on the cultivation of a cash crop.

Changing economic systems

In the centuries before the spread of Islam, it is clear that the nature of long-distance trade was already changing. There were established trade routes between the Sasanian and Byzantine Empires in the first part of the first millennium AD, but the rivalry between the two

¹⁵⁹ Bulliet 2009, 34-37.

¹⁶⁰ Bulliet 2009, 28, 41.

¹⁶¹ See this chapter, fn. 52.

empires intensified in the sixth and seventh centuries, as demonstrated by the sixth-century *Codex Justinianus* which stated that both Roman and Persian merchants were required to trade in designated areas in a highly regimented system.¹⁶² These areas could also charge heavy tariffs and tolls, sometimes as high as ten percent, making trade centres not under Persian or Byzantine control, such as the Arabian coast, more attractive.¹⁶³ This made the coasts a diffusion point for cotton coming from both Africa, via Aksum and Yemen, and India, via the Persian Gulf and Bahrain. The question of diffusion, especially in relation to the two different species of Old World cotton, is one that will only be fully resolved by further DNA testing of archaeological samples. But for now, it is plausible to argue that cotton was moving along both of these networks, and clearly it was doing so long before the spread of Islam. While these networks overlapped, with Indian cotton reaching the shores of Egypt along the Red Sea,¹⁶⁴ and presumably other Red Sea ports, it was the area of Mesopotamia that seems to represent the true meeting place of these two networks, where the adoption of both cultivation and use collided. However, what is also clear is that neither of these cotton networks was functioning in a fully linear fashion.

Trade along the Indian Ocean ebbed and flowed, and increasingly it appears that it went into a sustained lull after the third century, not to be effectively revived until the early Islamic period when the documents reveal an uptick in commercial negotiations and trade connections between the societies that rimmed the Indian Ocean littoral.¹⁶⁵ While goods continued to move during the period of ‘lull’, the scale had shrunk dramatically. And the evidence from Egypt shows that cotton moving along the African network seems to have bypassed one of the largest textile production centres of the ancient world, finding foothold in more marginal regions first.

¹⁶² *The Codex of Justinian*, 4.63-64; Daryaee 2010, 408-409.

¹⁶³ Daryaee 2010, 409.

¹⁶⁴ As stressed in chapter five, the finds that attest to Indian cotton in late antique Egypt are removed from any evidence of cultivation, indicating a different process (and scale) of diffusion.

¹⁶⁵ Darley 2013, 357-356.

In keeping with the narrative of cotton's growth being caused by increasing trade relationships with the east, such gaps have gone largely unexamined and unexplained in the scholarship. The seemingly idiosyncratic nature of the adoption of both cotton use and cultivation, particularly in the period after the spread of Islam, reveals the beginnings of a fundamental shift to economic structures as the regions transitioned from Roman and Sasanian to Umayyad, and finally Abbasid, rule.

The archaeological evidence points to changing patterns of trade in the Mediterranean and the Middle East beginning in the sixth century, changing the structure of interregional connectivity.¹⁶⁶ Hugh Kennedy, based on accounts in surviving historical sources, determined that this period should be defined as one of both social and economic decline, enabling the relatively easy incursions in the seventh century.¹⁶⁷ While this has created a traditional historiography of the seventh and ninth centuries characterised by de-urbanisation and economic collapse within the Byzantine empire, this was highly regionally dependent in both scale and impact,¹⁶⁸ and overall ceramic evidence, discussed later, suggests that both production and trade continued. This suggests that rather than pulling the Mediterranean out of economic stagnation, the rise of Islam in fact brought about a reorientation of urban centres and the relationship between urban and rural production, in which cotton played a role. While the Rashidun and early Umayyad caliphs presided over a decentralised conglomeration of lands, the process of political centralisation beginning with Abd al-Malik and economic consolidation under the early Abbasids resulted in new systems of both production and exchange that fundamentally changed the way urban and rural centres interacted with each other, and the nature of trade systems.

¹⁶⁶ Wickham 2005, 759-769 for Egypt, 774-780 for the Levant; Daryaei 2010, 409.

¹⁶⁷ Kennedy 1985b, 141-149. This is also the thesis of Harper 2017, which argues that the combination of widespread climate cooling in the mid-sixth century (termed the 'late antique little ice age') combined with the Justinianic plague in the 540s left the Byzantine Empire severely weakened.

¹⁶⁸ Brubaker and Haldon 2011, 453-454.

Study of archaeological finds and settlement landscapes in the sixth and seventh centuries demonstrate that there was a shift in the economic orientation of the late antique world. Analysis of ceramic evidence has shown that there was a noticeable shift in both production and consumption of goods along interregional networks in the sixth century. Except for a brief period in the 530s when it saw a resurgence African Red Slip ware, which had been widely circulating in the Mediterranean, began to decline in the ceramic assemblages in inland areas, replaced by imitative Phocaeen Red Slip wares, Cypriot Red Slip wares, and fine wares from Syria and Cilicia.¹⁶⁹ A similar pattern is seen in Syria, Palestine and Arabia.¹⁷⁰ Changing orientations of supply is also reflected in the numismatic evidence. A study of coin finds in Jordan from the sixth and seventh century found a decline in both the supply and circulation of copper coins after the reign of the Byzantine emperor Justin II (r. 565-574), but before this decline, the coins were largely coming from the central mints at Constantinople and Nikomedia, with fewer from the mints at Kyzikus, Antioch, Thessaloniki or Alexandria.¹⁷¹ After Justin II, this changed and larger proportions of coins came from the closer, more local mints of Antioch/Theoupolis and Alexandria, suggesting the end of major shipments of currency from the state and instead the distribution of coinage through localised commercial activities.¹⁷² And in urban centres, previously public spaces were being built over with private structures, public building programs and largely abandoned and existing structures received

¹⁶⁹ African Red Slip ware continues to be found in coastal regions through the sixth century. And while North African cook and transport vessels continued to be transmitted throughout the period, Aegean forms were increasingly being used throughout Syria, Palestine and Asia Minor. For Italy, see Wickham 2005, 728-741; for the Levant and Asia Minor, see Brubaker and Haldon 2001, 151-152.

¹⁷⁰ Da Costa 2007 summarises sixth century ceramic finds from fifteen sites throughout Syria, Palestine and the Arabian Peninsula.

¹⁷¹ Walmsley 1999, 342.

¹⁷² Walmsley notes a brief reversal under Herakleios in the seventh century, when the majority of coins found were minted in Constantinople and Alexandria, but this revival is short lived prior to the Islamic conquests between 633 and 636. Walmsley 1999, 345-346.

minimal repair, outer suburbs were being abandoned and large domestic structures within cities were being subdivided into smaller units.¹⁷³

Several reasons have been proposed for the reorientation of Mediterranean trade networks. Wickham suggests that since the primary driver of long distance exchange was the Roman state (the process of resource distribution outlined in chapter two), as established state networks broke down due to invasion and conflict, commercial supply and demand relationships adapted to new political realities.¹⁷⁴ Walmsley, somewhat similarly, places more emphasis on political and military upheavals, such as the Persian threat and conflict between Phokas (r. 602-610) and Herakleios (r. 610-641).¹⁷⁵ Kennedy suggested a combination of factors which combined to lead to an overall economic decline throughout the region of Syria-Palestine, of which decreasing Mediterranean trade was a contributing factors, along with earthquakes, invasions and an outbreak of plague.¹⁷⁶ While there are a number of factors that contributed to the changing commercial patterns of the sixth century, there is little convincing data that a shift to localisation was both widespread or an indicator of economic decline. For example, in Egypt, the artisan quarter of Alexandria grew in the sixth century, and public building works continued, proof of flourishing artisanal production and commerce.¹⁷⁷ And Jodi Magness, in re-examining the excavation reports of some of the sites Kennedy used in his own study, has determined that many settlements actually expanded in the sixth century, rather than retracted, and that the changing nature of the urban landscape, with open markets moved to the outskirts of the city and the open spaces of the classical city being covered by houses and workshops, was not necessarily a sign of ‘decline and degeneration’, but is instead reflective

¹⁷³ For Arabia and Syria-Palestine, see Walmsley 1996; 2007; Kennedy 1985a. For similar developments in Iran, see Kennedy 2006.

¹⁷⁴ Wickham 2005, part 4.11 for the different regions of the Mediterranean.

¹⁷⁵ Walmsley 1999, 346.

¹⁷⁶ Kennedy 1985b, 180-183.

¹⁷⁷ Kiss 2007, 197-203.

of a changing commercial emphasis in cities.¹⁷⁸ And as both Wickham and Magness note, along with Fanny Bessard, the evidence suggests that maritime trade was still occurring and trade amongst the coastal towns was still thriving, though fewer goods were passing from the coastal regions inland.¹⁷⁹

Such economic reorientation in the sixth century, which continues through the early Islamic period seems to be signifying not a period of decline, but rather a realignment of the relationships between urban and rural areas, and as a consequence, urban centres to each other. This continued into the early Islamic period, and until recently the Rashidun and early Umayyad caliphates were seen as periods of industrial and commercial decline, a continuation of the sixth century, often attributed to similar factors.¹⁸⁰ However, re-analysis of the chronologies of artefacts instead indicates that whatever degree of localisation of trade was occurring in the sixth and early seventh centuries, there was little actual economic disruption amidst the political changes brought about by the Islamic conquests, and that Umayyad, and later Abbasid, policies encouraged an intensification (rather than a reduction) of both production and commercial activity,¹⁸¹ through which the spread of cotton and its availability in areas further removed from centres of cultivation should be viewed.

¹⁷⁸ Magness 2003. Magness notes that Kennedy himself has argued that the restructuring of streets and commercial infrastructure was one of the key developments of early Islamic cities, and rather than being a sign of demographic change and decline, they should be read as signals of economic vitality. Magness 2003, 207-208, cf. Kennedy 1985a, 17. And as noted by Brubaker, the more functional use of space may have contributed to the archaeological appearance of population contraction. Brubaker 2001, 33.

¹⁷⁹ This is demonstrated repeatedly throughout Wickham 2005; Magness 2003, 212-214.

¹⁸⁰ Walmsley 2007, 319. Walmsley notes that such conclusions have often been based on evidence of architectural dedicatory inscriptions rather than archaeological investigation of the structures themselves, but as Kennedy has shown (Kennedy 1985a, 25), there was less of a concern for monumental construction in early Islamic cities.

¹⁸¹ Walmsley 2007, 321; Bessard 2013, 386. It should be noted, within the remains of the Byzantine empire the question of economic vitality was quite different as the empire was forced to establish and exploit new networks to make up for the produce from lands that were lost, although as discussed by Brubaker and Haldon 2001; 2011, this was not a period of all-encompassing and sustained economic decline, rather a period of transition.

Changing economic policies

This re-orientation of the economy began with land policy and taxation. Upon the incorporation of Egypt into the new Islamic empire in 641/642, the caliph ‘Umar ibn al-Khaṭṭāb (r. 634-644) left landholding rights in the hands of the local elites they had conquered, and this became the basis of the concept of the Muslim *fay’*, lands held for the benefit of all Muslims which would be taxed at a higher rate (by virtue of being owned by non-Muslims), with revenue going to pay salaries, stipends and pensions.¹⁸² The Byzantine monetary economy persisted into the seventh century in conquered areas, with a variety of issues circulating throughout. Hoard finds indicate that the last Byzantine emperor whose coins received widespread circulation in the area of Syria-Palestine was Constans II (r. 641-668), though coins from the penultimate issue of Constantine IV (r. 668-685) have been occasionally identified (indicating that commercial trade with the Byzantine empire continued),¹⁸³ and the caliphs began to issue their own coinage. The result was the minting of imitative pseudo-Byzantine coins, Umayyad Imperial, and the Standing Caliph types, whose production and circulation periods overlapped each other.¹⁸⁴ This gradually began to change as the Umayyad caliphs began the process of political centralisation. When Mu‘āwiyah ibn Abī Sufyān (r. 661-680), the first caliph of the Umayyad dynasty, came to power, the Islamic empire was administratively decentralised, having retained many of the vestiges of the Byzantine bureaucratic structure without an attempt at exerting full political or fiscal control, which continued to be dictated at a local level.¹⁸⁵

While the provinces each had a governor accountable to the caliph, the governor’s positions were not based on military control and therefore their actual power was limited,

¹⁸² This had an added benefit of preventing the creation of a land-based military aristocracy which would potentially challenge the authority of the caliph. Sijpesteijn 2013, 115-116; Kennedy 2016, 86.

¹⁸³ Walmsley 2007, 321; Phillips, 2004, 22.

¹⁸⁴ Walmsley 2007, 321-324; Goodwin and Gyselen 2015, 12-13.

¹⁸⁵ Kennedy 2016, 75-76.

relying on compromises and negotiations with local leaders.¹⁸⁶ This made the enforcement of tax policy and collection difficult. Continued conflict on the borders (particularly with the Byzantines in Asia Minor and the Berbers in North Africa), the expense of maintaining internal peace and political control, and the growing costs of the *dīwān* (the pensions owed to families of the original campaigners of the Prophet) 'were a substantial drain on caliphal income, and the devolved nature of both taxation and provincial government meant that the caliphs had a constant struggle on their hands to secure their share of revenues from more distant provinces'.¹⁸⁷ The evidence suggests that the Umayyad tax system was fully monetised, as were all salaries and pensions, in a system with its roots in the late Roman tax system following the monetary expansion of the fourth to sixth centuries.¹⁸⁸ Lands owned by non-Muslims, which were later termed *kharāj*, meaning they were conquered 'without treaty' and were therefore part of the Muslim *fay'* and subject to higher taxation, the *jizyat al-arḍ*, which had to be paid alongside a poll-tax (*jizyat al-ra'as*) and an 'expenses tax' (*nuzūl*), which were generally lumped together under the heading *jizya*.¹⁸⁹ Such taxes provided the bulk of income for the early caliphs. The jurist Abu Yusuf, in recounting the debates Umar had in how to designate land captured, recalled:

‘Umar’s decision not to distribute the land amongst those who had captured it was guided by God’s book and was of benefit to all Muslims. The taxes collected from such lands enabled the payment of pensions and wages from this perpetual income, thus making the wars of jihad possible and providing security against the recapture of their lands and places by enemies.’¹⁹⁰

¹⁸⁶ The power of the office of the governor was further limited by frequent turnover and the independent judiciary and fiscal institutions. The additional need of relying on local leaders for military support made their positions unstable. Kennedy 1981.

¹⁸⁷ Haldon 2016, 29-30.

¹⁸⁸ Banaji 2010, 168-172; Sijpesteijn 2013, 151. There were exceptions for certain types of taxes, such as the wheat tax (*ḍarībat al-ṭa’ām*) which was usually paid in kind. Sijpesteijn 2013, 173.

¹⁸⁹ Sijpesteijn 2013, 173.

¹⁹⁰ Abu Yusuf, *Kitāb al-kharāj* 3.15 trans. Shemesh 1969, 68.

Artisans and craftspeople who did not have their own lands were expected to pay a specialised trade tax, and other levies, tolls and customs charges on trade could also be charged; in comparison, Muslims were only expected to pay the alms-tax (*ṣadaqa*, *'ushr*, or *zakat*) for their assets.¹⁹¹ Collection of taxes was further complicated by the tax schedule. In Egypt, where papyri provide the most detail for analysis of the early Islamic tax system, payments were broken into five instalments; the value of one-eighth the total tax due was paid in Tybi (December-January), Mecheir (January-February), Phamenoth (February-March), and Pharmuthi (March-April). The balance was due in Messori (July-August) after the harvest, during which additional taxes, such as a grazing tax, were also calculated, all of which were collected by different officials.¹⁹² This rigid tax system proved to be quite burdensome on farmers—in order to meet the tax demand farmers had to offload surplus crops quickly after the harvest, flooding the market and driving prices down, increasing the burden the monetized tax system placed on farmers.¹⁹³ Again, the papyri from Egypt demonstrate the consequences of such policies. The large number of debt acknowledgments dictating repayment after the harvest, either in coin or in kind, show that farmers were often cash-poor throughout the year, and since such agreements often acted as advance payments which fixed prices prior to the harvest, they were immune from inevitable price fluctuations that came from both bad and surplus crops years.¹⁹⁴ This resulted in large-scale abandonment of farm lands in favour of cities.¹⁹⁵

At the same time, the incorporation of so much established farmland into the Muslims *fay'* created an environment in which the Muslim aristocracy had to seek out new means of acquiring wealth and creating private estates. This led to the custom of *qatī'a*, borrowed from earlier Roman and Mesopotamian practice, in which wasteland (*mawāt*) could be claimed and

¹⁹¹ Sijpesteijn 2013, 173.

¹⁹² Sijpesteijn 2013, 178-180.

¹⁹³ Banaji 2010, 172.

¹⁹⁴ Sijpesteijn 2013, 176-177.

¹⁹⁵ Banaji 2010, 172.

brought under cultivation through investment in intensive irrigation, owing only the lower alms-tax, and inheritable by descendants.¹⁹⁶ Again, Abu Yusuf provides detail of this legal policy, noting that ‘*ushr* only is charged on fiefs when the granted lands require investment for digging canals, erecting farm buildings and other heavy expenses for the farming of the granted fief.’¹⁹⁷ This provided an incentive for the Muslim elites to expand cultivatable lands, and one of the defining characteristics of these newly cultivated lands is that they often specialised in various types of cash-crops.¹⁹⁸ This practice seems to have largely fallen out of use by the end of the Umayyad period, but provides a precedent for the type of land conversion seen in the Iranian Plateau in the eighth and ninth centuries when wasteland was converted for cotton cultivation.

By the time Abd al-Malik ibn Marwān (r. 685-705) came to power, it was clear the policies of decentralization were not working efficiently to administer the empire, and he began a series of reforms that sought to standardize and centralize administration, at the same time increasing central revenues for the state.¹⁹⁹ Administration officials were required to conduct official business in Arabic, local tax revenue was to be sent to Damascus (rather than reserved), and new coinage was issued, the gold *dinar* in 696-697, and the silver *dirham* in 698-699.²⁰⁰ The caliphs also began to attempt to exert greater fiscal control over tax collection, provoking a series of tax revolts, particularly in Egypt where the default fiscal administration had been entrusted to the Coptic church.²⁰¹ This was only one of the problems that would lead to the downfall of the Umayyads, following a series of events and longstanding conflicts which served to undermine the authority of the caliphs.²⁰² In particular, the increasing tensions

¹⁹⁶ Kennedy 2011, 186-187; Kennedy 2016, 86; Banaji 2010, 171.

¹⁹⁷ Abu Yusuf, *Kitāb al-kharāj* 3.33, trans. Shemesh 1969, 73.

¹⁹⁸ Kennedy 2011, 187.

¹⁹⁹ Kennedy 2016, 85.

²⁰⁰ Kennedy 2016, 85.

²⁰¹ Frantz-Murphy 2014, 101.

²⁰² The first was Mu‘awiya’s decision to name his son, Yazīd ibn Mu‘āwiya (r. 680-683), as his successor, thus creating a hereditary dynasty; this was unpopular particularly as the Umayyad caliphs were not part of the Prophet’s family. Second was Yazid’s authorisation to

between Muslim converts who assumed positions of authority and their Arab 'superiors', despite a doctrine meant to emphasise the equality between all Muslims, and regional conflicts underscored by resource exploitation, allowed for the rise of movements claiming the egalitarian ideal, and the eventual rise of the Abbasids.²⁰³

The Abbasids, backed by the Khurasan army, quickly came to the forefront of these movements and benefitting from their positions as members of the Prophet's family (descended from an uncle) they defeated the army of the last Umayyad caliph Marwān bin Muḥammad bin Marwān bin al-Ḥakam (r. 744-750) under the leadership of Abul 'Abbas as-Saffaḥ (r. 750-754) and took Damascus in 750. Though they would not fully consolidate their power until 762, when Abu Ja'far Abdallah ibn Muhammad al-Mansur moved the capital from Damascus to Baghdad,²⁰⁴ the rise of the Abbasids completed the transition of the early Islamic economy from one based on conquest to one founded on production.²⁰⁵ This transition has been used to construct the mid-eighth century as a point of change within the Islamic world, and a material shift in economic progression of the caliphate.²⁰⁶ One of the biggest administrative changes implemented by the Abbasids was in the fiscal administration, drawn largely from the former Persian empire and their rural elites, who were also underpinning Abbasid authority through the support of the Khurasan army. Persian administrators were appointed to positions in both the central and the provincial governments,²⁰⁷ intended to reinforce the central control of the

crush a rebellion being led by the Prophet's grandson, Al-Ḥusayn ibn Ali ibn Abi Talib (625-680), at Karbala in a battle in which many members of the Prophet's family were also killed. Husayn's grandson, Zayd ibn 'Alī (695-740), was also killed during a rebellion against Hisham ibn Abd al-Malik (r. 724-743) at Kufah, and his son, Yaha ibn Zayd (d.743), was killed in an uprising in Merv. Third, the Umayyad aristocracy largely consisted of ethnic Arabs, which not only exacerbated conflict between Arabs and non-Arabs, but also reinvigorated a historical rivalry between northern Arabia (the Qays or Mudar) and southern Arabia (the Yemen), which pre-dated the rise of Islam. Bennison 2009, 18-21; El-Hibri 1999, 4.

²⁰³ Bennison 2009, 22-23; Haldon and Kennedy 2012, 343-352.

²⁰⁴ El-Hibri 1999, 2.

²⁰⁵ Bennison 2009, 28.

²⁰⁶ Bennison 2009, 27-29; Bessard 2013, 406-407.

²⁰⁷ Frantz-Murphy 2014, 106. While the fiscal administrators were largely drawn from the Persia, the aristocracy under the Abbasids was no longer determined by ethnicity and opened new opportunities to non-Arabs and converts. Bennison 2009, 28-29.

caliph by taking the enforcement and collection of taxation out of the hands of the provincial governors. They also sought to standardize the tax status of lands within their empire, which had largely been left to the discretion of the provincial administration under the Umayyads, formally defining *kharāj*, and for the first time imposing the *kharāj* tax on Arabs at the end of the eighth century, instigating a period of tax revolts.²⁰⁸

Understanding of the early Abbasid empire is perhaps somewhat hindered by a lack of sources—the majority of the surviving accounts date to after the change of the capitol from Baghdad to Samarra in 833 and then back to Baghdad sixty years later, thereby looking back to the early Abbasid period through the lens of successive regimes.²⁰⁹ The archaeology augments these later accounts. Fewer finds of coins minted under the Abbasid caliphs compared to those minted under the Umayyad caliphs, particularly in rural areas further from the new capital of Baghdad, and fewer mints have led scholars to conclude that the early Abbasid period was marked by an economic retraction, abandonment of urban centres and a return to increasingly demonetized rural modes of production.²¹⁰ However, as Walmsley notes, ‘alternative explanations can also be sought in realigning and adaptive economic strategies by local communities as they came to rely increasingly on their own abilities – intentionally, willingly, or not.’²¹¹ The next section will examine the archaeological evidence of urban centres and production in the early Abbasid period as it reflects economic achievement in the period, and will contextualize the cotton evidence discussed earlier in terms of larger economic trends.

²⁰⁸ Frantz-Murphy 2014, 107-110. The tax receipts from Khurasan are very similar to those from Egypt, reflecting the high degree of fiscal centralisation implemented by the Abbasids. That such receipts appear earlier in Khurasan than in Egypt is indicative of the Persian influence on the Abbasid administration. Khan 2014, 205-206.

²⁰⁹ El-Hibri 1999, 11.

²¹⁰ As detailed in both Walmsley 2010, 21-39; Avner and Magness 1998, 39, 51 specifically for Syria-Palestine.

²¹¹ Walmsley 2010, 40.

New production centres

Increasingly, the archaeology of seventh- and eighth-century sites throughout the newly conquered Islamic lands have demonstrated that, as was the case in the sixth century, the economy of the late Umayyad and early Abbasid empire was geographically varied and dynamic. This re-assessment has largely been driven by the development of new chronologies for artefacts, particularly the ceramics, allowing scholars to re-evaluate the internal chronologies of many regions; in Syria-Palestine, which had previously been thought to have been experiencing continued demographic contraction into the seventh and eighth centuries, re-examination of ceramics at Pella in Jordan found a great deal of material from the seventh century, dominated by local production but also including some examples that had originated in Egypt.²¹² Likewise, amphora from Gaza have been found in seventh-century contexts in Kellis and Alexandria from Egypt, showing that inter-regional trade along the Mediterranean continued uninterrupted in the seventh century, though it seems to have declined in scale.²¹³ These trade connections continued into the eighth century as well.²¹⁴ In Jerusalem, the construction of structures at the southern end of the Temple Mount and continued use through the Abbasid period, as well as the repair and continued use of the monumental bath complex at Hammath Gader (previously thought to have been destroyed in the earthquake of 749) through to the eleventh century, indicate consistent occupation until at least the earthquake of 1033.²¹⁵

While the evidence is increasingly indicating that there was not a demographic decline in the seventh and eighth centuries, it is clear that there was a fundamental change in the

²¹² Walmsley 2007, 327.

²¹³ Walmsley 2007, 327-329. Walmsley also notes that the fewer amphora found does not necessarily mean that trade connections decreased, but could also be an indicator that ceramic vessels were replaced by other containers made of organic materials that no longer survive, such as skins or wood. Walmsley 2007, 329. This is indeed a possibility, and references to skins appear in the Cairo Genizah in later centuries, but as yet cannot be substantiated as early as the seventh century.

²¹⁴ Amphora manufactured at Terenouti along the Nile have been found in the eighth-century levels at both Pella and Kursi. Walmsley 2007, 330.

²¹⁵ Magness 2010, 147-162.

foundations of the economy and the relationship between urban and rural areas. Through the end of the seventh century, the economy was still based on agricultural production, much as it had been in the Roman period as well, with artisanal production largely centred on meeting local demand.²¹⁶ This largely changed in the eighth century. The payment of salaries and pensions for government officials and the army created large centres of demand in urban areas for goods that could be bought for cash.²¹⁷ The result was an expansion of agricultural exploitation around the cities as well as the shift of workshops from peripheries of cities to the centres, and a higher concentration of settlement rather than demographic decline.²¹⁸ The foundation of the Abbasid capital at Baghdad in 762 also shifted the agricultural dynamic throughout the empire.

The period of the seventh to eighth centuries was highly productive in the area of Greater Mesopotamia as well. The intensive construction of irrigation systems throughout the regions resulted in the province of Greater Mesopotamia generating four times the amount of tax revenue as Egypt, and five times more than Syria-Palestine.²¹⁹ Unlike Rome, which required large amounts of grain to be imported from the provinces of the empire, especially Egypt, Baghdad was able to draw from the agriculture of its immediate surroundings, negating the need for the large-scale resource transfer across the provinces. This is also reflected in the tax system, based on currency rather than redistribution. The caliphs in Baghdad were concerned only with the collection of taxation, not in how the provinces produced their payments. This, combined with cash markets supported by payments made by the central administration, shows a shift to a new type conception of production and the foundations of industrialization. These patterns can be seen in urban areas throughout Syria-Palestine, Mesopotamia, the Arabian Peninsula, and coastal regions along the Mediterranean.

²¹⁶ Bessard 2013, 413.

²¹⁷ Kennedy 2011, 177.

²¹⁸ Kennedy 2011, 177; Bessard, 2013, 413.

²¹⁹ Kennedy 2005, 11-12; Kennedy, 2011, 178.

At Jerash, the eighth century saw the construction of new production areas on top of Roman ruins in the centre of the city, with large clusters of workshops all dedicated to the same goods which would have been highly dispersed and on the periphery in antiquity; extant structures and their associated finds have identified groups of ceramics, glassmaking, dying and textile workshops.²²⁰ The concentration of production areas in public urban spaces, often near the construction of new market spaces, can be found in other cities.²²¹ Coin finds also revealed that by the eighth century, approximately forty-six percent were minted outside the province, showing increased inter-regional monetary transactions, circumstances similar to those found in the excavations of Herodian Jericho.²²² At Beirut, extensive finds of objects associated with glass production and the remains of glass furnaces in a cluster of structures (most likely workshops) beyond what would be expected by local demand, beginning in the eighth century, suggest multiple workshops functioning in an industrial centre.²²³ In the area of Aila, on the Gulf of Aqaba, a number of towns sprang up in areas that had previously been uninhabited in response to several industries for which Aila served as a commercial centre. The copper mines at Nahal Amram, first used by the Nabataeans, went through their most intensive period of activity in the early Islamic period, and along with the gold mines at Wadi Tawahin near Eilat, provided for a number of smelts found throughout the area.²²⁴ Four stone quarries were located near the Darb el-Hajj, three for red-stone and one for limestone, one of which (Nahal Roded) seems to have been founded in the early Islamic period to build the Darb el-Hajj and camps alongside it.²²⁵ At both 'En 'Avrona (where cotton was found) and Yotvata (where it was not), large farm complexes fed by *qanats* and a large fortress constructed at Yotvata are consistent

²²⁰ Bessard 2013, 397-406.

²²¹ Bessard 2013, 406-407.

²²² Walmsley 2007, 340.

²²³ These objects included blocks of raw glass, glass ribbons and threads, refuse from glass blowing, fragments of glass objects, and pieces of furnaces with layers of glass melted onto them. Bessard 2013, 74.

²²⁴ Avner and Magness 1998, 39-44.

²²⁵ Avner and Magness 1998, 45.

with the large scale agricultural development of previously marginal areas,²²⁶ as also seen in the regions of Mesopotamia and Iran.²²⁷

Conclusions

In the final centuries before the spread of Islam, the nature of long-distance trade was already changing. The established trade routes between the Sasanian and Roman, and later Byzantine, empires were becoming centres of the increasing rivalry and conflict between the two empires. This made trade centres not directly under Byzantine or Persian control, such as those on the Arabian coasts, more attractive to merchants.²²⁸ As a result the ports and commercial centres of Arabia became diffusion points for a number of goods and commodities. On the west coast, cotton was already being traded from Africa into Arabia across the Red Sea, and from India via the Persian Gulf and Bahrain, allowing for diffusion into the rest of the Mediterranean. The questions of which routes diffused to where will only be fully resolved by further testing of archaeological samples, but based on the evidence currently available, it is clear that cotton was moving along both of these networks, and was clearly doing so long prior to the spread of Islam.

These shifts in long-distance trade networks had an impact on local economies as well. The process of reorientation which began in the sixth century continued under the Umayyads. The recentralisation of economic structures under the Abbasids saw a further increase in overlapping inter-regional trade networks that resulted in regional commodity exchange.²²⁹ This meant that cotton, which had previously been diffused by way of its cultivation, was now entering markets as a finished commodity and was progressively available to markets removed from its production sites. This could also explain why the process of the adoption of cotton was so different in the regions that have been examined. The recentralisation under a principal

²²⁶ Avner and Magness 1998, 46-49.

²²⁷ Kennedy 2011, 117

²²⁸ Daryaei 2010, 409.

²²⁹ Wickham 2005, 780.

authority in Baghdad corresponds to the increase in cotton use in the Levant, attested in the archaeological record, evidence of large-scale investment in cotton cultivation in the Iranian Plateau, and a development of a monopoly of linen production in Egypt at the expense of industries elsewhere (such as in the Levant). So, it seems that it was the centralisation of the economy of the Islamic lands under the Abbasids which brought commodities that had been diffusing from disparate areas across the new Caliphate into the same wider network, and resulted in a degree of regional specialisation of production. For textiles, this meant potentially offering alternative, and closer, sources of cotton, which were not involved with external Indian trade networks.

Cotton was not only an Islamic phenomenon; but the fact that the areas where textiles are preserved from this time period were early Islamic conquests makes their prominence in discussions of cotton a necessity. However, there is evidence that cotton was being used throughout the Mediterranean, eventually making its way to Europe. It is mentioned in both the tenth-century Byzantine *Book of Ceremonies* as well as the roughly contemporaneous *Book of the Eparch*,²³⁰ in which its status as an utilitarian textile may explain its apparent absence from other sources. There was also a thriving cotton industry in Italy by the twelfth century, although this development, heavily reliant on Syrian production and Mediterranean trade, is outside the scope of this study.²³¹ So while cotton has historically been associated with the development of Indian trade networks, I would propose it should actually be seen as a commodity functioning within several networks, representing a confluence of global interactions and overlapping circulation of commercial goods. As such, it should not be seen as evidence of increasing trade along Indian Ocean networks, but as an indicator of cultural change and economic consolidation. Cotton as a cultivated cash crop had been transmitted across parts of Central Asia, the Middle East, Mediterranean and North Africa long before the

²³⁰ Constantine Porphyrogenetos, *Book of Ceremonies*, II 45.678.

²³¹ Mazzaoui 1981.

spread of Islam, and as a commodity circulating along multiple networks, it highlights the complex way in which economic systems of the first millennium developed.



Figure 7.1 Map of early cotton finds in Middle East and Central Asia. Red indicates prior to 1st century AD, blue is after the 1st century AD. The At-Tar caves are marked in purple for their uncertain date. 1. Mohenjo-Daro 2. Majkop 3. Dhuweila 4. Nimrud 5. Vani 6. Qalat al-Bahrain 7. Saphar Kharaba 8. Arrajan 9. At-Tar Caves 10. Dedopolis Gora 11. Shar-I Qumis 12. Tsitauri 13. Merv



Figure 7.2 Fibres showing the structure of cotton. Reproduced from Shishlina et al. 2003, 335.



Figure 7.3 Sites with cotton finds in the Middle East. Red marks later sites. 1. Hegra 2. Aila 3. Rogem Zafir 4. Khirbet Qazone 5. Bosra 6. Palmyra 7. Dura-Europos 8. 'En 'Avrona 9. Nahal 'Omer 10. En Marzev 11. Nessana 12. Deir Ain 'Abata 13. En Boqeq 14. Qasr el-Yahud 15. Zenobia

Chapter Eight: Conclusions, Cotton in the First Millennium

This study was framed by a recognition of a central fact, that textiles were important in the ancient economy and culture. Their production employed a large proportion of the population (whether professional or not), they were being consumed in some way by every level of society, and they were being traded along established exchange networks. And their study is able to provide information about both social and economic organisation, production capabilities and specialisation, trade relationships, and communication networks. However, in historical studies, textiles are largely not being used to their full potential. The problems that keep scholars from fully using textiles are numerous. Their preservation is typically regionally dependent, and from the places where textiles have been preserved, the sheer quantity of the fragments, and the varying qualities found within the corpus, is daunting. In attempting to create categories to manage so much material, iconography was used as a means of creating coherent groups. However, as discussed in chapters one and two, similarity in iconography is not necessarily a good indicator of date or origin of the material. The way in which many textiles were collected, in excavations in the nineteenth and early twentieth centuries, where the primary goals were to find visually impressive objects that would satisfy investors, universities and museums in the west rather than academic study as would be understood today, means that scholars studying many of the textiles in collections have no immediate means of approximating either date or place of origin. This has further hindered the use of the actual material in studies outside the realm of art history.

As demonstrated in chapter two, advances in scientific analysis are increasingly opening new avenues for overcoming these problems, but are not yet in a place where they can be fully

implemented. Radiocarbon dating remains a destructive process, which gives pause to institutions considering whether to have samples of their textiles tested. Dye analysis has also been used for dating, but is of limited utility. Determining provenance is even more difficult; different means of analysis are being tested, but it is unknown if they will work on all fibres, and how useful the information they reveal will actually be. In textile studies more generally, several barriers keep the material from being used in larger historical studies. For many types of textiles, such as wool and linen, their ubiquity in the ancient world makes dealing with the material difficult without a defined framework.

Cotton, however, provides a way around many of these problems. Cotton as both a textile fibre and a commodity is very different from either linen or wool. It was not native to the regions of the Mediterranean, North Africa or the Middle East. In each case, it was introduced and then adopted by local populations. In all of these regions, the archaeology has demonstrated approximately when these events happened, and it is therefore possible to trace the diffusion of cotton throughout these regions in relative, if not definite, terms. Once the route of this diffusion is defined, the mechanisms can be explored. Cotton was an important fibre in the first millennium, but its presence in this time period has been largely relegated to a side note, rather than being given the social and economic consideration it deserves. What this study shows is that the reason for this is that the previous understanding of early cotton in the first millennium was wrong. Tracking the spread of cotton, and considering it both as a textile fibre as well as a commodity, reveals the dynamic nature of the economy in the regions discussed as they transitioned through changing socio-political and economic realities.

For decades, the prevailing narrative of cotton was that it was a product of India that became a luxury import into the Mediterranean during the Roman period, and spurred demand that resulted in limited amounts of local cultivation on the peripheries of the Roman empire to help meet this demand. Africa outside the North African province was never really considered as a source of anything other than occasional exotic curiosities and slaves, provided by mediator

societies which opened up the African interior to the Mediterranean. In the ‘Grand Narrative’ of late Roman and early medieval history the regions that acted as the intermediaries between the Roman world and sub-Saharan Africa existed only to serve this function; their socio-political fortunes therefore tracked those of their Roman neighbours to the North. The reasons for this, as detailed in chapter three, largely stems from the colonial legacies of both India, where cotton had first become an economic driver for the British East India Company and then the British Empire itself, and Africa which was seen as dangerous and impenetrable. It is also the result of the prevailing economic models that have been used to describe the Roman economy which have relied on Roman institutions as an organising principle. However, this was not the case of cotton. Cotton was not a luxury good, nor is there evidence that there was high demand in Roman urban centres. It was, however, still important within the context of its local economies, and in connecting regions along the peripheries of the Roman world. This study does not mean to imply that cotton was the cause for the development of these connections, but it serves as a marker to demonstrate that they were there.

Emphasising the local importance of production was the subject of chapter four. Here, the methodology ran into a problem in the evidence. As stated, it is difficult to parse the evidence of production based on fibre, particularly as there seems to have been significant overlap. However, the fact that there is significant evidence that cotton, the ‘wool from trees’, was treated as if it was actual wool, and that the textile industry was similar throughout large geographic regions, allows for an examination of the significance of the social production of textiles, which demonstrates an industry that was intricately embedded within the fabric of society. The evidence shows that there were multiple modes of production, from individuals, small workshops, monasteries, and large state-owned factories, and that the work force was highly specialised. Most importantly though, the textile industry was also at least one example where women were permitted to participate in the commercial economy, and it defied a traditional urban/rural production divide; different production steps were likely taking place in

different places. Therefore, given the importance of local textile production throughout society, the adoption of cotton in specific areas is highly significant, representing a shift that was driven not by a state, but by the people who were working within a dispersed and diversified industry.

The process of the adoption of cotton highlights this. African domesticated cotton, though not originating in Nubia, was cultivated there on a wide scale, and it is from Nubia that we have the most evidence of cotton use. The study of Nubia has long been tied to Egypt, with the assumption that Nubia's fortunes were subsumed by Egypt; Nubia was seen serving as a subsidiary kingdom to their neighbours to the north. While this was true, to varying degrees during various periods, there is also evidence that Meroitic Nubia was different. As argued in chapter five, the elites of Meroë dropped many of the visual associations with Egypt they had adopted, and began creating a material culture that was very different from both traditional Egyptian and Roman Egyptian forms. This was reflected in the textiles, most explicitly from the province of Lower Nubia. After the Romans left Lower Nubia in the early second century AD, cotton, which had been known but was not the dominant fibre type, rapidly became the principal textile fibre used, as evidenced by the findings at Qasr Ibrim. There is also evidence that the adoption of cotton became deeply ingrained; even after the fall of Meroë in the fourth century, cotton remained the most commonly used fibre. Therefore, it seems that cotton use had become a part of Nubian culture that was removed from any 'Roman' influence, and in light of the lack of evidence that there was a Roman demand for cotton, it is a sign of Nubian cultural independence.

Chapter six demonstrates one of the more interesting aspects of the diffusion of cotton through Africa, which is that it largely bypassed the Roman world and instead moved along desert routes through Africa (and as detailed in chapter seven, western Arabia), and presented several possibilities for the diffusion of cotton. While there is evidence of cotton at the Roman Red Sea Ports of Berenike and Myos Hormos in Egypt, much of it is almost certainly the result of maritime trade along the Indian Ocean, a combination of both Indian cotton and local African

cotton coming from the east coast of Africa and down the Nile from Nubia. It is also possible that at least some of this cotton was being produced in Arabia and being trade along the Red Sea by the Nabataeans. The evidence from these sites is formed entirely of finished textile products; there is no evidence that there was any type of processing or production going on at these sites. There is also no evidence that the cotton at these sites made it further inland.

The situation is very different in the oases of the Western Desert in Egypt, the oases of the Fazzān, and the city of Aksum. Not only have cotton textiles been found in these regions (with the exception of the Fazzān), but seeds have also been found. These are highly significant findings because they suggest that it was not just cotton textiles that were spreading, it was cotton cultivation as well, and cotton had truly begun the process of diffusion by the first century AD. Here I do not mean to suggest that each of these regions had independent trade relationships with Nubia. They may have, but there is not enough evidence to claim one way or another. But it is clear that they were functioning within overlapping pan-African networks, which were completely independent of the networks that were being used and promoted by the Roman world. Cotton cultivation may have entered the Fazzān first from sub-Saharan Africa, and spread from there, or it may have been introduced into both the Fazzān or Nubia from sub-Saharan Africa independently, meeting in Egypt's Western Desert. Further excavation, particularly in the Fazzān and at sites in Nubia outside the Nile Valley may help clarify this point. But what this chapter also shows that there was not a single network for cotton; India was trading cotton, but many communities in Africa were as well. The findings in Africa suggest that the Indian Ocean network has received too much emphasis, and that Africa had an equally important, if not more important, role in the diffusion of cotton.

This argument is strengthened in chapter seven, which proposes that the African network was responsible for the introduction of cotton into western Arabia. Arabia is a particularly significant region because it is where the two networks overlap. In east Arabia, perhaps most visibly on Bahrain island, cotton had clearly spread from the Indian coasts at an

early date, and this perhaps continued into Central Asia. But on the west coast, where there were already significant agricultural ties to the east coast of Africa, the earliest evidence of cotton—both textiles and seeds—come from roughly the same time period when cotton was diffusing into Egypt, Libya, and the Horn of Africa. From Arabia, it is possible that African cotton spread more widely, into the Levant, where cotton began making an early impact, and eventually into Europe. This has an additional impact on the Indian cotton narrative, in that it shows that cotton was already a diffuse material prior to the spread of Islam, and that the role the early Islamic empires played in the spread of cotton, rather than being part of an ‘agricultural revolution’ as proposed by Andrew Watson, was in its economic policies. While cotton may have been travelling from India with Arab traders, diffusion had occurred many centuries previously and cotton was becoming available throughout the new Islamic lands from a variety of locales. What changed is that it was becoming available in areas further removed from centres of cultivation, and in response the regional specialisation to another major fibre type, linen. Again, this reinforces the argument that the significant exchange networks were not the few long-distance maritime routes, but instead were many varied interregional networks. The movement of cotton in the first millennium was therefore much more complex than previously suggested.

The presence of two cotton networks sheds light on studies of other materials as well. In the conclusion of her own thesis, Darley wrote that while she suspected the intersection of east and west in the late Roman period was in the Persian Gulf, rather than the Red Sea, this was not yet provable through the archaeology, referring to the coins and ceramics which had been the bulk of her discussion.¹ The evidence of cotton from India entering eastern Arabia from the Gulf while on the west it derived from Africa, and at a much later date, may be a point of entry for this question. It suggests that Arabia was itself at the centre of multiple expansive

¹ Darley 2013, 385.

networks aligned by more than mere geography, but also ecology and adaption techniques that allowed for the development of agricultural strategies.

The full reach of African cotton at this point remains necessarily speculative. Until more samples from more diverse assemblages undergo DNA testing to determine species and isotopic testing to determine origin, the exact extent of both the Indian and the African cotton networks cannot be known. But there are steps that can be taken, directly examining the material. Analytical comparison of construction techniques, where apparent in the textile remains, opens the possibility of tracing influence in textile production. For example, one of the interesting characteristics of the cotton textiles from Qasr Ibrim is that they were woven on warp weighted looms, which required weaving from the top down, and resulted in particular ways of creating starting and finishing borders, and of weaving edges.² Taking collections of textile from known collections and creating comparative models that overlay multiple identifying criteria—such as construction technique and iconography—with evidence of the movement of cotton will ever clearer insight into the multiple networks along which cotton was moving.

² Wild and Wild 2014c, 218.

Appendix 1

Sites Referenced (Listed chronologically)

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Range	Reference/Notes
Baluchistan	Mohenjo Daro	Unknown	Textile	N/A	4th mil. BC	Moulherat et al. 2002
Caucus	Majkop	Funerary	Textile	N/A	4th mil. BC	Shishlina et al. 2003
Central Sudan	Afyeh	Domestic	Archaeobotanic	N/A	mid-late 4th mil. BC	Chowdhury and Buth 1970, 1971
Jordan	Dhuweila	Settlement	Imprint	N/A	4 th – 3 rd mil. BC	Betts et al. 1994
Caucus	Saphar-Kharaba	Funerary	Textile	55%	15th - 14th cent. BC	Kvavadze et al. 2010 Wool was likely the dominant fibre, but was preserved at a lower rate due to climate conditions
Mesopotamia	Nimrud	Funerary/Elite	Textile	~15%	8th cent. BC	Alvarez-Mon 2015
Caucus	Vani	Domestic	Textile	N/A	8 th – 1 st cent. BC	Chichinadze and Kvavadze 2013
Mesopotamia	Arrajân	Funerary/Elite	Textile	100%	7th - 6th cent. BC	Alvarez-Mon 2015
Arabia	Qal'at al-Bahrain	Domestic/Urban	Archaeobotanic	Seeds (minimal)	7th - 5th cent. BC	Bouchaud et al. 2011; Tengberg and Lombard 2001
Arabia	Qal'at al-Bahrain	Funerary/Elite	Textile	N/A	6th - 4th cent. BC	Højlund and Hellmuth 1994; Haerinck 2002
Mesopotamia	At-Tar Caves	Funerary	Textile	Minimal	3rd cent. BC - 3rd cent. AD	Fujii <i>et al.</i> 1989; Fujii and Sakamoto 1990; Matsumoto 1997

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Lower Nubia	Aksha	Funerary	Textile	~50%	late 1st cent. BC - 1st cent. AD	Vila 1967; Yvanez 2015
Lower Nubia	Qasr Ibrim	Domestic/Urban	Textile	Varies over time	1st cent. BC - 19th cent. AD	Adams 1987, 2000, 2007, 2013; Crowfoot 2011; Wild 2011; Wild and Wild 2006, 2008, 2009, 2014b
Lower Nubia	Qasr Ibrim	Domestic/Urban	Archaeobotanic	Present in nearly all contexts in the ancient city	1st cent. BC - 19th cent. AD	Wild et al. 2007, 2008; Clapham and Rowley-Conwy 2007, 2009
Caucus	Dedopolis Gora	Domestic/Palace	Textile	58%	until 1st cent. AD	Kvavadze and Gagoshidze 2008 Wool was likely the dominant fibre, but was preserved at a lower rate due to climate conditions
Iran	Shar-I-Qumis	Funerary	Textile	Minimal	1st cent. AD	Kawami 1992 Cotton was found lining the shoulder and neckline of a felted wool tunic
Lower Nubia	Shablul	Funerary	Textile	N/A	Roman	Yvanez 2015
Central Sudan	Muweis	Domestic/Village	Archaeobotanic	Seeds	1st - 2nd cent. AD	Bouchaud et al. 2018
Syria	Palmyra	Funerary	Textile	~12	1st - 2nd cent. AD	Stauffer 2000 42 items containing cotton were found, both z-spun and s-spun

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Egypt- Eastern Desert	Berenike	Urban Port	Textile	~50%	1st - 2nd cent. AD; late 4th - early 6th cent. AD	Wild 1997, 2006; Wild and Wild 1996, 1998, 2000, 2004, 2007, 2014a There were rough equal proportions of z-spun and s-spun cotton textiles in the late Roman contexts; s-spun is more rare in the early Roman contexts
Egypt- Eastern Desert	Myos Hormos	Urban Port	Textile	N/A	1st - 3rd cent. AD	Eastwood 1982; Handley 2011
Arabia	Hegra	Funerary/Elite	Textile	>10%	1st - 3rd cent AD	Bouchaud et al. 2011; Bouchaud 2015a
Jordan	Khirbet Qazone	Funerary	Textile	~7%	1st - 3rd cent AD	Granger-Taylor 2006 A single child's tunic was discovered
Central Sudan	Western cemetery of Meroë	Funerary	Textile	~80%	1st - 4th cent. AD (??)	Massey, 1923; Dunham, 1963; Clapham and Rowley-Conwy 2009 Very few textiles were found in any context
Lower Nubia	Karanog	Funerary	Textile	100%	1st - 4th cent. AD	Woolley and Randall-Maciver 1910; Griffith and Crowfoot 1934; Clapham and Rowley-Conwy 2009
Upper Nubia	Island of Sai	Funerary/Elite	Textile	72%	1st - 4th cent. AD	Yvanez 2011/2012, 2015

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Egypt- Western Desert	Qasr el-Sumayra (Kharga)	Domestic/Village	Archaeobotanic	Seeds	1st - 4th cent. AD	Ikram and Rossi 2007
Arabia	Hegra	Domestic/Urban	Archaeobotanic	Seeds	1st - 4th cent. AD	Bouchaud et al. 2011; Bouchaud 2015a
Central Sudan	Hamadab	Domestic/Village	Archaeobotanic	Seeds	late 1st - 4th cent. AD	Fuller 2014
Lower Nubia	Ashkeit	Funerary	Textile	~10%	Late Nubian	Bergman 1975 Cotton textiles were identified in 1 of 12 tombs, broadly dated to after 100 AD, wool was the dominant fibre
Central Sudan	Gabati	Funerary	Textile	N/A	Meroitic	Mallinson 1994
Egypt- the Fayyum	Karanis	Urban	Textile	<1%	2nd - 3rd cent. AD; 4th - 5th cent. AD	Wilson 1933; Batcheller 2002 3 fragments were dated to the 2nd to 3rd centuries, and a single skein of yarn was dated to the 4th or 5th century
Upper Nubia	Sedeinga	Funerary	Textile	~20%	2nd - 4th cent. AD	Yvanez 2015
Egypt- Western Desert	Kellis (Dakhla)	Domestic/Village	Textile	<50%	2nd - 4th cent. AD	Livingstone 2007, 2009

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Syria	Bosra	Domestic/Village	Archaeobotanic	Seeds	2nd - 4th cent. AD	Bouchaud 2015a
Lower Nubia	Jebel Adda	Funerary	Textile	~50%	2nd - 5th cent	Watson 1977; Gevers 1990; Wild et al. 2008; Yvanez 2015 The presence of cotton gradually gives way to animal hair fibres in the post-Meroitic period, but cotton does not disappear. Yvanez 2015, 124-125.
Lower Nubia	Ballana	Funerary	Textile	Decreases over time	2nd - 7th cent. AD	Mayer Thurman and Williams 1979; Williams 1991
Lower Nubia	Qustul	Funerary	Textile	Decreases over time	2nd - 7th cent. AD	Mayer Thurman and Williams 1979; Williams 1991
Lower Nubia	Sahaba	Funerary	Textile	~15%	2nd - 7th cent. AD	Bergman 1975 Cotton textiles were identified in 2 of 9 tombs, wool was the dominant fibre
Upper Nubia	Semna South	Funerary	Textile	>50%	Meroitic - Christian periods (2nd - 9th cent. AD)	Žabkar and Žabkar 1982; Yvanez 2015 As at Aksha, distinction was not made between linen and cotton in the preliminary report, and while a more comprehensive report on the textiles written by Joanne Segal Brandford of the Peabody Museum is referenced, it was never published. Cotton confirmed in Yvanez 2015.

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Fazzān	Jarma	Domestic/Urban	Archaeobotanic	Seeds	2nd - 9th cent. AD	Pelling 2005, 2007, 2008, 2015 Although not present in high densities, they were present in most samples taken
Egypt-Western Desert	Trimithis (Dakhla)	Domestic/Village	Archaeobotanic	Seeds	3rd cent. AD	Thanheiser and Walter 2015; Boozer 2015a, 2015c
Egypt-Western Desert	Trimithis (Dakhla)	Domestic/Village	Textile	50%	3rd cent. AD	Boozer 2015d Only two textile fragments were found, but one of them was cotton
Syria	Dura-Europos	Domestic	Textile	N/A	3rd cent. AD	Pfister and Bellinger 1945 Fragments found were interpreted as part of a tent
Egypt-Western Desert	Ayn Umm Dabadib (Kharga)	Funerary	Textile	~14%	3rd - 4th cent. AD	Jones and Oldfield 2006
Egypt-Western Desert	Ayn Umm Dabadib (Kharga)	Domestic	Archaeobotanic	N/A	3rd - 4th cent. AD	Jones and Oldfield 2006
Aksum	Aksum City	Funerary	Archaeobotanic	Seeds	3rd - 4th cent. AD	Phillipson 2000

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Lower Nubia	Wadi Qitna/Kalabsha South	Funerary	Textile	~33%	3rd - 5th cent. AD	Strouhal 1984; Clapham and Rowley-Conwy 2009 When combinations of cotton and wool are included, the proportion increases to ~38%. Proportions of cotton were about equal in each cemetery.
Egypt-Western Desert	Kellis (Dakhla)	Domestic/Village	Archaeobotanic	Capsuls, seeds and bolls	3rd - 5th cent. AD	Thanheiser and Bagnall 1997; Thanheiser 2002; Clapham and Rowley-Conwy 2009
Egypt-Western Desert	El-Deir (Kharga)	Funerary	Textile	N/A	3rd - 5th cent. AD	Letellier-Willemin 2011; Gradel et al. 2012; Clapham and Rowley-Conwy 2009 Cotton was identified in the mummy wrappings in the cemetery, but were not quantified
Gulf of Aqaba	Aila	Domestic/Urban	Archaeobotanic	Seeds	Late Roman through Abbasid periods	Ramsay and Parker 2016 4 seeds were identified in late Roman contexts, 3 in Byzantine, 1 in Umayyad and 1 in Abbasid. There were an additional 50 that could not reliably be associated with a specific context
Egypt-Western Desert	Kysis (Kharga)	Funerary	Archaeobotanic	Seeds, capsules, twigs	4th cent. AD	Gradel et al. 2012

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Egypt-Western Desert	Kysis (Kharga)	Funerary	Textile	N/A	4th cent. AD	Dunand et al. 1992, Gradel et al. 2012
						Only a few fragments of dessicated cotton were noted
Egypt-Western Desert	El-Deir (Kharga)	Domestic/Village	Archaeobotanic	Seeds and bolls	4th cent. AD	Gradel et al. 2012
Israel	Rogem Zafir	Domestic/Village	Textile	N/A	4th cent. AD	Shamir 2001, 2007
						Only a single fragment was found
Aksum	Aksum City	Urban	Inscription		c. 350 AD	Clapham and Rowley-Conwy 2009
Upper Nubia	Abka	Funerary	Textile	~17%	4th - 6th cent. AD	Bergman 1975
						The only example of cotton from 3 tombs was composed of a cotton warp and wool weft, wool was the dominant fibre
Caucusus	Tsitamuri	Funerary	Textile	<50%	4th - 6th cent. AD	Kvavadze et al. 2008
Egypt-Eastern Desert	Abu Sha'ar	Fort	Textile	~3%	4th - 7th cent. AD	Bender Jørgensen 2004, 2006, 2007, 2018
						14 fragments of cotton (2% of total assemblage) were identified in phase 1 of the site and 21 (7%) in phase 2

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Central Asia	Merv	Domestic/Urban	Textile	Seeds	4th - 7th cent. AD	Herrmann and Kurbansakhatov 1994 1995; Herrmann et al. 1993, 1996, 1997, 1998, 1999
Lower Nubia	Serra East	Funerary	Textile	~3%	associated artefacts date 4th - 7th cent AD, 10th cent; possibly as early as 2nd century	Bergman 1975 Wool was the dominant fibre type in graves from all period (2nd - 10th cent. AD), 3 of 6 cotton textiles were from X-Group burials (400 - 600 AD), 2 of 6 were broadly dated to after 100 AD
Aksum	Kidane Mehret	Domestic/Urban	Textile	N/A	5th - 6th cent. AD	Phillipson 2000 Organic material is rarely preserved at Aksumite sites, but fragments of charred cotton were identified
Aksum	Kidane Mehret	Domestic/Urban	Archaeobotanic	Seeds	5th - 7th cent. AD	Phillipson 2000
Syria	Zenobia	Domestic	Textile	N/A	6th cent. AD	Pfister 1951 A single cotton tunic was found
Israel	En-Boqeq	Fort	Textile	18%	7th cent. AD	Sheffer and Tidhar 1991
Palestine	Nessana	Domestic	Textile	>50%	7th cent. AD	Bellinger 1962

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Jordan	Deir 'Ain 'Abata	Domestic/ Monastery	Textile	<50%	7th - 8th cent. AD	Granger-Taylor 2012
Niger	Mammanet	Funerary	Textile	N/A	7th - 8th cent. AD	Paris 1996
Israel	Nahal 'Omer	Midden	Textile	<60%	7th - 9th cent. AD	Shamir and Baginski 2014
Israel	En Marzev	Domestic	Textile	Minimal	7th - 9th cent. AD	Shamir 2016a
Israel	'En 'Avrona	Domestic	Textile	Minimal	7th - 9th cent. AD	Shamir 2016a
Egypt- Fustat	'Ayn al-Sira	Funerary	Archaeobotanic	Wads of raw cotton	8th - 9th cent. AD	Gayraud et al. 1994
Israel	Qasr el-Yahud	Monastery/Hospital Mass Burial	Textile	~34%	8th - 9th cent. AD	Shamir 2001, 2015
Euphrates Valley	Shheil	Domestic	Archaeobotanic	1 seed	8th - 9th cent. AD	Samuel 2001
Euphrates Valley	Dībā	Domestic	Archaeobotanic	7 seeds	8th - 9th cent. AD	Samuel 2001
Morocco	Volubilis	Domestic	Archaeobotanic	N/A	9th cent. AD	Pelling 2014

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Israel	Qarantal Cave 38	Storage	Textile	~58%	9th - 13th cent. AD	Baginski 2001; Shamir and Baginski 2012 A further 28% were composed of mixed cotton and linen threads
Euphrates Valley	Tell Guftān	Domestic	Archaeobotanic	N/A	10th - 13th cent. AD	Samuel 2001
Mali	Essouk	Domestic	Textile	Minimal	c. AD 950 - 1100	Nixon 2009
Mali	Dia (Shoma and Mara)	Domestic	Archaeobotanic	N/A	11th cent. AD (possibly as early as the 6th)	Murray 2005, Arazi 2005, Schmidt and Bedaux 2006
Senegal	Ogo	Domestic	Archaeobotanic (Pollen)	N/A	11th cent. AD	Chavane 1985, Arazi 2005
Niger	Tellem Caves	Domestic	Textile	N/A	11th - 12th cent. AD	Bedaux and Bolland 1980; Bolland 1991
Egypt-Eastern Desert	Quseir el Qadim	Urban Port	Archaeobotanic	2 seeds	11th - 12th cent. AD	Van der Veen 2011
Egypt-Eastern Desert	Quseir el Qadim	Urban Port	Textile	N/A	11th - 13th cent. AD	Handley 2011

Region	Site name	Context	Evidence Type	Proportion/Scale	Date Ranges	Reference/Notes
Euphrates Valley	Qasr Medād	Domestic	Archaeobotanic	Seeds and bolls	12th cent. AD	Samuel 2001
						189 seeds and 41 bolls were found within a single hearth
Mali	Essouk	Domestic	Archaeobotanic	N/A	12th cent. AD	Nixon 2009
Indian Ocean-Island	Jasirat Fara'un	Trading outpost	Textiles	<50%	12th cent. AD	Baginski 2001

Appendix 2

Papyri and Ostraka Referenced (Information from papyri.info or publications listed in the *Checklist of Editions*)

Papyri Referenced						
Papyrus number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
BGU 2.617	AD 216	Soknopaiu Nesos	Soknopaiu Nesos (?)	Payment of Tax		
BGU 3.948	4th-5th cent. AD	Herakleopolis	Unknown	Letter from Kophaëna to Theodoulos		
BGU 7.1564	AD 138	Philadelphia	Philadelphia	Requisition of Clothing		
BGU 7.1615	AD 84	Philadelphia	Philadelphia	List of Weavers in Philadelphia		
Pap.Choix.13	after AD 127	Unknown	Unknown	Letter from Senpikos to Melas		SB 5.7737
P.Bodl.Arab.2	9th cent. AD (?)	Unkown	Unknown	Business Letter		Arabic
P.Brem.59	AD 113-120	Hermopolite nome	Hermopolite nome	Letter from a Woman to Apollonios	Apollonios <i>strategos</i>	
P.Brem.63	AD 116-117	Hermopolite nome	Hermopolite nome	Letter from Eudaimonis to Aline	Apollonios <i>strategos</i>	C.Pap.Jud.2.442; SB 1.4515
P.Coll.Youtie 1.36	AD 184	Soknopaiu Nesos	Soknopaiu Nesos	Receipt for Weaver's Tax		
P.Dubl.31	AD 355	Panopolis	Panopolis	Lease of a Linen Weaving Shop	Descendants of Alopex	
P.Fouad.77	2nd cent. AD	Unknown	Unknown	Letter to Dionysios		
P.Giss.Univ.3.32	3rd-4th cent. AD	Unknown	Unknown	Letter from Eusebios to Aphroditarion		P.Giss.Bibl.3.32

Papyrus number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
P.Graux.30.col.7	AD 155	Krokodilopolis	Krokodilopolis	Receipt for the Payment of Grain and Transport Fees	Public Bank of Arsinoe (Krokodilopolis)	An opisthograph over 7m. long, fragments of which have been published under P.Berl.Frisk 1; SB 5.7515; BGU 13.2270; BGU 13.2271
P.Heid.4.326	AD 98	Ankyron	Ankyron	Apprentice Contract		
P.Heid.4.327	AD 99	Ankyron	Ankyron (?)	Apprentice Contract		
P.land.7.142 *	AD 164-165	Kharga Oasis	Kharga Oasis (Kysis?)	Account of Local Farms		
P.Kell.1.12	4th cent. AD	Kellis	Unknown	Letter from Samun to Tithoes		
P.Kell.1.61 *	4th cent. AD	Kellis	Kellis (?)	List of Money in Arrears		
P.Köln.3.151	AD 423	Kynopolite nome	Kynopolite nome	Loan and Purchase Agreement		
P.Laur..3.75	AD 574	Hermopolis	Oxyrhynchos	Interest on a loan		
P.Lips.1.26	AD 300-325	Hermopolis	Unknown	Record of Inheritance		
P.Lond.2.257	AD 94-95	Krokodilopolis	Philadelphia	Poll Tax List		
P.Lond.3.928 *	3rd cent. AD	Unknown	Unknown	List of Expenses		
P.Lund.4.14	AD 275-299	Narmuthis	Unknown	List of Expenses		SB 6.9350
P.Margoliouth Monneret 4	11th cent. AD (?)	Aswan	Aswan (?)	Business Account		Arabic
P.Mert.3.114	AD 175-199	Arsinoite nome	Unknown	Letter from Achillas		
P.Meyer.23	AD 375-399	Unknown	Unknown	Private Letter		

Papyrus number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
P.Mich.3.170	AD 49	Oxyrhynchos	Oxyrhynchos	Registration of an Apprentice	Pausiris son of Pausiris the Weaver	
P.Mich.3.171	AD 58	Oxyrhynchos	Oxyrhynchos	Registration of an Apprentice	Pausiris son of Pausiris the Weaver	
P.Mich.3.172	AD 62	Oxyrhynchos	Oxyrhynchos	Registration of an Apprentice	Pausiris son of Pausiris the Weaver	
P.Mich.5.243	c. AD 14-37	Tebtynis	Tebtynis	Guild Ordinances	Kronion son of Apion	
P.Mich.5.244	AD 43	Tebtynis	Tebtynis	Guild Ordinances	Kronion son of Apion	
P.Mich.5.346a	AD 12-13	Tebtynis	Tebtynis	Apprenticeship of a Weaver	Kronion son of Apion	
P.Mich.8.466	AD 107	Karanis	Bostra*	Letter from Iulius Apollinarius to his father Iulius Sabinus	Iulius Sabinus and Iulius Apollinarius	C.Pap.Jud.3.486b, P.Mich.inv.5903
P.Mich.8.487	c. AD 100-147	Karanis	Rome*	Letter from Iulius Apollinarius to Sempronius	Iulius Sabinus and Iulius Apollinarius	P.Mich.inv.5825
P.Mich.8.500 *	c. AD 100-147	Karanis	Unknown	Letter from Rullius to Iulius Apollinarius	Iulius Sabinus and Iulius Apollinarius	P.Mich.inv.5638
P.Mich.14.684	5th-6th cent. AD	Unknown	Unknown	Reciept for Garments		P.Mich.inv.1050
P.Neph.48	AD 323	Phathor	Phathor	Sale of a House		
P.Oxy.1.103	AD 316	Oxyrhynchos	Oxyrhynchos	Lease of Land	Leonides son of Theon	P.Lond.3.767
P.Oxy.2.275	AD 66	Oxyrhynchos	Oxyrhynchos	Apprentice Contract	Tryphon the Weaver	P.Lond.3.794; Sel.Pap.1.3; Jur.Pap.42

Papyrus number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
P.Oxy.4.725	AD 183	Oxyrhynchos	Oxyrhynchos	Apprentice Contract		Sel.Pap.1.14; C.Pap. Hengstl 102
P.Oxy.8.1130	AD 484	Oxyrhynchos	Senokomis	Record of a Loan of Money		
P.Oxy.8.1142	AD 275-299	Oxyrhynchos	Unknown	Order of Purchases to Achillis		
P.Oxy.12.1411	AD 260	Oxyrhynchos	Oxyrhynchos	Proclamation of a Strategos		Sel.Pap.2.230; Jur.Pap.73
P.Oxy.12.1414	AD 271-272	Oxyrhynchos	Oxyrhynchos	Report of Proceedings of the Senate		
P.Oxy.14.1647	AD 175-199	Oxyrhynchos	Oxyrhynchos (?)	Apprenticeship to a Weaver		
P.Oxy.14.1679	3rd cent. AD	Oxyrhynchos	Unknown	Letter from Apia to Serapias about clothing		
P.Oxy.31.2585	AD 315	Oxyrhynchos	Oxyrhynchos	Lease of Fallow Land	Leonides son of Theon	
P.Oxy.31.2593	2nd cent. AD	Oxyrhynchos	Unknown	Letter from Apollonia to Philetos and Herakleides		
P.Oxy.31.2599	3rd-4th cent. AD	Oxyrhynchos	Unknown	Letter from Tauris		
P.Oxy.36.2760	c. AD 179-180	Oxyrhynchos	Alexandria (?)	Petition to a Prefect		
P.Oxy.41.2977	AD 239-240	Oxyrhynchos	Oxyrhynchos	Apprentice Contract		
P.Oxy.45.3255	AD 315	Oxyrhynchos	Oxyrhynchos	Lease of Land	Leonides son of Theon	P.Coll.Youtie 2.80
P.Oxy.45.3256	AD 317-318	Oxyrhynchos	Oxyrhynchos	Application for Lease	Leonides son of Theon	
P.Oxy.45.3257	AD 318	Oxyrhynchos	Oxyrhynchos	Application for Lease	Leonides son of Theon	

Papyrus number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
P.Oxy.45.3258	AD 319	Oxyrhynchos	Oxyrhynchos	Application for Lease	Leonides son of Theon	
P.Oxy.45.3259	AD 319	Oxyrhynchos	Oxyrhynchos	Lease of Land	Leonides son of Theon	
P.Oxy.45.3260	AD 323	Oxyrhynchos	Oxyrhynchos	Sub-lease of Land	Leonides son of Theon	
P.Oxy.45.3261	AD 324	Oxyrhynchos	Oxyrhynchos	Contract of Guild Recruits	Leonides son of Theon	
P.Oxy.45.3262	AD 328	Oxyrhynchos	Oxyrhynchos	Receipt (?)	Leonides son of Theon	
P.Oxy.50.3595	AD 243	Oxyrhynchos	Senephta	Lease of Pottery Workshop		
P.Oxy.51.3617	3rd cent. AD	Oxyrhynchos	Oxyrhynchite nome (?)	Wanted Notice for Runaway Slave		
P.Oxy.56.3855	c. AD 280-281	Oxyrhynchos	Unknown	Thermuthion to Isidorus		
P.Oxy.56.3860	AD 375-399	Oxyrhynchos	Unknown	Taesis to Tiron		
P.Oxy.59.3991 *	2nd-3rd cent. AD	Oxyrhynchos	Unknown	Sarapias to Ischyron		
P.Oxy.67.4596	AD 232 or 264	Oxyrhynchos	Oxyrhynchos	Apprentice Contract		
P.Oxy.72.4918	c. AD 494-496	Oxyrhynchos	Oxyrhynchos	Loan of Money with Interest in Kind		
P.Oxy.Hels.40	after 3rd cent. AD	Oxyrhynchos	Oxyrhynchite nome (?)	Account of a Laundry (?)		
P.Rein.2.118	AD 275-299	Unknown	Unknown	Letter to Thatous from his daughter (?)		
PSI 3.241	3rd cent. AD	Antinoopolis	Antinoopolis	Didaskalike		

Papyrus number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
PSI 4.341	256 BC	Philadelphia	Arsinoite nome (?)	Apollophanes and Demetrios to Zenon	Zenon son of Agrephon	C.Pap.Hengstl 103
PSI 5.469	AD 334	Oxyrhynchos	Oxyrhynchos	Lease of Land	Leonides son of Theon	
PSI 6.599	263-229 BC	Philadelphia	Arsinoite nome (?)	The Workshop of Zenon	Zenon son of Agrephon	
PSI 9.1055	AD 265	Arsinoite nome	Arsinoite nome (?)	Tax Reciept		
P.Tebt.2.413	2nd-3rd cent. AD	Tebtynis	Unknown	Letter of Aphrodite		
P.Vindob.G.40822 *	AD 125-175	Uknown	Unknown	Customs Declaration in Connection with a Loan		Muziris Papyrus; SB 18.13167
P.Wisc.1.4	AD 53	Unknown	Oxyrhynchos	Apprenticeship of a Weaver	Pausiris son of Pausiris the Weaver	
P.Wisc.1.5	AD 185	Unknown	Oxyrhynchos	Lease of a Slave to a Weaver		
SB 5.7572	Early 2nd cent. AD	Philadelphia	Unknown	A Daughter Reports on her Pregnancy and Other Matters	Thermouthas' Family	P.Mich.inv.188
SB 6.9025 *	2nd cent. AD	Oxyrhynchite nome ?	Unknown	Letter from Herakleides to Horion		P.Mich.inv.3630
SB 6.9026 *	2nd cent. AD	Unknown	Unknown	Letter from Areskoussa to Herakles		P.Mich.inv.1648
SB 10.10759	AD 33-34	Krokodilopolis	Krokodilopolis	Census Return of Brothers		P.Mich.inv.124
SB 14.11881	4th cent. AD	Unknown	Unknown	Letter from Allous to Faustina		P.Mich.inv.430
SB 14.12140	4th cent. AD	Unknown	Unknown	Order for Nonna		P.Corn.29

Papyrus number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
SB 16.12314	after AD 130	Oxyrhynchos	Oxyrhynchos	Account of Ophellios		P.Mich.inv.1933
SB 18.13305	AD 271	Arsinoite nome	Karanis, Herakleidou Meris, or Krokodilopolis (?)	Apprentice Contract		P.Mich.inv.5191
SB 24.15901	c. AD 299-300	Kellis	Kellis	Petition for Breach of Contract		P.Kell.1.19a
SB 26.16580	AD 362-363	Herakleopolis	Herakleopolis	Lease of Part of a House and Workshop		P.Corn.inv.2.43
Stud.Pal.20.53	AD 246	Herakleopolis	Herakleopolis	Lease of a Workshop		SPP 20.53
Stu.Pal.22.40	AD 150	Soknopaiu Nesos	Soknopaiu Nesos	Apprentice Contract	Segathis Daughter of Satabous	SPP 22.40
Ostraka Referenced						
Ostraka number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
KSB 1.045	8th century AD	Western Thebes (?)	Western Thebes (?)	Apprentice Contract		Coptic, SB Kopt. 1.045
O.Douch 1.51 *	AD 350-399	Douch (Kharga)	Douch (?)	List of Women Spinners and Weavers		
O.Douch 4.381 *	AD 350-399	Douch (Kharga)	Douch (?)	Requisition of Garments for the Military		

Ostraka number	Date	Provenance	Origin	Subject	Archive	Inventory number/Reprinted number/Notes
O.Douch 5.537 *	AD 350-399	Douch (Kharga)	Douch (?)	Accounts		
O.Douch 5.634 *	AD 350-399	Douch (Kharga)	Douch (?)	Private Letter		
O.Kell.68 *	AD 271	Kellis	Kellis	Reciept for Cotton		
O.Kell.69 *	AD 276-277	Kellis	Kellis	Reciept for Cotton		
O.Mich.1.2	2nd-1st cent. BC	Unknown	Unknown	Account of Money		
O.Trim.38 *	c. AD 350-370	Trimithis	Trimithis (?)	Account of Cotton		
O.Trim.44 *	c. AD 350-370	Trimithis	Trimithis (?)	Account of Cotton		
O.TT 29.61	8th century AD	Monastery of Epiphanius	Monastery of Epiphanius	Receipt of payment	Frangé	
O.Waqfa 66	AD 350-399	Ain Waqfa	Ain Waqfa	Account		
P.Mon.Epiph.85	7th cent AD	Memnoneia	Memnoneia	Sale of Flax		Coptic

* indicates mentions of cotton

Appendix 3

A Note on Spin-Direction

One of the biggest issues facing textile historians is how one determines the origin of a particular textile. Textiles were produced for both local and commercial purposes, often travelling long distances to be sold or given as gifts. In the absence of text that assigns a specific location as the place of textile manufacture (this becomes more common in the Islamic period with the increasing use of *tiraz* textiles), or even provenance, it has often come down to iconography and evidence of spinning and weaving technology. One of the most cited of these characteristics has been the spin-direction of the threads, which, in the Mediterranean represents two distinct spinning traditions suited to the particular textile types used in each region. In the southern Mediterranean areas of Egypt and Nubia, where linen had long been the predominant textile type, the majority of textiles found have s-spun thread, or a left leaning spin-direction, while in the northern and eastern regions of the Mediterranean, where both wool and flax were being spun, the spin-direction of the yarns have tended to be z-spun, or right leaning.¹ Textiles from the subcontinent also exhibit z-spun threads,² although the lack of finds of archaeological textiles due to the climate of the region means this has been based on a much smaller dataset. Because it was assumed that spinning was a deeply rooted tradition resistant to change, spin-direction has been widely accepted in the field of textile studies as indications of where a textile originated from.

The reasons for the variance in spin-direction were two-fold. First was the fact that certain fibres have a natural twist when wet that may have encouraged spinning in one direction or the other. For example, when damp linen tends to curl to the left (s-spin) while cotton and hemp tend to curl to the right (z-spin).³ This was proposed as the reason for the seeming

¹ Barber 1991, 65-6.

² Barber 1991, 65-6.

³ Bellinger 1962, 6-10; Barber 1991, 66.

uniform adoption of the s-spun tradition in Egypt and z-spun tradition in India. However, this does not explain the apparent uniformity in the spinning of wool, which exhibits no tendency to curl in either direction. The tendency towards z-spun yarns in regions where wool was the dominant fibre has been explained as the result of technology combined with right-hand dominance; the vast majority of people are right-handed and the uniformity of spin-direction might have been the result of left-handed people adapting to the way a right-handed person would handle a spindle.⁴ Therefore, the resulting differing spin dominances observed between Egypt (and Nubia) and the rest of the Mediterranean was a consequence of fibre and tradition. Barber also attributed the difference in spin-direction to the technology being used: in Egypt, images of linen production show spinners rolling spindles with the whorl attached to the top (high-whorl) down the thigh with the right hand, resulting in an s-spun yarn; European and Indian spinners, in contrast, attached the whorls at the bottom of the spindle, spinning with a twist to the right resulting in a z-spin.⁵ However, it has since been shown that the placement of the whorl has no bearing on the direction of spin.⁶

In many instances, indications of technological variance support the assumption that textiles with z-spun yarns did not originate in Egypt. A study of 94 fragments from 74 taqueté textiles from Maximianon, Krokodilô and Didymoi found several fragments with z spun warp and weft threads that displayed features more commonly found in textiles from Central Asia, such as the weave direction and ordering of the warp and weft threads.⁷ It has also been proposed that some of the patterns displayed on these textiles indicate an origin outside of Egypt,⁸ although as many scholars have noted, transmission, imitation, and adaptation of motifs

⁴ Barber 1991, 67.

⁵ Barber 1991, 67.

⁶ Langgut *et al.* 2016, 974-975

⁷ Verhecken-Lammens 2007, 205.

⁸ Such as the double palmette motif which originated outside of Egypt. Pfister 1948, 56-57.

was common in textile production.⁹ As a result caution should be exercised when using either criteria for establishing the origin of a textile.

This is also true for the utilisation of spin-direction. In the course of this study, I have found that addressing spin-direction alone when discussing origin of textiles does not adequately account for the variations and spatial deviation found in the textiles of Egypt, Nubia and the surrounding regions. I would therefore propose that spin-direction should only be used in conjunction with other technical criteria when discussing production origin. In particular, examples where threads exhibiting different spin-direction have been used within a single textile, or where threads of the non-local tradition are found but without evidence of links to other regions where it would have been local, complicate strict delineations.

The port cities on the Red Sea would seem to represent the most straight forward application of the spin-direction rule. At Berenike, just under half of the assemblage recovered were z-spun while the other half were s-spun; the z-spun were interpreted as being from India and the s-spun as being local Egyptian products.¹⁰ At Myos Hormos, a large proportion of the cotton textile fragments were z spun.¹¹ At Abu Sha'ar, the majority of the textiles were s-spun with some z-spun and even a few mixed (with the warp and weft threads twisting in different directions).¹² There is also evidence of z-spun textiles found at Mons Claudianus, which was located much further inland from the previous three cities, but these have not yet been identified as cotton.¹³ It has since been suggested that the s-spun cottons found at these sites could have also come from Nubia, either up the Nile,¹⁴ or potentially via trade with Aksum on the Red Sea.¹⁵ As all the sites mentioned above are either known Red Sea ports or inland trading

⁹ See Galliker 2014, 10-11 for a summary of studies.

¹⁰ Wild 1997, 287-292.

¹¹ Eastwood 1982, 302-4.

¹² Bender Jørgensen 2006, 169.

¹³ Bender Jørgensen 2006, 169.

¹⁴ Wild *et al.* 2008 145; Hatke 2013, 27.

¹⁵ Hatke 2013, 27 argues there is no evidence for trade between Aksum and Roman Egypt. Evidence to refute this is discussed in chapter six.

partners of these ports, and it is known Indian goods were being traded at the sites, it is possible that the z-spun textiles originated in India. However, this does not explain the mixed direction textiles identified at Abu Sha'ar, nor does it take into account z spun textiles found in the more remote regions of Roman Egypt.

Z-spun cottons are also found at sites outside the Eastern Desert. At Qasr Ibrim, most of the cotton yarns recovered were s-spun, but about fifteen percent were z-spun; however, excavators felt that the site was so far from a port that it was unlikely items from India were being traded there,¹⁶ and the z-spun cotton found at Qasr Ibrim was probably not originally from India.¹⁷ At the habitation levels of Kellis, all of the cotton recovered was z-spun, as were many of the wool and hemp textiles found; all the linens were s-spun.¹⁸ Not only is it significant here that all of the cottons are z-spun, but also that the wool and hemp were. This could represent the importation of a new spinning tradition, or different spinning techniques being adopted based on fibre. In comparison, all the cotton textiles recovered from Kharga were s-spun.¹⁹ If the rule that all z-spun textiles represented an Indian or northern Mediterranean origin were applied, it would mean that a high percentage of the non-linen textiles from Kellis in the Dakhla Oasis were not locally produced while those from the Kharga Oasis were. This seems unlikely as Kharga, the largest of the oases, was not only geographically closer to the Nile Valley, where goods imported by the oases would likely be passing through, but also had closer trade and administrative links.²⁰ If cotton from India was making its way to Dakhla, it could be assumed that it was also making its way to Kharga as well. The fact that there are so few

¹⁶ Wild and Wild, 2006, 19.

¹⁷ Wild *et al.* 2008, 146.

¹⁸ Bowen 2002, 87, 89; Livingstone 2009.

¹⁹ Jones and Oldfield 2006, 27.

²⁰ In documents the routes from the Nile Valley to the Kharga Oasis are described as ὁδός (road) while the routes from the Dakhla Oasis to the Arsinoite nome are described as ἵχνος (footpath) indicating that those to Kharga were larger and considered more important. Adams 2007, 30-1.

examples of cotton in the Nile Valley outside of the Fayyum, z-spun or otherwise, also indicates that it is unlikely cotton from outside of Egypt was being transported to the oases.

Further archaeological evidence seems to contradict the conclusion of imported textiles. As previously mentioned, cotton bolls and seeds were also excavated from Kellis, indicating local cultivation, as well as loom weights and spindles, indicating processing and weaving.²¹ A more probable explanation of the different spin-directions is that they simply represent the adoption of different spinning traditions, and that while the characteristics of flax fibres while damp might explain the uniformity of spin-direction found in linen, this does not necessarily mean that all fibres were spun in the same way. We know that cotton spinners were experimenting in the treatment of cotton fibres, with the earliest textile examples exhibiting threads where cotton and wool were spun together.²² It is also possible that spinners were experimenting with technique, especially as expanding trade networks meant that not only were new goods increasingly being introduced to new areas but also people and technologies, or that left-handed spinners were not adapting to the right-handed technique. A further intriguing possibility, though admittedly one that adheres to the conventional wisdom of spin-direction, is that the z-spun textiles came from the western Sahara. In his analysis of two wool textile fragments from Zinkekra, John Peter Wild noted that they were z-spun, indicating the development of a spinning tradition independent of Egypt and Nubia.²³ However, this requires more research.

On the basis of the above accumulated evidence, I would propose that spin-direction can no longer be taken as a reliable means of establishing the origin of textiles, and should be used with caution. Instead, spin-direction should be considered in conjunction with documentary and archaeological evidence of production and trade to determine origin and examine the movement of textiles.

²¹ Bowen 2002, 87.

²² Clapham and Rowley-Conwy 2009, 890.

²³ Wild 2010.

Appendix 4

Production: Looms and Dyes

A. Looms used

There were three—possibly four—basic looms used in the Roman world, although discussion of transmission and progression of loom technology is complicated by the fact that different looms were in use at different times throughout the different regions. The ground loom consisted of two beams affixed to the ground (hence the name) with the warp threads mounted between the two beams and two rods separating the warps for the shed (where the weft passes through the warp to make the established pattern) [fig. A.1]. It was in use in Egypt from at least the Neolithic period,¹ and are known from depictions in tombs and models included in funerary goods [fig. A.2], but there are no Roman period depictions of ground looms.² The horizontal ground loom is still in use in Sudan.³

The vertical two-beam loom [fig. A.3], employed the same basic concept as the ground loom, but standing upright. The warps were again threaded on a frame between two beams. The frame was rigid and had to be fixed in place, making them less mobile than other loom types. Fittings for two two-beam vertical looms were located in one of the houses of Kellis, and the remains of a warping frame were found in another.⁴ They are known from depictions in Egyptian funerary paintings from as early as the fifteenth century BC, and continued to be used in Egypt throughout the Roman period.⁵ The two-beam vertical loom began to replace the warp-weighted loom (discussed shortly) throughout the Roman world in the first and second centuries AD.⁶

¹ Barber 1991, 83-84.

² Ciszuk and Hammarlund 2008, 121.

³ Yvanez 2015, 183.

⁴ Bowen 2002, 97.

⁵ Ciszuk and Hammarlund 2008, 125.

⁶ Wild 1992, 17; Sheffer and Granger-Taylor 1994, 231.

John Peter Wild has proposed the early adoption of another type of fixed place loom, a horizontal loom, which was raised and would have been operated by a seated weaver. He has based this conclusion on the evidence of new weaving techniques, namely the beginning of the production of damask silks.⁷ As there are so few images depicting Roman looms,⁸ or remains of Roman looms, which tended to be constructed from wood, this is difficult to substantiate, but I find the argument based on the kinds of designs that could only be produced with consistent tension on the warp convincing. However, as no finds of such looms exist from the desert regions of Africa or the Middle East in the time period in question, it is not necessary to delve further.

The most important loom type for this study is the warp-weighted loom. For the warp weighted loom, the warps are strung from a cross bar that is held vertically by two beams, but the tension for the warps is created by weights, often stone or unfired clay, tied at the bottom [fig. A.4]. Because these looms are not fixed to the floor or ceiling, they were usually propped against the wall, making them portable but also leaving few traces behind. The warp-weighted loom was common in the Roman empire everywhere but in Egypt, where John Peter and Felicity Wild argue it was only used by immigrants from other parts of the Roman world.⁹ As the Egyptian two-beam loom began to spread throughout the Mediterranean, the use of the warp-weighted loom began to disappear. However, the one exception is in the communities that were producing cotton textiles, and loom weights continue to be found at these sites until at least the fifth century AD indicating a shared weaving culture.¹⁰

⁷ Wild 1987.

⁸ Summarised in Wild 1987, 460

⁹ Wild and Wild 2014b, 76.

¹⁰ This evidence is described in chapters five, six and seven.

B. Dyes used

The compound in blue dyes, indigotin, can be extracted from a large number of tropical and subtropical *Indigofera* species and from the leaves of the woad plant (*Isotia tinctoria* L.). Woad grew naturally in the areas of South East Europe and Central Asia, and was possibly cultivated in Egypt beginning in the Hellenistic period; use of woad has been confirmed in the Roman period and was also described in the *Graecus Holmiensis*.¹¹ Current methods used for dye analysis cannot determine the source of the indigotin chemically.¹² Yellow was obtained from the plant weld (*Reseda luteola* L.), containing luteolin as the main compound and apigenin as the minor component, and was cultivated throughout the Mediterranean and West Asia.¹³ Brown was achieved using a variety of plants that provide hydrolysable tannins containing ellagic acid, which could be used without the use of mordants. As with plants that contain indigotin, the HPLC method of dye analysis cannot differentiate between the sources of tannins.¹⁴ The petals of the safflower plant (*Carthamus tinctorius* L.), which was not native to Egypt but was introduced from Palestine during the 18th Dynasty, used in Pharaonic times for pink, red and very rarely yellow.¹⁵ In Egypt after the first century AD, it was occasionally used for pink, from the water-insoluble red dyestuff carthamin.

There were several types of red dyestuffs used in Egypt in the time period, and it was one of the more widespread colours used, making its identification important in dye analysis. The roots of the madder plant (*Rubia tinctorum* L. and *Rubia peregrina* L.) were used to achieve various shades of red. The cultivated madder plant (*Rubia tinctorum* L.), which

¹¹ *Indigofera coerulea* Roxb. is native to the regions of the Arabian Desert, the Red Sea and Nile Delta, but it does not seem to have been cultivated for use as a dyestuff in Egypt in this time period. Hofmann-de Keijzer *et al.* 2007, 215.

¹² Hofmann-de Keijzer *et al.* 2007, 215.

¹³ Verhecken 2007, 210; Hofmann-de Keijzer *et al.* 2007, 215.

¹⁴ Hofmann-de Keijzer *et al.* 2007, 215.

¹⁵ There is 1 Pharaonic example of safflower being used for the water-soluble dyestuff safflower yellow. Verhecken 2007, 210; Hofmann-de Keijzer *et al.* 2007, 215.

contains the major component alizarin and minor component purpurin, was indigenous to South East Europe and South West Asia, and was likely introduced to Egypt again from Palestine during the 18th Dynasty.¹⁶ Wild madder (*Rubia peregrine* L.), containing mostly purpurin and little or no alizarin, grew naturally in the Mediterranean region, and seems to have been used as a dye, though this assertion has been disputed.¹⁷ Kermes was another important red dyestuff, derived from the female scale insect *Kermes vermillo* containing kermesic acid, and which live on the kermes oak that are native to the Mediterranean. Root cochineal was actually two different scale insect species, Polish cochineal (*Porphyrophora polonica* L) which live in eastern Europe on the roots of the perennial knawel, and Armenian cochineal (*Porphyrophora hamelii* Brandt), found on the roots of two species of reed grasses in the area surrounding Mount Ararat. The active components in these dyes are carminic acid and kermesic acid as the minor component.¹⁸ Identification of species of root cochineal is only possible with quantitative HPLC analysis, though differentiation between the two species remains difficult, especially when analysing the results between different labs.¹⁹ Brazilwood containing the dyestuff brasilein, was the name of a number of redwood tree species (sappanwood) imported from South East Asia.²⁰ The final red dyestuff that had widespread use was Indian lac, another scale insect (*Kerria lacca* Kerr) that lives on the branches of trees in India and South East Asia. The insects secrete large amounts of resin in which they become embedded, and produces a solid red dye containing laccaic acid. While lac is mentioned in the

¹⁶ Hofmann-de Keijzer *et al.* 2007, 215.

¹⁷ Some have claimed that the absence of alizarin does not necessarily mean wild madder was used, but could instead indicate an unknown dyeing method unique to madder. Hofenk de Graaff *et al.* 2004, 107-110.

¹⁸ Hofmann-de Keijzer *et al.* 2007, 214-215.

¹⁹ Wouters and Verhecken 1989, 393-410; Verhecken 2007, 209; Hofmann-de Keijzer *et al.* 2007, 215.

²⁰ Verhecken 2007, 208. In the medieval period, sappanwood was called 'bresil' or 'brasil' from the term 'brazá' meaning 'blaze'. When a new country discovered in 1500 was found to be rich in brazilwood, it was named 'Terra de Brazil' after the tree. Hofenk de Graaff *et al.* 2004, 142.

Periplus Maris Erythraei, it is generally accepted that it was not being used by the Romans as a dyestuff.²¹

The final important dyestuff used in Late Antique to Early Islamic textiles are the various shades and means of creating the colour purple. With a long history of indicating the elites of society, there were several means of achieving the purple colour through both expensive and inexpensive means. The terms ‘true purple’, ‘Tyrian purple’, ‘imperial purple’ and ‘royal purple’ all refer to mollusc purple, produced by the glands of three Mediterranean purple snails: the banded dye-murex (*Hexaplex trunculus* L.), the spiny dye-murex (*Bolinus brandaris* L.) and the red-mouthed rock-shell (*Stramonita haemastoma* L.). This purple was the most expensive of all dyes and was considered a status symbol, tightly regulated by the state.²² The active components in all of these molluscs were dibromo-indigotin, monobromo-indigotin, dibromo-indirubin, monobromo-indirubin and indigotin in various concentrations.²³ The dye orchil, containing the colour compound orcein, was derived from the lichen *Rocella* species and was used as a cheap substitute for ‘true purple’.²⁴ Purple could also be made using a multi dye process.

²¹ Verhecken 2007, 208; Hofmann-de Keijzer *et al.* 2007, 215.

²² Hofmann-de Keijzer *et al.* 2007, 215, Verhecken 2007, 209.

²³ Hofmann-de Keijzer *et al.* 2007, 215.

²⁴ Hofmann-de Keijzer *et al.* 2007, 216.

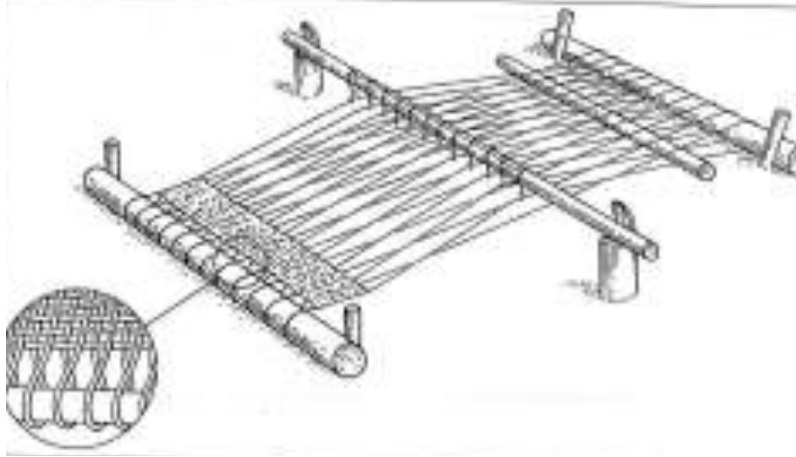


Figure A.1 Depiction of a ground loom. Reproduced from Ciszuk and Hammarlund 2008, 120.

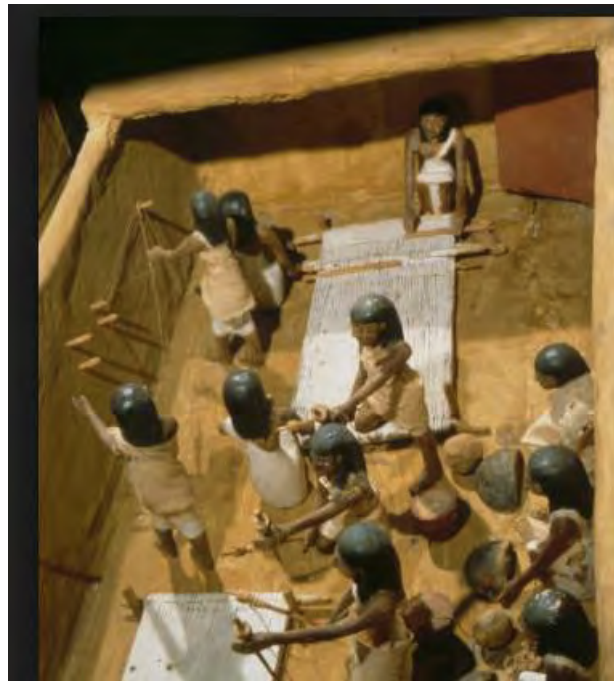


Figure A.2 Model of a weaving workshop included in an 11th Dynasty Egyptian tomb as a grave good. Reproduced from the Egyptian Museum, Cairo.

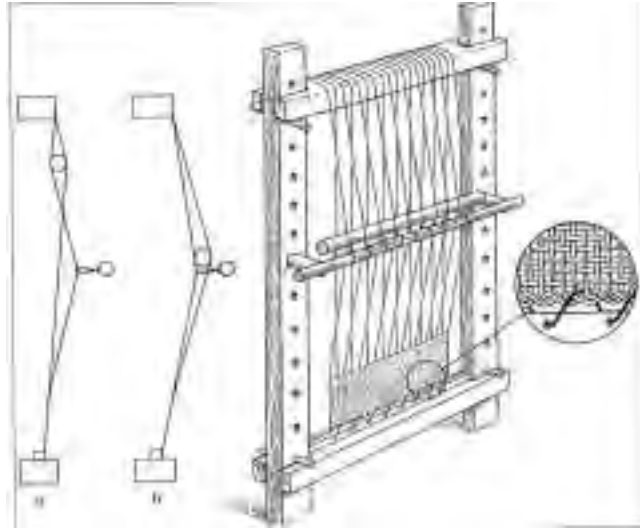


Figure A.3 Depiction of a two-beam vertical loom. Reproduced from Ciszuk and Hammarlund 2008, 124.



Figure 9 Depiction of a warp-weighted loom. Reproduced from Ciszuk and Hammarlund 2008, 122.

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