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ARCHAEOLOGY IN GREECE 2016–2017

Archaeological textiles excavated in Greece

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This paper offers an account of the archaeological textiles excavated in Greece, consideration of the challenges one has to deal with when studying such materials and a discussion of ways to overcome them. A complete list of archaeological textiles excavated in Greece is not within the scope of this paper, since such comprehensive studies have been published previously (Spantidaki and Moulhérat 2012; Moulhérat and Spantidaki 2016) and, of course, the corpus of such textiles is continuously expanding.

The study of textiles is an emerging and fast-growing field of Greek archaeology (Gleba 2011). The number of archaeologists and conservators working with and studying archaeological textiles is steadily increasing, thus raising the general awareness of textiles and expanding the corpus of known ancient fabrics. In recent years, several research projects have investigated ancient Greek textiles, such as those conducted by the Centre for Textile Research at the University of Copenhagen (for example *Textile Economies in the Mediterranean Area*), several funded by Marie Skłodowska Curie Action grants and some by European Research Council grants (for example *Production and Consumption: Textile Economy and Urbanisation in Mediterranean Europe 1000–500 BCE* hosted by Cambridge University).

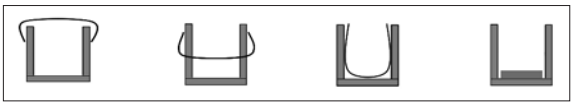
Despite the wealth of spectacular archaeological objects found in Greece and the humble appearance of extant textile fragments, recently there have been significant methodological advances regarding textile discoveries in excavations, which have led to several new finds. Furthermore, textiles held in storage have been rediscovered by researchers who are more aware and hence more appreciative of the importance of such finds. This shift in mentality has occurred particularly over the course of the past 20 years.

The chronology of textile discoveries in Greece spans the Neolithic era to the Roman period, while the types of data available to aid their study range from the actual finds themselves, to preserved imprints, to literary references and representations in other forms of art, like sculpture and vase painting.

The finds

The oldest extant textile discovered in Greece is a minute fragment of a cellulosic bast fibre, which was identified amongst other finds dating to around 6000 BC from the ongoing excavation at the Drakaina Cave on Kephallonia, conducted by the Hellenic Ministry of Culture, Ephorate of Palaeoanthropology and Spelaeology, under the direction of Georgia Stratouli (Inkefalonia 2012; Drakaina Cave 2013). In addition, textile fragments have been preserved on stone weapons and tools from the Neolithic period in Thessaly (Apostolaki 1999: 7). Similarly, a fourth-millennium BC needle found at Methoni, northern Greece, still contained a plant fibre thread (Myrtsioti 2015).In contrast, examples of more recent finds dated to the Roman period include an eighth-century AD carbonized textile of impressive size and unprecedented technological characteristics discovered at Katapola on the island of Amorgos (Alexiou *et al.* 2017), a gold-woven, purple-coloured textile found in a fourth-century AD female burial (Moulhérat and Spantidaki 2012) and a significant amount of possible silk fabrics housed in the Archaeological Museum of Thessaloniki (Karolidis and Christophoridou 2017).

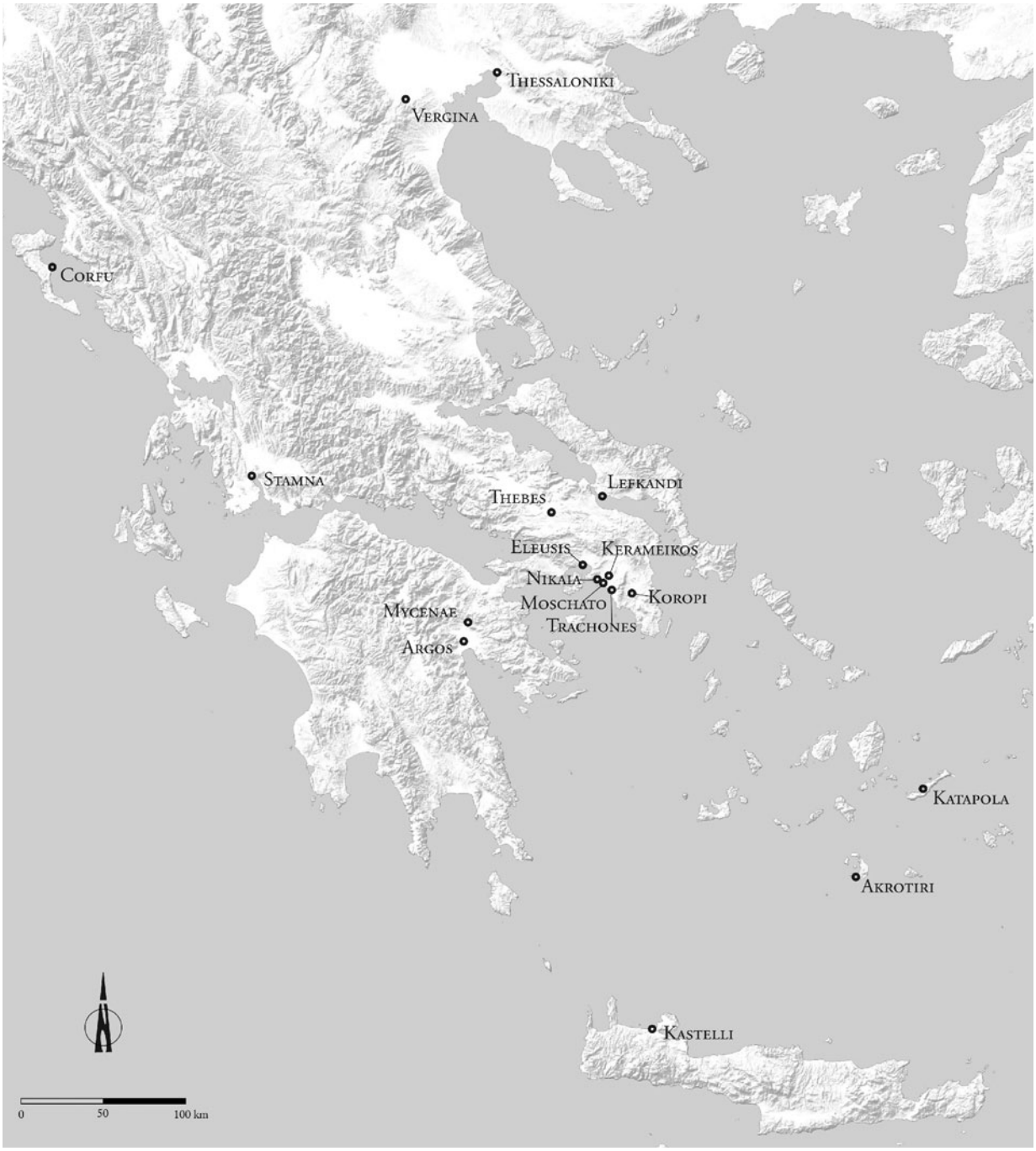
Although the number of finds has increased, the corpus is not representative of the variety of textile production in ancient Greece nor of everyday textiles, since almost every textile find in Greece derives from a funerary context (**Fig. 57**). The textiles retrieved



57. The various positions of fabrics in relation to funerary urns. © Stella Spantidaki.

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Map 4. Map of key locations/sites mentioned in the text. © BSA.

seem to belong to a specific type and/or quality of fabric that was most probably regarded as suitable for funerary use. However, information on the variety of fabrics and garments used in everyday life is available via sources other than extant textiles, such as ancient texts and iconography. In addition, there are noteworthy exceptions to the occurrence of textiles in funerary contexts, such as the fabrics discovered in the Prehistoric settlement of Akrotiri (*ca*. 2,500–1,650BC: Spantidaki and Moulhérat 2012: 187–89), the Mycenaean textile fragments recovered from a 13th-century BC context in Thebes (Margariti *et al.* 2010) and the recent find of eighth-century AD textile and rope fragments on Amorgos (Alexiou *et al.* 2017).

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Preservation

Archaeological textiles are made of organic materials (such as plant and/or animal fibres), which are sensitive to aggressive taphonomic processes. In addition, the environmental conditions prevailing in Greece are not generally favourable to the preservation of organic materials. Nevertheless, there are circumstances which can considerably decelerate deterioration. For example, the presence of another material (such as metal) may aid the preservation of textiles, as may the partial burning of textiles, resulting in their carbonization (**Fig. 58**).



58. Amorgos: rope fragment from a fourth-century AD carbonized find. © Christina Margariti.

The process of textile preservation in association with a metal object (less often with a ceramic one) is known as mineralization: for example fifth-century BC fabrics from Kalyvia and third- to fourth-century AD textiles from Glyphada (Spantidaki and Moulhérat 2004: 12; Moulhérat and Spantidaki 2007a). This process begins when the organic fibres of a textile which are in close contact with a metal object are gradually replaced by the products of the metal's corrosion (Anheuser and Roumeliotou 2003: 24; Moulhérat 2008). For precipitation and final replacement to occur, the organic fibre must be preserved, and, where certain metal ions, such as copper, nickel, mercury and lead, act as micro-organism inhibitors, the fibres are resistant to attack by bacteria (Turgoose 1989: 30). At a molecular level, this means that the atoms of the fibres are replaced by metal ions or that the spaces between the molecular chains are filled with metal ion complexes (Chen *et al.* 1998: 1016). The progress of this process may terminate at any time or continue until the replacement is complete. In either case, the physical shape of the fibre is preserved. The process can be divided into three stages: (1) the corrosion of the metal; (2) the migration of metal ions towards the organic fibre; and (3) the precipitation of metal ions onto the textile fibre. This last stage requires a damp environment, which suggests that at some point during burial the metal items, such as copper vessels, were in contact with water or subject to high levels of humidity. Significantly, although the appearance of the textiles remains relatively intact, their original physical and chemical properties are altered, sometimes to an unrecognizable degree (Margariti and Loukopoulou 2016: 145–46).

Similarly, in the process of carbonization, the textile fibres change from a cellulosic or proteinaceous material to carbon; it is an irreversible chemical reaction of incomplete burning, similar to the process of wood becoming charcoal. The carbonized textiles are black and very brittle, but short lengths of fibre may remain virtually intact (Ryder 2000: 2–8).

Challenges

The particularities of the state of preservation (for example the effects of mineralization and carbonization) and of the provenance (for example associated burial finds) of textiles excavated in Greece raise certain challenging issues for conservators and archaeologists alike.

Challenges in conducting studies

The overwhelming majority of textile finds excavated in Greece come from funerary contexts and the majority of these are found in a very poor state of preservation and in a fragmentary condition, meaning that the available sample for study is small. Since the types of fabrics found were most probably specially made for funerals (for both burials and cremations) their range is limited. In addition, since the conditions prevailing in Greece are unfavourable to their preservation, well-preserved textile finds are rare, allowing for significant errors when drawing conclusions. Finally, those textiles which do survive are more often than not found in poor – and puzzling – conditions, thus further complicating their study.

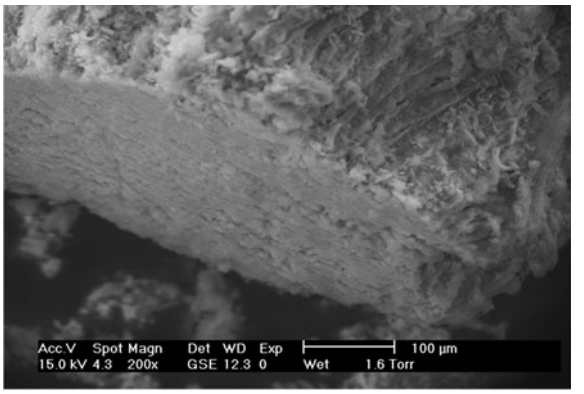
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In very small fragments, some technical characteristics (such as the thread structure, weaving mistakes, or decorative patterns) are difficult to identify, since there is no possibility of following a thread to see its path for any real length. It is thus not possible to understand whether a peculiar feature is a decorative effect or a mistake.

Textiles are frequently mentioned in ancient written texts, such as administrative texts related to temple and palatial economies or legal documents, such as marriage contracts. They may also be depicted iconographically, for example on pottery or sculpture. The texts provide information on the types of textiles, the dyes and raw materials used for production and the amounts of finished products traded; iconography mainly offers information about decorative patterns. However, such evidence must always be corroborated with other types of data, due to the ambiguity of Greek textile terminology and the possible employment of artistic conventions, in relation to textiles and garments in inscriptions and literature (Spantidaki 2016).

Challenges in conducting analyses

The alteration of the physico-chemical properties of textiles, due to the processes of mineralization and carbonization, means that the application of fairly standard and straightforward analytical techniques and/or methods is significantly restricted. For instance, the morphology of fibres heavily impregnated by metal degradation deposits may have been totally masked and would thus be unrecognizable during SEM analysis (**Fig. 59**). The mechanical properties of the fibres may have been almost totally lost, making thin-section analysis impossible. Moreover, the rarity of the finds hinders the reliability of analytical results, whilst the vast variety of textile fibres used over time inhibits the accuracy of the results. In addition, any chemical analyses which are generally widely applicable to excavated textile studies (such as Raman and FTIR microscopies) are not applicable in the case of carbonized fibres. Past (Janaway 1983; 1989) and recent (Moulhérat 2008: 20) studies carried out by the Centre de Recherche et de Restauration des Musées de France, involving the application of a combination of optical and scanning electron microscopies, have offered very promising results with regards to material identification and the technical analysis of finds in very poor states of preservation.



59. Argos: SEM image of a thread from a seventh- to sixth-century BC textile which has been totally impregnated and masked by copper degradation products. © Christina Margariti.

Finally, it should be noted that, in order to allow for the accurate analysis of extant fabrics, sampling for analysis must be undertaken before any conservation treatment is applied to the finds, since treatment will alter the fabrics and hinders both the recognition of technical characteristics and the identification of the fibres (Rast-Eicher 2016: 56). It is therefore important that, before any conservation treatment is undertaken, samples destined for future analyses should be isolated.

Challenges in conservation

The generally poor condition and rarity of textile finds in Greece makes their conservation especially demanding, necessitating the customized adaptation of particular conservation techniques and materials. In order to be successful, any conservation process undertaken should meet the minimum intervention criterion, control the surrounding environment to acceptable levels, aim for accessibility and transportation of the find with minimum handling and be cost- and labour-effective (Margariti and Loukopoulou 2016).

Challenges in exhibition

The majority of extant textiles are kept in storage rather than displayed, either because of their poor state of preservation and fragile nature or because they are not the most attractive or intelligible museum

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exhibits. Consequently, they are not generally accessible to the wider public and often end up 'lost' in storage. Currently, very few textile finds down to the Roman period are on display in Greece; exceptions are the Mycenaean textiles on spearheads in the National Archaeological Museum, the fifth-century BC Eleusis textile in the Archaeological Museum of Eleusis, the fourth-century BC Vergina textile in the Museum of Aigai and the Roman textile from Thessaloniki in the Archaeological Museum of Thessaloniki. It is no coincidence that these textiles are all exceptions to the rule that textiles are normally small, obscure and fragmentary finds.

When on display, archaeological textiles can benefit greatly from audio-visual supplements which can offer a more direct and interactive source of information. Textiles can be valuable within museum educational programmes, in which visitors can handle and use reconstructed objects. Mobile exhibitions are another versatile means of displaying textiles. When these are designed to be easily transportable and to travel to multiple locations, they can expand significantly the recipient audience, by overcoming the normal limitations on the transportation of textiles imposed by their poor state of preservation. New technologies such as 3D scanning and 3D printing already play a crucial role in the transfer of knowledge and the dissemination of research results to the public (as discussed, for example, at the international conference on *New technologies for heritage: opportunities and challenges*, Quai Branly Museum, Paris, November 2014), and textile archaeology could benefit greatly from their utilization.

Interdisciplinary approaches and collaborations

Recent research has convincingly demonstrated that in order to exploit data better and achieve a more holistic and comprehensive understanding of textile manufacture and technology in ancient Greece, one cannot study each source, such as texts, iconography, textile tools and extant fabrics, separately. They should, rather, be considered simultaneously; all the available information should be combined in order to assemble all pieces of the puzzle (Spantidaki 2016).

Archaeometry

Archaeometry – the study of archaeological material by the application of science – is crucial to the study of ancient textiles. Recent advances in analytical techniques and equipment have shed light on and unlocked the secrets of even very degraded and minute textile fragments. Thus the awareness of ancient textile finds has been increased, which, in turn, has increased the frequency of the techniques' application and their acceptance by the textile community. Resistance based on ethical concerns, such as the sacrifice of preserved samples, has been successfully answered. Whilst many state-of-the-art techniques and equipment are not available in Greece, both the textiles and researchers benefit through collaboration with other European and international projects.

Language

Another significant issue in the study of archaeological textiles is the use of terminology. This is both a Greek and an international concern, applying to every country. Thus, the Centre International d'Études des Textiles Anciens has established a technical glossary of French terms translated into English, German, Italian and Spanish in order to overcome this problem (see also Michel and Nosch 2013; Gaspa *et al*. 2017). In Greece, textile terminology lacks a universal system shared by all researchers and this has created several misunderstandings and problems in communicating technical characteristics of extant fabrics. Several attempts have been made to create glossaries of textile terms applicable from Antiquity to the Modern period, but there is still no universal system (Cleland *et al*. 2007; Spantidaki 2016).

Furthermore, there is a significant number of technical ancient Greek terms related to textiles that present interpretative difficulties. This is most common amongst the terms for tools and those referring to types of decoration. Moreover, the polysemic nature of the ancient Greek language, in which one word may express more than one meaning, either simultaneously or according to context, leads to further difficulties of interpretation (Spantidaki 2016: 97–105).

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The study of textile tools

A recently developing area of study in the field of textile archaeology is the functional study of textile tools. This, in turn, may yield information on the types of textiles that might have been produced in a certain area. Textile tools, although ubiquitous in excavations in Greece, have traditionally been regarded as minor finds and thus not given particular attention. However, this approach is gradually changing, as large scientific projects approach the study of the topic. The research programme *Textiles, Tools, Texts and Contexts* at the Centre for Textile Research, Copenhagen, for example, has enabled the establishment of a new methodology for the functional study of spindle-whorls and loomweights (for example Andersson-Strand and Nosch 2015).

Experimental archaeology

In the case of archaeological textiles, experimental archaeology provides an opportunity to investigate the functions of textile tools involved in the production process and to test the validity of research hypotheses concerning these tools and textile technology in general (for example Spantidaki 2008; 2009–2010).

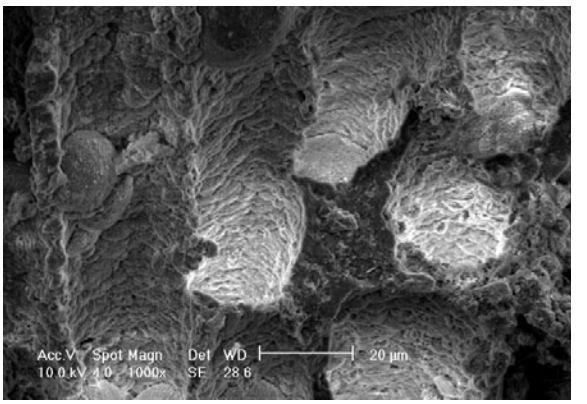
Types of fibres used in textile production

A rich variety of natural fibres, both proteinaceous and cellulosic, has been identified in the textile finds excavated in Greece.

Animal fibres

Wool fibres are not preserved well in the alkaline conditions of Greek soil and funerary environments, since the isoelectric point of wool amino acids lies on the acidic side of the pH scale (Tímár-Balázsy and Eastop 1998: 37). Hence the preservation of wool fibres in Greece is not as common as that of plant fibres.

The earliest surviving sheep's wool in Greece has been reported from the Bronze Age settlement of Akrotiri, Thera, where many minute fragments of wool threads have been discovered (Moulhérat and Spantidaki 2008; Spantidaki and Moulhérat 2012). Early wool fabrics (*ca*. 1050–900 BC) have also recently been identified among other textiles in an impressive find from Stamna in Aetolia (Kolonas *et al.* 2017). Further mineralized wool fabrics derive from Lefkandi (dated *ca*. 1000 BC) and from a seventh-sixth century BC cemetery on Corfu. These both present a very fine fleece with average fibre diameter of *ca*. 30μm (**Fig. 60**; Metallinou *et al*. 2009: 40, 47, 50; Moulhérat and Spantidaki forthcoming).



60. Corfu: SEM image of a seventh- to sixth-century BC mineralized fabric (inv. no. 24724-25726). The scales characteristic of animal fibres are visible. © ARTEX.

Goat's wool has been identified in a Late Minoan textile band, discovered in Agia Aikaterini Square, in Kastelli, Chania, on Crete (**ID1854**). The study of the narrow band has shown that its warp was made of flax, the weft of goat's wool and the additional, decorative weft of nettle fibres. The average diameter of the wool fibres is *ca*. 60.91μm (Möller-Wiering 2006; Moulhérat and Spantidaki 2006; 2009: 8–15).

A cast of a cocoon and part of the enclosed pupa, indicating possible silk production, has been retrieved from Akrotiri, Thera (Panagiotakopulu *et al.* 1997). It is believed to date to the second millennium BC. Moreover, the depictions of transparent garments on the wall paintings from Akrotiri indicate the possible use of wild silk varieties in textile production (Doumas 1999: 136, figs 100, 101, 105, 107). The possibility of the presence of wild silk in one of the textiles of a pyre burial from Argos in the Peloponnese has also been suggested (Margariti and Papadimitriou 2014: 14–23). However, recent analyses of the Kerameikos fifth-century BC textile, that had been previously reported as silk, have not confirmed the earlier analytical results (Hundt 1969: 66–70; Margariti *et al.* 2011; Spantidaki 2016).

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Plant fibres

The vast majority of the preserved textile finds retrieved from Greece are made of flax fibres (Margariti *et al.* 2014). The study of several extant linen fabrics has brought to light evidence characteristic of various fibre preparation methods. Ancient Greeks were able to clean and separate the individual flax fibres to produce extremely fine and shiny fabrics, such as those from Koropi, Cape Zoster and Kerameikos (Spantidaki 2016). The plant was harvested at different stages of maturity according to the desired quality of the final fabric. For extremely fine fabrics, it was collected while still green; when intended for thicker textiles it was collected later, in its mature state.

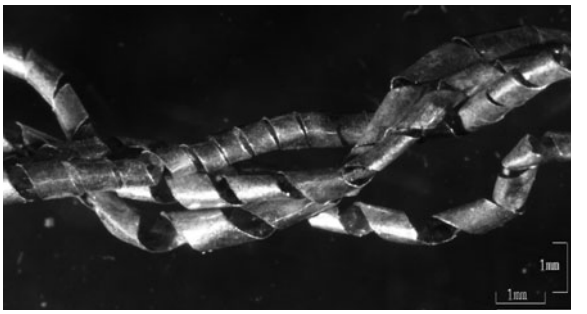
Hemp and cotton fibres have also been identified in two fifth-century BC Greek fabrics from an excavation in Trachones, Attica. Vassilios Zisis, a chemist who analysed and treated the textiles retrieved, reports the presence of one fabric made of hemp fibres, a second made of cotton fibres and a third made of flax fibres (Zisis 1955). Since hemp and cotton were not local plants in Greece, these fabrics may have been imported or they may have belonged to a foreigner. However, since the find from Trachones is the only one of ancient Greek cotton and hemp fibres and Zisis was able to differentiate between three very similar cellulosic bast fibres, there is clearly a need to revisit the past analyses of this find.

Nettle fibres have been identified in the additional, decorative weft thread of a Late Minoan band from Kastelli, Chania, as noted above. The fibres have an average diameter of 8μm. As nettle has a bright white colour, it is easily distinguishable from the flax and goat's wool fibres that were used to make the band, and provided an easy alternative for a decorative pattern (Möller-Wiering 2006; Moulhérat and Spantidaki 2006; 2009). There are, of course, cases where the fibres have not been positively identified. The settlement of Akrotiri, Thera, has yielded fabrics made of still unrecognized plant fibres, while a felt find was produced using fibres from different plants of the *Cyperaceae* family (Zorzos n.d.).

Finally, there are several case studies in which different fibres have been identified for the warps and wefts of the same textile. This combination usually involves both proteinaceous and cellulosic fibres, as in the case of the band from Chania mentioned above. For one of the Archaic textiles from Argos, a combination of wild silk (weft) and cellulosic bast (warp) fibres has been suggested, while another seems to have been made of wool (weft) and cellulosic bast (warp) fibres (Margariti and Papadimitriou 2014). Combinations of fibres in the same textile have also been reported for the Kerameikos textiles, despite the fact that definitive fibre identification is still awaited (Margariti *et al.* 2011; Spantidaki 2016).

Metal threads

The fourth-century BC textile from Vergina is lavishly decorated with wefts made of golden metal strips interwoven with purple wool to create floral motifs (Flury-Lemberg 1988: 234). A, now lost, third-century AD fabric from the Athenian Kerameikos cemetery was a tapestry woven with gold strips wound around an organic core (**Fig. 61**; Touratsoglou 2002: 98; Moulhérat and Spantidaki 2016: 141, fig. 20).



61. Kerameikos: stereoscope image of a gold strip wound around an organic core from a third-century AD fabric. © ARTEX.

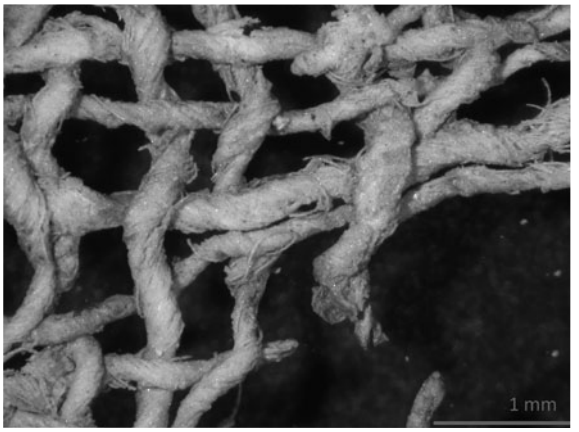
Thread production

Although there is no indication of evolution or change concerning the main style of loom used in ancient Greece, recent research indicates that the same tools and techniques were not used everywhere and across all periods to make the thread.

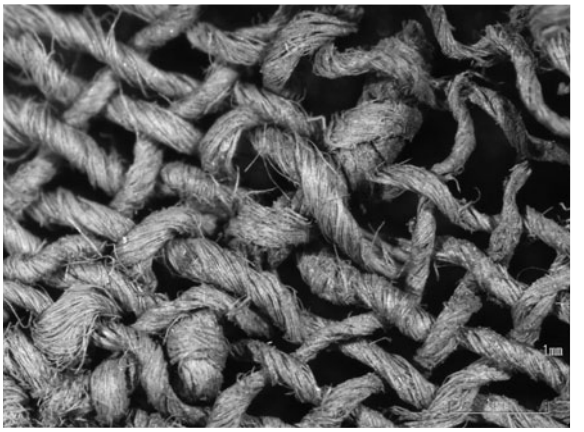
Spinning

Spinning with a draft spindle in ancient Greece is attested through iconographic, written and archaeological evidence (Tzachili-Douskou 1997). This technique produces threads that vary from lightly to very tightly spun (**Fig. 62**). Recovered spindle-whorls date back to the Early Neolithic period (Perlès 2001: 247, n. 31).

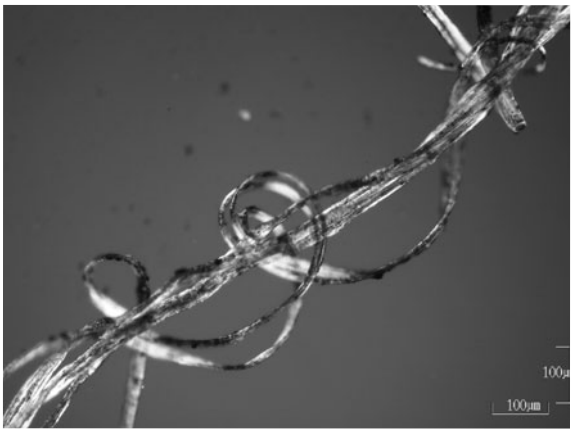
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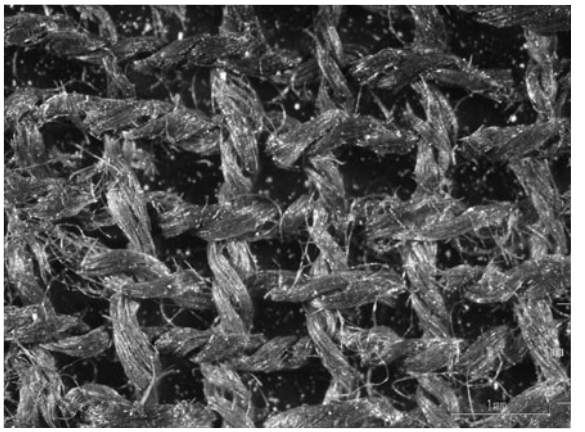
62. Marathon: example of very tightly spun threads from a fifth-century BC fabric. © ARTEX.



63. Mycenae: detail of fabric (inv. no. 15863) showing a splicing joint. © ARTEX.



64. Kerameikos: spliced threads found on one of the fifth-century BC textiles, viewed through an optical microscope. © ARTEX.



65. Thebes: stereoscope image of the S-twisted threads of a 13th-century BC fabric. © ARTEX.

Splicing

In addition to draft spinning, there is also evidence for splicing, a technique used for the production of particularly fine fabrics, known from Egypt. Textiles from Mycenae bear strong evidence of this technique, with cylindrical threads produced by joining together bundles of fibres (**Fig. 63**). Similarly, one of the tabbies ('plain-weave' cloth) from the fifth-century BC textile find from Kerameikos shows extremely fine, ribbon-like threads with a diameter ranging between 0.04mm and 0.10mm. These are among the finest ever discovered in Greece, and they bear the connective joints distinctive to this technique (**Fig. 64**).

Splicing has been connected with iconographical scenes depicting the twisting of fibres on the thigh or calf, as well as the wetting of fibres in the mouth to add moisture and/or correct imperfections. Since saliva contains a glue-like substance that helps to consolidate/reinforce the splices (joints), scenes depicting a spinner passing a thread through her mouth may indicate the employment of this technique.

Other techniques

Flat, ribbon-like bundles of fibres with no significant twist visible, which are, however, twisted together to form a thread have also been found. In such examples, the processing of the fibres does not seem to have been completed fully. The fibres were probably only lightly retted and they have not been combed, so they remain in bundles and are not completely separated (Rast-Eicher 2016: 48). This can be seen in the threads of the find from Thebes, possibly dating to the 13th century BC. These are made of two flat,

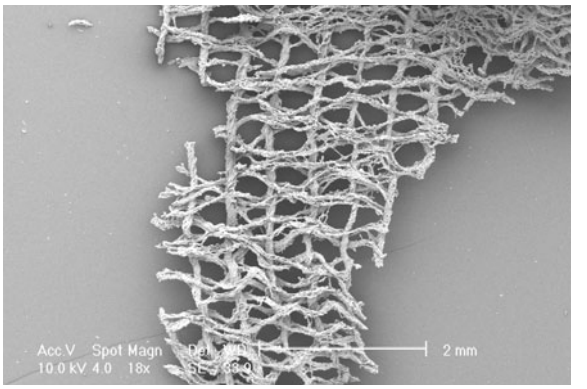
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ribbon-like strands that have no apparent primary twist and are twisted together in an S-direction (right-twist, or counterclockwise) (**Fig. 65**; Emery 1994: 11; Margariti *et al.* 2010). Another example comes from Mycenae. Here the threads are again flat like ribbons and tightly twisted in an S direction (textile find 17976 in an unpublished study by ARTEX).

Technical characteristics

There are certain technical characteristics of textiles that seem to have persisted in use for many centuries.

For example, the study of preserved textiles has indicated the ability to produce – and a preference for – extremely fine weft-faced tabbies. The fineness of these tabbies is remarkable, with thread counts reaching as high as 100 per centimetre, as recorded for one of the fifth-century BC Kerameikos textiles (Margariti *et al.* 2011: 523); a thread count of 80 has been recorded for a much earlier example of the tenth century BC from Stamna (Kolonas *et al.* 2017). In the former case, the degree of twist in the two elements can vary from the tight 35° for the warps to a very light, undetermined degree of twist for the wefts. There is also a significant difference between the measurements of the warp and weft diameters and, consequently, thread counts. For instance, the warp threads of the fifth-century BC Kalyvia textile have an average diameter of 0.12mm and a thread count of between 20 and 25 threads per centimetre, while the weft threads have an average diameter of 0.05mm and a thread count of between 60 and 100 threads per centimetre (**Fig. 66**; Moulhérat and Spantidaki 2007a: 164).



66. Kalyvia: SEM image of an isolated layer of fifth-century BC fabric. © ARTEX.

The timespan for the use of this weave stretches from the tenth-century BC Stamna and Lefkandi textiles, to the seventh-century BC Corfu and seventh- to sixth-century BC Argos textiles, and on to the fifth-century BC fabrics from Kalyvia, Moschato and Kerameikos. There have been several discoveries – particularly from Classical Athens – of very fine fabrics and loomweights of pyramidal shape weighing less than 100g. These data, in combination with frequent depictions of very fine and transparent garments, as well as references to similar fabrics in the written sources, indicate a preference for, if not a specialization in, high-quality, very fine fabrics. This fact, by itself, points to a technically extremely advanced textile industry, that was able to produce constant amounts of extremely fine threads, sometimes finer than 0.05mm, as well as fabrics with 60–100 threads per centimetre (for example that of Kalyvia). This fineness is currently impossible to achieve, despite the elaborate industrial methods in use today (Spantidaki 2016: 40, 212, table A.1, figs D.3–5).

Decoration

Purple dye

Decoration with the purple dye extracted from molluscs is attested quite commonly in ancient Greece from the tenth-century BC Stamna textiles (Kolonas *et al.* 2017) to the third-century AD fabric of Philotera Amymonis from Kerameikos (Moulhérat and Spantidaki 2016: 141). Usually, one of the elements, most often the weft, was dyed before weaving, and this resulted in purple stripes decorating the end fabric (examples from Corfu, Kalyvia, Maroussi, Kerameikos: Spantidaki 2016). In the Vergina textile of the fourth century BC the purple-dyed threads were interwoven with golden strips (De Graaff 1977; Drougou 1987: 306).

Painting

Fabrics were also painted in Antiquity. Painted textiles are archaeologically attested in Egypt dating from the Pre-Dynastic period (Barber 1991: 266). A fifth-century BC fabric from Koropi provides evidence of

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the use of painting on Greek textiles. This fabric has a painted pattern of lozenges of a darker colour than the rest of the cloth, and in the centre there is an unrecognizable red painted pattern. These colourations must be traces of painting, because the colour has not penetrated inside the fibres, but has remained on their surface (Spantidaki 2016: 89, fig. 8.3).

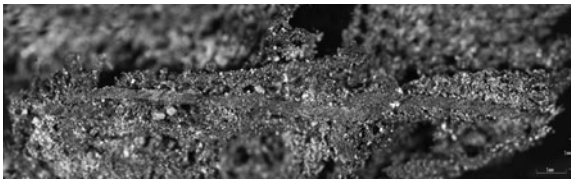
Embroidery

The earliest evidence of embroidery derives from a carbonized fabric from Akrotiri, Thera. One of its fragments presents a thicker thread passing across the textile to create a fringe. According to its researchers, this appears to be a type of embroidery or brocade with a pattern that – due to the small size of the fragment – is non-discernable (Moulhérat and Spantidaki 2007b: 50, 51, fig. 3; Spantidaki and Moulhérat 2012: 187).

Embroidery is also attested on two extant fabrics deriving from fifth-century BC Athens. The first is a linen fabric from Koropi decorated with a pattern of lions embroidered with a metallic, silver-gilt thread inside a grid of embroidered lozenges (Spantidaki 2016: 81). The second is a fabric from Nikaia (south of Athens), which presents a decorative, floral pattern (Margariti forthcoming). In both cases, the embroidered pattern is recognizable from the holes left by the embroidery thread; the latter has almost totally disappeared.

Decorative stitching

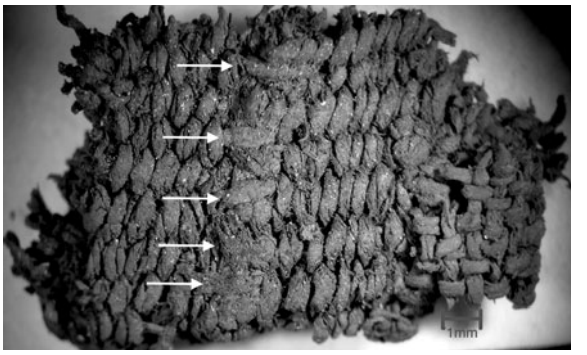
The study of the carbonized textile from pit no. 52 in Akrotiri has revealed the presence of decorative stitching near the edge made with a thicker thread (**Fig. 67**; Moulhérat and Spantidaki 2007b: 50, 51, figs 4, 5; Spantidaki and Moulhérat 2012: 187).



67. Akrotiri: decorative stitching along the edge of a fragment of fabric. © ARTEX.

A seventh-century BC fabric from Corfu preserves a fragment of its lateral edge where thicker threads are observed on top of the last two rows of warp threads, crossing the material diagonally and thus having no connection with the weaving proper, but reflecting a later stage of manufacture. It is not possible to determine whether this stitching was originally decorative or simply reinforced the edge (Metallinou *et al*. 2009: 35, fig. 19α, β).

Stitching for functional rather than aesthetic reasons has been identified along the selvedges of the seventh- to sixth-century BC Argos and fifth-century BC Eleusis textiles (**Fig. 68**; Zisis 1955: 588; Margariti and Papadimitriou 2014; Spantidaki 2016: 65, 93, 114).



68. Argos: stitching along the selvedge of a seventh- to sixth-century BC textile. © Christina Margariti.

Fringes

When the fabric is complete, a seam is made to fasten the weft threads. If the warps are left hanging beyond this seam, they form fringes that can be decorated in different ways. Among the extant Greek fabrics, three bear traces of fringes. The earliest is a fine 17th-century BC linen tabby from Akrotiri, Thera, which was decorated with fringes made of an external thread and adorned with beads (Moulhérat and Spantidaki 2007b: 51, fig. 6; Spantidaki and Moulhérat 2012: 187). There is also a 13th-century BC linen tabby from Mycenae and a seventh-century BC wool tabby from Corfu (unpublished study by ARTEX; Metallinou *et al*. 2009: 46, fig. 67).

Additional thread

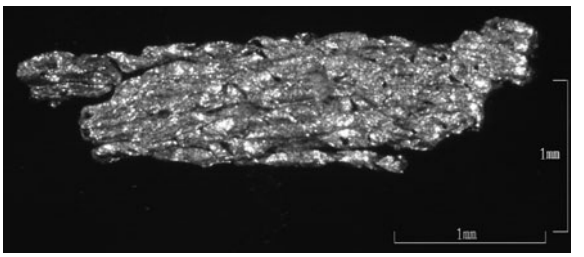
The Late Minoan band from Chania, already discussed above, was decorated with an additional thread made of nettle fibres, although the fragment is too small for the pattern to be discernible (Möller-Wiering

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2006; Moulhérat and Spantidaki 2006; 2009). Furthermore, the tenth-century BC woven band from Lefkandi incorporates an additional thread in order to produce a geometric pattern (Barber 1991: 197). Finally, in one of the three fifth-century BC Koropi fabrics, threads of a black colour were added near the lateral edge, most probably for decorative reasons (Spantidaki 2016: 112).

Elaborate, figurative patterns

In addition to the textile from Vergina, elaborate figurative patterns executed with golden threads can also be seen in the Roman textile from Thessaloniki (Moulhérat and Spantidaki 2012; Karolidis and Christophoridou 2017). Several fragments of the fabric of Philotera Amymonis display loops in the gold weft; this is an indication of the use of tapestry to create complex decorative patterns. Unfortunately, no trace of the pattern has been preserved (**Fig. 69**; Moulhérat and Spantidaki 2016: 141, fig. 20).



69. Kerameikos: fragment of the third-century AD fabric of Philotera Amymonis showing the gold weft forming loops: an indication of the use of tapestry to create complex decorative patterns. © ARTEX.

Looped fabrics

Looped textiles are also known from ancient Greece (Tzachili-Douskou 1982). They are made with a variety of techniques in which a ground or additional weft is wrapped around the warp of the fabric and left hanging to form a raised surface (Emery 1994: 148; Tsourinaki 2007); this results in hairy fabrics resembling bath towels. Finer or thicker threads can be used for the additional weft forming the loops and this affects the appearance of the finished cloth, adding thickness and warmth. The only looped fabric that has been discovered in Greece is the so-called 'tunic' from Lefkandi (*ca*. 1,000 BC), which combines an upper part of looped fabric with a lower part of tabby (Sackett and Carrington-Smith 1980: 227–29; Popham *et al*. 1982: 169–74).

Conclusions

The focus and efforts of archaeological and conservation research have only fairly recently shifted towards textile finds retrieved from Greece. This shift has raised the awareness of such finds and has greatly contributed to an impressive growth in the corpus of textile finds and the level of information regarding ancient textile technology. Despite the fact that such finds are rare and, more often than not, in a very poor condition, analytical and methodological advances allow for comprehensive study and the application of efficient conservation treatments. As a result, a wide range of plant and animal fibres, such as flax, hemp, nettle, cotton, sheep and goat wool, and wild silk, has been identified. Technical elements – such as spinning and splicing for the production of threads, stitching and very fine tabby weaves with high threads counts executed on warp-weighted looms with very small and light loomweights – have also been reported. Decorations such as the use of natural dyes, metal threads, additional threads and embroidery have all been observed on ancient Greek textiles. The application of interdisciplinary methodologies, collaboration between professionals and the adoption of state-of-the-art technologies will enable comprehensible presentation of these finds to the public and greatly contribute to their long-term preservation.

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