



Survey of archaeological textile remains from the Aegean and Eastern Mediterranean area

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TOOLS, TEXTILES AND CONTEXTS

*We dedicate this book to Betschen Barber,
the pioneer of the study of Aegean Bronze Age textiles.*

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Investigating Textile Production in the Aegean
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edited by

Eva Andersson Strand and Marie-Louise Nosch
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Front cover: clockwise: MM II Quartier Mu, Malia, Crete, map (after Poursat 1996, pl. 81), spindle whorls from Phaistos, Crete (courtesy of P. Militello), Khania, Crete, Late Bronze Age ribbon, reconstructed loom weights in TTTC experiments.

Back cover: Splicing (drawing: Annika Jeppsson)

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CHAPTER 3

Survey of archaeological textile remains from the Aegean and Eastern Mediterranean area

Irene Skals, Susan Möller-Wiering and Marie-Louise Nosch

Remains of textiles from the Aegean, the Near East and Egypt in the Neolithic, Chalcolithic and Bronze Ages are mostly small fragments that are mostly fragile, often mineralised or charred, and are sometimes just impressions in the surface of clay, or imprints in the soil surrounding objects. They are like flashes of what once was. They originate from burial contexts in which they served as garments or other types of burial textiles from ritual offerings, or from shelters and settlements, where they can have had a variety of either decorative or functional uses. Due to the poor preservation of the finds, the information they can yield is limited, but an increased interest in textiles in recent years, aided by improved scientific methods of analyses, have inspired new studies of old finds which have resulted in new information. Additionally, a growing awareness of the possibility of finding textiles and improved excavation methods on the archaeological sites have resulted in new finds which help to increase the knowledge of prehistoric textile technology.

This technology is visualised through many factors, such as the identification of the fibres, the methods of spinning, splicing and the plying of the threads, the regularity and thickness of the threads, the kind of weave

and the uniformity and number of threads per centimetre. From these analyses it is possible to draw conclusions regarding the tools and the technological stages of textile production and its developments over time as well as to gain an idea of the use of different types of textiles for different purposes.

Background and framework of the present survey

Defining the geographical boundaries for this survey of textile finds from the Mediterranean area has been somewhat difficult. It is based on Elizabeth Barber's work *Prehistoric Textiles. The Development of Cloth in the Neolithic and Bronze Ages with Special Reference to the Aegean* which contains references to almost all the relevant archaeological material until 1988 (Barber 1991). Barber includes Egyptian textiles as comparative material in her publication and it was decided to also include them in the present survey, as they constitute a natural part of the collected material. New Egyptian finds as well as analyses of old finds have since been published and are also listed (Vogelsang-Eastwood 1999; Kemp and Vogelsang-Eastwood 2001; Jones 2002b, 2–8). Additionally, Elisabeth Völling's publication *Textiltechnik im Alten Orient*

from 2008 is used (Völling 2008). Elisabeth Völling lists all textile finds from the earliest spun thread dated *c.* 18000 BC to finds from about 500 BC in present day Iran, Iraq, Syria, Israel, Jordan, Lebanon and Turkey, and has a comprehensive list of references regarding each find. Furthermore, information from Catherine Breniquet's *Essay sur le tissage en Mésopotamie* from 2008 is incorporated (Breniquet 2008). The work has a summary of the textile finds from the area of the Tigris-Euphrates rivers from the Neolithic until *c.* 3000 BC.

The most recent information regarding textile finds from the Aegean and Eastern Mediterranean area was obtained by the research team working in the research programme *Tools and Textiles – Texts and Contexts* whose data is also included in this survey. We are most grateful to all colleagues who have shared their published and unpublished data with us, in particular Nicole Reifarth, Ulrike Rothenhäusler, Jana Jones and Orit Shamir. Based on the information from these different sources, this survey covers the Aegean, the neighbouring areas around the Eastern Mediterranean and the Near East.

Chronologically, this survey concludes with the end of the Bronze Age and the beginning of the Iron Age around 1000 BC. Finds from the Neolithic have been included since they are few and can help to give some suggestions regarding the development of textile production. The finds are listed according to their dating and the location of the sites (see Appendix A and B).

It has been attempted to provide a comprehensive list of all textiles and textile impressions mentioned in the relevant literature. This was possible to some extent although, in some cases, a different approach has been necessary. Regarding textile finds from Egypt, the Neolithic sites have yielded few textile finds, but from the time of the Old Kingdom the preserved material, especially from burial contexts, is so abundant that it is rather the types of textiles than each textile find that are listed. The textile material from the well-known Neolithic finds from Çatal Hüyük and Nahal Hemar are also so abundant that it is not possible to give information about each textile find and thus we list the types of attested techniques. Therefore, the reader is recommended to seek further information

from the available literature for more detailed information about the textile finds.

The manner of annotating the different aspects of the technical analyses varies somewhat in the literature and can cause misunderstandings. This is particularly evident from descriptions of the plying of threads, the thread diameter and the thread count. When it was possible to interpret the data, the following method of describing thread count is used: the number of threads in one system x the number of threads in the other system per centimetre (in the cases where warp and weft can be distinguished this is mentioned). In cases where the data are not easily interpreted, thread counts are listed as found in the literature.

Regarding the spinning and plying of threads, the following annotations are used:

s- or z- spun.

S2z – for threads that are plied S of 2 z-spun threads.

Z2s – for threads that are plied Z of 2 s-spun threads.

S2s – for threads that are plied S of 2 s-spun threads.

This method of listing the data is used when possible.

The thread diameter is listed as found in the literature (see Appendix A and B).

The fibres

The preserved material could not be studied in any uniform manner and the obtainable information is, occasionally, very scant and, in other cases, quite detailed. The types of fibre are often unidentified, but when identification has been possible, it is mainly plant fibres of the bast type which has been preserved, specifically flax. Other types of bast fibres have also been found. Fibres of hemp and jute have been identified in textiles from Shahr-i Sokhta (Good 2007, 179–184) and nettle has been identified in a ribbon from Khania (Moulhéat and Spantidaki 2009). Cotton as a possibility is only mentioned once from the Neolithic site Dhuweila (Breniquet 2008, 57). Reed and grass fibres are listed, which are the most likely fibres to have been used in basketry (Völling 2008, 208–209; Frangipane *et al.* 2009, 19). Tree bark fibres have been identified in a necklace (Médard *et al.* 2004, 19–25) and palm fibres are mentioned as a possible fibre in a find from Jordan (Völling 2008, 227–228).

Wool is extremely rare in these early textile finds. Wool is mentioned as a possibility in a

mineralised fragment on a silver figurine from Susa (Barber 1991, 164) and as the fibre used in the textile impression from Telul eth Thalathat (the information is questioned by Völling 2008, 206). Scholarly work on the textile impressions from Abu Hamid mentions wool as a possible fibre (Breniquet 2008, 56) and it is claimed to have been preserved from an unnamed location in Egypt (Burlington Fine Arts Club Catalogue, 23). But no evidence for wool in the Neolithic and Chalcolithic is conclusive; and wool is also rare in Bronze Age archaeological textiles.

The number of finds of textiles made of wool seems to increase throughout the Bronze Age, and can be an indication of an increasing use of wool during that period. According to Shamir 2014, wool appears only from the Middle Bronze Age in the southern Levant. In some cases, it has been possible to distinguish the type of wool, such as sheep wool, camel wool or goat hair, which is found in textiles from Shahr-i Sokhta (Good 2007, 179–184; Völling 2008, 203). From Ur, sheep wool and goat hair have been identified in strings and ropes (Waetzoldt 2007, 112–121) and goat hair has been identified in textiles from Timna (Shamir and Baginski 1993, 9–10), in a ribbon from Khandia (Moulherat and Spantidaki 2009) and in a textile from Arslantepe (Frangipane *et al.* 2009, 19).

Unspecified wool fibres or the possibility/probability of such fibres is mentioned in textiles from the entire area:

- Tell el-Armana (Kemp and Vogelsang-Eastwood 2001).
- Timna (Sheffer 1986, 8; Shamir and Baginski 1993, 9–10; Rothenhäusler forthcoming-a).
- Tel Masos (Barber 1991, 166; Rothenhäusler forthcoming-a).
- Qatna/Tell Mishrife (James *et al.* 2009, 1109–1118).
- Arslantepe (Frangipane *et al.* 2009)
- Tell Mozan (Rothenhäusler forthcoming-a).
- Tepe Hissar (Völling 2008, 203).
- Ur (Barber 1991, 164; Völling 2008, 208; Breniquet 2008, 58).
- Santorini (Spantidaki and Moulherat 2012).
- Lefkandi (Spantidaki and Moulherat 2012).
- The Caucasian sites of Martkopi (Barber 1991, 168), Eastern Manych River, Kalmykia/Russia (Orfinskaya *et al.* 1999) and Shakhavskaya, Manych River (Shishlina *et al.* 2005, 6–9).

Thread thickness

Measuring the thread diameter or the thickness of the threads is a parameter which has become standard procedure in textile research during recent years and most often data in this regard only exist from the finds which have been found and analysed recently. It is a parameter which has to be understood as a range, because it is impossible to spin completely evenly. There is a lack of systematic recording of measurements, and sometimes the obtainable data are not altogether clear, but the collected data show that the thread diameters, to a large extent, range between 0.1 mm to 1 mm. Coarser weavings with threads measuring between 1–2 mm are also found in several cases, but in only three cases are threads thinner than 0.1 mm found. In a fragment from Tell Brak the threads measure *c.* 0.07 mm (Völling 2008, 216) and from Arslantepe fragments of a funerary sheet have thread diameters around 0.08 mm (Frangipane *et al.* 2009, 18). Threads that are thicker than 2 mm are equally rare in weavings. In fact only one of the four cases where it is found, is a weaving. It is a fragment from Bronze Age Tepe Hissar with both s and z spun threads perhaps made from wool (Völling 2008, 203). Of the three remaining examples, two are cords (Laurito 2007, 380–394) and one is simply a loose thread (Möller-Wiering 2006).

Neolithic and Chalcolithic fibres, yarn and textiles

Spinning, splicing and plying in the Neolithic and Chalcolithic

In the Neolithic and Chalcolithic, there is only evidence for plant fibre textiles and plant fibre thread. The Chalcolithic textiles from Nahal Mishmar previously considered as wool are now identified as flax (Shamir 2014). Likewise, the debated textiles at Çatal Hüyük are identified as being entirely of plant fibre (Vogelsang-Eastwood 1987a).

Thread can be made by either spinning or splicing, and is often subsequently plied. There seems to be a wide mix of both z and s spinning traditions. Threads which are spun or spliced, but not plied, are also widely attested and mostly with an s-spin (Deb Luran, Nahal Hemar, Judean Caves III/3, III/7, V/49, VI/46, VIII/9, Nahal Lehat, Christmas Cave, Naga-el-Der, Abydos, Hierakonpolis), and a few with an z-spin (Nahal Hemar, Dhuweila, Çatal Hüyük).



Fig. 3.1. Neolithic and Chalcolithic sites with textiles. See Appendix A for more information.

There are, generally, more sites with s-spinning than with z-spinning but the amount of material is too small to draw any definite conclusions on spin directions. In the southern Levant, however, which has a high concentration of finds, Shamir (2014, 145) notes that the threads are primarily s-spun coinciding with the natural spin direction of flax fibres. She also observes that Chalcolithic warps and weft are similar in textiles in the southern Levant (2014). A very small piece of fibre with a slight z-twist from Neolithic Greece (Nosch *et al.* 2011) may not be secure evidence for z-spinning.

Regarding plying, there are more sites with attestations of S2z plying (Susa, Judean Desert

Cave V/49, Nahal Lehat, Nahal Mishmar, Cave of the Warrior, Wadi Muranna'at, Dhuweila, Ghassul, Tell Halula, Fayum, Abydos, Hierakonpolis, Cayönü) than of sites with Z2s plying (Netiv Hagdud, Nahal Hemar, Çatal Hüyük) or S2s plying (Cave of Warrior, Christmas Cave, Naga-ed-Der, Hierakonpolis), but again, the numbers are too small to draw conclusions.

Israel and Egypt are the only two areas with abundant Neolithic and Chalcolithic textile and yarn evidence. In the southern Levant sites, both S2z plying and Z2s plying, and even S2s plying are encountered. In the Egyptian sites, there is s-spinning and there is also both S2z and S2s plying, but no evidence of Z2s plying, nor of



1: Shahr-i Sokhta	20: Beth Shean	36: Meydum	54: Khania
2: Tepe Hissar	21: Deir el-Balah	37: Saqqara	55: Kommos
3: Tepe Sialk	22: Timna	38: Qau	56: Knossos
4: Marlik Tepe	23: Bâb edh-Dhrâ	39: Gebelein	57: Akrotiri, Santorini
5: Tell Abu Salabikh	24: Tell Abu al-Kharaz	40: Naga ed-Dêr	58: Thebes
6: Hafagi	25: Tell es-Sa'idiyeh	40: El-Hawawish	59: Mycenae
7: Tello	26: Kamid el-Loz	41: Asyût	60: Athens
8: Karrana 3	27: Tell Mardikh, Ebla	42: Meir	61: Pylona, Rhodes
9: Ur	28: Tell Beydar	43: Kahum	62: Kazarma
10: Nippur	29: Terqa	44: Tell el Amarnah	63: Dendra
11: Nuzi	30: Tell Mishrife	45: Afrodisias	64: Lefkandi
12: Hili	31: Tall Bderi	46: Arslantepe	65: Azoria
13: Umm an-Nar	32: Tall Mozan	47: Tekeköy	66: Idalion
14: Arad	33: Umm el-Qaab	48: Troia	67: Paleoskoutella
15: Bareqet	34: Tomb of Dier	49: Acmehüyük	68: Tell Brak
16: Ramon I	34: Deir el-Bahari	50: Kaman-Kalehöyük	
17: Jericho	34: Tomb of Thutmose IV	51: Kültepe-Kanish	
18: Tel Masos	34: Ramses III	52: Agia Kyriaki	
19: Tell Qasileh	35: Tarkhan	53: Amorgós	

z-spinning that is not subsequently S-plied. This may be the result of the random preservation situation. Jones (2002b), however, concludes that from 3500 BC there is no evidence of z-spun yarns in Egypt, and only s-spinning appears to have been practised. Jones (2002a, 326) notes that the earliest samples from Fayum (5000 BC) and Abydos (3600 BC) are z-spun, but subsequently, the majority of yarns in pharaonic Egypt are s-spun.

Neolithic and Chalcolithic textiles

Neolithic and Chalcolithic textiles are overwhelmingly tabbies, either balanced or slightly faced tabbies. Most evidence comes from Egypt and Israel. Generally, the Neolithic and Chalcolithic textiles are of a high quality and weaving mistakes are rare (Shamir 2014, 148). There is one possible example of twill (Alişar Höyük dated to the Chalcolithic by excavator, but probably Early Bronze Age).

Fig. 3.2. Bronze Age sites with textiles. See Appendix B for more information.

The earliest archaeological textiles are from Çatal Hüyük and Cayönü in Turkey, but even earlier imprints from Jarmo illustrate the use of textiles and the loom.

Examples of high thread counts are 40×40 (Tepe Lungar, dated 4000 BC), 30×36 in Chalcolithic Desert Cave VI/46 and 44×45 in Nahal Mishmar, Israel, 21×25 in Hierakonpolis, Egypt dated 3500 BC. Low thread counts are 7×5 in Cayönü of the 8th–6th millennia, 6×14 in Abydos in Egypt dated 3250 BC, 8×8 in El Kowm 2, Syria dated 7100–6000 BC. The average thread count seems to be *c.* 10–15 threads per centimetre in the Neolithic and Chalcolithic textiles. Shamir (2014, 148) observes a slightly higher number of warp threads than weft threads in the southern Levant. There are examples of other textile techniques, particularly from the earliest sites, especially twining (Chalcolithic Wadi Murabba'at), weft-twining (PPNB Halula, Syria, PPNB Çatal Hüyük, Cayönü of the 8th–6th millennia, and Nahal Hemar, dated *c.* 7000 BC) and tablet weaving (Neolithic Dhuweila, Jordan). Nahal Hemar is also the find place of many other textile techniques: looping, knotted netting and interlinking. Finally, there is evidence for a Neolithic 3/3 basket weave from Mersin, Turkey. None of these techniques are attested in the Egyptian textile material.

In predynastic Egypt, Jones concludes that fabrics are mostly balanced (2002a, 329) but unbalanced fabrics also seem quite common, especially for the fine qualities.

The Weaving

It can be very difficult to analyse weavings from mineralised or charred textiles or from impressions. It is often only possible to see one side of the weaving and the threads and the structure can be deformed and fossilised in their positions. The remains are so fragile that the slightest touch will destroy them.

Some weaving techniques employed will appear similar on both sides of the textile so it does not matter if only one side is visible. A tabby weave has no front or back side, and 2/2 twill weavings will look the same on both sides. Other types of twill, such as a 2/1 twill have distinct back sides, which can be mistaken for tabby weaves.

By far the majority of the textiles throughout the period are registered as tabby weaves. There

are variations, such as either warp- or weft faced tabby or basket and half basket weaves. Twill was previously believed not to have appeared until the Iron Age. From the Bronze Age, twills are documented in fragments from Timna (Rothenhäusler forthcoming-a), Bâb edh-Dhrâ (Ballard and Skals 1996, 6–10), Tell Bderi (Rothenhäusler forthcoming-b), Alişar Höyük (Barber 1991, 167) and Martkopi (Barber 1991, 168) and two questionable twills are found in Marlik Tepe (Völling 2008, 204) and Tell Beydar (Breniquet 2008, 58).

Other techniques, such as twining, looping and knotted netting are listed for several textiles at a very early date, whereas a technique such as tapestry is not seen before *c.* 1500 BC in Egypt and in Shahr-i Sokhta (Barber 1991, 159; Good 2007, 179–184) and from Kaman-Kalehöyük (Völling 2008, 240).

The textile impression from Dhuweila dated to the Neolithic is believed to have been made by tablet weaving (Breniquet 2008, 57), a technique which is not attested again until the Late Bronze Age (Barber 1991, 156).

Bronze Age fibres, yarn and textiles

Flax is still by far the most commonly preserved textile fibre in the Bronze Age. However, in the 3rd millennium, wool thread and wool textiles start to appear in Iran and Iraq at Shahr-i Sokhta, Tepe Hissar, Ur, and in the Caucasian sites. In the southern Levant and the Aegean, the earliest evidence for the use of wool in textiles is from the Middle Bronze Age (Jericho, Akrotiri). Only in Late Bronze Age sites do wool finds begin to appear more frequently (Timna, Tall Mozan). However, this distribution may also be due to conservation, and in any case, the material is too small for definite conclusions about the spread of animal fibres. Currently, the oldest animal fibre textile of the Eastern Mediterranean area is from Arslantepe dated 3000–2900 BC (Frangipane *et al.* 2009). They are followed by Tall Mozan with two wool textile pieces, a coarse tabby dated 2700/2600–2500/2400, and a fine tabby dated 2500/2400–2100 (Rothenhäusler forthcoming a). It is worth noting that the early wool fibre textiles are of a very fine quality.

The Bronze Age wool is generally identified as from sheep and, in a few cases, also from goat (Arslantepe, Ur, Khania, Tell el-Armana, Timna) or camel (Shahr-i Sokhta).

Spinning in the Bronze Age is both z and s. There are fabrics woven of two s-spun threads (s/s at Arslantepe, Timna, Tall Mozan, Mochlos) or of two z-spun threads (z/z at Tell Abu al-Kharaz, Lefkandi and Caucasian sites), or of a mixture (s/z) which suggests that the spin direction is used to obtain a visual effect on the fabric's surface. At Tall Bderi, all three combinations are attested. At Tall Mozan, Rothenhäusler observes that most yarn is s-spun and if z-spun yarns are used, these are interwoven with s-spun yarn, and she suggests that this is a design choice. "Egyptian textiles are distinguished by the s-direction of the spin", notes Jones (2002a, 326).

In the Bronze Age, plying is still in use, both Z2s and S2z. It seems that as the thread counts increase, plying becomes less used.

Weaves in the Bronze Age are overwhelmingly tabbies. Outside Egypt there are a few attestations of other technologies, primarily for decorative purposes, such as tablet weave (Shahr-i Sokhta), knotless netting (Karrana), twill bands (Ur), twill (Bâb edh-Dhrâ), and tapestry (Shahr-i Sokhta, Qatna, Kaman-Kalehöyük).

Most Bronze Age textiles have thread counts of 10–12 threads per centimetre (tpc) and are balanced. A few have lower thread counts (Timna, Tall Bderi, Akrotiri). Thread counts over 20 tpc are very rare outside Egypt but do exist at Qatna (16 × 70–80), Bâb edh-Dhrâ (11 × 30 and 16 × 39), Tell Abu al-Kharaz (25 × 13), Tell es-Sa'idyeh (24 × 14), Kamid el-Loz (24 × 14), Arslantepe (38 × 18) and Tall Mozan (10 pieces have 51 × 100 tpc). Moreover, most Egyptian dynastic textiles are unbalanced, according to Jones (2002a, 329), with an average ratio of 2:1.

Faced fabrics with a remarkable difference in thread counts between the two thread systems are attested at Bareqet (15 × 8), Timna (3–5 × 8–20), Bâb edh-Dhrâ (11 × 30 and 9 × 22 and 16 × 39), Tell Abu al-Kharaz (25 × 13), Tell es-Sa'idyeh (24 × 14), Kamid el-Loz (24 × 14), Qatna (16 × 70–80), Tall Mozan (26–96 × 3–17) and Arslantepe (38 × 18). It should thus be noted that outside Egypt, fabrics with high thread counts are mostly strongly faced, with a high thread count in only one system.

The textiles and garments from Egypt are very well preserved, and real costume studies are possible. Again, the linen fabrics

dominate, with the special pleating technique as a prominent feature (Jones 2014).

Conclusion

The data collected for this survey only provide a little insight into the textile production of the past. Although a large geographic area is covered, the information remains limited. What has been passed on to us is only a small fraction of a large production through thousands of years. Looking at these snippets of information, it is important to keep in mind that the textiles were created through conscious choices made by the people working with the material. Choices made in order to obtain the desired qualities of their finished textiles. The textiles are not only the result of the limitations of a primitive technology.

The relatively limited number of textiles preserved and the randomness of the finds raises a wide range of questions, and although a somewhat surprising number of fine qualities with high thread counts and small thread diameters have come to light, emphasising the technical skills of the people of the past, a critical reflection should also be made here: we tend to excavate palaces and elite funerary contexts, and this may explain the large amount of fine archaeological textiles. The selection of textile qualities is thus precisely as random as the excavation activities themselves.

The finds from the southern Levant differ in techniques and are generally less uniform in their manufacture. This conclusion must, however, also be contextualised: these finds are primarily from caves where they have been used, disposed, or lost, while many of the other textile finds in this present survey are from urban environments or burials where they were intentionally deposited.

The obvious need for standard procedures in the manner of analysing and describing the textiles has revealed itself in the course of the results presented here. In several cases, the annotation of the data is not immediately understood and the information risks being lost or misunderstood. It could easily be avoided if a few agreed, shared guidelines were followed. Short forms, which can be understood universally, are recommended. This way making notes whilst working is facilitated and long descriptive explanations can be avoided.

Spinning and plying:

The standard for describing spinning and plying used in this survey is recommended. For single spun threads lower case *s* or *z* is used to describe the direction of the spinning. Capital *S* or *Z* is used to annotate the plying of threads followed by the number of *s*- or *z*-spun threads (*i.e.* S2z or Z2s).

Thread diameter:

For the thread diameter measurements are given in millimetres. The measurements should be understood as a range and as the numbers are quite small – often less than 1 millimetre, 1 or 2 digits are adequate (*i.e.* 0.1–0.3 mm; 0.05–0.1 mm).

Thread count:

Thread count is easily understood if it is listed as the number of threads from one system × the number of threads from the other system per centimetre. If warp and weft can be distinguished, warp should be listed before weft. It is also a range and can never be completely the same throughout one textile (*i.e.* 10–12 × 14–15 threads per centimetre).

The data which yield the most thought-provoking information in this chapter seems to be the spinning of the threads. Tradition can be one answer but is perhaps only a partial answer. Why is it that the common Neolithic use of plied yarns decreases through the Bronze Age? Is it the contact with new people and new materials, better technology, and improved skills? Or the introduction of wool?

The span of thread counts is also illuminating. It reveals a very large variety in the otherwise very simple technique of the tabby weave.

With the technological development and improved scientific methods of analysis it also seems that the concept of a ‘primitive’ textile technology of the past is being pushed further back into the Neolithic. The more we learn, the more advanced the past technology seems. In this respect finding more textiles and studying old finds again appear crucial to any scholarly progress and will hopefully be inspired by the results of the studies presented in this volume.

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