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Perished Material - Vanished People
Understanding variation in Upper Palaeolithic/Mesolithic
Textile Technologies

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Spring term 2014
Master Essay One year; ARKM02

Abstract

The pilot project which is reported here was triggered by the author's curiosity of the origin and development of basic textile technologies in early Palaeolithic and Mesolithic hunter-gatherer groups. The research question for the study is: Can comparisons of textile artefacts over a large range of areas and time spans tell us something about the early manufacture, use and development of textiles technologies? The methodology chosen for the study is to make a large scale survey of textile artefacts, primarily from excavations in Northern and Central Europe/Eurasia during three very different climate periods: the last interglacial period of Pleistocene, the latest glacial maximum and the first part of Holocene, the present interglacial period– the timespan for the study begins ca. 30 000 BP to ca. 6 000 BP. In total, textile findings from 17 excavation sites are described as they were reported either by excavators or by archaeologists specialized in prehistoric textile analysis. The analysis shows that there is evidence for quite an advanced weaving technology in the earliest phase (30 000–22 000 BP), but then very little textile remains in Europe during the next glacial phase (22 000–10 000 BP). And again, during the latest phase (11 000–6 000 BP), more evidence of both clothing and a variety of textile items is shown in the assemblage of artefacts. The issue of continuity of textile technological knowhow and skills between the three phases cannot be answered by the empirical approach of the study, but it can well be suspected that there is such a transfer in time between the different cultural groups.

Keywords: prehistoric textiles, Upper Palaeolithic, Mesolithic, textile technologies, hunter-fisher-gatherer societies

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1. Introduction

Which factors contribute to the long history of certain objects like the rope, the hunting/fishing net, the bag and cloths and the twisted fibre string in itself? When starts a textile technology to evolve? How does textile manufacture develop and how is its technology transferred between generations and geographic regions? These are questions that have been in my mind for many years and in studying archaeology and thus the long history of humankind I hope to be able to complete my own knowledge in this area (Hopp 2011:210f.).

1.1. Problem, aim and research question for the study

There are reasons to believe in a very old (1.8 million years) textile production, such as making of fibre strings for stringing beads and making ropes and basketry, and even cloth like shoes etc. (Hardy 2008; Wigforss 2014). A problem, with a theory of an early (advanced) textile technology, is where and how to find enough evidence for its validity and relevance. The archaeological records provide us with very little material due to the perishable nature of all organic material. If preserved, the textiles must have been deposited either in dry cold or warm caves, waterlogged sites and bogs, or deserts. There is no hope to find as much textile material as e.g. flint artefacts, and yet we need to incorporate all these imagined perishable materials in our understanding of the prehistoric technological development.

The aim of this pilot study is to look closer into traces of very early textile manufacture with the goal to get a better understanding of variation in early textile technological development. The archaeological focus (due to the limited time for the study) is on regional variation in primarily Northern and Central Europe/Eurasia during the latest part of Pleistocene and early Holocene, that is the Upper Palaeolithic and the Mesolithic eras (ca. 30 000–6 000 BP¹).

The overall research question for the study is: *Can comparisons of textile artefacts over a large range of areas and time spans tell us something about the technologies, development, use and genealogy of early textiles?*

1.2. What is a textile?

Today there is a vast scientific literature on prehistoric textiles, concerning terminology for description (Michel & Nosch 2013), and methods for excavation, conservation and analysing (Gillis & Nosch 2007). For the purpose of the present study, textile is defined in its broadest context: all objects manufactured by twisted threads of either various plant fibres (e.g. flax, nettles, hemp, linden and willow bast) or animal hair (e.g. wool and camel/goat hair). Included are then basketry types of textile, made manually (plaiting, knotting, coiling) or with needle interlaced strings, - like hats, baskets, bags, cloth, shoes, hunting and fishing nets, see figure 1 and 2. ‘True’ textiles (Adovasio et al. 1996) include twisted (or spun) thread, interlaced (twined or woven) by some kind of tool (frame, loom) in two systems (a warp and a weft), see figure 3. For a short introduction to textile materials and technologies see Appendix 2 in Wigforss (2014).

¹ All dates in the study will be given in BP - Before Present and if C-14 calibrated dates are available this will be specifically marked.



Figure 1. Looping a linden bast basket or hat. Photo by the author



Figure 2. Twisting a linden bast rope. Photo by the author

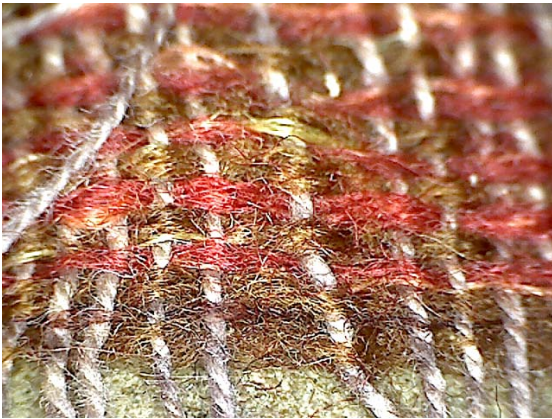


Figure 3. Plain weave (tabby) under the microscope. Photo by the author

1.3. Research History

The aim and motivation for the present study is in many ways inspired by the following well-known researchers in archaeological prehistoric textiles: Elisabeth Wayland Barber, Lise Bender Jørgensen Olga Soffer as well as by the previous work by the author.

Elisabeth Wayland Barber (1991, 1994, 2010)

In her dissertation: *Prehistoric Textiles. The development of cloth in the Neolithic and Bronze ages with special reference to the Aegean (1991)*, Barber gives global insights, as well as in-depth studies, of prehistoric plants and textile technological development in areas such as hand twisting versus tool spinning, hand plaiting and twining versus tool weaving; dyeing and weaving technical developments etc. In her subsequent book, Barber (1994:42) claims that humans in the late Upper Palaeolithic began to act very differently from before, they invented the string and sewing thus giving us: “*the first chapter in the story of women’s long association with the fiber craft.*”

Lise Bender Jørgensen (1992, 2003, 2013)

Bender Jørgensen, in her dissertation *North European textiles until AD 1000* (1992) makes a more or less complete inventory of the - at that time known and available - North European prehistoric textiles. She also notes that there have not been found any textile remains in Central or South Europe (Bender Jørgensen 1992:101). In her summary of the Mesolithic Stone Age textiles, including early Neolithic textile artefacts, she constitutes three specific groups which are characterised by following variation in textile technology:

- A Near Eastern group (with Çatalhöyük in the centre): tabby woven fabrics; twined fabrics, various types of looping; all textile remains seem to be of (not specified) vegetable fibres
- A Central European group (with reports from the Swiss lakes, French and Moravian sites): tabby woven fabrics of flax and non-woven textiles of bast
- A North European group (with mainly Danish textiles): non-woven textiles of bast, no traces of woven textiles

Bender Jørgensen summarizes the period in Northern Europe in the following way:

“Mesolithic textile technology was based on bast, which was spun and worked into various forms of twined weave and knotless netting. These techniques were most likely developed out of basketry [...] what distinguish Mesolithic textiles from baskets are that they are made of pliable spun fibres. The fabric is also softer and thinner than the baskets.” (1992:116).

And she also asks the relevant question, why did they not use flax or nettles, instead of tree bast for the needed softer textiles? Her answer is that they used hides and furs and tree bast was not replaced by softer fibre material until the wool was introduced in the Northern part of Europe through farming (Bender Jørgensen 1992:116).

Olga Soffer (1985, 2004 and Soffer et al. 1993 and 2000)

In her book *The Upper Paleolithic of the Central Russian Plain* (1985) Olga Soffer describes the settlements and social networks of the hunter-gatherers of the Russian Plain during the Upper Palaeolithic. Her detailed descriptions are quite essential for our understanding of the textile cultures of the Gravettien time in Europe and Eurasia. Later on, especially her (and her research collaborators) in-depth analysis of the ‘dressed’ Venus figurines during the Gravettien time (28 000 - 22 000 BP) has given the Upper Palaeolithic focus of the present pilot study. In line with Elisabeth Barber (1991, 1994), Soffer et al. (2000:512) state that:

“We use the iconographic evidence for woven clothing often found on European ‘Venus’ figurines to argue that these technologies² were employed by Upper Palaeolithic women, that they varied across Europe, and that they were sufficiently valued to be immortalized in fired clay, ivory and stone.” (2000:512)

By comparing the figurines from the Czech Republic with contemporary and similarly dressed figurines from Austria, France and Russia, the research team is able to give a good picture of the kind of stringed articles that were at hand (Soffer et al. 2000:524), see a more detailed description in section 3.1.3.

² They refer to following textile technologies as seen as impressions in clay: twined basketry, braided cordage, knotted netting, plain woven and twilled textiles (Soffer et al. 2000; Adovasio et al. 1996).

Eva Wigforss (2014)

In a previous study (a Bachelor Thesis in Archaeology: *Evidence for a Stone Age fibre technology – a closer look at the prehistoric String Theory*), the author has examined the evidence for a theory of early string making in humankind, a theory postulated by Karen Hardy in her article *Prehistoric string theory. How twisted fibres helped to shape the world* (2008). The substance for such a Grounded Theory was based on five evidence from archaeological artefacts: 1. Stringing and knotting techniques; 2. Textile imprints and impressions in clay; 3. Direct textile remains; 4. Perforated beads and pendants; 5. Tools for fishing, gathering and weaving, and four evidence from ethnographic studies: 6. String technologies; 7. Use of plant fibres; 8. Skill learning; 9. A social-cultural context³ (Wigforss 2014:10).

Through a careful analysis of the quality of the so perceived claimed evidence, the conclusion was that the overall result of the analysis of the archaeological evidence showed an uneven profile, where some evidence such as direct textile artefacts from Upper Palaeolithic and textile impressions in clay had the highest relevance and validity for the theory. Presented evidence from the ethnographic studies illustrated the role of plant fibre technologies in “modern” Stone Age societies, as well as the required technologies and their development and learning in a community of practice. However, the ethnographic evidence presupposes that humans in Upper Palaeolithic had the same kind of cognitive and social minds for string technologies as modern humans, and were therefore rated as having a much lower relevance and validity for a prehistoric theory of string manufacture (Wigforss 2014:24-25). In the concluding remarks, the author suggests that the textile technologies might be much older, and perhaps not even with an origin in central or western Europe but rather in the Eastern parts of Asia (Wigforss 2014:28-29) – perhaps even in the Far East parts of Asia (e.g. China and eastern Russia). In the study, two related research questions (RQ) were also formulated:

RO2-What constitutes the textile materiality of the Stone Age? with a tentative answer: *“The fact that some of the textiles still surround us, like cordage and thread, indicates a very long biography of such items and it is reasonable to suppose that fibre string technologies were at the centre of the Stone Age technologies and societies. The research question calls for further studies into the materiality of the prehistoric hunter-gatherer groups”* (Wigforss 2014: 29).

RQ 3-Do we have evidence for a new Theory of a Palaeolithic technological mind for string manufacture? with the following answer in the discussion of the posed question: *“We cannot any longer observe authentic Stone Age behaviour, unless we accept that some still living ethnic group on earth have the same cognitive level and technological skills. We can, however, speculate on good grounds, and with the help of experimental archaeology, about the motoric and symbolic skills needed for fibre preparation and textile manufacture.”* (Wigforss 2014:28).

³ See an overview of the evidence presented in the essay in Appendix 1 (Wigforss 2014:35-36)

2. Theory and Method

The study partly borrows ideas, material and methodologies from the author's previous Bachelor Thesis in Archaeology (Wigforss 2014: 8-11).

2.1. Relevant theoretical perspectives for the study

Underpinning the study is a hermeneutic/interpretative approach to evaluate and reflect on the sparse empirical data with an aim to construct relevant hypotheses for a theory of early textile technological variation before Neolithic and hence the domestication of animals and plants and introduction of wool and domesticated flax. No such theory has yet been formulated. There are some hypothetical reasoning (mostly of the nature of deductive logistics) around an early textile development in the articles and books of the four previously referred textile researchers. However we might still be in the stage of a pre-theoretical level for the full discovery of textile technologies in the Upper Palaeolithic hunter-gatherer societies, mostly due to too sparse empirical data.

2.2. Methodological considerations

The adopted methodological approach is characterized by a reflexive methodology similar to the reflectiveness needed in archaeological excavations (Apel 2002). The present pilot study can best be described as a basic inventory of direct and indirect textile artefacts from reported excavations from some Upper Palaeolithic and Mesolithic sites in Europe.

The aim of the author was to find as many reports as possible of ancient textile artefacts for each so selected time span, based both in the published records by the previously mentioned researchers (section 1.3) and by a new (5 week long) literature search (in relevant journals and books) for more evidence of an early textile technology. A search in Lund University Library's vast collection of accessible journals in archaeology and e-books, as well as a search in Google Scholar for publications in ancient textiles published in English, French, and German was performed in February 2014. In the Library search several libraries have been used in the region, including the departmental library and the Lund University Library, and at Copenhagen University the libraries of the Centre for Textile Research and the Saxo Institute.

The description and interpretation of each textile artefact is based on direct and/or second hand published records of the archaeological textile. Efforts to find descriptions by archaeology specialist in analysing prehistoric textiles have been essential for the interpretation and for a second opinion of the initial analysis. The following types of textiles and textile related artefacts have been selected for the study:

- ✓ Direct textile artefacts: fishing net, rope, cordage, cloth, fragments
- ✓ Indirect textile artefacts: impressions in clay
- ✓ Tools and other textile related artefacts: needles, warp weights, whorls, looms
- ✓ Iconographic representations of textiles like in the 'Venus' figurines (portable art), and engravings of humans wearing (interpreted) textile clothing.

In the descriptions, for each so categorized item, the following parameters are used (when available):

- Site and dating
- Raw material
- Structure and technological description of the analysed textile
- Social context (if possible)

According to Soffer (1985:486), and in line with many other international archaeologists, we can see large-scale fluctuations in the behaviour complexity during the Upper Palaeolithic (based on the density of sites found, the high volume of artefacts and features recovered, and thus the high archaeological visibility). It has been described as two or more peaks of intensification of the production and use of art as well as traces of more advanced textile technologies (Barber 1991): in France the Périgordien⁴ (30 000 - 22 000 BP) and the Magdalenien (after 18 000 BP) periods, and in Germany one period around 30 000 BP, one around 24 000 -22 000 BP and the third around 13 000 BP (Soffer, 1985:486).

In Soffer's own study of the social complexity of the Russian plain (1985), she notices similar patterns of complexities in behaviour, with a first period in the river settlements around 27 000 BP, then a disappearance of humans around 20 000 BP due to the maximum glacial period, and then with an early re-colonisation around 18 000 BP, when the ice cap starts to melt down. In central and northern Europe, the late glacial maximum around 20 000 BP also had a tremendous effect on the northern hunter-gatherer societies, so it is presumed that most of them moved down to south-west France and Spain to escape the harsh climate. The same effect is valid for the Scandinavian area, see Jensen (2001); however, traces of any human societies before the last glacial maximum is no longer possible to find due to the heavy and moving ice sheet over northern Europe. So an archaeological focus on traces of textile technologies from this area has to be from a (presumed) re-colonisation when the ice starts to withdraw around 13 000 BP. Inspired by these facts, I decided to focus my search and focus for the study to three distinct climate periods in which I suspected that both enough complex societies were at hand, as well as access to enough plants (either grass etc. or trees) to produce textiles.

The analysis will then be divided into the following three selected chronological periods based on climate fluctuations and relatively dated by their Oxygen Isotope Stages (Renfrew & Bahn 2008:130-131):

- the last part of the warm Pleistocene interglacial period (30 000–22 000 BP)
- the latest maximum Pleistocene glacial period (22 000–13 000 BP)
- the beginning of the present warm period in Holocene (13 000 BP)

For each so defined period, the analysis starts with a short description of the overall context for the selected sites and textile artefacts, including climate, geography and flora/fauna and assumed cultural groups of northern and central Europe.

⁴ Also referred to as the Gravettien period

In order to make a large-scale discussion of regional and cultural variation over the chosen time and geography easier to follow for the reader, three consecutive maps were constructed by the author (and drawn by a specialist on map design), on the basis of several different sources in books and of Internet resources. The maps intend to illustrate, hypothetically, the European geography during the following Oxygen Isotope Stages (OIS): map 1 from ca. 30 000 BP (OIS3), map 2 from ca. 20 000 BP (OIS2) and map 3 from ca. 10 000 BP (OIS1).

In the study, uncalibrated dates are given for several sites and/or textile artefacts in the reports. Perhaps due to the artefacts early discovery, some has not yet been calibrated with e.g. C-14 or other methods (Renfrew & Bahn 2008). However, all artefacts are dated through stratigraphic and/or typological methods.

2.3. Critical aspects of the proposed methodologies

Most excavated textile fragments are very tiny (sometimes measured in millimetres), and according to Barber (1991, chapter 4) so small that early excavators probably did not detect them or paid any attention to possible textile remains. Large areas of Northern Europe/Eurasia have very few excavated and reported actual textile artefacts from Upper Palaeolithic, perhaps due to both severe preservation conditions, but also to the excavation methodology. Today, water-sieving of the excavated deposits is mostly standard when excavating settlements. Another problem is the procedure for archaeological excavations before ca. 1990, when often little attention was paid to what could later have been interpreted as organic textile materials. Artefacts of bone, if found in these sites from Upper Palaeolithic were not interpreted as tools for textile activities and later re-evaluated textile fragments - due to newer technical opportunities - reveals new aspect of known and mastered textile technologies, like spinning and dying. The process of this re-evaluation of textile artefacts in museums has just began, and more information from more careful excavations will perhaps change our views of the role of textiles in early Stone Age societies (Barber 1994; Soffer et al. 2000).

In this study, not only direct remains of textiles and related tools have been accessed, but also iconographically depicted textiles have been searched for. There is a problem with how to interpret the depiction of dresses, since we do not know whether they are contemporary and have been used by real people, or perhaps only dresses of imaged goods. Some, of the problems with comparing iconographic representations e.g. details in clothing, with similar artefacts from graves calls for a critical mind. In her dissertation, Ulla Mannering has compared the dressing style of around 1000 depictions of clothing of both women and men in the so-called gold foil figures from Sorte Muld (Denmark) and Uppåkra (Sweden). She found out that when comparing their depicted dresses to contemporary findings of clothing in pictures and graves, the humans on the tiny golden sheets were often depicted with a brick-woven border on their capes and shirts representing a dressing style in the older Germanic period and not the younger period to which the artefacts were dated. So the change in dressing styles from the older to the younger Germanic age was not represented in the iconographic art. (Lecture March 11, 2014, by archaeologist Ulla Mannering, Centre for Textile research at Copenhagen University and the National Museum of Copenhagen).

A drawback when trying to scoop up as much information as possible about the textiles of the Upper Palaeolithic, is that several findings might not yet have been published, or published in languages unfamiliar to the author. Thus, due to limits in the author's knowledge of languages, only publications in Swedish, Danish, English, German and French have been accessed for the study.

3. Results from the analysis

The aim of the analysis was to find as many archaeologically reported textile artefacts (or artefacts related to textile technology) in order to make a comparison between them on a large scale time span, with the ultimate goal of being able to say something of the possible technological development of textile objects. However it became evident during the search that, there are very few reported direct textile remains from the two earliest investigated periods, only ropes and twisted fibres. But there is empirical evidence - like textile impressions in clay and depicted dresses in the iconography - for the presence of an early quite advanced textile technology. For the last selected period, the Mesolithic period, more direct textiles have been found and the here reported findings are the most well-known artefacts, and with for the study analysis usable (and known) published records. The analysed textiles in the study are summarized in a table in Appendix 1.

3.1 The warm interglacial Pleistocene period 30 000–22 000 BP

Natural context: Dolukhanov (1996) describes the climate and the landscape of northern Europe/Eurasia during the first isotopic stages (OIS 5–4) in the last Ice Age as a treeless arctic tundra, dominated by vegetation cover and then in the slightly warmer period a forestation of the vast more or less ice free northern hemisphere around 69 000 BP. In the next stage, lasting from 69 000–24 000 BP that is OIS 3, the greater part of Europe was free of glaciers. However the climate was generally quite cold, interrupted by milder episodes during which tundra forest was spread all over the northern parts of Europe. The maximum rise in temperature occurred at 31 000 BP and 26 000 BP (Dolukhanov 1996:22). So during the investigated period little ice affects the climate and landscape, however, the climate is generally cooler than at the peak of this interglacial period. The map 1 in figure 4 aims to illustrate a hypothetical landscape of this period.

Cultural context: The following hunter-gatherer societies where textile artefacts have been excavated are identified based on type of settlements and a lithic assemblages: Gravettien including the western Périgord culture; the central European cultures Pavlov-Willendorf and Kostenki -Avdevo on the Russian plain.



Figure 4. Map 1 illustrates the hypothetical relation between land, water and ice in Europe/Eurasia around 30 000 BP⁵ (OIS 3), and with the following excavation sites marked: A-Dzudzuana; B-Moravia; C-Kostenki; D-Willendorf and E-Lespugue. Drawing after basic map by Alf Dahlberg.

3.1.1. Dzudzuana cave, Georgia (27 000 BP)

The Dzudzuana cave is located in the foothills of the Caucasian mountains in Georgia and was excavated during two campaign periods, 1966–1975 and 1996–2008, see location in figure 4, ref. A. It is from the last excavation period, that the discovery of possible textile production is reported, through findings of twisted wild flax and textile related tools. In the article by Bar-Yosef et al. (2011), the findings and the excavation procedures are reported in detail together with the C-14 calibrated dates of the several layers of human presence in the cave (Bar-Yosef et al. 2011:333).

Textile description: In the more detailed report of the findings (Bar-Yosef et al. 2011) the following description with reference to actual photos is made of their findings:

“numerous non-pollen polymorphs were discovered. Among these were unique finds of wild flax, including spun and dyed ones[...] It is interesting that besides spun fibres, there are

⁵ Some of the facts and the shown lines concerning the water/land proportion in Northern Europe have been inspired by *The Times Archeology of the World* (Scarre 1999:84)

remains of knitted string with numerous knots[...]. Dyed fibres are more numerous in C3⁶. The colours identified are blue, green and pink.” (Bar-Yosef et al. 2011:344).

In a previously published more popular text in Science Kvavdaze et al. (2009) also state that the fibre material is flax, based on comparing the fibres with white light microscope images of similar modern flax and ancient samples of flax. Kvavdaze et al. (2009) also assume that because the presence of twisted fibres the people living in the cave were used to make ropes or strings. They were able to use the wild flax for colouring the fabric and making cloth for keeping warm in the sometimes harsh climate (as indicated by the pollen analysis from the excavations). However, the analysis performed by Kvavdaze et al. (2009), trying to identify the raw material as flax, has been questioned by Bergfjord et al. (2010). This group of experienced researchers in ancient textile emphasises that separating flax from other bast material on the basis of only white light compound microscope images is not possible⁷. They conclude their objections thus: “*The fiber samples may be flax, but they have not been proven to be so.*” (Bergfjord et al. 2010:1634).

However this is by no means the first conflict between researchers in determining the exact nature of the raw material in the ancient textile fragment. In the first micro-photographed analysis of the small textile fragments from Çatalhöyük (an Anatolian Neolithic settlement dated to around 9 000 BP), Helbaek, 1963⁸ a specialist in ancient flax, determines the raw material to be of wool. Later Burnham (1965:170) also agrees with this view with the added argument: “*The complete and total absence of flax seeds among the many cereals grains eliminates this possibility.*” However, Ryder, a specialist on wool fibres, also 1965, in her deep and experimental analysis of the same textile fragment rejects the argument that the fibres are of wool and summarizes her analysis: “*This almost unrecognizable material is therefore conclusively identified as flax, thus lending support to the theory that flax was spun at an earlier date than wool.*” (Ryder 1965:176). Barber, in her dissertation from 1991, elaborates extensively on the textile findings from Çatalhöyük and in recapitulating the controversy thirty years earlier with newer insights on determining materials of charred textile fragments, concludes that: “*So once again, the early textiles turned out to be of plant fiber, specifically of some sort of linen - an interesting fact in itself.*” (Barber 1991:11). She further elaborates the fact that use of flax does not necessarily implies domestication, since the longer stems of the wild flax harvested before the seeds develop are better suited for textile technology than the shorter domesticated ones, where the bigger seeds are used primarily for food (Barber 1991:11).

Social context: The Dzudzuana cave seems to have been used intermittently for many ten thousands of years (34 500 BP – 6 000 BP) and among the interpretations of the earliest users even Neanderthal humans have been suggested. During the period when large amount of wild flax were found people related to the late Aurignacien or early Gravettien cultural groups are possible habitants.

⁶ Calibrated to 27 000-24 000 BP (Bar-Yosef et al. 2011:333).

⁷ See my photo, figure 3 (p. 6) of a 140 y. old woven textile under white light microscope.

⁸ Referred in Burnham 1965, Ryder 1965 and Barber 1994

3.1.2. Moravia, Czech Republic (27 000 BP)

Textiles from Moravia in the present Czech Republic (see figure 4, ref. B), come from at least two excavation sites: Pavlov I and Dolni Vestonice I and II. The sites were excavated in the 1950s. Radiocarbon calibrated dates for the two settlements are between 27 000–25 000 BP.

Textile description: All remains of textile artefacts are negative impressions in fired clay and there are also iconographic representations of textiles in Venus figurines (all in burnt clay and ivory). All material for the textiles is identified as being of various plant fibres. Pollen analyses from the sites indicate the presence of bast-bearing plants (trees like alder and yew), as well as herbaceous plants (milkweed and nettle) (Adovasio et al. 1996:532). Several artefacts (use wear on mammoth bones) have later been interpreted as tools for more advanced weaving (Soffer 2004). All in all 33 small impressions in clay have been (re)analysed by different researchers during different times.

In the first analysis by Adovasio et al. (1996), four different clay impressions from Pavlov I were studied by high-resolution scaled photographs, and the specimens are described in detail as representing two types of textiles: twined basketry and plain weave (Adovasio et al. (1996:529 -531). The fragments are too small for any specification of the use of the textiles. In the article the research team (recognizing that the Moravian textiles are the oldest textile findings) compare their analysis to other a little bit younger textile findings from all over the world, for example the rope from the French Lascaux cave, 17 000 BP (see description in section 3.2.1) and the cordage from Ohala II in Israel ca. 19 000 BP (see description in Nadel et al. 1994; Wigforss 2014:14-15). The conclusion from the technological comparison is that “*twining technology is at the base of virtually all textile and basketry production*” (Adovasio et al. (1996:533).

Their further analysis of the textile impressions in clay at the Moravian sites Pavlov I and Dolni Vestonice I and II includes 33 items (Soffer et al. 2000). Their analysis is summarized in the article in a detailed table labelled: *Fiber Technologies from Upper Paleolithic Moravia* with the following wordings: “*the inventory includes single-ply, multiple-ply, and braided cordage, knotted netting, plaited wicker style basketry and a wide variety of non-heddle-loom woven textiles, including simple and diagonal twined pieces and plain woven and twilled objects. Some of these pieces even exhibit intentional structural decoration.*” (Soffer et al. 2000: 513).

The research team concludes their analysis of the textile and possible tool artefacts by stating that “*people wove and/or plaited plant-fiber-based products by at least the Gravettian time*” (Soffer et al. 2000: 514) and that they, very likely, were capable of sewing and hence could produce more complex textile artefacts as shown by the findings of needles and other textile related bone artefacts.

In later studies Soffer (2004) has more explicitly studied textile related tools from the Moravian excavations and compared these artefacts and traces of use-wear with ethnographically similar tools from museums. Most of the studied ethnographic material from hunter-gather groups, supposedly living under the same conditions as the groups occupying the Moravian and the Kostenki settlements some 27 000–22 000 years ago, showed that

textile related tools were made of antlers, bone and wood, thus only preserved under very specific conditions. By establishing some diagnostic criteria for textile use on those (not so old but used) objects she re-examined and compared them with some of the inventories from the Moravian excavations. Although, yet only suggestions, Soffer claims that some mammoth bones have marks indicating being used as weaving sticks or part of a weaving frame. In a comparison with similar findings from other sites in Europe (e.g. Vogelherd dated to at least 32 000 BP), mammoth bones fashioned to long thin needles were found but not so previously analysed. She concludes her study with following exclamation: *“This evidence calls for a re-examination of bone and ivory inventories to identify such implements across Europe.”* (Soffer 2004:412).

Social context: The Moravian findings are assigned to the Pavlovian hunter-gatherer group that forms part of the central/eastern Gravettien culture. The pollen analysis from the sites indicates a steppe-tundra like environment. Adovasio et al. (1996) are surprised by the sedentary nature of the Gravettien group in Moravia and their skills and knowledge to produce finely woven basketry or fabrics. These competences can also be identified in later Pleistocene/early Holocene hunter-gatherer groups in similar or slightly warmer climates: *“While it is now certain, that perishable fibre industries were part of the first Americans, they also seem to have been part of Upper Palaeolithic techno-economic suite for much longer than we have imaged.”* (Soffer 2004:533).

3.1.3. Textile variation in the Gravettien dressed Venus figurines

As described in the introduction, the most common iconographic representations of early cloth, and evidence for a variation in textile manufacture, are the assumedly dressed Venus figurines. The findings and the interpretation of the Upper Palaeolithic small portable figurines have a long research history, all the way back to the first discovery in south west France (Brassempouy 1892). These kinds of statuettes have an almost 5 000 years long spreading area all over Europe and Eurasia (from Siberia to western France). The oldest figurines (30 000 BP from the early Gravettien) are from the eastern parts thus indicating diffusion from East via Central to West Europe - the youngest being found in France from the Magdalenien period around 25 000 BP (the artistic head from Brassempouy), (Barber 1991; Soffer et al. 2000)

Some of these Venus figurines with engravings have been re-analysed by Soffer et al. (2000) and the research team suggests that the marks and engravings indicate that some of the Venus figurines actually were dressed. They could visually identify three different types of dress details: headgears, various body bandeaux, and at least one type of skirt. They could also discern a variety in the dresses used, related to the geographic site (West, Central, or East Europe) where the figurines have been found. This phenomenon, together with the analysis of textile impressions in clay compared to other similar textile expressions around the world (Adovasio et al. 1996), is seen as evidence for an Upper Palaeolithic advanced plant based textile culture, including twisting fibres and woven textile. However, the interpretations of the “dressings” have been discussed and in some cases challenged by other archaeologists. These comments are published in connection with their analysis in *Current Anthropology*, 2000 (41), 3:525-535), together with a longer argumentative reply from the research group. It is in

particular the analysis of the depicted weaving techniques that have been questioned by others. From the analysis by Soffer et al. (2000:517-522) as reported in the article we can summarize their findings concerning three different types of figurines in order to give further information of the level of textile technology during the study's reported period.

A. Venus figurines from Kostenki and Avdeevo with head gear, bandeau and belt

In the excavations of the many Upper Palaeolithic settlements along the rivers on the Russian Plain (Don, Dnepr, Dnestr), see figure 4, ref. C; many female figurines of all sorts have been found. The figurines from the Kostenki-Avdeevo are the oldest dated to around 30 000 BP. Soffer et al. (2000: 517-518) specifies only in more detail the so called marl figurine from the Kostenki I excavations⁹ in 1988. In their description of the figurines' headgear, they claim that the basic textile technology is the same as for the headgear of the Willendorf Venus (see next section), but that there are a greater number of the circuits encompassing the Kostenki I figurine:

“The top of this head made of marl depicts a method of starting which may involve systematically superimposed weaving elements such as those which characterize certain types of twining centers and so called plaited starts in coiled basketry.” (Soffer et al. 2000:518).

The presence of upper body bandeaux has previously been noted (by Gvozdover) in a large number of the figurines from Kostenki and Avdeevo and described as *“linear wedge-shaped notching with staggering spacing or checkwork and suggested that they might be elements of clothing.”* Soffer et al. (2000:519) conclude their analysis with the following statement: *“Whatever the weave of the straps, these engravings clearly depict woven fabrics.”* They also note in their comparison between the Eastern and Western figurines that Western figurines have no headgear or bandeaux, whereas most Eastern figurines with headgear almost always also have engraved bandeaus or straps.

They also notice that a belt is sometimes depicted around the waist or low on the hips. There is a variety in the position of the belt so the Eastern Europe belts are around the waist, sometimes only depicted on the back or the front of body and the Central and Western European figurines have their belt always low on the hip (Soffer et al. (2000:520).

B. The Venus from Willendorf with a head gear and bandeau

The figurine was found 1908 in the Willendorf settlement, Austria, see figure 4, ref. D. The figurine is made of limestone and the height is 11 cm. The figurine together with other artefacts from the settlement is dated to 30 000 BP. Now exposed in the Naturhistorisches Museum of Vienna, see photo of the figurine on the museum's web address:
<http://www.nhmwien.ac.at/en>

The examination of the original figurines was done by the research team, with no indication of how close they could examine the figurine. They describe the headgear as a fibre-based cap

⁹ The settlements are known for the many huts of mammoth's bones, see more of their societies in Soffer, 1985.

or hat in the following way: “a spirally or radially hand-woven item which may be initiated by a knotted center in the manner of some kinds of coiled baskets” (Soffer et al. 200:518).¹⁰

In their description of the weaving technique they assume a “two-element structure in which an apparently flexible, horizontal foundation element or warp is vertically wrapped with stem stitches.”[...] “Work direction is right to left, and at least two circuits encircle the head, with two extra half-circuits over the nape of the neck [...]. Several areas on the body of the cap appear to illustrate splices, where new material has been added.” (Soffer et al. 200:518).

C. *The Venus from Lespugue with a string skirt*

The figurine (the youngest of them, 26 000 BP) was found in pieces (and later reconstructed) 1922, in the Grotte de Rideaux, Lespugue, France, see figure 4, ref. E. It is made of mammoth ivory and ca. 15 cm high. Now exposed in the Musée de l’Homme in Paris, see video of the figurine at the web address http://www.youtube.com/watch?v=CBT4i_OPWEI

The examination of the original figurines was done by the research team with unaided eyes and low-power magnification. They describe the skirt in the following way:

“The Lespugue skirt is composed of 11 cords plied around a base cord which serves as the belt. The cords are secured to the belt by looping both ends of a single-ply construction over the belt and then twisting the ends together [i.e., replying] with a final Z twist. Several of the cords show as many as 30 to 40 separate incisions illustrating individual twists, and great care has been taken to depict progressive changes in angle of twist [...] The overall configuration of the skirt is tapered not unlike a tail by employing a long central cord and immediately contiguous segments with progressively shorter cords towards the lateral margins of the skirt.” (Soffer et al. 2000:520)

Barber (1991, 1994:44-45) has also made a close-up examination of the figurine by drawing in detail the stringed skirt and her analysis (also referred in Soffer et al. 2000) complies well with the description above. However she also remarks that “the bottom end of each twisted string fraying out into a mass of loose fibers (not possible for e.g., a twisted piece of gut or sinew).” (Barber 1991:40). Interestingly, Barber has followed up this dress style (a string skirt) through its long biographic history, by comparing the Lespugue figurine’s dress with other remarkable findings such as the string skirt of the girl from the Danish Egtved Bronze Age excavation until contemporary use of almost the same style of dressing in Russian folk dances (Barber 1994: 54-68; 2010).

¹⁰ See also my photo of a linden bast hat/basket on page 6.

3.2 The cold glacial Pleistocene period 22 000- 13 000 BP

Natural context: The landscape of Europe and Eurasia was dominated by the Last Glacial Maximum (LGM). The ice cap on the Northern parts is thick and moves very little during the maximum around 20 000 BP, see figure 5. South of the ice edge the climate is now most of the time (about 8 000 years) very dry, with cold wind driving up dust, successively creating a great layer of loess in central Europe. There is very little vegetation and most parts of the ice free Northern and Central Europe are not habitable for humans, although in climate fluctuations with warmer periods seasonal habitat can be traced, mostly in connection with reindeer hunting. The hunter-gatherer mobility is now much more visible than in the previous interglacial stages, where high population density created more or less permanent settlements like on the Russian plain and in Moravia. In the period 20 000 –18 000 BP no traces of people are found on the Russian plain, where most of the rivers and lakes were probably frozen all around the year (Soffer 1985). However, the Russian Plain was free of ice earlier than Northern Europe so traces are found of re-colonisation, now however more seasonal. The mammoth disappears probably due to extensive hunting and to the changing of the flora of the steppe-tundra environment with now much more meagre flora on the large plains in northern Europe/Eurasia. (Soffer & Praslov 1993; Gambler 1999). They are replaced by reindeers which prefer the meagre lichen vegetation on the tundra. The reindeers probably had a higher mobility by their seasonal wandering towards the edge of the ice during the summer, forcing the hunters to the same kind of mobility (Jensen 2001).

Cultural context: In the search for textile remains, whether iconographic or direct material and tools almost nothing has so far been found or reported. The conditions for conserving organic material are by far the worst in this glacial period, with fluctuations between cold dry and cold wet and even temperate wet climate. Traces of the previously so abundant and advanced textile technologies are no longer visible in the archaeological records. Few settlements or seasonal habitat have been found, although during the reindeer hunting era cultural groups such as the late Magdalenien, the Hamburg, Federmesser and Swederian groups moved around in the landscape close to the edge of the moving and melting ice cap (Soffer 1985; Gambler 1999; Jensen 2001 ch. 2-3). Denmark is more or less free of ice around 13 000 BP (Jensen 2001 ch.2).

In the following analysis (of primarily European archaeological records) only one important rope has been found (from the Lascaux cave) and one important more permanent settlement (Gönnersdorf) with abundant textile related artefacts. But there is more evidence of a textile technological continuity from the earlier period, e.g. the (re)analysis of the osseous material found, specifically tools made of antlers and bone among the numerous reindeer artefacts (Bahn 2001; Stone 2009).



Figure 5. Map 2 illustrates the hypothetical relation between land, water and ice in Europe/Eurasia around 20 000 BP (OIS 2) and with following excavation sites: A- Lascaux and B- Gönnersdorf. Drawing after basic map by Alf Dahlberg.

3.2.1. Lascaux cave, France (17 000 BP)

The location of the well-known Lascaux cave, with the impressive paintings of huge animals, is in the mountainous landscape along the Dordogne, see figure 5, ref. A. The cave was found 1940 and was excavated between 1940 and 1966. The estimated age of the cave paintings and the few found artefacts is dated to 17 000 BP.

Textile description: The rope of the Lascaux cave was accidentally found by abbé André Glory, while copying the more famous cave paintings. The interpretation of the use of the rope was to help visitors to orient in the very inner dark rooms of the cave.

In a modern analysis of the rope, Leroi-Gourhan (1982) describes the textile artefact as a rope, which is 7 mm in diameter. The rope was fossilized so limestone had replaced the plant fibres but it was still possible to see that they had been twisted together to form the rope. And Leroi-Gourhan argues that plant fibres were in common use around 17 000 BP.

Bender Jørgensen (1992:101) describes the textile artefact in the following way: “A piece of cord...30 cm long, diameter 7–8 mm, S-plyed from 3 s-spun yarns. The cord is made of unidentifiable vegetable fibres”. However, Barber (1991:40) suggests it could have been bast fibres in the rope and has the following description: “Painstaking analysis showed that the

cord, of which we have about 30 cm (now in five pieces) had been neatly twisted in the S direction...from three Z-plyed strands of vegetable fiber, to a thickness of 6 to 8 mm.”

Social context: The cave paintings are assigned to the Magdalenien culture in south west of Europe and the cave was not used as a settlement but rather for ritual activities. The cave is narrow and long and dark so some kind of guidance into the inner rooms, where the most famous paintings are located, was needed. A lamp as well as material for torches and a rope have been found, and they can all be related to tools for entering the caves underground rooms (Leroi-Gourhan, 1982).

3.2.2. Gönnersdorf, western Germany (13 000 BP)

Gönnersdorf is located at the western end of a Rhine Middle Terrace, close to where the river leaves the open Neuwied Basin and re-enters the narrow Rhine Gorge through the Andernach Gate (see figure 5, ref. B). The site is seen as a “base-camp” (Bosinski 1982; Jöris et al. 2011). An area of 687 m² of the locality was excavated between 1968 and 1976, with calibrated dates around 13 000 BP. This sets the occupation time before a central European major volcanic eruption that changed the course of the Rhine (de Laet, 1982).

Textile descriptions and context: Disappointingly, it was not possible to find more evidence for textile artefacts than some female figurines and depictions of probably dressed females engraved in cave walls and on schist (Bosinski 1982:40-41; 18:3 figure 53). There was also abundant bone and antler material with some interpretations of a textile technological use (Bosinski 1982; de Laet, 1982, Jöris et al. 2011). No analysis of the dresses of the female figurines have been found by the author (material is stored at the University of Tübingen). In my opinion, further studies and excavations at the large settlement might later give evidence for a fibre-based textile manufacture, due to the many descriptions of the settlement’s social organisation and the diversity of material found, e.g. the exploited lithic raw material. Another factor which speaks for a more advanced textile technology is Gönnersdorf’s location at a central European crossroad, which ought to have given the Gönnersdorf-Andernach hunter-gatherer a social connection to the other Magdalenien cultures in the south and west of Europe.

3.2.3. The role of bone tools for Palaeolithic textile industries

Bahn (2001) discovers when rereading the book of the French archaeologist Gustave Chauvet¹¹ (published 1910) *Os, ivoires et bois de renne ouvrés de la Charente Hypothèses Palethnographique* that some of these early French excavators both found and interpreted several items as related to advanced textile manufacture. In his book Chauvet has a special section on the possibility of basketry and weaving in the Magdalenien context. Well aware of the fact that he could not hope for finding direct textile remains, he turned to both possible tools and textile engravings in bones e.g. from the Grotte de Placard (Bahn, 2001:272). Chauvet describes the engraving as depicting a weave or fine basketry, which is woven out of plant fibres He also relies on observations done by other contemporary archaeologists e.g. a bone tool that could have been used for splitting flexible bark. Bark and bast from the lime

¹¹ Gustave Chauvet lived between 1840 and 1933. He was a lawyer and amateur archaeologist, doing excavations in the Charente region (Paleolithic, primarily Magdalenien sites) (Bahn, 2001).

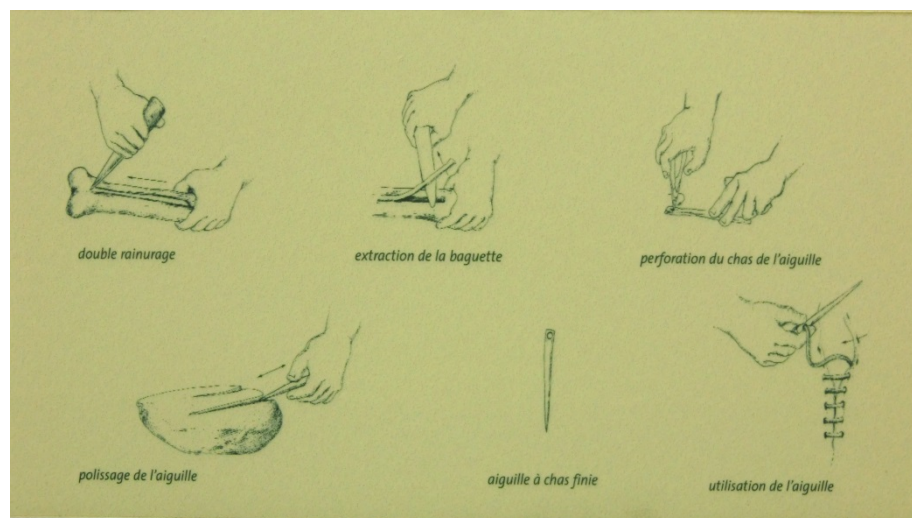
(linden) tree was still used as raw material for making cords in the medieval time in France. This hypothesis, of a very old age for preparing lime bast for cord-making is well supported by a much later observation done by Myking et al. (2005) – in a Mesolithic Norwegian context. Bahn concludes his close reading of Chauvet’s book thus: *“It is a long overdue development that, 90 years after Chauvet’s publication, prehistory seems ready to at last accept the probably huge importance of basketry and simple weaving in the Upper Palaeolithic.”* (Bahn 2001:272). In Soffer’s (2004) re-examination of prehistoric bones possibly used for textile manufacture, she calls for a wider understanding of those artefacts by placing them in an alternative Upper Palaeolithic context, where the textile manufacture plays an important role. Stone (2009), much inspired by this call from Soffer, sets up a methodology for studying evidence of fibre industries through examining and analysing use wear on bone artefacts. She starts with a reinterpretation of the Magdalenien assemblage of bone tools like needles (see examples in figure 6 and 7, below). Her doctoral thesis within this framework has not yet been published.



Figure 6. Magdalenian bone needles in the middle of the photo. Photo by the author and by the courtesy of the Museum of Archaeology in Saint-Germain-en-Layer, France

Figure 7. Preparing a hypothetical Magdalenien bone needle.

Photo by the author and by courtesy of the Museum of Archaeology in Saint-Germain-en-Layer, France



3.3 The warm interglacial Holocene period 13 000-6 000 BP

Natural context: During, this long period - the end of the Palaeolithic period and beginning of the Mesolithic - the landscape in northern and central Europe is heavily affected by shorter or longer periods of fast or slow melting of the great icecap in northern Europe. The large fluctuation in the temperature causes successively cold and warm periods. The late glacial time is therefore divided into five periods: older, middle and younger Dryas (cold climate) and the warmer periods in between the Bölling and Alleröd periods, followed by the Atlantic temperate more stable climate. The dramatic fluctuations in the climate during 6000 years changed both the landscape (more rivers and lakes) and the fauna, where reindeers successively disappear from central Europe and southern Scandinavia. However, they are replaced by smaller animals, which were probably more difficult to hunt than the previous bigger animals. The flora of this changing landscape is also dramatically shifting from steppe-tundra environments to bushes and small trees in open landscape, and to more dense forests. There are now a variety of wild plants which can be used for textile manufacture like tree bast, hemp, nettles and flax. However, this changeable climate creates conditions which are not good for preserving any organic material, unless waterlogged and thus not exposed to oxygen after buried in the sand of the rising sea, in rivers and most of all in lakes, which quickly became overgrown by plants, hence creating many bogs in the late Mesolithic/Neolithic landscape. The map in figure 8 below intends only to illustrate one of the many changings in the landscape around 10 000 BP. However, the selected textile findings, described in the section are from different periods and especially the mapping of the later findings from around 6 000 BP, where the (now named) Baltic Sea is smaller in the south and the land bridge between Denmark and Sweden is replaced by a sound. The icecap over northern Scandinavia is now very small compared to the illustrated bigger icecap (Jensen 2001).

Cultural context: Many seasonal settlements of the hunter/fisher-gatherers, some in the later stages more foragers, have been found in Northern Europe. They are now invading or re-colonising this new regions with its rich and diversified fauna (e.g. plenty of fishes) and flora (a variety of herbal plants, bushes and threes). Some of the identified cultures in Northern Europe, based on flint knapping technologies, and relevant for the study, are Federmesser/Bromme (13 000–11 000 BP), Maglemose (11 000–8 000 BP), Kongemose (8 000–7 200 BP), Ertebölle (7 300–5 950 BP) (Jensen 2001), and Kunda (10 000–7 000 BP) (Bender Jørgensen 1992:9).



Figure 8. Map 3 illustrates the hypothetical relation between land, water and ice in Europe/Eurasia around 10 000 BP (OIS 1) and with following excavation sites: A-Antrea, B-Wis-Moor, C- Friesack, D-Rydemarksgård, E-Dejrø and Skjoldnæs, F-Tybrind Vig. Drawing after basic map by Alf Dahlberg.

3.3.1. Antrea, Karelia, Finland (11 000 BP)

The site, a bog was excavated in 1914, see figure 8, ref. A. Among the findings were artefacts of bone, stone and plants (tree bark). Most notable were fragments of a fishing net, (see figure 9, below), together with 31 net sinkers of stone and 18 net swimmers of birch bark. The findings are dated by Bender Jørgensen (1992:93) to ca. 9 000–8 000 BC, in the Ancylus Sea Period.

Textile description: The raw material for the fishing net was identified as willow bast (Bender Jørgensen, 1992:93). Previously, in connection with the actual excavation, Pälsi (1920:17) (perhaps wrongly) identified the raw material in the net and the ropes for tying the swimmers and sinkers as linden bast or nettle. According to Bender Jørgensen (1992:254) the net were knotted by 2-ply, Sz ply strings. Pälsi (1920:17-18) estimates the dimension of the net based on the knotting techniques and the proportion of sinkers/swimmers to have been ca. 1.3 m high and ca. 27 m long. He also claims that the knotting technique is quite primitive comparing to the found stone and bone material (axe, sinkers and swimmers). But he further argues that there were two different technological methods available for the contemporary

people, one more elaborated for weapons and cultural items and one more simple for practical use – all items from the excavation belonging to the latter technologies. (Pälsi 1920:18)



Figure 9. The fish net, according to photo in Pälsi 1920:21; Taf.V.

Social context: The Antrea site had no trace of a settlement; however all artefacts were found in a close surrounding, so the fishing gear as well as the other items might have fallen from a canoe or from the ice surface of the lake (Pälsi 1920: 19). At the time in the area the Kunda cultural group (with possible roots in the earlier Swederian group) has been identified, with cal. dating 10 000 -7 000 BP. A contemporary culture group were the Maglemose communities in south western Scandinavia. The Kunda culture had an elaborated bone and antler technology in relation to fishing gear, where most fishing took place from rivers and lakes. Some of these tools were decorated with geometric lines.

3.3.2. Wis-Moor I, North East Russia (8 000 BP)

The site, a bog, is located in the north eastern part of European Russia, see figure 8, ref. B. The textile finding is reported by Bender Jørgensen (2013:359) with reference to the British archaeologist Burrow, 1973. It has not been possible to locate this reference.

Textile description: Bender Jørgensen describes the textile, interpreted as a net for fishing, as made of fibres from a strong half-grass (*Carex*). The net was knotted of 2-ply fibre strings as a 5 cm mesh networks, see figure 10 below.



Figure 10. Illustration of a hypothetical knotted mesh network, not the actual finding.

Social context: No report on possible culture group has been found by the author, but the net-makers were probably part of the western Siberian hunter-fisher-gatherer groups.

3.3.3. Friesack, Germany (9 700 BP)

The location of the textile findings is within a larger excavation area north east of Berlin, see figure 8, ref. C. The area was excavated in 1930-40 and 1970-1989, with Gramsch (1987) as the leading excavator in the latest period. Due to good preservation, several finds such as artefacts of bone, antler, wood, pitch, ropes and nets as well as lithics have been excavated. The artefacts from the excavations are radiocarbon dated to three successive periods: Preboreal and Boreal (Friesack 4; Friesack 27a) and Atlantic (Friesack 4). The textiles are dated to 9 700 BP (Gramsch 1992:69)

Textile descriptions: Gramsch (1992:69) describes the textiles as outstanding with many fragments of nets, twine, cord and rope found in nearly all layers from in Pre-Boreal and Boreal periods. He describes two types of net-making techniques: knotless netted and knotted. The ropes were plaited, twisted fibres. Gramsch (1992:69) concludes his description with suggesting “*that the manufacturing of bast had already a long history, including making of knotted nets*”. This view is in accordance with the same observation by Myking et al. (2005) regarding the long bast tradition in Norway.

Bender Jørgensen (1992: 394) describes the technology of one of the fishnets made of bast fibres as “*a honey comb stich or twisted looping from 2-plyed, S-spun string. The diameter of the string ca 2-3 mm and the mesh size ca 18 mm.*”

Social context: The early Maglemose culture is probably the dominant culture in area. These hunter/fisher-gatherers had small summer settlements in Denmark and probably also around the southern borders of the Ancylus sea (Jensen 2001:70ff.).

3.3.4. 'The Mesolithic Family', Rydemarksgård, Denmark (9 000 BP)

The location, Rydemarksgård for the finding is on the western part of Zealand. Denmark at that time not an archipelago as today, but striated with small and bigger rivers, see figure 8, ref. D. Figure 11 below depicts the engravings in the bone.



Figure 11. The Mesolithic family, engravings in an aurochs bone. Drawing from the homepages of the National Museum of Denmark (<http://natmus.dk>)

Textile description: There have been many suggestions on what the 5 people on the engraving depict: Two men and three women in a procession? Five pregnant women? Or? (Jensen 2001:73). The motive for selecting this artefact for the discussion in the study is that it probably depicts people with clothes! Interpretations on whether these clothes are of patterned

and woven fabrics or stripes of different hides or fur can probably not be solved, unless (quite unlikely) some direct textile findings of clothing are made for the same early Danish period.

Social context: Jensen (2001:73) suggests that the engraving is depicting a common Maglemose hunter-gatherer family of 6 to 8 members, living in one of the many summer seasonal habitat in Denmark around 9 000–7 000 BP. Apart from hunting, fishing and collecting plants etc. they also expressed their skills by engraving geometric patterns in bone from hunted animals often from the giant aurochs. These kinds of geometric engravings are common all over Northern Europe at the time.

3.3.5. Dejrø and Skjoldnæs, Denmark (8 500 BP)

The two submerged settlements were discovered between 1973 and 1983 through tentative diving along the western shores of Ærø, see figure 8, ref. E.

Textile descriptions: Skaarup (1983:142-150) describes the textile finding from Dejrø as a very short string attached to a wooden swimmer and made of spun plant fibres. The string, found on Skjoldnæs (in 1981) is much longer, a lashing of a leister ca 27 cm long. The broken handle of the leister was made of hazel and the leister's side branches of hawthorn. He interprets the string for the tight lashing as made of lightly twisted nettle fibres. Bender Jørgensen (1992: 159) also describes the two pieces of string in the same way as Skaarup, but she adds further information: “*both strings were Z-twisted and of unknown vegetable fibres*”.

Social context: The two settlements are assigned and dated to the Ertebølle cultural group. Skaarup (1983:145), suggests that due to the many fishing and hunting related artefacts the fauna related, material indicates that hunting, fishing and gathering was the economic base of the settlement. He also suggests, that the fishing gear found were related to hunting and fishing larger prey like big cods and seals.

3.3.6. Tybrind Vig, Denmark (7 400-6 000 BP)

The first submerged settlement excavated in Denmark was the Tybrind Vig on the west Funen, see figure 8, ref. F. The site, now about 300 m from the shore, was “excavated” (1977) by diving down to ca. 3 m below the present water level. Artefacts are radiocarbon dated to around 7 400–6 000 BP (Andersen 2013).

Textile descriptions: Bender Jørgensen (1992:260) in her inventory of all Danish prehistoric textiles describes the artefacts from this excavation as strings, ropes and 10 true textiles. The textiles were not more than 10 cm big, all in needle netting technique (‘weaving’ in one system with a needle) but with great variation. She suggests that the textile pieces could have been part of cloths or carrying-bags. The raw material for the textiles was willow or poplar bast and grass. In her revision (Bender Jørgensen 2013) of the findings, she gives a much more detailed picture of the textile findings. There were 33 strings, six bundles of fibres and 14 fragments of various fabrication styles. In the manufacture of the true textiles she also confirms that each piece represents a separate variation (2013:393) where some fabrics are more tightly bound and others more netlike, the latter in her view resembling modern string bags.

Social context: The findings from Tybrind Vig have been assigned to the Ertebølle cultural group ca. 6,200 BP. The culture was concentrated in Southern Scandinavia, but linked to related cultures in Northern Germany and the Northern Netherlands.

3.3.7. Chertovy Vorota Cave, Russia (9 400-8 400 BP)

A recent analysis from an excavation in Far East Russia (Kuzmin et al. 2012), has been included in the study due to two factors; the settlement is very much alike the northern European sites at the same time and secondly the abundant textile findings might remind us of the possible loss of similar textiles from the North European settlements. The site, a large (730 m²) cave dwelling, excavated in 1973, has been included in the study to illustrate the world wide know-how of textile technologies. The site, see figure 12, ref A below is a cave in Far East Russia, north east of Vladivostok.



Figure 12. Map 4, demonstrating the localisation ref A of the Cave in the Far East Russia. Drawing after basic map by Alf Dahlberg.

Initial C14 calibration gave a dating to ca. 7 750 – 6 880 cal. BP however, a new dating on the textile artefacts was performed by Kuzmin et al. (2012) with AMS and this calibration gave a much older date for the found textiles in the cave (9 400–8 400 cal. BP). In the central part of the cave incomplete skeletons of humans were found together with stone and bone tools, pottery, wood and fibre artefacts and carbonized textile fragments. The limestone as well as the oxygen reduced environment (due to fire and collapse), made the textiles slowly carbonise and they are quite well preserved.

Textile descriptions: Among the textile fragments three types of textiles could be identified, ropes and plaits, nets, and woven textiles. The raw material for the textiles was blades of sedge grass (Kuzmin et al. 2012:328). The ropes were made of two twisted bundles of twisted fibres and plaits were made of two separate threads containing many twisted fibres. The nets were of two types: “the first (rhomboid net) was made of plaits consisting of two twisted threads about 1 mm thick” “The second type of net was made of twisted threads each 1 mm thick, with twining of crossed threads.” (Kuzmin et al. 2012:329). The woven textile fragments were so called weft-faced plain weave and of three identified different twisted fibre types. However, no spindle whorls were found in the cave (Kuzmin et al. 2012:328). They also suggest that the lack of textile tools indicates a more primitive technology for twisting fibres and weaving.

Social context: Kuzmin et al. (2012:328) identified the cave dweller as belonging to the Rudnaya cultural group of the Primorye. This hunter-fisher-gatherer group is characterized by both specific stone and bone/antler manufactures for hunting and fishing. Needles have been found elsewhere in the region. According to Kuzmin (1995:80), in the early Holocene period, the Middle-Late Atlantic time (8 000–6 000 BP), the climate was humid and comparatively warm. During this period, there is a development of pre-ceramic cultures and Kuzmin et al. (2012:335) argues that: “*An early intensification of textile use occurred not only in the agricultural societies of China but also in the hunter-fisher-gatherers’ communities of the Russian Far East and Japan.*”

4. Discussion

As stated in the methodology for the study, my intention was to make a multi-voiced project, where my own voice of reflection and understanding as expressed in this section, takes a starting point in the many voices of established and well-known textile researchers as expressed in section 3. I am quite aware that the choice of the selected textile materials as well as of the descriptions is made by the author. However, I have tried to follow the sources as close as possible, even to a point where perhaps too many direct citations have been inserted in the descriptions. In the following discussion of the results of the analysis in a wider archaeological perspective, based on my present knowledge (one year master level), direct references to others will only be used if quoting or rewriting others statements.

In returning back to the aim and the research question for the study (see section 1.2), several pieces of evidence for an early start of a textile technological development have been focused in the analysis. Some of these will be discussed below under three headlines, also referring to the title of the essay. The first paragraph deals with the empirical base, that is the substance for a Grounded Theory of an early use of textile technology (from Upper Palaeolithic around 30 000 BP). The next paragraph deals with the people, or rather hunter-gatherer societies, upholding and transferring those technologies over long time spans and large areas in Europe and Northern Eurasia. And the final section is a discussion of my own present position in the studied object: the origin and transference of fibre-based textile technologies.

4.1. Perished material? - Comparing textile fragments over large areas and time spans

From the analysis of the ‘sparse’ material in section 3.1–3.3, a comparison of the excavated textile artefacts and the interpreted technology for producing such artefacts is performed, with four (A-D) hypothetical conclusions about the material used, the structure of the textiles, the technology, and interpretations on possible use of the textile.

- A. The raw material for textiles was taken and prepared from tree bark (bast) and plants (wild flax and grass) from the earliest period through the Upper Palaeolithic and Mesolithic

In the earliest records plant fibre of bast (bark) and flax were used, see the evidence in section 3.1). The fact that people were able to use these materials postulates that they know how to extract the fibres. To obtain bast from trees, you have to soak the stem in water for a longer time and to have a tool to split away the outer coarser bark to get to the inner layer of more or less fine bast. The tree bast fibres are very long and useful for twisting fibres into ropes and cordage. The very inner parts of the bark contain e.g. in linden an almost paper thin bast that probably could have been twisted or spun into fibres for weaving, or at least for making finer items like bags and hats etc. As has been shown (3.1.1), flax was also early at hand – very early, but the technology for extracting fibres from flax is a little bit more difficult, since you both have to ret¹² the stems for a longer period and then hammer on the stems to withdraw the inner finer fibres. The same process is used in extracting fibres from nettle plants. In my view, if grass was used no extraction procedure is necessary but the material is best suited for plaiting and basketry. Grass plants dresses are probably both noisy and coarse in comparison with hide and furs.

- B. The knowledge of creating different structure and size of the textiles is at hand already in the Upper Palaeolithic, and with the introduction of wild flax in the Mesolithic as well as a greater variety in weaving techniques; more sophisticated textiles could be created.

The ability to form different styles and sizes is evident in the dresses of the Venus figurines from the earliest period. The narrow ribbons on the upper part of their bodies can be contrasted to the broader belts on the hips. The manufacture of the string skirt for the Lespugue figurine (section 3.1.3) requires a know-how of putting several textile elements together. The presence of early needles (section 3.2.3) informs us also that stitching items to make both adornments e.g. with beads, and more complex clothes can have been at hand. From the Mesolithic evidence (section 3.3) there seems to be many examples of both dyeing the textiles, making thinner threads for linen and elaborating with borders on the fabrics (Barber 1991:127).

- C. The technique of interlacing strings is developed in the Upper Palaeolithic and onwards, from knowing how to interlace in one system (basketry) to interlace in two systems (plain weave).

Among the Upper Palaeolithic artefacts (see section 3.1 and 3.2), the most salient evidence for an early knowledge (at least from 27 000 BP) of extracting, twisting and interlacing textile fibres, are the many (here reported 33) textile impressions in clay. In the analyses done by Adovasio et al. (1996) and Soffer et al. (2000), descriptions and interpretations of the presence of both plain weave and basketry textiles technologies are convincing evidence for

¹² Soak in water

an already developed advanced technology around 27 000 BP. Was the technology invented in Moravia or would it be possible to trace the technologies even further back in time?

In the analysis (section 3.3) I also find evidence for a Mesolithic continuation of these technologies as well as in both Barber's (1991) and Bender Jørgensen's (1992) works. Support for this hypothesis can be fetched from many other sources (e.g. Adovasio et al. 1996; Soffer et al. 2000), as well as from my analysis of the material in section 3.3, especially from the Friesack excavations in section 3.3.3. I think it is possible to postulate that basketry techniques with a coarser string precede twined weaving, with a spun thinner thread.

In addition, Barber (1991) gives an overall view of the early Mesolithic/Neolithic technological development from the Near East and compares the technological development between different times and regions in the Old World. For the Near East parts she found both plain weave and basketry and weft-twining very early. By comparing more or less contemporary prominent areas in the region, she can state a difference in developmental level but also a sharing of technologies so that weaving is shared in the north and weft-twining in the south:

“Jarmo¹³, to the northeast shows true textiles¹⁴ close to 7000 BC [...] Çatalhöyük¹⁵, to the northwest, shows full-fledged textiles by 6000 BC [...] Nahal Hemar¹⁶, to the southwest, [...] at about 6500 BC [...] has a lively fiber industry that includes weft-twined and netted cloth and bags as well as mats, baskets and caulked-twine receptacles¹⁷” (Barber 1991:132).

So looking at this evidence from the Near East (not reported in the analysis of the present study), I think it is possible to postulate a technological development from weft-twining to weaving and during some phases both techniques might be at hand but then the more time consuming technique (weft twining) is replaced by weaving in a frame with two systems.

- D. The use of textile clothes is documented from the very earliest phase (27 000 BP), although, only as head gears, ribbons and string skirts. Also ropes and nets are commodities in the Upper Palaeolithic and onwards.

A problem in discerning variation in use of the textiles is to interpret the full textile from mostly tiny fragmented, often much changed by the preservation conditions (e.g. burnt in fire, soaked in water) of the textile elements. The interpretation often lends its prototype in studies of more recent textile items, such as more or less complete cloths from the Bronze Age and onwards, or from ethnographic studies, or even from contemporary textile items such as carrying baskets, fishing nets, ropes and cordage. However, careful examination and experimentation with the fragmented artefact can reveal interesting hypotheses of its use, see e.g. Pälsi's reconstruction of the full fishnet from Antrea (Pälsi 1920). Many of the Mesolithic findings concerns interpreted fishnet, and I think a specific study around the construction of

¹³ In present Iraq

¹⁴ Meaning weaving in two systems (warp and weft)

¹⁵ In present Turkey

¹⁶ In present Israel

¹⁷ Containers

these excavated nets should be undertaken. The variation in knotless net and knotted net seems to be a good starting point. The ongoing reconstructive archaeological work of Eva Andersson Strand at the Centre for Textile Research in Denmark, gives us many new insights into both the technology and the use of ancient textiles (Andersson Strand 2013).

The documented, but debated interpretations of the so called dressed Venus figurines from Upper Palaeolithic (see section 3.1.3) at least tell us that the pan-European and Eurasian societies around 27 000 BP knew how to make and put on a hat, a string skirt, some ribbons and a belt. However, Soffer and her collaborators (2000) draw attention to that we should not see the use of head gears, ribbons and string skirts as a common dress code for the period, but more as perhaps symbolic depictions of fertility in the otherwise almost nude figurine. In my view, I think it is possible make a further conclusion, that women had some kind of textile dresses, at least hats and skirts. Perhaps the common dress style of the Upper Palaeolithic societies was a combination of textiles and hides?

4.2. Vanished people? – Textile materiality in hunter-gatherer societies

All these now fragmented and changed textile artefacts reported here has once been part of for us now vanished peoples and their societies. How then can we through these fragments reconstruct their role and their technology? Before discussing the hypothetical role textile manufacture could have had in the many postulated hunter-gatherer cultures over a vast territory and a large time span, we need a reminder of the role of things in human societies:

“[...] humans have always been cyborgs¹⁸, and that human condition is characterized by its inextricable enmeshment with things and other non-human entities. [...] humans are not naked hominids that enter into relationships with things and non-humans; they rather emerge from such mixtures. To search for humans behind the artifact may actually be seen as a search for a pre-human condition” (Olsen 2012:209)

The role of textile production in the hunter-gatherer societies: need and resources

What are then the societal driving forces for textile manufacture in a prehistoric hunter-gatherer group? There are probably as many answers to this question as there are groups, but some tentative hypotheses could be formulated. Simple answers include a need for tools for catching food, like hunting and fishing nets and bags for carrying collected food like berries, nuts and bird eggs. Rope and cordage must also have been valuable textile objects for tying things together, like sticks and branches to construct shelters, or secondary tools like weapons. The need for textiles for clothes is not so obvious, since in many environments hide and furs were probably used as protection in the sometimes harsh and cold climate of the northern hemisphere. During the warmer period, textile clothes were probably more suitable compared to being totally naked as in the tropical climate zones. Another aspect of the need for textiles could simply be twisting fibres together and with one of the many needles found from the upper Palaeolithic making a necklace of tiny beads or attach them to the clothes – e.g. the basis for the String Theory (Hardy 2008; Wigforss 2014).

¹⁸ A cyborg is a being with both organic and mechanical parts.

A society going from simple twisting of fibres for strings to more complex technologies and use for textiles needs a constant supply of raw fibre material. To find, extract and prepare suitable fibres take a long time and must be done during specific seasons, like the springtime is best suited for extracting tree bast and late summer for harvesting wild flax. All fibre plants are easy to store for a longer period, both unprepared and prepared for manufacture. From later on in history we have seen that e.g. flax is harvested in the summer, prepared, and then the prepared fine fibres are stored for spinning and weaving in the winter time. Can we postulate the same kind of seasonal behaviour in these vanished societies? If then storage places were at hand – does that imply that we can consider the earliest textile producers as being hunter-collectors rather than hunter-foragers, according to Binford’s terminology (Binford 1980)¹⁹? The societal knowledge of where and when to find suitable plants for textile manufacture must be quite essential for upholding a textile technology, as well as for being able to develop it if changes in material was necessary. And if the textile raw material resources were at hand closely (or even far away), can we postulate some kind of harvesting behaviour – that is to take care of the site of the valuable plants like wild flax or trees for bast? These and many other issues concerning the role of the textile industry in the various hunter-gatherer societies are a challenge to understand, and it has not been possible to grasp the full picture within the available time for the present study.

If we consider some of the hunter-gatherer groups living on the steppe-tundra environment of Northern Europe during the Upper Palaeolithic, there must have been many thousands of years when the climate slowly was getting colder (from 30 000 to 22 000 BP), gradually changing the plant and fauna environment. But also the reverse when the climate was getting warmer (and wetter) in the late Pleistocene and early Holocene. Perhaps these climate changes were not too obvious during an individual’s life span, but for the societal knowledge of fibre plant resources it must have had an effect on the collective memory of where to find the right material. In the next section I will discuss how (and if) this kind of memories and skills could have been transferred through the times by the skilled individuals through the collective memory of the group.

Transfer of knowledge of textile technologies

In using a large scale methodology for comparing textiles over long time spans (26 000 years) and large geographic areas (Northern Europe and Eurasia), I can see variations in textile technologies in several ways. One of these is the development of interlacing threads in different ways, from basketry to weft-twining, to plain weaving. The technology for manufacture with fibre plants requires knowledge and skills which most likely are not invented in each new society, but rather skills that are learned from generation to generation. It is quite intriguing to speculate on how this transfer can have taken place when people obviously moved over large areas due to the life style and the changing environment for food supply. We know that the manufacture of textiles is very time-consuming (see e.g. Andersson

¹⁹ *Foragers* seek an environment with more or less constant supply of needed resources, and when they have used the resources like animals for hunting or edible plants, they move the settlement to the next area with resources. Their technology is characterized by a toolkit of more universal tools. *Collectors* set up a stable basecamp with several surrounding seasonal smaller camps for collecting and hunting specific food and animals. Their technology and toolkit is characterized by more specific tools (Binford 1980).

Strand 2013), and therefore probably quite central in the daily life of a hunter-gatherer society. The least time-consuming activity was probably to find and harvest the bast fibres. However, the extraction and the twisting of the extracted fibres into threads, and then weaving or plaiting with them, was certainly time-consuming and required motoric skills that probably were trained early in the small children's life. How this learning took place is not possible to understand, but somehow there must have been a transfer between the generations and the groups, since the technologies are so similar and develop in almost the same way. Looking at transfer of technological knowledge and skills in our modern societies, we can turn to Wenger's concept of Learning Communities, where the less skilled members learn central skills from the older in the community (Wenger 1998).

It is also a challenge to understand the pattern seen in section 3.1, with an advanced textile technology (plain weaving) in the Gravettien cultures around 27 000 BP, then seemingly vanishing during the Latest Glacial Maximum (LGM) around 20 000 BP – and then again being visible in the archaeological reports from the late Pleistocene (shown in section 3.2) and the early Holocene (shown in section 3.3). Are these technologies dormant in those hunter-gatherer groups that probably moved south-west and south-east in Europe – away from the cold and sterile landscape at the edge of the great ice cap? In my view, the know-how did not vanish, since it was already firmly rooted in all hunter-gatherer groups during Upper Palaeolithic and hence resistant to the decrease in population during the LGM. Could we postulate that the textile knowledge and skills are part of an inherent capacity in hunter-gatherer groups, which is independent of time and context?

4.3. Understanding variation in textile technology and materiality

In my own understanding of the role of textiles and their technology in prehistoric societies, I primarily take an empirical approach to my own knowledge formation (as well as in other circumstances). I have a basic natural science approach to my understanding of the world. It has been a challenge to grasp behaviours of vanished people through a few accidental and fragmented excavated artefacts, thus not being able to acquire a more complete picture in forming a knowledge base. For example, I have taken for granted that artefacts like rope/cordage, bags, mats and even woven cloth were more or less similar as they are today. I have also postulated a very long cultural biography of those artefacts – but 30 000 years? Today, the evidence for this presumption is much more incomplete, than it seemed to be before I started this work. Now I ask myself: is it even possible to approach the issues raised in this work through an empirical stance? But then on the other hand, where do all these things and their technology come from? I would like to think that people, through the many thousands of years, have transferred their textile technological know-how about finding suitable raw material, how to prepare the material and how to manufacture much needed objects from it.

5. Conclusion

It has been a very difficult project to find solid evidence for an Upper Paleolithic/Mesolithic plant based textile technology for the manufacture of baskets, cloth, mats, ropes, nets etc., due to the perishable nature of organic material. The aim, of the study was to compare on a large scale (geography and time span) those textile remains which were available and searchable in archaeological published records. During the far reaching search for textile artefacts, it became obvious, that an Internet based database of all documented textile would have made the study much easier and more valid in the representativity of accessed and described/interpreted textile remains.

However, from the presentations of the selected, described and analysed textiles, some conclusive observations based on the variety of textile manufacture in time and geography can be made. There are solid evidence for a variety in textile technologies (basketry versus plain weaving) already around 27 000 BP, illustrated by analysis of the textile impressions in clay from Moravia (see 3.1.2). The material for the textile industry must have been plant fibers, most likely bast from trees. Although, still under debate also wild flax has been proposed (see 3.1.1). For the latest period around 10 000–6 000 BP there is more and more solid evidence for a great variety in textile technologies, however still basketry techniques are dominant in the artefacts like in all the findings from Northern Europe. However evidence from the southern part of Europe and the Levant with a centre in Anatolia show both a diversified and skilled textile manufacture technology with the dominant material of probably wild flax. There is no evidence for the use of wool during the investigated long period.

Those observation, might constitute a Theory of a transfer²⁰ over time and areas of advanced textile technologies before the actual domestication of plants and animals, takes evidence from the Upper Paleolithic/Mesolithic variety in textile objects; in fiber interlacing techniques like basketry and weaving and in the use of raw material like tree bast and plant fibers.

6. Summary

The pilot project which is reported here was triggered by the author's curiosity of the origin and development of basic textile technologies in early Paleolithic and Mesolithic culture groups. So many of these very early textile "inventions", like ropes, bags, mats, nets and cloth, are still around us, and manufactured almost in the same way as 30 000 years ago.

From the results of a previous study Evidence for a Stone Age fiber technology – a closer look at the prehistoric String Theory (Wigforss 2014), it became evident that the fiber string technology must have been around for a long time, perhaps as long as 1.8 million years. Further tracing the origin and development of textile technologies – like twisting and spinning threads, knotting and plaiting, weft-twining and plain weaving of textile items, as well as choosing and preparing (e.g. retting and dyeing) the plant fiber material – in the very early

²⁰ Presupposing, that the shown varieties in technology were not invented several times during the studied period.

phases of humankind is not easy, since the textile material has mostly perished. Yet a research question for the study was formulated: Can comparisons of textile artefacts over a large range of areas and time spans tell us something about the early manufacture, use and development of textiles technologies?

The theoretical starting point for the study is that technologies are upheld and transferred within and between various communities of practice (culture groups). The methodology chosen for the study was to make a large scale survey of textile artefacts, primarily from excavations in Northern and Central Europe/Eurasia during three very different climate periods: the last interglacial period of Pleistocene (OIS 3), the latest glacial maximum (OIS 2), and the first part of Holocene, the present interglacial period (OIS 1) – the timespan for the study concerning cultures and textile artefacts from ca. 30 000 BP to ca. 6 000 BP. In total, textile findings from 16 excavation sites were described as they were reported either by excavators or by archaeologist specialized in prehistoric textile analysis, see summary in Appendix 1. There was a substantial variation in both manufactured items (e.g. cloth versus fishing nets), and textile technique as knotting versus plain weaving. However, this variation can probably be explained by the different conditions for conserving the actual textiles until our time. There is evidence for quite an advanced weaving technology in the earliest phase (30 000–22 000 BP), but then very little textile remains in Europe during the next glacial phase (22 000–10 000 BP). And again, during the latest phase (10 000–6 000 BP), more evidence of both clothing and a variety of textile items is shown in the assemblage of artefacts. The issue of continuity of textile technological knowhow and skills between the three phases cannot be answered by the sparse artefacts studied, but it can well be suspected that there is such a transfer in time between the different cultural groups.

In conclusion the pilot study shows how difficult it is to compare technological development for textile items over time and regions, specifically due to the sparse remaining artefacts. One outcome of the study is a wish for an easy accessible database of textile artefacts from archaeological excavations from Upper Palaeolithic and Mesolithic sites, preferable with standardized information.

Acknowledgement

I would like to thank my supervisor Associate Professor Jan Apel for constructive discussions during difficult stages of this one year Master thesis as well as providing me with new insights by inviting me to a very useful workshop on *Human Responses to Changing Landscapes – An Archaeological Perspective*, arranged by the department of Archeology and Ancient History in Lund on February 19th to 20th 2014. I would also like to express my gratitude to my examiner Professor Debbie Olausson, for her very useful comments of the final manuscript. All remaining mistakes are caused by my own ignorance.

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Section, site and country	Description of textiles	References
3.1.1 Dzudzuana Cave, Caucasia, Georgia (pp. 13-14)	Material: wild flax or unspecified plant fiber	Bar-Yosef et al. (2011)
Excavation: 1966-1975, 1996-2008	Technology: spun, twisted, knitted string with knots; dyed	Kvavadze et al. (2009)
Dating Layer C, 27 000-24 000 cal BP	Interpretation: rope, string, cloth	Bergfjord et al. (2010)
Comments site in use 34 500 - 6 000 BP		
3.1.2 Pavlov I, Dolni Vestonice I-II (pp. 15-16)	Material: various plant fibres	Adovasio et al. (1996)
Excavation: 1950th	Technology: twined basketry, plain weave, knotted netting, etc	Soffer et al. (2000)
Dating 27 000 BP	Interpretation: a complex weaving culture, cloth etc	Soffer (2004)
Comments impression in clay		
3.1.3 A. Venus from Kostenki and Avdeevo (p. 17)	Material: fiber plant, bast	Soffer et al. (2000)
Excavation:	Technology: coiled basketry	
Dating 27 000 BP	Interpretation: headgear, belt and bandeaux	
Comments figurine in marl		
3.1.3 B. Venus from Willendorf (p. 18)	Material: plant fibre, bast	Soffer et al. (2000)
Excavation: 1980	Technology: basketry, 2 element structure, woven	
Dating 30 000 BP	Interpretation: Headgear and bandeaux	
Comments figurine in limestone		
3.1.3 C. Venus from Lespugue (p. 18)	Material: plant fibre, bast	Soffer et al. (2000)
Excavation: 1922	Technology: basketry, plaiting	Barber (1991, 1994)
Dating 26 000 BP	Interpretation: string skirt with 11 cordage attached to a belt	
Comments figurine in ivory		
3.2.1 Lascaux cave, SW France (p. 20)	Material: plant fiber, bast	Leroi-Gourhan (1982)
Excavation: 1940, 1966	Technology: twisted strings	Barber (1991)
Dating 17 000 BP	Interpretation: part of a rope	Bender Jørgensen (1992)
Comments fossilized textile		
3.2.2 Gönnersdorf, NW Germany (pp. 20-21)	Material: more comparative studies needed	Bosinski 1982
Excavation: 1968-1976	Technology: geometric depictions	Own interpretation from photos
Dating 13 000 BP	Interpretation: dressed females	
Comments engravings in schist		

Section, site and country	Description of textiles	References
3.3.1 Antrea, Finland (pp. 24-25)		
Excavation: 1914	Material: plant fibre, linden bast/hettles or willow bast	Pälsi (1920)
Dating 11 000 BP	Technology: 2-ply knotted net	Bender Jørgensen (1992)
Comments textile fragment	Interpretation: fish net	
3.3.2 Wis-Moor I, NW Russia (p. 25)		
Excavation: 1973	Material: fibre plant, grass	Bender Jørgensen (2013)
Dating 8000 BP	Technology: 2-ply knotted fibres	
Comments textile fragment	Interpretation: fish net	
3.3.3 Friesack, NE Germany (p.26)		
Excavation: 1930-1940, 1970-1989.	Material: plant fibre, bast	Gramsch (1992)
Dating 9 700 cal BP	Technology: knotted, twined fibre	Bender Jørgensen (1992)
Comments textile fragment	Interpretation: nets, rope and unsp. Fragments	
3.3.4 Rydemarksgård, Zealand, Denmark (p. 26)		
Excavation no information	Material: geometric depictions	Jensen (2001, ch. 3)
Dating 9000 BP	Technology: patterned woven textiles or sewn hides	National museum of Denmark
Comments engraving in bone (Auroch)	Interpretation: depiction of 5 "pregnant women" in clothings	Own intreprtation
3.3.5 Dejro and Skjoldnæs, Ærø, Denmark (p.27)		
Excavation 1973, 1981	Material: plant fibre, nettle, bast	Skaarup (1983)
Dating 8 500 cal BP	Technology: twisting of fibres to string and cord	Bender Jørgensen (1992)
Comments textile fragment	Interpretation: string and lashing	
3.3.6 Tybrind Vig, Funen, Denmark (pp. 27-28)		
Excavation: 1977	Material: bast fibre	Bender Jørgensen (1992, 2013)
Dating 7 400-6 000 cal BP	Technology:neddle knotting, looping, weft-faced weaving	
Comments textile fragment	Interpretation: cloth, carrying bags	
3.3.7 Chertovy Vorota Cave, NE Russia (p 28-29)		
Excavation 1973	Material: plant fibre; sedge grass	Kuzmin et al. (2012)
Dating 9 400-8 400 cal BP	Technology: twined, plaited and weft-faced weaving	
Comments textile fragment	Interpretation: rope, plaits, nets, woven textiles	