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TRAVELS, TRANSMISSIONS AND TRANSFORMATIONS – AND TEXTILES

Marie-Louise Nosch, Ulla Mannering, Eva Andersson Strand and Karin Margarita Frei

Abstract: This paper follows the path forged by Kristian Kristiansen in his scholarship on 'Travels, Transmissions and Transformations'. Specifically, this investigation into Bronze Age textiles, skins, tools and techniques from Denmark, which also incorporates the strontium isotope tracing system and textual evidence from the Mediterranean and Near East, adds the textile dimension to his impressive scholarly contribution. The various aspects of textiles highlight and demonstrate both similarities and differences in the archaeological record in the areas investigated. Even if it is not possible to make direct comparisons between southern and northern Europe in the Bronze Age, the various results clearly inspire and provide significant new insights into the production and consumption of textiles and the rise of Bronze Age societies.

Keywords: Textiles, skins, costume, textile production, textile tools, strontium isotope, textile terminology, textile economy, textile trade

Introduction

A textile is not simply a binary system of spun, twisted or spliced fibres, but first and foremost a result of a complex interaction of resources, technology and society. Textiles have enormous potential in archaeological research as they enable us to acquire knowledge of social and cultural aspects of ancient societies, and provide us with a unique opportunity to come very close to the prehistoric individual (Andersson Strand et. al. 2010).

Textiles are rare finds in archaeological contexts in Europe, but the oak coffin graves from Bronze Age Denmark with their well-preserved assemblages of personal belongings are a notable exception. They display a rich and varied range of garments and wool textiles (Broholm & Hald 1940; Hald 1980; Bender Jørgensen, Munksgaard & Nielsen 1982; Bender Jørgensen 1986, 1992; Nielsen 1989; Bergerbrant 2007, 2010). Thus, researchers of Bronze Age Europe turn to Denmark when they wish to understand how people of the past dressed and how they used textiles in life and death to manifest themselves.

In southern Europe, such textile remains are very rare and fragmentary. However, in contrast to northern Europe, there is an abundance of data on textile techniques, tools, transmission of knowledge, trade, and textual evidence from the Mediterranean region and the ancient Near East. Textiles and clothing are seen depicted on seals, statues, and frescoes; texts of all kinds contain details of textiles and textile production, from fibre to finished product. The study of these sources provides rich and original sets of data on the textile economy, techniques, terminology and production (Barber 1991, 1994; Breniquet 2008; Michel & Nosch 2010a; Nosch & Laffineur 2012), thereby providing a framework for understanding Bronze Age societies in northern Europe.

In one of his major works on Bronze Age society, Kristian Kristiansen primarily follows a comparative method in search of analogous data for interpreting the rich Scandinavian evidence (Kristiansen & Larsson 2005). In this paper, we demonstrate the potential of textile research and how textiles can supplement and further develop his ideas on travel, transmission and transformation in Bronze Age societies.

Bronze Age Scandinavia – and Textiles

Some of the most spectacular and well-preserved costumes

in Europe dating to the early Bronze Age (1700-1100 BC) in Denmark have been recovered in the oak coffin graves from Borum Eshøj in East Jutland, Egtved, Skrydstrup, Trindhøj, Guldhøj and Jels in Southern Jutland, and Muldbjerg in Western Jutland (Broholm & Hald 1940; Bender Jørgensen 1986; Bender Jørgensen 1992).

Clothing from oak coffins associated with women includes garments such as the tailored, body-fitting blouse, the string skirts, belts, sprang caps and hairnets. Less specific are large rectangular pieces of cloth that could be wrapped around the body to function as a skirt, dress or mantle (Fig. 1) (Broholm & Hald 1940). Some of these (Borum Eshøj C and Skrydstrup) were sewn together to form tubes similar to the later early Iron Age costumes (Mannering & Gleba forthcoming). Clothing from the oak coffins associated with men comprises garments like oval cloaks, wrap-around garments often made from the leftover corner pieces from cutting the oval cloaks, wrap-around kilts, belts and hats (Fig. 2) (Broholm & Hald 1940). The wrap-around kilt also has a parallel in a Danish early Iron Age bog find, albeit in a skin version (Hald 1980). It is characteristic that some of these garments were gender specific, while others were essentially unisex.

Both sexes wore one-piece leather shoes with tie strings, or textile shoes, or mittens (Broholm & Hald 1940; Hald 1972). The nicely folded textile foot-wraps, on the other hand, which were sometimes placed at the feet of the deceased in the oak coffin burials, are examples of costume items that have a symbolic rather than functional use as they were neither large enough to represent a sock nor do they seem to have been used as linings for shoes. While the function of some costumes, such as the female blouse, is easy to determine, the function and manner of wearing the large tubular outfits found in the Borum Eshøj and Skrydstrup burials is not straightforward. These costumes cannot have been worn as they were placed in the grave, and it is necessary to interpret how this enigmatic item might have been worn (Hald 1980:359-379; Hägg 1968; Mannering & Gleba forthcoming).

Kristian Kristiansen suggested nearly 40 years ago that these large textiles could have been worn in a flexible way, as a kind of overgarment that covered most of the body and the jewellery worn underneath it (Kristiansen 1974). This interpretation definitely appears plausible. There also seems to be continuity of Scandinavian costume from the Bronze Age into the early Iron Age regarding the use of the tubular costume items in the Huldremose



Fig. 1 Borum Eshøj C. Female costume. Photo: Roberto Fortuna.

II find from Djursland, Denmark and a similar garment from an unknown location in Denmark, which have now been ¹⁴C-dated to the Pre-Roman Iron Age (Mannering et. al. 2009).

A superficial glance at the textiles may give those unfamiliar with the subject, the impression that north European Bronze Age textiles were coarse and primitive (Bender Jørgensen 1986). However, the new analyses have highlighted properties and techniques which indicate that these costumes were perfectly and very intelligently adapted to the very specific demands of costume design of that time. The new analyses have also shown that many Bronze Age textiles were subjected to hard finishing treatments which were probably applied for both practical and aesthetic reasons. The finishing techniques provided the textiles with a uniform and firm surface which obscured the thread structure. A further functional advantage of this production method was that it allowed the fabrics to be cut into shapes without fraying and avoided the cut ends having to be secured by hemming. In this way, many Bronze Age textiles were technologically, aesthetically, and in terms of shape embedded into a costume tradition which had significant similarities with the skin costume technology (Broholm & Hald 1940; Hald 1980; Hägg 1986).

The Danish Bronze Age textiles demonstrate from their very first appearance a fully developed textile technology in contrast to



Fig. 2 Borum Eshøj B. Male costume. Photo: Roberto Fortuna.

their costume design, which was still to some extent influenced by the possibly much older skin craft (Mannering 2011). So, which tradition had the most impact on the Scandinavian early Bronze Age costume? Do the textiles represent an independent development from the late Stone Age or was the textile craft influenced by external factors? As there seem to be close connections between the crafts needed to produce early Bronze Age textiles and skins, it is likely a mixture of both, with local traditions influenced by know-how and new resources as well as raw materials coming from other areas. As the weaving technology is documented much earlier in central and southern Europe than in Scandinavia (Barber 1991), it is hoped that the renewed focus on Scandinavian Bronze Age costume and textile technology will shed new light on these intriguing questions.

Moreover, the clear connection between garments made from textiles and skins indicates that there must have been many more items made of skin that were not placed in the Danish burials. A Dutch bog find dated to the twelfth century BC, which contained a skin cape, a skin cap, a skin shoe, and the remains of a costume made in typical Bronze Age textile (Sanden & Stuyts 1996:124-126; Comis 2003:193-197) indicates that skin garments played an important role in the Bronze Age although they are not easily identified in the finds. Furthermore, the Dutch skin garments, which have close similarities with the Danish early Iron Age bog finds, demonstrate that there was a continuing skin craft tradition which has been previously overlooked (Mannering & Gleba forthcoming).

Another interesting dimension of the Danish Bronze Age textiles and costumes is that some of these garments, such as the string skirt and oval cloaks, have parallels in contemporary bronze figurines and rock carvings, which indicates that religion and everyday life

were interwoven into the costume design (Madsen 1981; Kjærøum & Olsen 1990). Indubitably, both male and female costumes played a significant role in Bronze Age cosmology and mythology (Almgren 1960; Goldhahn 2005). The presence of exact replicas and patterns of well-known textile costumes in the iconography cannot be a coincidence, nor is it of minor importance. With the focal point on textile and costume production, it will be vital in the coming years to identify intersections where different Bronze Age spheres meet and new meanings are created, and this is an area which at present is being further investigated.

Bronze Age Textile Tools and Technology

Visually, textiles could have very different designs. Comparing the coarse and brown Bronze Age northern European textiles from the oak coffins (e.g. Figs. 1-2) to the colourful costumes recorded in the iconography in southern Europe is at best an uneven task. Although the textiles have great regional variations, textile technology and production is more universal and the same types of tools and raw materials were used in both the Scandinavian and Mediterranean regions. It is therefore of highest importance to study and discuss the similarities and differences between those areas and thereby the transmission and transformation of the knowledge of textile production in the Bronze Age.

Textile production is a craft that needs meticulous planning before execution, and the craftspeople involved possessed many different skills and *a priori* know-how. The ability and knowledge to produce a textile from fibre procurement to finished textile would have been lodged within more than one person as several people would have been involved in the various production processes. The amount of raw material and time required for processing the fibres should not be underestimated. In northern and central Europe, the Mediterranean and the Near East the most common fibre materials were animal fibres from sheep and goats as well as plant fibres from flax, hemp and nettle (e.g. Broholm & Hald 1940; Bender Jørgensen 1986; Bender Jørgensen 1992; Barber 1991). Both analyses of textiles from Scandinavia and texts from the Near East demonstrate that fibres were processed in similar ways across regions and periods. The wool was plucked from the sheep and sorted into various fibre groups and then teased or combed before spinning. Flax and hemp were cultivated, while nettle was grown wild. After harvesting, the plant stalks had to be retted. The stems could then either be placed in water or spread on the ground. The next step was breaking, which was done with a wooden club or a similar tool, to crush the stems and allowed the various constituent parts to be separated from the fibres. Finally, the fibres had to be scutched with a broad wooden knife, scraping away the remnants of stem and bark and the fibres were then ready to be hackled or combed and processed further (e.g. Barber 1991).

Thereafter, the fibres could be spun into a yarn. Various spinning techniques and tools have been used since the Neolithic era (Barber 1991:51; Tiedemann & Jakes 2006:301). A spindle consists of a spindle rod, generally made of wood, and often also a spindle whorl. Various types of materials can be used to make spindle whorls, for example, fired clay, stone or bone and they can change in shape and size (e.g. Barber 1991:52-68; Carington Smith 1992:675-686; Völling 2008; Rahmstorf 2008). However, in general in Bronze Age Scandinavia spindle whorls are rare in the archaeological record, and it is plausible that yarn was spun using only a spindle rod (fig. 3). Spindle whorls are known from central Europe and the Mediterranean area, but in some regions and Bronze Age periods the numbers of whorls are also low (Andersson Strand & Nosch forthcoming). Therefore, it is possible



Fig. 3 Spinning on a spindle rod. Drawing: Annika Jeppsson.

that a spindle rod (without a whorl) was also used in these areas as the primary spinning tool.

Spinning tests have shown that spinning a thin thread requires a light spindle while spinning a thicker thread requires a heavier spindle. Spinning is highly time-consuming and experiments clearly demonstrate that it takes a longer time to spin a thinner thread than a thicker one (Andersson Strand et. al. 2008; Olofsson, Andersson Strand & Nosch forthcoming). A skilled spinner can spin on average 35 metres of yarn per hour with a 4 g whorl, while a spinner spinning a thicker thread with an 18 g spindle can spin 50 metres per hour. The given spinning time did not include fibre preparation or winding up the yarn from the spindle when it was full. Furthermore, to produce a single m² of cloth, with ten threads per cm in warp and weft, one would need to spin 2000 m which would have taken a spinner 40 hours to produce (Olofsson, Andersson Strand & Nosch forthcoming). The question of whether or not it is possible to estimate ancient textile craftspeople's working capacity or compare the time it takes craftspeople today with the time it would have taken in the past is subject to debate. However, these calculations clearly demonstrate that textile production is a time-consuming activity/process. Finally, it should also be noted that using a spindle without a whorl and thereby another spinning technique is even more time-consuming (Tiedemann & Jakes 2006).

Fabric is created by weaving together two thread systems. The warp system constitutes the threads fixed on the loom, running parallel to the sides of the loom. The warp is kept stretched by loom weights during weaving. The weft system is inserted at right angles to the warp and runs alternately over and under the warp threads. Depending on the weaves, e.g. tabby and twill,

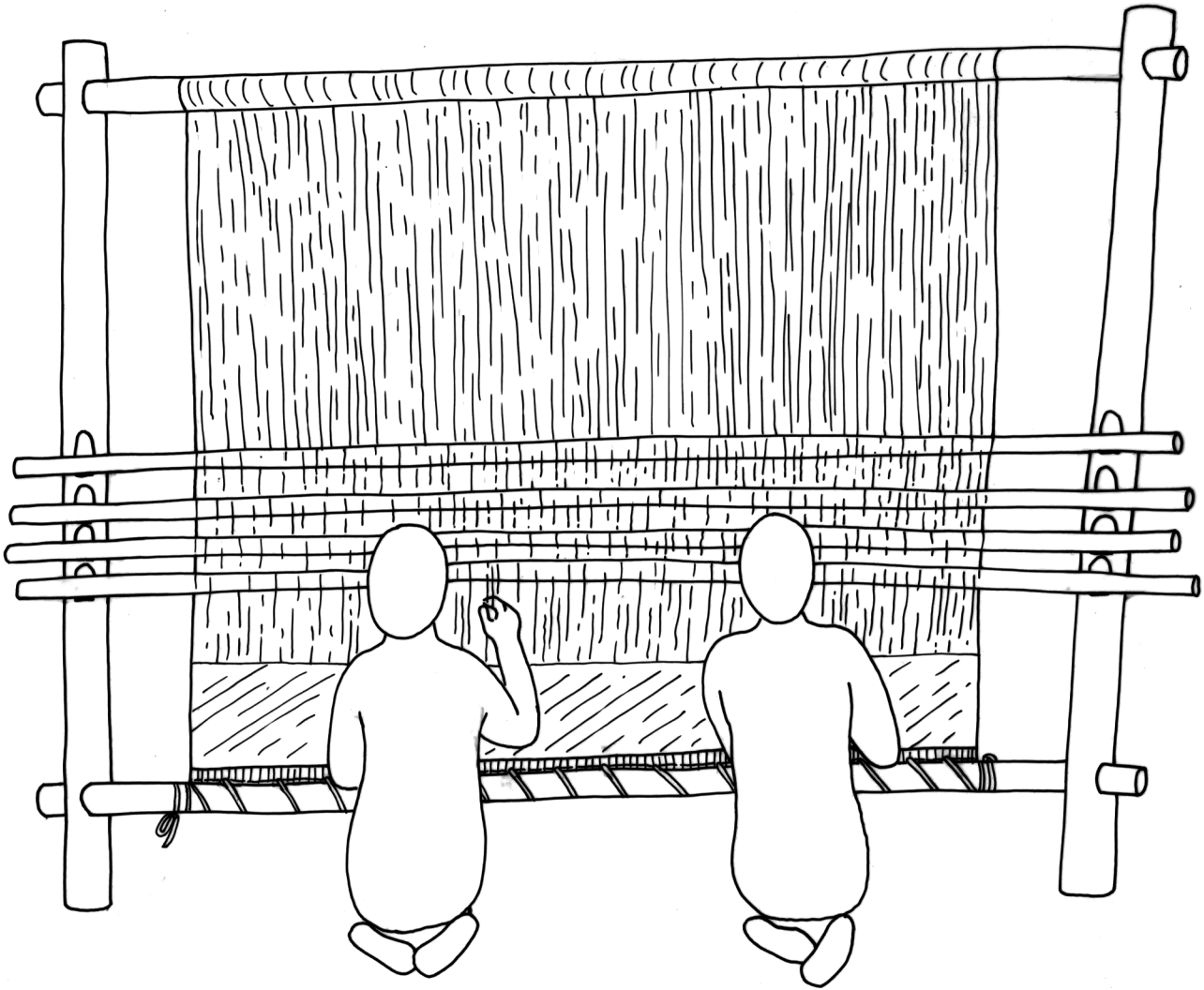


Fig. 4 Weaving on a two-beam loom. Drawing: Annika Jeppsson.

different patterns can be created. Several types of loom, such as the horizontal ground loom and the vertical two-beamed loom, were used in ancient times (Fig. 4). However, the archaeologically best-attested loom is the warp-weighted loom as loom weights are frequently found on excavated sites in many regions and chronological periods. It is important to note that most types of loom can be used to produce similar fabrics. Moreover, even if textile tools are sparse or absent in the archaeological record, textile production cannot be excluded, as the textiles from the Scandinavian Bronze Age coffins amply demonstrate.

A textile is not just fibres and threads. A textile is the result of the needs, desires and choices of society, which in turn influences the exploitation of resources and development of technology. Conversely, the availability of resources and the state of technology condition the choices of society. The totality of these interactions is expressed in textile production. It is therefore important to investigate and discuss textile and textile production not merely via tools and textiles, but also through the physical, cultural, economic, social and gendered landscape (Andersson Strand et. al. 2010). Textile production and how it affected Bronze Age societies has not been the main focus of Kristian Kristiansen's previous work. However, in Kristiansen's new research, where transmissions and transformations are the focal points, the multi-

faceted topic of textile production will undoubtedly provide valuable fresh perspectives.

Tracing Bronze Age Textiles

The phenomenon of travel, transmission and trade in the field of textiles and fibre material has often been investigated through comparative studies (e.g. Barber 1991). Kristian Kristiansen has made valuable contributions to this field providing us with insights into the significance of textiles during the Bronze Age (e.g. Kristiansen & Larsson 2005). New technologies and new methodologies in textile research now hold the promise of generating even further perspectives. One of these novel methodologies deals with the important aspect of provenance. This transdisciplinary investigative method can produce promising results when applied, for instance, to Kristian Kristiansen's previous work.

Tracing the origin of Bronze Age textile fibre material is possible by geochemical analysis using the strontium isotope system. Theoretical and analytical tools from the Earth Sciences are combined with archaeological material culture and research on ancient textiles to achieve this goal (Frei et. al. 2009).

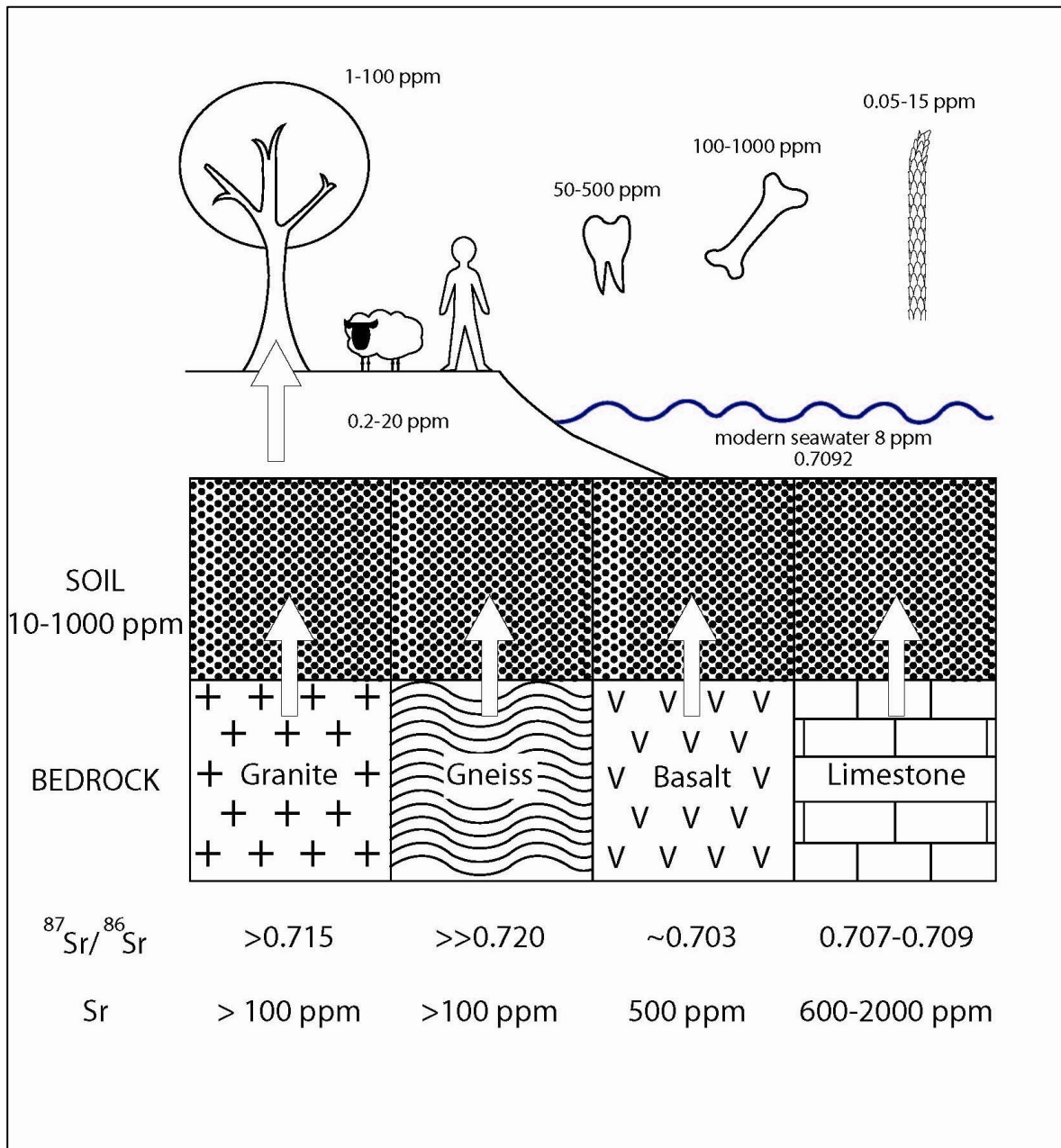


Fig. 5 Diagram illustrating the path of strontium from the geological strata to the human/animal hair. (Frei, K.M., PhD thesis 2010, and references therein).

Within archaeology, strontium (Sr) isotopes serve as geochemical signatures which can be applied to source a prehistoric skeleton to a particular geological area, and thereby to a geographical locality (Ericson 1985; Price et. al. 2001). The reason why this methodology proves ideal for migration studies is that strontium isotopic signatures are conveyed from eroding geological material through soils and food chains into the human/animal skeleton without undergoing any changes. Within the skeleton, strontium substitutes for calcium within the mineral lattices. The strontium isotopic tracer system relies on the use of two of the four naturally occurring isotopes, namely ^{87}Sr and ^{86}Sr , and particularly on the variations of their ratio $^{87}\text{Sr}/^{86}\text{Sr}$. This ratio is related to the natural abundance of these two isotopes and thereby often referred to in the literature as numbers in the order of ~ 0.7 ($\sim 7\%$ $^{87}\text{Sr}/\sim 10\%$ ^{86}Sr) (Faure 1986). The variations of the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio are mostly

dependent on the age and type of geological material (i.e. rock, soil or mineral). Thus geographical variation in strontium isotopes is primarily controlled by the underlying geology, thereby creating a suitable tracing system for human and animal mobility and in turn contributing to our knowledge of transmission, trade and travel during prehistory (Ericson 1985; Frei 2010; Price et. al. 2001) (Fig. 5).

Prehistoric textiles, as earlier mentioned, are primarily made from one of two types of natural fibres: animal and plant fibres. Animal fibres are composed of proteins and plant fibres are made of cellulose. Both types of fibre can be investigated by this recently developed geochemical methodology to gather information on the origin of the raw material (Frei, et. al. 2009).

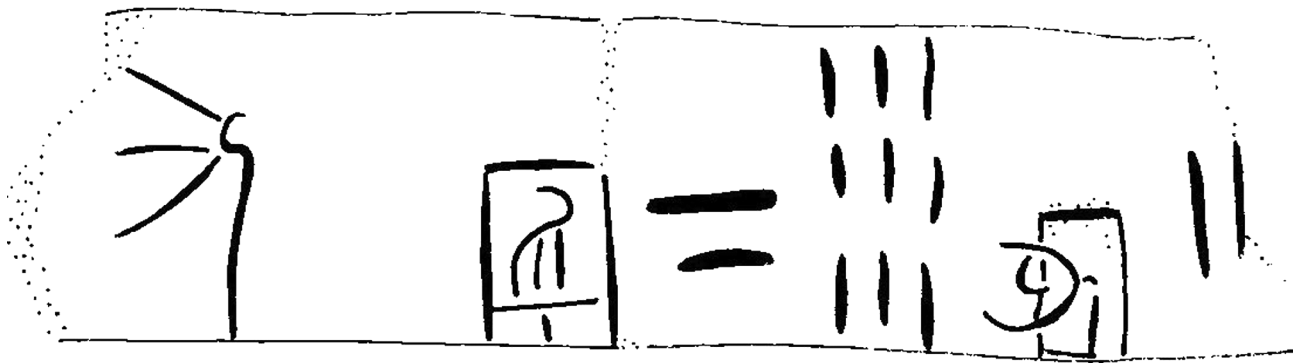


Fig. 6 Linear B tablet L(4) 515 from Late Bronze Age Knossos. It is written by scribe 208 and counts 26 textiles of the type PU (*pu-ka-ta-ri-ja*) and at least 2 textiles of the type KU.

The first Bronze Age textiles that have been studied applying this new methodology are the textiles from the Lusehøj burial mound near Voldtofte on the Danish island of Funen. The Lusehøj burial find includes two textiles as well as a skin, all of which were unearthed in 1861-62. A plant fibre textile was wrapped around the cremated human remains placed within a bronze urn, while a wool textile and an animal skin were wrapped around the entire assemblage of grave goods (Thrane 1984). The typological features of the bronze urn indicate a provenance in eastern central Europe. The bronze urn and the other impressive grave goods make this find one of the richest late Bronze Age graves in Denmark (Jensen 2006; Thrane 1984). The find is typologically dated to the Scandinavian Late Bronze Age Period V (900-700 BC).

The unique possibility of investigating three types of organic material (plant, wool, and fur) all deriving from the same burial context provides a perfect opportunity to investigate not only the provenance of each textile or fur, but also textile networks related to textile production, exchange and trade.

The results of the strontium isotope analyses of the two textiles and the skin demonstrate that none of these originate in Denmark (the island of Bornholm excluded) (Bergfjord et al. 2012; Frei & Mannering forthcoming). In other words, the animals had not grassed in present day Denmark nor had the plants grown there. Furthermore, a surprising result of the strontium isotope analysis of the three different types of organic material is that they all come from geologically different areas. Thus, in the world of textiles, travel, transmission, and trade are also the first words that come to mind. This pilot study reveals that textiles must have been a commodity that was part of a larger trading network during the Scandinavian Bronze Age. When strontium isotope analysis is applied to a larger assemblage of textiles and skins in the coming years, we expect that it will provide new and unexpected perspectives on the transmission and trade of raw materials and textiles in Bronze Age societies.

Transmissions, Trades and Textile Terminologies

Evidence for textiles in the Bronze Age Mediterranean and ancient Near East indicates that they comprised plant and animal fibres, e.g. hemp, nettle, flax, sheep and goat wool, and are as such the consequence of cultivation, domestication and selective breeding. Wool acquired the status of being the primary fibre material in the Early Bronze Age (third millennium BC) and by the second

millennium had been fully integrated into the economy of society. This is evident from the fact that textiles were a commodity in long distance trade (Veenhof 1972; Michel 2001; Michel & Veenhof 2010), and from here textiles were formalised as a payment method and distributed to workers as rations (Waetzoldt 1972). The diversity of textiles types, trades and techniques is strongly reflected in the rich and varied textual evidence, including textile-related terminologies, found within the scripts and languages of the Bronze Age Aegean and ancient Near East (Michel & Nosch 2010a; Michel & Nosch 2010b).

The Indo-European languages distinguish between braiding or plaiting, and weaving (Barber 2001: 7; Del Freato, Nosch & Rougemont 2010) and share common textile terms for wool. The development of sheep husbandry and its socio-economic consequences have led to third-millennium Mesopotamia being considered the 'homeland of wool' (Breniquet 2006b, 2006a, 2008, 2010). From the third millennium onwards, cuneiform inscriptions document men, women and children working in large textile manufactories. The large-scale workshops produced fabrics and clothing on an unprecedented level, and the phenomenon spread to the Aegean in the second millennium. In Mesopotamian institutions and Aegean palaces, scribes recorded standardized production targets for wool yields and for textile production. Thousands of specialised textile workers, primarily women and children, were monitored and supported by the central authorities (Nosch 2003, 2011).

At the beginning of the second millennium, international textile trade increased and consolidated in Anatolia (Veenhof 1972; Michel 2001; Michel & Veenhof 2010). The Kanish Kültepe correspondence, combined with studies of Anatolian geography, allows us to follow the trajectories of traders, caravans, wool and textiles (Barjamovic 2011; Wisti Lassen forthcoming). In these networks, textiles were produced and traded by household members in less centralised structures and were to a large extent based on private enterprise. Wool played an important role in the trade networks during the Bronze Age in the Aegean and Near East, and served to finance international trade in other goods. These textile transmissions modified both the physical and the political landscape, and thus trade and network, in the entire eastern Mediterranean (Michel & Nosch 2010a).

Thus, wool and textiles functioned as currency in pre-monetary economies. The historical perspective from the ancient Near East and Aegean in the Bronze Age illuminates how wool and

textiles integrated and transformed into political and religious institutions, and how these institutions set up control mechanisms and standardized quality systems (Waetzoldt 1972; Nosch 2011). The written sources shed light on the various ways in which production was organised and monitored (Michel 2001; Nosch 2003, 2011). They also demonstrate how textile trade, techniques and products generated textile terminologies and we can assume that similar developments took place in any textile-producing society (Michel & Nosch 2010b). This can provide a framework for the understanding of North European Bronze Age societies and the impact of raw materials and textiles on the development of a society.

Concluding Remarks

Textile research in Europe represents a transdisciplinary and international domain. As demonstrated above, in the last decade new analytical methods have been developed within textile research. This has provided excellent opportunities for combining archaeological and textual evidence with research on textile technology and production, enabling discussions of cultural, social, religious and economic aspects of Bronze Age society. However, comparing textiles and textile production in northern and southern Europe also demands a clear source critical methodology and a profound knowledge of the areas and materials under investigation. Nevertheless, the insights and information provided by textile research are invaluable, especially when discussing travels, transmissions and transformations.

We congratulate Kristian Kristiansen on his birthday and wish him well on his research projects. We are pleased to contribute with our expertise on textiles to his research on Bronze Age culture and look forward to many stimulating discussions in the years to come.

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