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First Textiles. The Beginnings of Textile Manufacture in Europe and the Mediterranean

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Abstracts (in alphabetical order)

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First looms. Loom types in the ancient societies

A fabric is created by weaving together two thread systems. One of these systems, the warp, runs parallel to the side of the loom and is kept stretched during weaving. The other system, the weft, lies at right angles to the warp and runs alternately over and under the warp threads. The idea of stretching the warp threads between two beams appears in different variations in many different cultures and time periods all over the world. What types of looms that have been used is an open question. Looms themselves are rarely preserved and the most common evidence is the loom weight which indicates a use of the warp-weighted loom but the absence of evidence is not evidence of absence.

One challenge for archaeology is that we can never expect to find all remains of the past and that an archaeological record never mirrors ancient everyday life accurately. Houses and furnishing, tools and textiles (and the people themselves) have naturally disappeared. Yet, in the interpretation of prehistoric society, it is crucial to be aware of and consider this fundamental premise in our reconstruction of the past. This premise is particularly valid for textile research where the preservation of textiles and tools is extremely rare, and textile tools, such as looms and spindles were, and are, preferably made of perishable materials, e.g., wood or bone.

The horizontal ground loom is considered to be the oldest loom type and the earliest depiction is dated to the Late Neolithic and comes from Badari, Egypt (Broudy, 1979: 38; Barber, 1991: 83). The warp-weighted loom has been used from the end of the Neolithic to the present day and it has been suggested that it originated in the northern part of the Fertile Crescent (Barber, 1991: 91; Broudy, 1979: 26). Finally, it has been suggested that the two-beam loom originated in Syria or Palestine, but the earliest representation occurs in Egypt during the final part of the second millennium BC. It has also been suggested that this loom could have been developed in connection with the introduction of wool. Wool is, in comparison to flax, quite easy to dye and this could have inspired tapestry weaving; the two-beam loom is considered to be the most convenient loom for this weaving technique (Broudy, 1979: 44; Barber, 1991: 113). Moreover, there are other types of looms and weaving and different types of looms can be used at the same region and time period.

In this presentation I would like to open up for a discussion on the use of different loom types and with the aim to render weaving and looms visible in areas and periods where the archaeological evidence is scarce or absent, thereby giving a fuller and more differentiated view of textile production.

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Textiles from lacustrine settlements of the first farmers at Lake Constance (Southwest Germany)

With its Neolithic and Bronze Age wetland settlements Lake Constance in Southwest Germany ranks among the most outstanding archaeological regions in Europe. The sites have world heritage status since 2011. They are part of a cultural heritage comprising the "pile dwellings around the Alps", including 111 pile dwelling sites in six circum-alpine countries (Switzerland, Austria, Germany, France, Slovenia and Italy). Of the approximately 120 known settlement sites in Southwest Germany, located in the shallow water zone of Lake Constance as well as in the silted-up zones of the Federsee and other small lakes and mires in Upper Swabia, 18 have been included in the UNESCO World Heritage pile dwellings.

The textiles from the prehistoric lakeside settlements in Baden-Württemberg are among the most significant remnants for the understanding and documentation of living conditions and economy of the inhabitants of the pile dwellings. The textiles provide impressive evidence of a highly skilled textile craft, its products not only used for a wide range of everyday purposes but also based on intricate knowledge of textile fibres and production techniques.

The oldest finds are more than 6000 years old, thus ranking among the oldest textile products known from Europe. Their deposition below water table has preserved a large body of textile remains made of plant-based materials, retaining their original shape in anaerobic conditions or having been preserved charred in burnt layers. In contrast to other prehistoric textiles from Central Europe, predominantly recovered from graves, they are conspicuous by their preservation condition, their belonging to everyday culture and their broad representation of the textile craft at that time. There is a body of evidence for numerous production techniques like mesh fabrics, warp fabrics and weaves; but there are also objects like shoes, fishing nets or baskets among the finds assemblages. The quantity and range of finds assemblages allows pursuing overarching questions which will cover, amongst others, the beginnings of weaving – or rather its possible derivation from warp fabrics – or the significance of linen for fishing. The most important raw material for the textiles, bast fibre, will also be focussed upon. Selection, processing and working of bast fibres point to a long experience in the handling of this textile fibre material. A knowledge that has been lost nowadays and which has so far only been regained piecemeal by experimental archaeology.

In the past three decades several finds assemblages have been analysed and published by various researchers. A synopsis of all finds kept in museums, archives and private collections is, however, still lacking. Thus far, many assemblages have not been recorded at all while others have merely been catalogued. The assemblage from Hornstaad-Hörnle IA, one of the oldest dwellings at Lake Constance dating to between 3917 BC and 3902 BC, comprises more than 1000 textiles. In conjunction with other finds from the settlements, for instance plant remains, cereal stores in burnt deposits, bones of domestic and wild animals, pottery, implements of wood and horn, stone axes or the innumerable wooden piles of the pile dwellings, they facilitate an impressive reconstruction of the lives of the first farmers at Lake Constance. Individual fields of activity like fishing allow pointing to specialised catching methods, based on fish bones, nets, fish traps and net sinkers, and

demonstrate their importance for everyday life at the time. Textiles belong to the small number of finds categories in the wetland archaeology of Baden-Württemberg which have seen little publication to date. It is intended that these textiles undergo comprehensive conservation treatment and textile archaeological analysis within the next ten years. A first assessment will be given in the scope of this presentation.

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Pyrgos/Mavroraki textile production in 2000 BC Cyprus

Ancient Cyprus is known as the source of precious textiles, mentioned in several passages of the Bible, and exported until the Renaissance from Venice merchants. According to the raiment of the clay figurines, in Early-Middle Bronze age, the clothes and mantles had different geometric patterns. This suggests that an important step in the evolution of the textile technology had already been reached with the interweaving of different fibers to obtain different designs and special effects. However, no Cypriot fabric of the Bronze Age has come down to us.

In 2004, the finding of a small room for the production of textiles in the industrial area of the Early-Middle Bronze age settlement of Pyrgos (Limassol) yielded some evidences which could confirm the fame and date back to the beginning of 2000 BC the production of quality clothes. The remains of a loom with its weights, 20 spindle whorls, bronze needles and implements to dye are the items that testify the activities performed in the place. The room was full of vases, probably used to contain balls of yarns and colors. Electron microscopy analyses made of the earth, found in the vases and in the holes of the spindle whorls, revealed the presence of animal and vegetable fibers. Wool, cotton, hibiscus and wild silk are the most, some were dyed with blue Indigo, red purple, green and black. More lumps of color have been found scattered on the floor, suggesting that the two rudimentary basins built against the eastern wall were used to dye the fibers. Chemical analyses of the red-pink substance found in a small bowl revealed the presence of “Bromo”, confirming the possibility that the wool fibers colored in “purple” tonality have been dyed with that precious pigment.

Regarding the weaving, the position and dimension of the heavy stone weights placed on the sides and the distribution on the ground of the mud weights suggest that the loom was vertical and located in a sort of niche built of calcarenite stones. Other finds in the same industrial area demonstrate how important the textile production was. A ground furnace with 70 loom weights (not completely fired) was brought to light in 2006, meanwhile tens of spindle whorls belonging both the Early and Middle Bronze age have been found everywhere, including the metallurgical placements. Their variation in weight and size suggests that they were used to spin fibers of different texture.

In 2012 in a workshop organized to produce cosmetics it was found a small laboratory to make comb pendants of picrolite very similar in shape to the comb clay models found in funeral outfits and to the combed decorative motives incised on the vases. Since spinning and weaving is deeply linked with the woman's world, it is possible that the comb picrolite pendants and clay models were a gender prestige status-symbol and the art of making precious textiles was considered in 2000 BC Cyprus a sort of social primacy, centuries before becoming the exclusive art of the goddess Athena.

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The introduction of wool in Europe

When did wool appear as raw material for textiles in Europe? This is a question that has engaged scholars of archaeological textiles, biologists and others for many years. Some argue that woolly sheep arrived early in the Neolithic, others that they were part of Andre Sherratt's Secondary Products Revolution and arrived with the Corded Ware or Bell Beaker cultures. This paper gives an overview over previous research, focusing on claims of early wool and of woolly sheep, and examines when they were made, by whom, by which methods, and what arguments were put forward.

In connection with the CinBA project (Creativity in Craft Production in Middle and Late Bronze Age Europe), a database of European Bronze Age textiles was created. While collecting data for this it became clear that the dating of many of them was based on assumptions. Some that have been considered Early Bronze Age wools since the 1930s have now proved to be Middle Bronze Age or even later; others that have been disregarded as undated or less securely dated have moved into prominence by radiocarbon dating. The paper explores and reassesses a series of claims for early wools from Europe in the context of the time when the find and the claim was made, by people like Walter von Stokar, Karl Schlabow or Michael Ryder. By the time of the conference, fresh Carbon14 dates of some of these finds have hopefully become available; this will allow discussing how their dating - re-assessment of dating - affect our knowledge about the introduction and spread of wool in Europe.

Through the CinBA project it became possible to examine, or re-examine, a large number of Bronze Age wools from Europe. This has allowed us to chart the evolution of wool through the Bronze Age, such as the emergence of sheep with little pigmented, almost white wool. The preparation of wool before spinning has been a further focus of our research, showing that in some textiles, the wool was not processed at all but appears to have been spun directly from the staple; in other cases, the wool had been meticulously sorted and combed before spinning. Other examples show that different types of wool had been blended. This shows that the textile craftspeople were aware of the properties of the wool available to them, and that they could be manipulated by various means.

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Evidences of textile technology in the Ancient Neolithic site of la Draga

This research paper is focused on the study of wooden and bone tools potentially related to textile processes, using recent methodologies.

The material analysed has been found in la Draga (Banyoles, Catalonia), a lake dwelling site of the Old Neolithic period (5300-4900 cal BC). At the site two phases of occupation have been documented. The oldest has remained below the water table since the Neolithic era, favouring the preservation of organic material, while the later one is slightly above. Both phases of occupancy are distinguished by building traditions: the oldest in wood, and the most recent introduces paved surfaces of travertine.

A large number of bone and wood artefacts have been recovered, which have been excellently preserved from the oldest level. Among them bone awls, spindles and/or shuttles and combs were found, similar to those used by modern societies in the processes of weaving and spinning as part of textile production. If we verify that these instruments are related to textile activity, they will be one of the earliest pieces of evidence of textile production in the Iberian Peninsula.

The research is being carried out by a multidisciplinary team involving various methodologies like experimentation, use-wear analysis, and archeobiological analysis. Morphological studies provide the identification of instruments and their possible roles, and allows us to observe similarities and differences between the archaeological and ethnographic items, proposing functional hypotheses. Various tools have been classified according to the activities in which they could have been used.

In this sense, an experimental program has been developed with the aim of reproducing these instruments and using them in order to verify the assumptions of their functionality. We replicate the actions and verify the effectiveness of the instruments, comparing their use to those used in traditional textile practises of current communities as a model, especially Quechua and Aymara weavers from the Bolivian Altiplano. This is due to the fact that some instruments used by these communities have morphological similarities to the tools recorded in la Draga.

On the other hand, we are drawing up a reference collection of traces of use on organic material (bone and wood) related to textile work. We are using replicas of the bone awls, spindles or shuttles, and combs made of boxwood for spinning and weaving, from the site of la Draga.

Integrated analysis of diverse categories of archaeobiological remains support the hypothesis of the exploitation of animal and vegetal fibres for textile production. The presence of combs and spindles evidences

the processing of fibers in the settlement. Meanwhile, the sheep slaughtering patterns correlate with the husbandry strategies for the exploitation of animal fibers. Finally, among the plant remains recovered at the site at least one of them (*Urtica dioica*) has been used traditionally for textile production.

In this presentation, we are going to present the first results of the preliminary analysis.

This work is part of the following projects:

- Social organization of the first agricultural and pastoral communities from domestic space: wooden architecture and areas of processing and consumption of food. Ministerio de Economía y Competitividad. Dr. Raquel Piqué

- Social organization of the first agricultural and pastoral communities from domestic space: structural elements and areas of production and consumption of goods. Ministerio de Economía y Competitividad. Dr. Xavier Terradas.

- La Draga in the process of Neolithic age of northeastern Spain. The agricultural and livestock settlements VI millennium cal BC. Departament de Cultura de la Generalitat de Catalunya.

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Textile provenance investigations by isotopic tracing techniques

In the last two decades, measurements of strontium (Sr) isotopes in archaeological bone tissues/skeletons have shown to be an effective technique for the characterization of human and animal mobility in prehistory (Montgomery, 2010). More recently, this tracing system is also being applied directly to the investigation of archaeological textile's provenance (Frei, 2014; Frei et al., 2009a; Frei et al., 2009b; Frei et al., 2010). These methodologies provide a new dimension to the field of textile research and helps scholars to identify potential trade routes and social networks connected to textile production.

Big efforts have been made in developing these methodologies, not only to measure the strontium isotope fractions of wool or plant fiber threads from archaeological textiles, but also there has been an intensive research in developing chemical protocols that will allow to pre-clean the textile fibers in such a way that the original strontium isotopic fractions can be recovered. These novel multi-step strontium isotopic tracing techniques are already proving to contribute with new important information regarding the provenance of archaeological textile's raw material. Furthermore, our investigations seem to point to that there are periods in prehistory which have a highly complex wool trade network.

This presentation aims at providing an overview of the multi-step strontium isotopic tracing methodologies and its limitations, as well as to present some of the highlights of the strontium isotope results from textiles from European Bronze and Iron Ages.

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Weaving together new Neolithic worlds: Pre-Pottery flax production and textile trade in comparative perspective

Gordon Childe's original concept of "The Neolithic Revolution" included new creative crafts, ceramics and textile production, alongside the origins of food production, but these elements have received less attention in the creation of new landscapes and social systems than the origins of agriculture. While it is clear that plant and animal domestication began before potting in the Near East, and perhaps before textiles, the Neolithic period needs to be seen as a protracted era of transitions and social transformations, at the end of which textiles were a key component of the new world created by agriculture and sedentism.

New evidence from Catalhoyuk indicates that flax textiles were being woven by the mid-7th millennium BC and being traded over long distances, as the extensive archaeobotanical record from this site indicates no local flax production to accompany finds of textiles from select burials. Instead, cultivation of flax, both for its edible seeds and for fibre production appears to have been regionally restricted to some parts of the Fertile Crescent (e.g. the northern Levant and the eastern Fertile Crescent). The production and trade of textiles then was one of the key ways in which interregional variation in primary production was shared — representing geographical spreads of cultural elements — and also provides a key basis for regional specialization of production that underpins post-Neolithic developments in specialization, both in cropping and crafts, which provided a necessary basis for the emergence of complex hierarchical societies. This trajectory in the Near East, from farming communities trading "exotic" culture for ritual contexts to more differentiated communities producing specialized trade commodities for high status consumption, can be used as a comparative framework for the consideration of trajectories of early textile development in other regions, such as Indus cotton and Chinese silk. In these cases too only a limited Neolithic geography developed early textiles, but these became more widely produced later with the emergence of political economies.

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Textile tools and manufacture in the Early Bronze Age Cyclades: the evidence from Amorgos and Keros islands

Evidence for the textile manufacture in the Cycladic islands during the Neolithic and Early Bronze Age, 4th and 3rd millennia B.C., was scarce and rare until recently. New significant finds about this, during the third millennium, has now been revealed and studied in the islands of Amorgos and Keros (Gavalas 2005, 2006, 2013, 2014).

The large quantities of spindle whorls and shaped perforated sherds found in Markiani on Amorgos, the only published so far Cycladic settlement- in total 203 artefacts, which may be compared only with similar quantities of tools from Troy-, revealed the variability of options for spinning, the early Cycladic weavers had already achieved, during the third millennium, and allowed further observations about the distaffs used in Amorgos. Taking in consideration the old and recent finds from various sites on this island, we may now set new light to a strong textile tradition established already in the early part of the third millennium. Further observations may also be put forward about the raw materials exploited and used for fibers, based on the solid evidence of old and new finds of textile remains seen on metals and imprints on the pot bases (Renfrew J. 2006)

The evidence for textile activities from the special site recently excavated on Keros island, both from the area of the special deposits on Dhaskalio Kavos and from the Dhaskalio islet settlement, opposite and close to its NW edge, is on the contrary remarkably little. Very few textile tools, such as spindle whorls and a unique fragment from a spinning bowl have been found. Only the mat and cloth impressions on pot bases from there (Renfrew J. 2013) are notable since many cloth impressions, some really fine ones, are visible on them. Most of them were found on pottery produced elsewhere in other Cycladic islands.

The evidence about flax, identified in the few cloth remains and wool, mainly coming from the study of animal bones, imply a rather sophisticated model adopted in many communities on the Cycladic islands, of successful strategies for the organization of agriculture and the animal herding for obtaining the necessary raw materials for fibers.

Finally, the important issue of the adoption of the vertical warp weighted loom in the third millennium Cyclades has been again questioned since no evidence so far of loom weights dated securely to this period has been attested. It seems that the warp loom was not in broad use there, as in the north east Aegean.

Renfrew's suggestion (Renfrew 1972, 351-354), about the Cycladic settlements that they show a high degree of craft specialization and they might have functioned together creating a functional economic network, should again be brought to discussion.

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Two sides of a whorl

Two sides of a whorl is an analogy which intends to outline a critical thought on a traditional approach, which either strictly divides spindle whorls representative character from its supposed primary use as a textile tool, or tries to derive and explain its symbolical meaning starting from its more obvious textile tool function. This theoretical approach based on an actual data analysis takes a similar route, but in a different direction- proposing and questioning a completely opposite empiricism which starts with spindle whorls symbolical and ends with its functional traits, without neglecting its representative character as a function on its own.

Eneolithic spindle whorls found in burials across the SE Europe are among the oldest spinning tools directly connected to the mortuary practice. Investigating similarities and differences in their metric and morphological characteristics, decoration, burial contexts and their occurrence frequency inner the studied spatial and temporal cage enables further analytical approach **WITHIN** and beyond the textile production framework. Focus on this selection within the larger and more complete assemblages of spindle whorls will further explain how these facts relate to their „cultural" contexts and most importantly textile traditions contexts to which they belong to. Exploring their relation to each of these contexts, their meanings and roles as their meeting points and what conclusions can be derived from these relations enables a basis for contemplating a spindle whorl as a representative object and its potential for transmitting symbolical meanings closely related to their functional roles in fibre processing. Their comparison with „culturally" and/or temporary and spatially related spindle whorl assemblages permits proposing reasons and arguments why they should be considered and examined as a (separate) part of the studied assemblages at all.

This paper takes a more theoretical and anthropological view on investigating spindle whorls functionality that is commonly studied via detailed analysis of the objects physical traits. It aims to outline limitations and possibilities of deriving conclusions relevant for the study of textile production facts and trends from the tools symbolical traits, which are traditionally considered and studied as a separate topic. With this in focus it tends to answer a question whether tools symbolical meanings could tell us more, less or anything at all on their use and its limitations in the context of fibre studies.

Discussion on deriving conclusions on functionality within the context of fibre processing and thread production from a metaphysical and not just physical aspect of a spindle whorl is a pioneering approach which combines two up till now separate perspectives in interpreting these spinning tools.

Attempts on defining their representative character from their place in the "chaines operatoires" within the textile production have been made, but with focus set from an opposite perspective to the one taken in this paper which only flips the starting point of investigation- deriving usefulness from symbolical and not vice and versa. Beyond this it aims to explore and outline where these two observation points can meet in order to paint a more colourful picture of a textile tools actual plaice within the (textile) archaeological interpretation. Questioning their function in textile production, primarily focusing on their adequacy for processing different types of fibre material, based on their symbolical function as grave goods objects in the context of burial

practice, is thought to be possible if these sets of „tools“ are treated as (separate) parts of larger assemblages from which they generate. This methodology calls for a large number of assemblages within a large spatial and temporal frame of reference, so patterns in mortuary practice which include spindle whorls as grave goods, patterns in complete relating assemblages of textile tools and patterns in (separate) burial assemblages can be observed, analysed and compared in order to provide new information through a simple change in perspective.

This aspect revolves around adding rather than deriving a fibre processing function to a symbolical one and it is based on an over 1000 spindle whorls sample collected and processed within the 3 year TOPOI doctoral research project which is investigating early evidence for wool use in the prehistoric SE Europe. Grave goods spindle whorls that are the main focus of this paper are still quite rare occurrence in eneolithic contexts. This makes them more approachable for comparison with the textile tools assemblages to which they are related.

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Experiments with Neolithic weaving tools (lunular or crescent shaped loom-weights)

Lunular or crescent shaped loom-weights are well known in Mediterranean area – from Spain, in France, Italy, Greece and Turkey. The weights have also been found even in the area around the Alps, in Hungary, Austria, Czech Republic and Southern Germany, especially accompanying the Jevišovice Culture and the Funnel Beaker Culture. The exact function of this unburnt or only less burnt artefacts is reconstructed in different ways.

The lunular (crescent shaped) loom-weights from the site Melk-Spielberg in Austria (Jevišovice-Culture, about 3000 BC) are the basis for experiments where it was the aim to compare the use-wear on the original weights with those resulting from the different experiments. Beside this, the fabrics made on the different types of looms were compared with original textiles from Late Neolithic in Central Europe.

The crescent loom—weights were prepared in the same shape and weight as the original artefacts from Melk-Spielberg. The reconstructed loom weights were banana-shaped, 16-18 cm long and 5-6 cm thick. Their weight was measured by 400-500 g. The distance of the holes of the weights was about 11-12 cm. Three different lay-outs of looms were tested according to lunular shaped loom-weights. The first was a simple band loom with 2 weights. The next was a warp-weighted loom with over 10 weights and at last a twining frame with crescent weights tightening the warp threads (warp-twining).

The first experiment was to test lunular-shaped weights on a band-loom, based on the experiments and publication of Annemarie Feldtkellner. It is possible to weave bands like they were found in the Late Neolithic Swiss Lake dwellings and the use-wear on the lunular weights is comparable to the original weights.

The second experiment dealt with the warp-weighted loom and crescent loom-weights, as it is the typical interpretation of that type of tools in the Mediterranean region and also was tested by Agnete Wisti Lassen, CTR. The experiments showed clearly, that it is possible to use those weights on a warp-weighted loom, especially in combination with a shed rod. The use-wear on the weights is somehow different to the original finds because of the “swinging” movement of the weights.

Finally, the function of crescent loom-weights was tested for twining. In Central European Neolithic various twining techniques were used to produce two- and three-dimensional objects. Some of the flat twinings („Kettenstoffe“) could have been produced on a “twining-frame”. The experiments show that it is possible to do warp-twinings on such a loom with the help of crescent-shaped weights. The use-wear fits very well in this activity. Some technical details on the fabrics (density, twist of weft) show that the twined fabrics of the Late Neolithic in Central Europe presumably were produced without any tool just by hand.

Crescent loom weights from Melk-Spielberg

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Expanding our thinking on early textiles: rare finds, unusual materials and different technologies

Recent discoveries and close inspection of older finds have provided evidence for expanding our thinking on the animal and plant materials exploited for early textiles and baskets and the technologies that are being used to work these materials: for animal fibres the use of cattle hair, and horse hair as well as wool; for plant fibres and strands the use of nettle, grasses, tree bast and runners as well as flax.

Technologies now include the possibility of twining and braiding as well as weaving, and for hides and sinews there are now discoveries which enable researchers to consider the range of hide processing techniques into multiple possible pathways. Furthermore new discoveries are expanding our thinking on the way in which these different materials and processes are combined within one object.

The research will use published finds from Scotland (extant organic remains such as the Bronze Age 'Sheshader thing' from Lewis and pottery impressions such as the Neolithic Luce Sands textile-impressed sherd) as well as more recent material such as the unique organic finds from the Early Bronze Age Whitehorse Hill cist (including the textile panel made from woven nettle with decorative hidework beading and triangles and the cattle hair braided armband set with tin studs).

The research uses experimental and ethnographic evidence and demonstrates the value of crafted and 3D printed replicas for understanding the ancient objects at a research level. There will be a small exhibition featuring crafted replicas and 3D prints of some of the archaeological finds discussed in the paper. In some cases the 3D prints formed an invaluable aid to making the crafted replicas. The latter were made directly from the animal or plant replicating the earliest phases of the object biography and chaine operatoire all the way through to the finished object.

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From seed to thread – new evidence for prehistoric textile plant production in Europe

The process of textile production that is based on the raw material of plant fibers starts with either collecting the stems of wild growing plants or with the cultivation of appropriate plant breeds. In this lecture I will focus on two topics: the different breeds of cultivated flax (*Linum usitatissimum* L.) and the possibilities to trace the process of plant fiber production in the archaeological record.

Flax is known for its dual use: from its seeds a very healthy and multiple usable oil can be extracted and from the stems very fine threads can be produced. Modern flax breeds show that the oil type differs from the fiber type by having much bigger seeds. Morphometric studies on archaeological flax seeds dated to several time periods prove that this trait can also be seen in the archaeological material. It is therefore assumed that already in prehistoric times two different breeds of the flax plant existed.

The oldest flax records derive from the area of the Fertile Crescent and date back to the 9th millennium B.C. (Helbæk 1959). In Europe the archaeobotanical evidence for cultivated flax date back to the 6th millennium B.C. (Kreuz 2007). New bioarchaeological and archaeological investigations in sites that are situated in the circum-alpine region and date to the 4th millennium B.C. suggest that flax cultivation and textile production was probably already performed by specialized craftsmen and -women (Karg 2011).

However, looking at the entire *chaîne d`opératoire* from the flax seed to the product ”textile”, only few structures and finds are traceable in the archaeological record. Photographic documentation of retting features from the beginning of the 20th century illustrates how retting pits could have looked like in the past. At several sites in Southern Scandinavia dated between 800 B.C. and A.D. 1050 such pits were discovered and excavated during the last years. These structures are often re-used wells in which characteristic plant remains were preserved at the bottom. The archaeobotanical analyses proved that the remains belonged to textile plants.

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From Adorned Nudity to a Dignitary's Wardrobe: Raiment of the Southern Levant 13,500-4000BCE

The Southern Levant with favourable conditions for preservations of organics features a trajectory of garments of increasing size and complexity culminating in the 5th-4th millennium in full body robes and footwear, attested in frescoes and archaeologically intact artifacts. Early items of attire, minimal girdles, belts and headwear, paralleling developmental trends in Eurasian Upper Paleolithic, are limited in size by labour intensive methods of vegetable fibre processing and yarn and fabric techniques of production. The Ghassulian culture (4,600-3900BCE) witnesses the adoption and dispersion of the comparatively rapid, drop spinning technique and the horizontal ground loom engendering the production of elaborated textiles measuring 7m x 2m, from areas of flax cultivation to the desert fringe, via females in formal mating arrangements.

The fully clothed body in woven cloth was a cultural point of no return –henceforth those in positions of authority in the Southwest Asian sphere are fully clad and shod. Nudity or a de-clothed state was the domain of fertility figurines and the dehumanized enemy.

The Ghassulian attitude to clothing was an ideal state and only a partial reality despite the magnitude and sophistication of the industry. Flax, the only textile fibre, uses prime land and has high water and labour requirements. Linen is not warm. Thus, skins of herd animals continued as the major clothing medium. The ideal was only realized with wide access to rapidly processed, insulating sheep wool raised on marginal land.

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The earliest cloth culture in Denmark

Humans have used fur and skin for clothing, artefacts and furnishings for thousands of years. Fur-bearing animals provided food and warm, windproof and waterproof clothing. In Scandinavia fur-bearing animals have been hunted, caught in traps or bred as domesticated animals, and there can be no doubt, that without fur it was difficult to survive in the northern world.

The Danish Prehistory contains many different and surprising examples of how humans have obtained and used fur through time. In the Stone Age, fur was crucial for the survival, and in the Stone Age man used many different tools to prepare the skins. When Bronze Age people began to make clothes from textiles, they fur clothing tradition continued, and fur was even imitated in cloth.

I this paper I will give different examples of the earliest cloth culture in Denmark and outline the development from fur to textile production.

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Reading Impressions of prehistoric textiles on archaeological ceramic

Prehistoric textiles, due to their perishable nature, are very rarely found in archaeological sites.
The chance to get information about these kinds of prehistoric materials, even if they have disappeared long ago due to their degradation, is offered by the imprints of textile materials on clay or ceramics vessels.

The paper deals with research on such imprints left on some archaeological shards, once parts of the supporting base of some ceramic pots. These were discovered during the archaeological studies carried out in the settlements of the Cucuteni culture, in Romania and Republic of Moldova (ca. 4600-3700 B.C.). The Cucuteni Culture is part of the wider Eneolithic cultural complex Ariuşd-Cucuteni-Tripolie. Its territory is of more than 350.000 km^2, spreading over Romania (south-west of Transylvania and Moldavia), the Republic of Moldova and Ukraine (east of River Dniepr).

The surface of the above shards shows impressions of textile materials which took place during the manufacturing of the ceramic pots. Within the Cucuteni culture, during the modelling of the humid clay and then during its drying, the pots were placed on various textile materials. The clay, being wet and soft, allowed the textile pattern to be impressed on the bottom of the vessel. In the next stage of the process of manufacturing the vessel, burning of the clay resulted in saving the textile patterns on the bottom of the ceramic pots. And, in this way, these ceramic fragments have become, paradoxically, messengers, over millennia, of the textile art specific to the Neolithic period.

The first stage of the research consisted in taking the print of the ceramic surface with a silicone product. In this way, the positive moulds of the textiles imprinted on the vessels bottoms were obtained. The moulds were analyzed with the stereomicroscope, in direct light, under various angles, until the raking lights.

Most moulds highlight textile structures made by weaving. The weavings were plain weave, made of simple/double yarns (S twist sense).

Another category of textile materials is the one of the cell structured materials, of the net type, created by interweaving techniques quite complicated for the time period that the ceramic fragments are.

One of the investigated potsherds shows the impression of a net with a complex structure containing elements characteristic to the filling network specific to the needle lace with Alençon point.

Another identified interweaving technique on some potsherds is the so-called nalbinding. The textiles created in nalbinding technique have a structure made of closed loops, horizontally chained between them as courses of loops. These are made with an eyed needle. The aspect of the textile created in the nalbinding technique is similar to those of tricots with purl stitches but their structures a quite different. Taking into account this

similarity, the undertaken research has made a comparative study of the two techniques, identifying elements of differentiation of the outer appearance of textiles made by the knitting technique and by nalbinding.

The uniformity and thickness of the threads, the structures complexity and the accuracy with which textiles were made demonstrate that prehistoric people of the Cucuteni culture knew very well these textile technologies. The research undertaken testifies, also, that advances recorded in the textile technology field over a long period of time, were, perhaps, possible as a result of this prehistoric beginning.

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Textile production in Western Europe from the Late Neolithic to the Early Bronze Age: an examination of tools

The combined analyses of several hundred spindle whorls, loom weights, and textile remains from lakeside regions in Western Europe have allowed us to characterize the entire textile production process during the Neolithic period. The chronological repartition of examined artefacts covering approximately two millennia from the Middle Neolithic to the Late Neolithic have furthered the revelation of discreet signs attesting to the changes and signalling the end of the Neolithic Period. At the dawn of the Bronze Age, consequential technological advancements are identified through the emergence of metalworking, including the profound changes where textile production is concerned and does not appear to be excluded.
By themselves, the fabric and wicker (basket) remains do not constitute reliable chronological markers as indicators of technological progress--their production remains unchanged and continues to manifest the same technical characteristics. The textile evidence, *stricto sensu*, only provides statistical information, with chronological dating revealing only broad date-ranges.

Tool use is in contrast much more eloquent and allows for categorization on the basis of geographical, cultural, or chronological markers. Spindle whorls and loom weights, which constitute the essential elements Neolithic textile tools, demonstrate palpable modifications particularly near the end of the period. The first fact is related to the quality of the tool fabrication; earlier versions are made of unfired clay and near the end of the period we find a better quality of terra cotta and with improved finishings than in the late Neolithic. They become simply more solid and perennial. This change is accompanied by typomorphological modifications regarding the amount of utensils. This fundamental aspect, since the loom weights like the spindle whorls have no other role than to provide weight and stability to both the warp threads for vertical weaving and the fibres for spinning. The evolution of spindle whorls and looms weights is remarkably coherent: both categories of tools have a tendency to facilitate the spinning and weaving.

Finally, the number as well as dispersion of the artefacts signals an intensification of textile activity in and around villages. Beside the evidence, the interpretation of these changes must necessarily take into consideration the economic and social context at the end of the period (agriculture, animal husbandry, demographics).

Emerging elements, such as the availability of raw textile materials and the democratization of the craftsmanship that was previously reserved for specialists further the research. All of these important elements will be essential to examine what we know about the functionality of the populations of the Late Bronze Age. More so than a rift, continuity unites the two periods separated by arbitrary limits and a chronological separation put in place to facilitate discussion. The transition will become a new starting point for consideration, particularly in regards to textile activity.

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From East to West: The use of spinning bowls from the Chalcolithic period to the Iron Age

In my paper I propose to discuss a specific tool, spinning bowl, used in the production of yarn since the Chalcolithic period and until now associated with eastern and southern Mediterranean regions. My research identified spinning bowls at numerous Iron Age (ca. 800-218 BC) sites of Iberian Peninsula, where their use was. The paper will provide an overview of the emergence and development of the spinning bowl from the Chalcolithic period (ca. 4500-3650 BC) onward, in the Balkan, Palestinian and Egyptian areas, in an attempt to understand the causes of its development. It will also discuss the changes in yarn production techniques, which occurred with the introduction of spinning bowl in this region, particularly focusing on flax.

First, I will outline the emergence of this element of textile technology, reviewing the diversity of Chalcolithic bowl shapes with internal handles that have been classified as spinning bowls. I will provide a typological and functional analysis of this tool in order to identify spinning bowls and to differentiate them from other objects of similar shape but of different function. This will be followed by a geographical and chronological overview of spinning bowls in order to identify their distribution and use.

The last part of my paper will concentrate on spinning bowls documented in the Iberian Peninsula. Although they all come from significantly later periods than analogous tools found to date in the eastern Mediterranean (Iberian Iron Age I-II, ca. 800-218 BC), their appearance there is significant since they indicate a transfer and adoption by the indigenous people of a new textile technology used in the eastern Mediterranean for the production of yarn for preceding millennia. The sites where the spinning bowls have been documented include: Cossourado (Paredes de Coura, Portugal),

Povoado do Castro Maximum (Braga, Portugal), Fríajao (Counha, Braga, Portugal), Castro de Torraso (Cortes de Galicia, Galicia, Spain), El Castro de Vigo (Galicia, Spain), El Castro Torroso (Mos, Pontevedra, Galicia, Spain), and castro "A Cidade" of Caneiro, Fozara (*pontearеas*, Galicia, Spain). All of these sites are located in the regions where Phoenician colonies have been documented.

Finally, I will attempt to suggest when and why the use of the spinning bowl began, and what adoption of this tool meant for the indigenous populations of the Iberian Peninsula.

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The Early Bronze Age textile implements from the Eskişehir region in inland northwestern Anatolia

Eskişehir region roughly covers the Eskişehir and Upper Sakarya plains and as well as the mountainous terrain of Phrygian Highlands. These fertile plains which form a natural communication route between Central Anatolia and the Marmara Basin are densely settled in the prehistoric times. Furthermore, the region is one of the best investigated areas of western Anatolia in terms of the Early Bronze Age. Thus, it provides a valuable contribution to the interpretation of the events which took place in western Anatolia during the EBA.

The topic of my presentation is the EBA textile implements recovered at Demircihöyük, Küllüoba and Keçiçayırı which are the main excavated sites in the region. The loom- weights which are almost the only remnants from the looms as well as related implements such as spindle whorls, brushes and some stone tools probably used as loom reed will be studied and their spatial distribution be given. The contexts of the loom-weights found all together *in situ* in the burnt rooms will also be examined.

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Textiles, baskets and pots: decorative craft transfer in the Aegean Neolithic

Due to the lack of true Neolithic textile finds from the region of the Aegean, all available evidence for weaving crafts comes from textile tool remains which are often found in archaeological record. These -although not always conclusive for their exact use - inform us about the existence of thread making technologies via spinning implements and about weaving technologies via looms that functioned as simple weaving systems with clay or stone loom weights for the holding the warp and complementary tools made of bone.

The knowledge obtained through the tools is however limited since it does not cover neither the whole range of textile techniques nor all periods, leaving many open questions about the precise thread production and the methods of textile manufacture and the use of the fabrics for clothing and the tool equipment. They also don't give any information for the decoration of fabrics and the variation and complexity of textile techniques for the cloth production.

This missing information is often supplemented by the interpretation of textile motifs recognized often on the decorated -painted or relief- surfaces of the pottery of this period. The Neolithic pottery of the Aegean offers a particularly rich variety of so-called ''textile motifs'' which represent clearly textile techniques and can therefore introduce us in an indirect way to the use of colors, the invention and practice of simple or complex textile and tailoring techniques. At the same time they supply information on a series of other related techniques such as the production of threads, ropes and networks, on basketry and on some decorative choices which led to the configuration of evolving styles characterizing local Neolithic cultures and chronological phases and are therefore used for the dating of assemblages.

The analysis of patterns, their interpretation and the reading of specific techniques need an approach through the aspect of the textile technology, which can see more behind the images and recognize the techniques used to create textile products. These pictorial representations combined with the tool technologies can explain how fabrics and textile artifacts have been manufactured and which was their patterns and forms. In combination with the study of anthropomorphic figurines, on which sometimes painted decoration and representations of clothes, jewelry and accessories are preserved, motifs are able to shed enlighten us about the Neolithic textile production.

This comparative study except from decoding technologies, it reveals a close interaction of various contemporary crafts, which were all still produced at households. It is rather obvious that technologies of pottery, weaving and basketry influenced each other, while they perhaps communicated through pictorial codes some symbolic patterns that had a special meaning for the traditions and the social cohesion of the Neolithic communities.

Although the significance of textile patterns has been early recognized and often referred in the literature, a systematic structural analysis of them has never been initiated. This presentation will be a first technological approach over the decorations and graphic elements on the pottery and figurines of the Neolithic Aegean that denote textile techniques and represent clothing elements. The aim is to start a conversation about possible

Methods of textile production, about transfers of technology and styles, about patterns of symbolic character and their chronological development throughout the Neolithic period.

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Development and changes of textile techniques from the Neolithic period to the Chalcolithic period in the Southern Levant

The Neolithic domestication of flax was an essential prerequisite for Chalcolithic textiles in the Southern Levant as experimental fiber extraction of wild flax in Israel proved that these plants had surfaces which were too heavily textured to allow the creation of threads suitable for textiles. By the Chalcolithic period, flax fiber processing was based on thousands of years of experience of using tree-bast fibers, and thus the quality of textiles from the Chalcolithic period is quite good.

Linen fabrics from the Pre-Pottery Neolithic period, Seventh Millennium BCE, were preserved only at the cave deposits of Nahal Hemar. They were not woven, but were made in other techniques such as looping and knotted netting. The Neolithic threads were spliced, usually Z-spun and S-plied. They display skill and variety but without using a loom which was already known at Asia Minor. These techniques don't continue in the Southern Levant to the Chalcolithic period.

The Chalcolithic period was a brief moment when the Southern Levant was at the forefront of human technological and artistic development. This moment is important for innovations in metallurgy, textiles, horticulture and animal husbandry. The people of the Chalcolithic did not just play a role in human development, they marked their contribution in style. We will examine if the textiles follow these changes and inventions.

Late Chalcolithic occurrences in the Judean Desert in Israel were identified in 400 natural caves, spread in the deep canyons and along the high escarpment west of the Dead Sea and the Jordan Valley. It became evident that excluding a shrine, clear Late Chalcolithic presence was found in the caves only.

Because of the exquisite preservation, these textiles allow all facets of weaving to be examined, so that we can pinpoint precisely where the Chalcolithic period falls in the history of textile technology. Without the excavations and surveys in Judean Desert caves, our understanding of the use of linen textiles in the region would begin some four thousand years later – in the Roman period.

The lecture will also represent the new discovery of textiles from recent excavations at "Yoram Cave", near Masada, yielded a stratum of nesting materials of raptors, as well as a stratum representing human activity in the Chalcolithic period with several hundred textile fragments, enabling us to shed new light Chalcolithic customs, technologies and traditions.

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More observations on functionality of Early Bronze Age textile tools from Greece

In the contemporary studies on the textile production experimental approach to the process of manufacturing textiles and the functional analysis of textile tools produce an important part of the research.

Thanks to the pioneer archaeological experiments conducted within the *Tools and Textiles – Texts and Contexts* (TTTC) Project of the Danish National Research Foundation's Centre for Textile Research in Copenhagen the most important technical parameters of the textile tools were acknowledged. During these experiments some copies of prehistoric Aegean spindle-whorls and loom weights were reproduced, tested and analysed in terms of their functionality. In the result the weight and the thickness of a loom weight were recognized as two crucial technical parameters directly influencing the quality of a fabric. The optimal set up of the warp weighted loom was estimated and the relation between the quality of warp threads and their optimal tension recognized. Moreover, the tests suggested that there is a possibility to approximate, what yarns and what fabrics respectively might have been produced with specific textile tools.

Textile production in the Bronze Age Greece is the main subject of my research carried in the Institute of Archaeology, University of Warsaw. Experimental approach to the textile techniques, specifically weaving, is applied together as a research and a didactic method of teaching. The experimenters are mostly students, who attend the teaching courses on prehistoric weaving techniques and who are supposed to learn the basic "body knowledge" of weaving and the textile terminology by practice.

In these experiments, mostly of experiential character, copies of loom weights from the Bronze Age Greece are also employed. Students first model themselves several copies of chosen artefacts and afterwards they weave with different sets of loom weights. In that way students gain 'hands on experience' in weaving, being able to understand the aforementioned relation between loom weights and fabrics by practice.

We have to our disposal several sets of copies of Minoan discoid, spherical and cuboid weights, three types of Late Helladic spools and finally two sets of Early Bronze Age loom weights from Tiryns. The last two sets consist of loom weights unique in the Aegean: a crescent like ("banana") weights and heavy cylinders with three perforations. Both sets where several times applied for weaving, which allows some observations on their functionality. More tests, including further modelling of artefacts, are planned for this winter/spring semester.

In my paper I present insofar results of our experiments with copies of Early Bronze Age tools, though I have to emphasize that the students are not experienced weavers and therefore their observations have to be analysed with a special caution. I refer to the significant difference between the parameters of the discoid loom weights and heavy crescent shape weights, and cylinders. I discuss difficulties in the proper reconstruction of the way in which these two last types of weights might have been set up on the warp weighted loom; the use of crescent shape weights for twill weaving and the possibility of using "bananas" and cylinders as somehow more universal weights in the process of textile manufacturing.

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Spindle whorls in Troy? A critical examination of a common opinion

Heinrich Schliemann's excavations at Tell Hissarlık, conducted between 1871 and 1890, produced a total of 8-9000 so called spindle whorls. More than ten years Schliemann was intensively looking for an explanation to this largest group of small finds in Troy. Finally he deter-mined these objects as spindle whorls and present a selection of incised clay objects on the first tables in his publication 'Atlas trojanischer Alterthümer' in 1884. He was not truly convinced of that interpretation just because he didn't find any traces or other evidence for using them by handicraft. From that time perforated clay and stone objects were usually named as spindle whorls, although their archaeological context was rarely scrutinized.

Only 2500 of Schliemann's clay objects are kept today in the State Museum of Berlin, where they have been evaluated statistically but also undergone a critical archaeological examination: parameters of quantity, shape, weight, size, quality of clay and an elaborate production presumably in models suppose another usage. This is confirmed by an additional overlay of the clay surface with lime, which is also filling the intentionally incised signs of many items. Based on the fact of repetitive deep incised signs on numerous pieces another purpose for these objects is evident: They represent an independent notation system analogue the so called abstract group of seals in and outside of Mesopotamia. In the Mediterranean linear and complex patterns engraved in bone and stone stamps and seals provide an administrative instrument dating in EM I-II.

The Trojan examples comparable clay objects are well known in the Chalcolithic period of Central Asia and in Iran. In the Early Bronze Age they spread from East to West and appear in Anatolia with an emphasis of quantity in Troy I-VI. Furthermore they were found in the Mediterranean, Poland, single examples in Italy too. These criteria argue for a supra-regional function labelling goods, counting and registering receipt and outgoing goods or other administrative proceedings. The location of Troy is obviously predestinated to establish close cultural and economic ties to Anatolia, the Aegean and the Greek Island as well as to the Balkan regions in the Early Bronze Age.

This group of finds is sufficiently understood as textile tools. C. W. Blegen compiled a compendium of thirty shapes of spindle whorls. Beads, seals, notation documents are also included as well as shapes of unknown purpose. Experimental spinning with so called spindle whorls require a clear definition of the small finds. Finally spinning is possible with seals and perforated tokens, wheels and beads but no one had ever done using identified items. This paper presents a method for exclusion a group of small finds as spindle whorls.

Posters

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The (In)Visibility of Animal Fibers - (First) Woolen Textiles in the Near East?

My research is based on my work for the research group "Textile Revolution" within the TOPOI Excellence cluster based at FU Berlin (www.topoi.org). The research group treats the introduction and spread of the wooly sheep in the Near East and Southeastern Europe. In my dissertation project I am dealing with the archaeological evidence for the early use of wool from Near Eastern prehistoric sites. In my presentation I will introduce a statistical analysis of spindle whorls and patterns of their distribution and a comparison to zooarchaeological data. The aim is to trace the use of wool into the prehistoric timeframe since by the 3rd Millennium BCE the cuneiform texts make a strong argument in favor of an immense use of wool. Therefore the main timeframe considered here, starts in the 6th Millennium BCE when considerable amounts of spindle whorls start to appear and ends by the 3rd Millennium BCE.

The archaeological record on early animal fibers and their products is scant. Partly this is due to the preservation of protein based organic materials, which survive only in very rare special conditions. Additionally, only in specialized studies are the fibers for textile production actually differentiated. In general overviews a difference in animal and vegetal fibers (in their use and procurement) is neglected or sometimes not even acknowledged as such. This paper aims to raise the awareness for this differentiation and its social and economic impact (McCorriston 1997) as well as the possibilities arising by trying to reconstruct the different "chaînes operatoires" for varying textile raw materials. Although I will be concentrating mainly on animal fibers, an inclusion of vegetal fiber materials for comparison is indispensable.

As my main archaeological artifact for this paper I will be treating spindle whorls somewhat detached from other "textile tools" like loom weights, shuttles or combs. I would like to concentrate on this particular object group to make sure that I can focus on the one of the initial steps of textile production: the manufacture of yarn. Within this production stage is where I hope to find the most significant differences in regard to the used raw material.

Spindle whorls have certain characteristics that need to be maintained to guarantee the functionality of the resulting tool, the spindle. Next to a (near) symmetrical shape and a central perforation, a restricted range of weight, height and diameter makes spindle whorls distinguishable from other object groups like beads or loom weights. Given these restrictions, still a great variety of materials and manufacturing methods exists that results in differently shaped, sized and decorated objects. Depending on the whorls shape and weight, the spinning properties of the spindles will vary considerably, which will also influence the properties of the resulting yarn. So the examination of the types and metric data of the whorls will allow for a closer look into the fundament of textile production.

The examination of spindle whorls as a means to study the evolution of textile production has to date been exercised usually on a small scale, restricted to one or two specific sites (cf. Keith 1998, Laurito 2010, Peyronel 2004, Rooijakkers 2012, Sudo 2010). In my presentation I want to enlarge the geographical as well as the chronological scope and compare the spindle whorl data from more than 20 sites, dating to the above stated timeframe.

Accompanying the whorl data I want to include basic zooarchaeological data that will give me the security to treat sites where (at least theoretically) an access to sheep wool and goat hair is conceivable.

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