HEINI KIRJAVAINEN

THE FLEECE TYPES OF LATE MEDIEVAL TEXTILES AND RAW WOOL FINDS FROM THE ÅBO AKADEMI SITE

Abstract

Some 800 pieces of textile fragments and numerous raw and waste wool finds were discovered at the medieval Åbo Akademi site in Turku, Finland. Samples of 27 pieces of the textile fragments and four samples of raw wool finds were selected for fibre analysis. Different kinds of wools were found originating from three different types of fleeces. Type I included mainly plain weave types and hairy medium types of fleeces. The most heterogeneous type was type II that contained 2/2- and 2/1-twill weaves and a coarse woollen cloth type. The widest range of fibres had been used in textiles, originating mostly from hairy types of fleeces. These textiles were woven of local wool. Fleece type III had only plain weaves that had been fulled, being called fulled woollen cloth. The medium type of fibre belonged to the medieval English sheep breed and textiles woven from it were imported to Finland during the Middle Ages.

Keywords: Finland, Middle Ages, archaeological textiles, raw wool, fibre analysis, fleece type

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INTRODUCTION

The fleece types studied in this article are from the Åbo Akademi excavation site in Turku, Finland. The excavation was conducted by the Turku Provincial Museum in 1998. The site situated in the heart of old medieval Turku near the Cathedral and the old market square (*Suurtori*). It belonged to the Mätäjärvi quarter, and the place was also a dwelling site. It contained many indications of different crafts activities, mainly leather and textile-working (Harjula 2002: 127; Kirjavainen 2002: 346; 2003a: 4; 2003b: 12; 2003c). The richest textile and weaving tool finds were in the two bottom layers which could be dated to between the 1350s and the 1450s (Seppänen 2003). Some 800 pieces of textile fragments were found along with vegetable and animal fibres, mainly raw and waste wool, yarn and cordage. The total amount may be as many as 1400 pieces.

Turku was the centre of ecclesiastical and secular administration in medieval Finland. It had a considerable colony of foreign tradesmen, mainly German, and its port was one of the most active in Finland and Sweden (Kallioinen 1999: 37, 47). Examination of 154 cloth pieces indicated that about 10% of them were probably imported as judged from the fine quality of the fibre and different appearance compared with textiles of assumedly local production (Kirjavainen 2003a: 16). According to medieval historical sources, there are mentions of cloth import from Flanders, Germany and England. Cloth was imported mainly from Flanders during the 14th and the 15th centuries. The cloths of Holland became popular in the 15th century and from the 1450s onwards, there was a growing amount of imported English cloth on the market (Taavitsainen 1982: 24). The textile trade, however, was conducted via Hanseatic towns such as Lübeck, Danzig and Tallinn (Kerkkonen 1981: 468). During the 16th century, Finland was known for its exports of fulled coarse woollen cloth to Germany and Sweden (Kjellberg 1943: 70;

Kaukonen 1962: 329-330). The first emergence of locally produced fine woollen cloth is a mention in a 16th-century account book from Turku Castle (Melander 1914: 2).

Among the Åbo Akademi textile finds we can expect to find some imported and locally produced textiles. There was possibly redistribution of imported and locally woven cloths to the other parts of Finland from Turku. The main emphasis of this article is an effort to separate locally produced textiles from imported ones by examining the fibres of archaeological textiles. Of course, there are no absolute signs or marks of the provenance of textiles, but through fibre analysis some differences between the wool and fleece types can be observed. Since there is no written information on wool imports to Finland during the Middle Ages, I presume there was primarily importation of the textiles and not the wool, although the possibility of wool imports cannot be completely excluded. Furthermore, many kilograms of raw and waste wool have been found at the excavation site (Kirjavainen 2003b: 12). I assumed that the wool originated from local domestic sheep breeds not foreign ones and some of the textiles must have been woven of it, and this should also be seen in the textiles and fibre types.

THE ÅBO AKADEMI TEXTILES AND RAW WOOL

The Åbo Akademi textile collection is rich and permits different typologies and categories according to weave type, thread count and so on. It may also reveal different textile-producing traditions along with the textile tools found at the excavation site. The sample of fifteen textile fragments was taken into account from among all the 154 studied pieces. The basic weave types were at present: plain weave, 2/2-twill and 2/1-twill weaves. In addition to these weaves, two types of fulled cloths woven in plain and 2/2-twill weaves are referred to, because they displayed a homogeneous appearance and standardization in production methods (Kirjavainen 2002; 2003a; 2003b; 2003c). The textile tool finds could be associated with actual weaving and the use of vertical and horizontal looms at the Åbo Akademi site (Kirjavainen 2003c: 273-277).

With regard to the discovered textile fragments, warp and weft yarn variation in 2/2- and 2/1-twill weaves is more considerable than variation in plain weaves. Twill weaves have smoother worsted, tight spun warp yarn and thicker woollen loosely spun weft yarn than plain weaves, the warp and weft yarns of which are equally spun. The most common spinning combination is z-spun warp yarn and s-spun weft yarn, although plain weaves have more s-spun warp and z-spun weft yarns (Kirjavainen 2002: 347; 2003a: 7-8; 2003b: 13, 15).

There are numerous raw-wool and waste-wool finds. They have been found in the same contexts as textile fragments, i.e., cesspits and farmyard refuse heaps. Probably most of the wool was used similarly to toilet paper, as might also have been in the case with textile fragments. In addition, they may have performed their part as sanitary towels in an ultimate recycling process (Walton 1989: 297; Kirjavainen 2003a: 4). Most of the raw wool consists of shorn staples cut out of fleece. They have kempy fibres of the outer coat and finer woolly fibres of the undercoat. In optical microscopy, the fibres of raw wool looked the same as the fibres examined from the textile fragments. However, by measuring the wool-fibre diameters, a more comprehensive answer could be obtained.

FIBRE, WOOL AND FLEECE

During the Middle Ages, sheep had somewhat uneven fleeces and even today the primitive descendants of the flocks also have great deal of variation in their fleece types (Schjølberg 1992: 152; Kantanen 1998: 32). Sheep fleece can actually include three types of fibre: underwool, hair and kemps. Underwool has in fact two kinds of types; fine fibres that are less than 30 µm and medium fibres that range from 30 µm to 60 µm. Kemps are very brittle, lifeless and thick in diameter ranging from 100 µm up to 250 µm. They do not dye well and they are almost impossible to spin. As a rule, fine and medium wool has usually no central channel i.e., medulla. Coarser fibres such as hair and kemps have uniform or broken central channels (Barber 1992: 21).

The weight of fleece as well as the thickness of fibre were affected by incipient breeding and pastureland (Postles 1981: 97). In addition, the season when shearing took place had a great effect on wool quality. Wool collected from fleece was sorted and mixed by type and then spun into varieties of yarns. These could be linked to different breeds of sheep. The same sheep may have coarser and stronger wool grown during the summer and a proportion of finer underwool is grown in the winter period. Due to this bilateral feature of fleece, double-coated sheep could produce "two fundamentally different yarn types" spun from thinner underwool and thicker hairs (Schjølberg 1992: 152, 153). Nevertheless, can fibre quality be so variable in the summer and winter grown fleeces? It is necessary to take into account the extraordinary amounts of fleeces which had been sorted, bowed, combed or carded before spinning. Can the procedures mentioned here change the fleece type status into something completely different, for example, the primitive hairy type becoming a generalized medium type? Moreover, from the economic point of view, sorting in such an extreme way is not worth the effort.

Furthermore, there is always the question of wool sorting or grading. It is quite easy to separate finer underwool from the coarser wool of primitive sheep breeds by hand. However, can it be done so exclusively? According to Michael Ryder, doctor of zoology and chemistry, the wool with "just one kind of diameter distribution represents only one type of fleece", not blended or sorted wools (Ryder & Gabra-Sanders 1985: 130). In the Middle Ages the fleece was used completely and wool from the abdomen and rear parts may have been separated from the fleece due to its dirtiness or felted appearance. Previously, Iron Age sheep had a tendency to moult their wool in springtime and wool was plucked by hand and not sheared at all. Towards medieval times, fleeces were changing to become more heterogeneous in Europe and the difference between hairy and woolly fleeces diminished (Ryder 1982: 225). Ryder (1995: 15) also states: "There is no conclusive evidence that fleeces were further split up to take account of the less marked variations in wool quality over the body. This sorting was to come at the end of the Middle Ages with the manufacture of a greater range of cloths of increasing quality". Good wool sorting for good quality cloths became common in the 17th century. Therefore, I presume that fibre distribution represents only one type of fleece and not the blended or sorted ones found in the textiles from the Åbo Akademi site.

WOOL FIBRE ANALYSIS

A short history of fibre analysis

Although wool fibre analysis is a common method to determine the fineness of fleeces in the wool industry, it was unknown in archaeological textile contexts before the 1960s, when Michael Ryder (e.g., 1969) introduced his statistics and history of fleece evolution into the Western archaeological study of textiles. According to published articles, it seemed for a long time that Ryder continued his work alone, because no archaeologists seemed to be interested in fibre statistics until the 1980s. After a while, more published articles, not all of which are to be mentioned here, appeared in Western archaeology discussing fibre microscopy, prehistoric and medieval textile raw materials and ship caulking in Northern Europe (Ryder 1974; 1982; 1987; 1998; 2000; Ryder & Gabra-Sanders 1985; 1992; Schjølberg 1992; Walton 1989; Walton Rogers 1995; 1997).

In the eastern part of Europe, fibre analysis was conducted on the basis of studies by the Polish scholar Adam Nahlik (1963) and the

medieval textiles of Novgorod. Perhaps due to political and language difficulties, it appeared that western and eastern experts did not meet in the archaeological fibre forum until the 1990s, when articles in German and English appeared in the NESAT publications (Maik 1990; 1998; Goldmann 1998). It could be seen that two different traditions of presenting statistics had evolved. A tabular presentation was favoured in the western parts of Europe and a diagrammatic presentation was mostly used in the eastern parts. Moreover, both research traditions gave the impression that they focused mainly on the question of local and imported textiles.

Indeed, fibre analysis has been used in Finnish archaeological textile surveys before it was taught to our textile researchers. Some twenty fibre samples taken from textile fragments found from the Iron Age graves at Vilusenharju in Tampere were sent to Ryder for analysis (Nallinmaa-Luoto 1978: Appendix 3, 28-29). The fleece types were mostly hairy medium and intermediates between hairy medium and generalized medium; only one hairy type and two generalized medium types were detected (Ryder 1974: 106; 1978: 28-29). By now, they seem slightly finer and more typical of Iron Age fleeces than the medieval wool as a whole from the Åbo Akademi site. Finnish textile researchers were taught fibre analysis according to the eastern method by the Estonian researcher Jüri Peets. I have used both tabular and the diagram presentation in this article.

Statistics for textile researchers

A separate counting graticule called a micrometer was fitted to an optical microscope using x125 magnification. I used about the same magnifications as Peets. Ryder uses magnification of x500 when counting with the mm scale. Fibre diameter was multiplied with the coefficient of 0.81 when the micrometer was used. Measuring was conducted by counting the diameter of 100 single wool fibres in each sample. The actual work was done by dividing the fibres into two rows on a glass slide being mounted with a mixture of purified water, ethanol and glycerol. Then each fibre was counted always from left to right to avoid confusion among fibres. The results are expressed in microns, 1 µm = 0.001 mm (for further information, see Ryder 2000: 4).

Various fleece types could be defined by examining the maximum fibre diameter and the skewness of fibre distribution. The counting of a mode is of greater meaning than the mean figures because it appears more frequently (Ryder 2000: 4). Skewness of fibre distribution reflects the distribution figures around the peak of a diagram. It can be positive

Table 1. Modern wool, medieval raw wool and textiles (= pigmentation analysed by Heini Kirjavainen, otherwise by Penelope Walton Rogers).*

Number	Type	Natural pigmentation	Diameter range µm	Mode (modes) µm	Mean diameter µm	Standard deviation µm	Medullation (kemp) %	Variation %	Fibre distribution	Fleece type
Modern sheep										
Sample 6	Åland sheep, staple	Dark grey*	21-120, 126-134	26 (91)	63	21	48	37 (35)	continuous/ skewed	H
Sample 26	Åland sheep, z-warp	Light grey*	18-96	31	50	22	44	12 (11)	continuous/ skewed	H
Sample 5	Finnish landrace, staple	White*	14-87	36	42	17	41	24 (3)	continuous/ skewed	H
Åbo Akademi, years 1350–1450 (TMM 21816:)										
Raw wool										
e391	Staple with z-yarn	White*	13-83, 91, 109,117	29	44	21	48	14 (9)	skewed	H
e424	Carded pad	Brown/ black*	14-79, 93, 105, 106, 139	41	40	22	54	4 (3)	skewed	H
e482	Caulking?, z-twist	Light grey*	15-95,104-112, 122	37	46	22	48	37 (27)	skewed	H
e653	Staple	Brown/ black*	17, 19,28-119, 127, 135-149	67	74	27	37	42 (26)	skewed	H
Textiles										
TE50312	Tabby, z-warp	White	7-67,81	32 (41)	39	14	37	0	slightly skewed	HM
TE50312	Tabby, s-weft	White	11-70	26	34	13	38	0	continuous/ skewed	HM
TE50428	Tabby, z-warp	White*	14-78, 88, 91	31	44	17	39	4 (4)	slightly skewed	HM
TE50428	Tabby, z-weft	White*	12-60, 66-71, 91, 101	28	36	15	42	2 (0)	skewed	H
TE13029	2/2twill, z-warp	White*	17-57	24 (28)	32	9	28	1 (0)	skewed	M
TE1472	2/2twill, z-warp	White*	15-69, 71-98	28	41	16	38	3(0)	skewed	HM
TE1472	2/2twill, z-weft	White*	12-78	41	42	16	37	0	skewed	HM
TE2091	2/2twill, z-warp	White	14-79, 101, 109, 124	26 (34)	40	19	47	4 (4)	skewed	H
TE2091	2/2twill, s-weft	White	15-79, 119, 122	23	42	19	46	8 (7)	skewed	H
TE50430	2/2twill, z-warp	White	17-112	79	55	25	45	17 (9)	continuous/ skewed	H
TE50430	2/2twill, s-weft	White	11-90,96-113	41 (66)	57	24	41	18 (9)	skewed	H
TE50422	2/1twill, z-warp	White*	18-75,82	41 (45)	45	15	33	0	slightly skewed	HM
TE50422	2/1twill, z-weft	White*	17-80,86	37	39	14	34	1 (0)	skewed	HM
TE5081	2/1twill, z-warp	White*	15-92, 104, 130	23 (24,26)	49	23	47	18 (18)	skewed	H
TE5081	2/1twill, z-weft	White*	14-47, 55, 79-90, 101, 117, 126, 145	24	35	23	66	11 (9)	skewed	H
TE1383	Fulled coarse cloth, z-warp	White	17-119	28	46	25	55	25 (24)	continuous/ skewed	H
TE1383	Fulled coarse cloth, s-weft	White	20-117, 132, 142	32	55	31	57	28 (15)	skewed	H
TE50416	Fulled coarse cloth, z-warp	White	9-79, 100, 104	32	37	19	50	5 (2)	skewed	H
TE50416	Fulled coarse cloth, s-weft	White	12, 21-100, 105-120,130,143	28	53	29	54	5 (7)	continuous/ skewed	H
TE50425	Fulled coarse cloth, z-warp	White	19-70, 78-80,147,151	28	45	20	44	11 (6)	skewed	H
TE50425	Fulled coarse cloth, s-weft	White	9-69, 89	28	32	13	41	3 (1)	skewed	HM

Number	Type	Natural pigmentation	Diameter range µm	Mode (modes) µm	Mean diameter µm	Standard deviation µm	Variation Medullation (kemp) %	%	Fibre distribution	Fleece type
TE50310	Fulled woollen cloth, z-yarn	White	16-65	32	33	12	37	1 (0)	symmetrical	M
TE50310	Fulled woollen cloth, s-yarn	White	14-52,59	19	29	9	32	0	slightly skewed	M
TE50414	Fulled woollen cloth, z-yarn	White	5,13-65	36	35	11	38	1 (0)	symmetrical	M
TE50414	Fulled woollen cloth, s-yarn	White	13-53,61	28	30	11	35	0	symmetrical	M
TE50421	Fulled woollen cloth, z-yarn	White	12-51	19 (28)	29	8	29	1 (0)	slightly skewed	M
TE50421	Fulled woollen cloth, s-yarn	White	11-58	28	29	9	32	0	slightly skewed	M

or negative, but then it is asymmetrical in other words, skewed. When it is equally distributed around the peak, fibre distribution is called symmetrical. In the case of fibre analysis, mode tends to reflect more precisely the diagram peak or peaks. When this occurs in the plural, it is referred to as the bimodal type. Mode is used as an index of distribution figures and it is nearer the actual centre than the mean, which can have more fluctuation and a rather wide range of outliers. Variance and standard deviation are also based on the difference from the mean (Drennan 1996: 17; 26; 29-30; 53-54; see Table 1).

In two of his articles, Ryder (1969: 517, 520; 2000: 4-6) defines six *fleece type* categories, the latter three being of importance for this article. *Fine wool* has a maximum fibre diameter of 30-40 µm with symmetrical distribution. This wool type can be found only in sheep of Southern Europe during the classical era, and it evolved later into Spanish merino wool (Ryder 2000: 6). This type of wool has not been detected at all in the Åbo Akademi samples. The *semi-fine* type is typical of medieval shortwools, the Cotswold and Lincoln breeds of England (Postles 1981: 96). Its maximum diameter is around 40 µm with a skewed fibre distribution (Ryder 2000: 4). This type is typical of the post-medieval wools. *Medium* wool is typical in the English longwool type of fleeces. It is coarse in texture and it was developed for coarse and worsted fabrics (Postles 1981: 96). It has a skewed distribution and diameters do not exceed 60 µm (Ryder 2000: 4) The semi-fine and medium fleece types represent results of continuous breeding activity for obtaining better quality wool suitable for the European woollen cloth markets (Postles 1981: 96). The semi-fine type is completely absent from the medieval Åbo Akademi textile collection.

The generalized medium and hairy medium types are more typical of Bronze Age and Iron Age fleeces but also of medieval fleeces in Northern Europe. *Generalized medium* wool has a skewed distribution and a fibre diameter of up to ca. 55µm fibre. It is slightly finer than the

hairy medium type, which has fibre diameters ranging 60 µm and some of the fibres can be coarser and over this limit. Fibre distribution is also skewed. Last but not least in this category is the *hairy* type of fleece, which has a limit of 100 µm and fibres passing over it. Usually fibre distribution shows skewed and continuous features. Hairy medium and hairy type of fleece are typical of the primitive double-coated sheep breeds of Northern Europe, and they can be considered to be relic varieties of the coat of the wild ancestor sheep known as the Mouflon (Ryder 2000: 4, 6). These two types are the most numerous in the Åbo Akademi textile material.

THE ANALYSIS

The reference group

In the analysis, I took into account two present-day primitive Finnish sheep breeds of native stocks – primitive Åland sheep (Finnish *ahvenanmaanlammas*) and Finnish landrace sheep (Finnish *suomenlammas*) whose genetic origins are highly international but they are still related to each other. Åland sheep seem to be related to Swedish Gute sheep (Swedish *gutefår*) originating from Gotland. The Finnish landrace breed appears to be about 1000 years old and it was generated from various local and previous sheep populations (Tapio & Kantanen 2000: 22-23; 2001: 38-39). It is necessary to mention here the native German *Heidschnucke* breed (Goldmann 1998: 236; Walton Rogers 1998: 154). It has a fleece type that is similar to double-coated primitive Finnish sheep breeds. It is not impossible that some textiles woven from this wool came to Finland when the Hanseatic trade and tradesmen were exchanging goods all around the Baltic Sea.

Interestingly, no brown versions of Åland sheep exist at all (Tapio & Kantanen 2001: 38). However, the Åbo Akademi raw and waste wool finds have many indications of brown hairy wool that may be evidence of other landrace sheep at the Åbo Akademi site or in its close proximity. In addition, grey fleeces distinguish Åland sheep and other primitive sheep breeds especially in Northern Europe and the Balkans (Ryder 1982: 225). All the textile fragments under examination were woven of white wool, which is a more typical colour for white sheep of selective breeding and it became a more common colour after the Iron Age (Ryder 1990: 139, 143). Furthermore, white is a more convenient base for the textiles to be dyed. These two contemporary fleece types were compared with samples from archaeological textiles, even though the present primitive sheep control group is far more than sufficient to

provide extensive conclusions, not to mention DNA tests that would give this study a broader and more precise context.

Due to the slowness and elaborate nature of this kind of research, only a few textile fragments are considered. Most of the samples were taken from warp and weft yarns of a single textile fragment, altogether 27 samples being analysed. In addition, four raw or waste wool samples were taken into account, being compared with five present-day wool staple samples, two of which are Åland sheep and one is a Finnish landrace sample.

The Åbo Akademi cloths are classified by type. This is based on the appearance of warp and weft yarns and their spinning angle (tight/loose), yarn diameter, yarn type (worsted/woollen), finishing treatments and exterior features of the cloth. I have used five categories based on my previous published articles (Kirjavainen 2002: 348-349; 2003a: 11-13; 2003b: 16-17). All the references in this chapter are based on those articles unless otherwise stated. The cloth types included in this study are fulled woollen cloth (English *broadcloth, woollen cloth*; Finnish *verka*), fulled coarse cloth (Swedish *vadmal*; Finnish *sarka*), tabby cloth (English *plain weave*; Finnish *villapalttina*), 2/2-twill cloth (Finnish *nelivartinen villatoimikas*) and 2/1-twill cloth (Finnish *kolmivartinen villatoimikas*).

After sorting, wool can undergo diverse pre-spinning processes and it can be handled separately for different yarn types. The combing of long-fibred wool was used for worsted-like textiles. Carding short and mostly medium-fine, fibred wool was carried out for woollen textiles; in the Åbo Akademi case mainly for plain weave textiles. Bowing was used for all kinds of wool fibres but these were relatively short shorn fibres i.e., sheep shearing took place more often than once or twice a year. In this case, all sorts of wool fibres could be detected principally in cloths based on 2/2-twill and 2/1-twill weaves. In all cases, the wool was spun directly from fleece without blending a different kind of wool (Ryder & Gabra-Sanders 1985: 130).

Fleece type category I

The homogeneous fleece type category I has almost identical yarn types in warp and weft. Woollen tabby cloth that has almost similar thread counts in warp and weft is the most prominent cloth type in this category. The wool types are alike except in weft of TE50428, but the difference is not so clear although the fleece type is hairy while the others are of hairy medium type (Fig. 1). The coarsest fibres are almost missing and the stress is on the medium type of fibres, the diagram

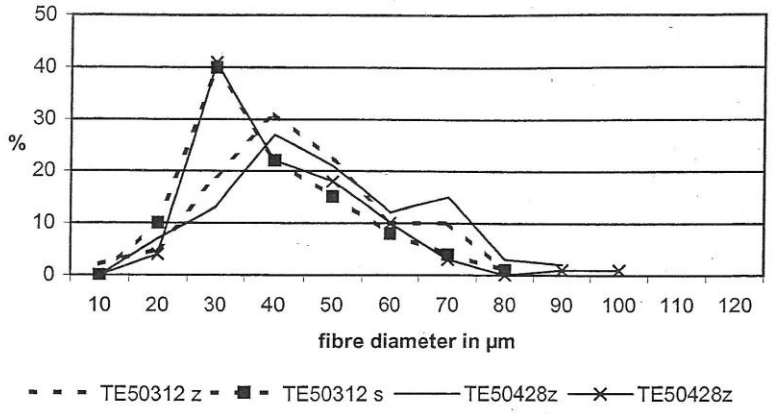


Fig. 1. Fibre diameters in woollen tabby cloths.

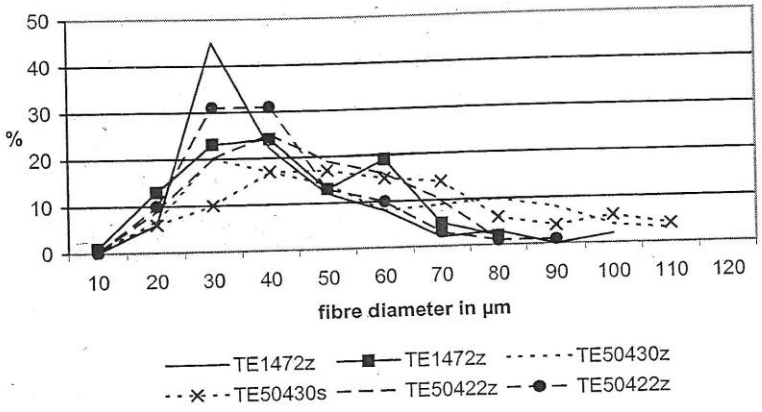
peaks varying between 30 and 40 µm. The coarsest hairs seldom exceed the limit of 80 or 90 µm. The mean diameters in the warp vary between 33-44 µm, and between 34-36 µm in the weft. The deviation in threads is as much as 4 µm. This can be interpreted as involving a single fleece type or the difference between summer and winter grown wool. In the summer-grown wool the peak is open and wide, while in the winter grown wool the diagram peak is sharp, indicating 30 µm.

The hairy medium type of wool was typical of wools in Northwestern Europe in medieval times. (Walton Rogers 1998: 154). Accordingly, this type can originate from Finnish sheep, or for example from German sheep. When this is taken into account, it can be said that fleece type category I can contain imported textiles brought in by tradesmen from Hanseatic towns or textiles made of local domestic wool.

Fleece type category II

Fleece type category II falls into 2/2-twill and 2/1-twill weaves. Typical of these cloth types is that the warp threads are thinner and tighter spun z-twisted yarns. The weft threads, which are bulkier and more stick-like are s-twisted yarns. This category actually has two groups of fibre types; as in categories I and II if the fibres are examined as a part of cloth types (Fig. 2). For all fibres in this category, the mean of the warp is 37-55 µm and that of the weft is 35-57 µm. The deviation between the two thread systems is about 6 µm in the 2/2-twill cloths and up to 9 µm in the 2/1-twill group. This means that a wider range of fibres was used but still they all fall into the category of hairy and hairy medium type of fibre.

Fig. 2. Fibre diameters in 2/2- and 2/1-twill cloths.



The difference cannot be explained by summer and winter growing, although it can be seen as in category I. More than one wool supply was available but the wools all still belong to the types of northern double-coated sheep breeds, probably of Finnish origin.

In category II, heavy fulled coarse cloths form the nucleus of this type of wool (Fig. 3). Characteristic of wool usage is a wide range of utilized fibres, which include fine and medium underwool and more coarse hairs and kemps. The diagram peaks have stress on the fibres between 30 and 40 µm as in category I and 2/1- and 2/2-twills. In addition, medullation numbers are high, which is a typical feature of coarse hairs over 100 µm. It appears that the whole fleece was used and sorting was minimized. The deviation in both thread systems is 18 µm. The number is very high compared with the figures of plain and twill weaves. Difference between the fibres is too wide to be explained by seasonal growth. Altogether, this cloth type has mostly hairy fibres; only one hairy medium type could be found in TMM 21816: TE50425 weft yarn. Although the fleece type is the same, the differences are so great that the origin of this wool cannot be the same sheep flock. It may be that wool was gathered in one place from separate sources possibly from different sheepherders in the near vicinity. Alternatively, the textiles came to one place from the separate weavers that had access to diverse type of fleeces of northern short-tailed sheep breeds i.e., our local sheep breeds. The raw wool finds (e391, e424, e482 and e653) from the Åbo Akademi site support the idea of wool gathering because it is the same kind of hairy type also found in most of the fulled coarse cloths. Of course, there is the German *Heidschnucke* already mentioned above, and other primitive breeds of Northern Europe and the textiles

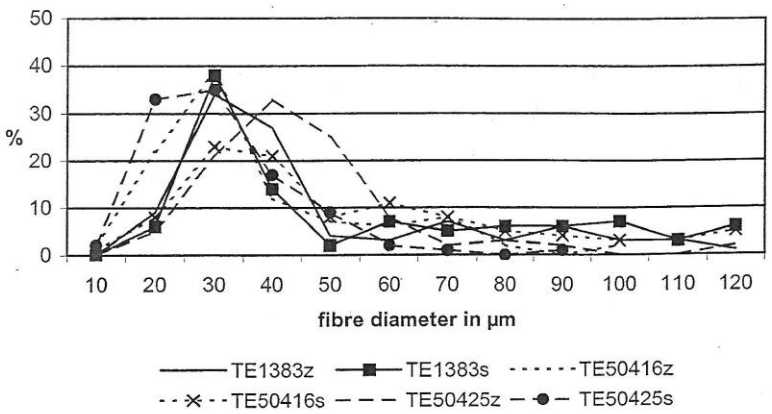


Fig. 3. Fibre diameters in fulled coarse cloth.

woven of their wool. Nevertheless, was it cost-effective to bring import textiles that could have been made locally?

The weft-faced appearance of TMM 21816: TE1472 is very different from the other textiles in this category. It has thick and tight spun warp and it seems to be similar to the diagrams of heavy fulled woollen cloths. The weft yarn is thin and shiny worsted loosely spun yarn, very tightly woven, and its diagram resembles that of plain weave cloths. At first sight, it seemed to be an imported textile similar to two isolated textile fragments found in medieval Lübeck (Tidow 1978: 144). However, the fibre analysis showed that it might also have been a locally woven textile. It can be definitely said that this textile is of Northern European origin, although the actual manufacturing area cannot be detected.

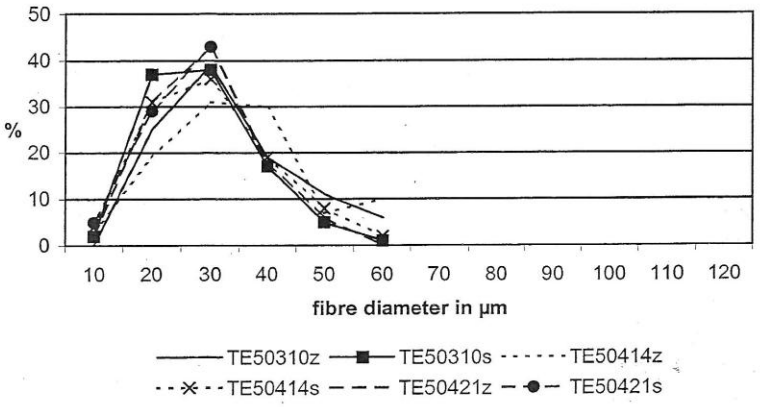


Fig. 4. Fibre diameters in fulled woollen cloth.

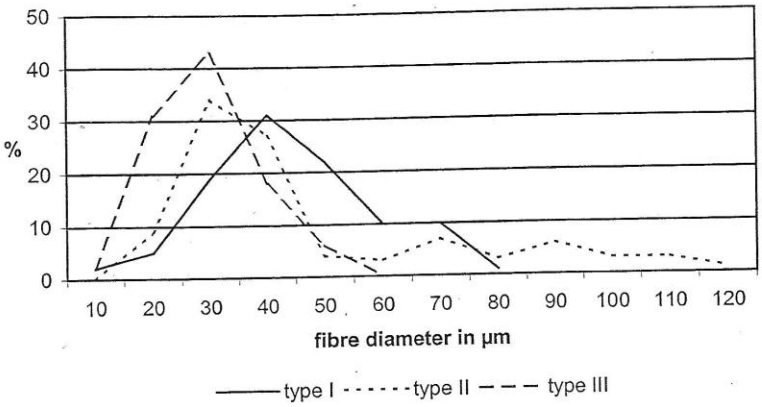


Fig. 5. Fibre diameters in three different fleece types.

Fleece type category III

Another homogeneous group is category III, which is based on plain weave and includes all the fulled woollen cloths. They have been considered as foreign textiles according to my previous studies. The wool of the Åbo Akademi woollen cloths is quality-carding wool identical in warp and weft (Fig. 4). The mean is 29-35 µm in the warp and 29-30 µm in the weft. The deviation in both thread systems is only 4 µm. The diagram peaks are around 20 to 30 µm descending rapidly towards 50 µm. Warps and wefts are of a medium type of wool that is typical of medieval English wools. The deviation is so small that wool must be from the same breed of sheep. The appearance of the diagram appears to be the same as the present-day wool of English Shropshire sheep and the medieval English wools found in Gdansk (Maik 1990: 121). The possibility that these textiles came from the same place of origin cannot be accepted, but the raw material is most probably from England. The fleeces differ from the Finnish native sheep breeds and from the textiles categorized as local production. In textile TMM 21816: TE50421 the warp and weft diagrams are almost exactly alike. The wool must have come from the same source and possibly from the same fleece.

An altogether different type of 2/2-twill cloth is TMM 21816: TE13029. It is a worsted textile with shiny and similar type of warp and weft yarns. At first sight, it did not appear similar to the category III textiles at all but when the fibre analysis was carried out, it proved to have a diagram similar to fulled woollen cloths that had been classified as imported textiles.

CONCLUSIONS

Three types of fleeces could be found in the Åbo Akademi textile material studied in this article (Fig. 5). Type I includes the hairy medium type of wool and it was mostly used for the plain weave cloths. These cloths are thinner, lighter and softer than the other cloth types. They were most suitable for undergarments, because the wool seldom contains the coarsest type of fibres of over 90 µm. In addition, some pieces could also be found among the 2/2- and 2/1-twill weaves. The warp threads appeared to be coarser than the weft threads, but this did not affect the overall appearance of the two thread systems.

Type II has the most heterogeneous fibre distribution of all the studied material, including the finest and coarsest fibres of up to 150 µm. The hairy type of fleece is typical of all the northern double-coated primitive sheep breeds. This type was used mostly for 2/2-twill weaves that includes fulled coarse cloths. Two samples were found in 2/1-twill weaves and one weft yarn in the plain weaves. It seems that this is the material used in the Finnish fulled coarse woollen cloths known from historical sources as *vadmal* (Finnish *sarka*). This type of cloth was for heavy duty wear for outer garments and they could resist cold and water better than thinner types of cloths such as the plain weave cloths. There seemed to be no difference between the fibre fineness in warp and weft.

The type III category is the most homogeneous group and it includes only fibres of up to 60 µm. The medium type of fleece is typical of the medieval English wools that were used in the European woollen industry called the 'New Woollen Industry' in the late medieval period. These novelty cloths meant for the upper classes of medieval society (Maik 1990: 120). The cloth type is fulled woollen cloth (Swedish *kläde*; Finnish *verka*) known from historical sources. Weft threads seemed to be not much coarser than warp threads. These changes can be explained by the seasonal growth of the fleece. The ethnographer Toivo Vuorela (1983: 472) mentions that the best warp yarns were spun from the summer-grown wool (Finnish *loimivilla*) which was coarser than winter-grown wool, and these differences can also be seen in the diagrams.

As noted by Ellen Schjølberg (1992: 156) in her article on fibre analysis, it is necessary "... to be extremely cautious when talking about textile types, and even more cautious when discussing their provenance". Of course, all this is true, but how can we study archaeological textiles without sorting them into categories and types and without making interpretations about them? I assume that this is what archaeology is all about. The fibre studies give us more information about archaeological textiles and the wool along with sheep breeds than research without

them. Although we cannot say the exact place of origin of the textiles, it is worth the effort to present interpretations and raise discussion. This makes the archaeological textiles more comprehensible to us.

Abbreviations

TMM – Turun maakuntamuseo (Turku Provincial Museum), Turku.

REFERENCES

Unpublished sources

Seppänen, Liisa 2003: *Åbo Akademin tontin relatiiviskronologinen matriisi.* Turku Provincial Museum.

Literature

Barber, Elisabeth 1992: *Prehistoric textiles.* Princeton.

Drennan, Robert 1996: *Statistics for Archaeologists.* New York.

Goldmann, Annelies 1998: Die Skudde, eine alte mittel- und osteuropäische Landschafrasse. Bender Jørgensen, L. & Rinaldo, C. (eds.), *Textiles in European Archaeology.* NESAT 6, Göteborg: 233-242.

Harjula, Janne 2002: Leather Artefacts and Leather Working in Turku, SW Finland: Tracing the medieval technology and fashion. Helmig, G. & Scholkmann, B. & Untermann, M. (eds.), *Centre– Region– Periphery. Medieval Europe Basel 2002. 3rd International Conference of Medieval and Later Archaeology.* Volume 1. Hertingen: 127-132.

Kallioinen, Mika 1999: Koggit Koroisissa, tavara-aitat Aurajoella. Lappalainen, T. (ed.), *Turun sataman historia.* Jyväskylä: 37-48.

Kantanen, Juha 1998: Ahvenanmaan alkuperäislammas on uhanalainen. *Lammas ja vuohi* 3/1998: 31-34.

Kaukonen, Toini-Inkeri 1962: Sarka ja kangas vanutetun villakankaan nimityksinä. *Virittäjä* 1962: 329-335.

Kerkkonen, Gunvor 1981: Klede. *Kulturhistoriskt Lexikon för Nordisk Medeltid* 8: 468-469.

Kirjavainen, Heini 2002: Medieval Archaeological Textiles in Turku. Helmig, G. & Scholkmann, B. & Untermann, M. (eds.), *Centre – Region – Periphery. Medieval Europe Basel 2002. 3rd International Conference of Medieval and Later Archaeology.* Volume 2. Hertingen: 346-351.

Kirjavainen, Heini 2003a: Åbo Akademin tontin keskiaikaiset tekstiilityypit. *SKAS* 1/2003: 4-18.

Kirjavainen, Heini 2003b: Medieval Archaeological Textiles found in Turku, Finland. *Archaeological Textiles Newsletter* 36/2003: 12-19.

Kirjavainen, Heini 2003c: Keskiaikaiset tekstiilityövälinelöydöt – käsityön jälkiä Åbo Akademin tontilta. Seppänen, Liisa (ed.), *Kaupunkia pintaa syvemmältä. Arkeologisia näkökulmia Turun historiaan.* Archaeologia Medii Aevi Finlandiae IX. Turku: 267-280.

Kjellberg, Sven 1943: *Ull och ylle.* Lund.

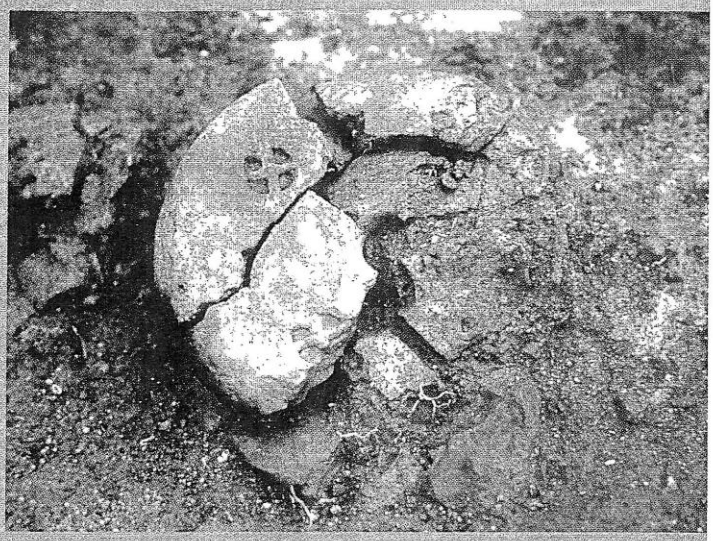
Maik, Jerzy 1990: Medieval English and Flemish textiles found in Gdańsk. Walton, P. & Wild, J. P. (eds.), *Textiles in Northern Archaeology.* NESAT 3, London: 119-130.

Maik, Jerzy 1998: Westeuropäische Wollgewebe im mittelalterlichen Elblag (Elbing). Bender Jørgensen, L. & Rinaldo, C. (eds.), *Textiles in European Archaeology.* NESAT 6, Göteborg: 215-231.

Melander, K. R. 1914: Muutamia tietoja kangasteollisuudesta Turun tienoilla Juhana Herttuan aikana. *Historiallinen arkisto* XXIV: 1-8.

Nahlik, Adam 1963: Tkani Novgoroda. Zhilishcha Drevnego Novgoroda. *Materialy i issledovaniya po arkheologii SSSR.* No 123: 228-296.

Nallinmaa-Luoto, Terhi 1978: *Tampere Vilusenharju. Nuoremman rautakauden kalmisto Pirkanmaalla.* Karhunhammas 3.
Postles, David 1981: Fleece weights and the wool supply, c. 1250–c. 1350. *Textile History* 12, 1981: 96-103.
Ryder, Michael 1969: Changes in the fleece of sheep following domestication (with a note on the coat of cattle). Ucko, P. J. & Dimbleby, G. W. (eds.), *The domestication and exploitation of plants and animals.* London: 495-521.
Ryder, Michael 1974: Wools from Antiquity. *Textile History* 5, 1974: 100-110.
Ryder, Michael 1978: Vilusenharju wools. Nallinmaa-Luoto, T. *Tampere Vilusenharju. Nuoremman rautakauden kalmisto Pirkanmaalla.* Karhunhammas 3: Liite 3: 28-29.
Ryder, Michael 1982: European Wool Types from the Iron Age to the Middle Ages. Bender Jørgensen, L. & Tidow, K. (eds.), *Archäologische Textilfunde.* NESAT 1, Neumünster: 224-238.
Ryder, Michael 1987: Merino History in Old Wool. *Textile History* 18 (2), 1987: 117-132.
Ryder, Michael 1990: The Natural Pigmentation of Animal Textile Fibres. *Textile History* 21 (2), 1990: 135-148.
Ryder, Michael 1995: Fleece Grading and Wool Sorting: The Historical Perspective. *Textile History* 26 (1), 1995: 3-22.
Ryder, Michael 1998: Animal Hair in Medieval Ship Caulking Throws Light on Livestock Types. *Environmental Archaeology* 2, 1998: 61-66.
Ryder, Michael 2000: Issues in Conserving Archaeological Textiles. *Archaeological Textiles Newsletter* 31/2000: 2-7.
Ryder, Michael & Gabra-Sanders, Thea 1985: The Application of Microscopy to Textile History. *Textile History* 16 (2), 1985: 123-140.
Ryder, Michael & Gabra-Sanders, Thea 1992: Textiles from Fast Castle, Berwickshire, Scotland. *Textile History* 23 (1), 1992: 5-22.
Schjølberg, Ellen 1992: The Wools in Some Medieval Textiles from Bryggen in Bergen, Norway. Bender Jørgensen, L. & Munksgaard, E. (eds.), *Archaeological Textiles in Northern Europe.* NESAT 4, Copenhagen: 151-157.
Taavitsainen, Jussi-Pekka 1982: Keskiajan kangaskaupasta kirjallisten ja esineellisten lähteiden valossa. *Suomen Museo* 1982: 23-42.
Tapio, Miika & Kantanen, Juha 2000: Mitä perinnöllinen muuntelu kertoo suomenlampaan historiasta? *Lammas ja vuohi* 3/2000: 21-24.
Tapio, Miika & Kantanen, Juha 2001: Itämeren saarilla vanhoja lammasrotuja. *Lammas ja vuohi* 4/2001: 37-39.
Tidow, Klaus 1978: Textilfunde aus einem Brunnen auf dem Schrangen in Lübeck. *Lübecker Schriften zur Archäologie und Kulturgeschichte.* Band. 1: 139-157.
Vuorela, Toivo 1983: *Suomalainen kansankulttuuri.* Porvoo.
Walton, Penelope 1989: *Textiles, Cordage and Raw Fibre from 16-22 Coppergate.* The Archaeology of York. Volume 17, fascicule 5. Dorset.
Walton Rogers, Penelope 1995: The raw materials of textiles from northern Germany and the Netherlands. *Probleme der Küstenforschung im südlichen Nordseegebiet.* Band 23: 389-400.
Walton Rogers, Penelope 1997: *Textile Production at 16-22 Coppergate.* The Archaeology of York. Volume 17. Dorset.
Walton Rogers, Penelope 1998: Fleece-types in five medieval textiles from Einbeck, Germany. Jordan-Fahrbach, E. & Sthürenberg, C. & Tidow, K. Mittelalterliche Gewebefunde aus Einbeck. *Einbecker Jahrbuch.* Band 47, 2000: Appendix 2: 153-154.



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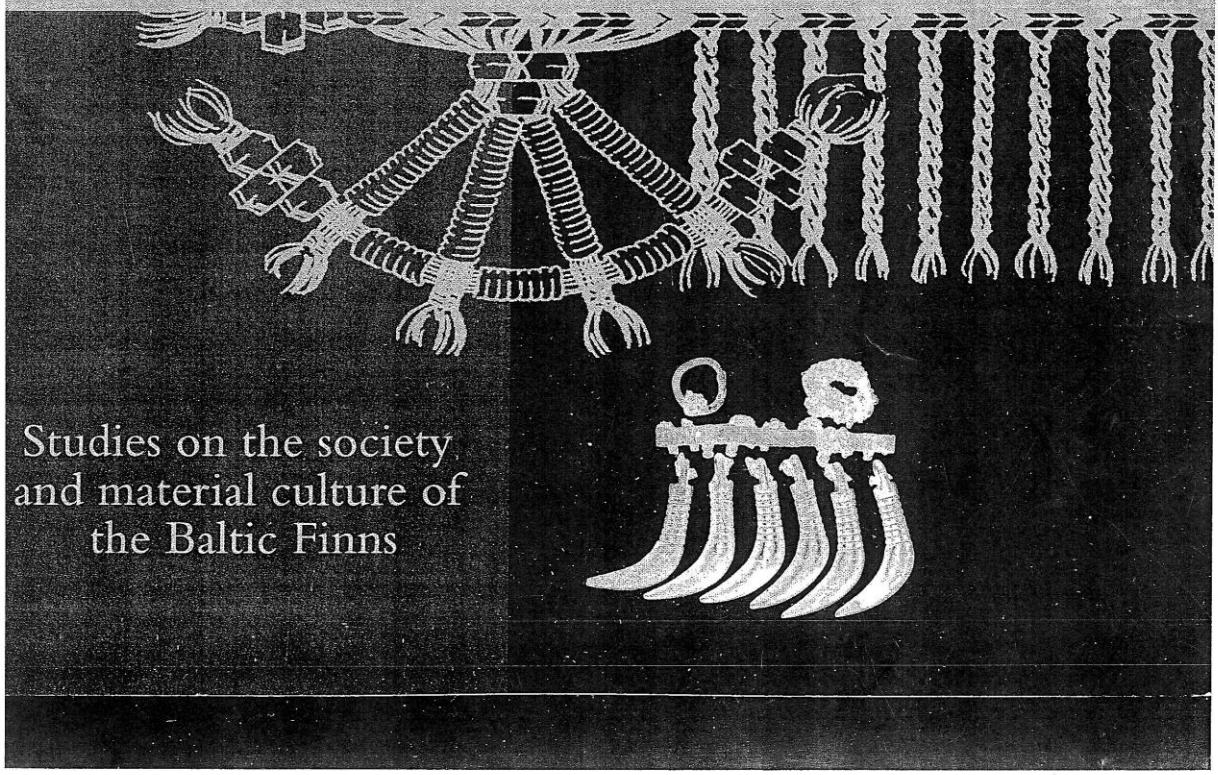

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