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WOOLS AND DYES IN NORTHERN EUROPE IN THE ROMAN IRON AGE

INTRODUCTION

In 1986 the Polish textile expert, Jerzy Maik, contributed an article to "Fascicula Archeologiae Historicae" in which he sought an explanation for the fine wools he had found in Pomeranian textiles of the Roman Iron Age[1]. Maik suggested that a fine-wooled strain of sheep may have been introduced from the northern Roman provinces, but ended his paper as follows: "in order to confirm or refute the above hypothesis there should be very careful investigation into wool originating in parts of the Roman Empire and the barbarian lands, such as Germany, Scandinavia and Poland" (A.Tr.).

While Maik was writing his paper, in 1983, Lise Bender Jørgensen of the University of Copenhagen was commissioning just such an investigation as Maik suggested, as an offshoot from her survey of prehistoric textiles from northern Europe.[2] Between 1984 and 1987, samples from selected textile-types were sent to Britain, where wool studies have been established for some time; dye analyses, a further speciality of British archaeology, were also carried out.[3] The samples came from Norway, Denmark and Germany, from sites of the Pre-Roman and Roman Iron Age, the Migration Period and the Viking Age.

By adding this large new body of evidence to that already collected by other researchers, it has been possible to outline developments in wools and dyeing in parts of northern Europe from the Bronze Age to the Viking Age.[4] There are, of course, still some regions and periods which are poorly represented and research is still continuing. Most recently, Maik has supplied a group of samples from the Pomeranian sites with which he is concerned, in order to extend the study.

As a result of this cooperation between researchers, it is possible to present the following paper, which has three aims:

(1) to make a comparison between the Polish and British methods of classifying wools, in order to facilitate exchange of information in the future;

(2) to present the results of analyses of dyes and wools in the group of Roman Iron Age textiles from Pomerania supplied by Maik;

(3) to place the Pomeranian evidence in the context of recent studies into wools and dyes from North–West Europe.

TECHNIQUES FOR CLASSIFYING WOOLS

The fleece of an adult sheep may include three types of fibre: true wool, which is relatively fine and crimpy; hairs, which are fibres of medium diameter, usually with a narrow central medulla; and kemp, a coarse fibre with a broad latticed medulla (fig. 1). Kemp and hair are not present in all fleeces and true wool may vary in diameter: the usual method of assessing the quality of wool is therefore to measure the diameters of a representative sample of fibres. This technique is used in the modern textile industry and in Britain and Poland it has been applied to textiles from archaeological sites. British and Polish

[1] J. Maik, *Das Vorkommen des sogenannten römischen Schafes in Pommern*, "Fasciculi Archaeologiae Historicae", 1986, I, pp. 55–64.

[2] L. Bender Jørgensen, *Forhistoriske Textilier i Skandinavien*, Copenhagen 1986; L. Bender Jørgensen, *A Survey of North European Textiles*, "Studien Zur Sachsenforschung", 1987, 6, pp. 99–121; L. Bender Jørgensen, *North European Textiles until AD 1000*, Copenhagen, forthcoming.

[3] The samples were analysed in the laboratory of the York Achaeological Trust, under funding from the Danish Research Council and Queen Margrethe's Fund.

[4] J. Bender Jørgensen, P. Walton, *Dyes and Fleece Types in Prehistoric Textiles from Scandinavia and Germany*, „Journal of Danish Archaeology", 1986, 5, pp. 177–188; P. Walton, *Dyes and Wools in Iron Age Textiles from Norway and Denmark*, "Journal of Danish Archaeolgy", 6, forthcoming.

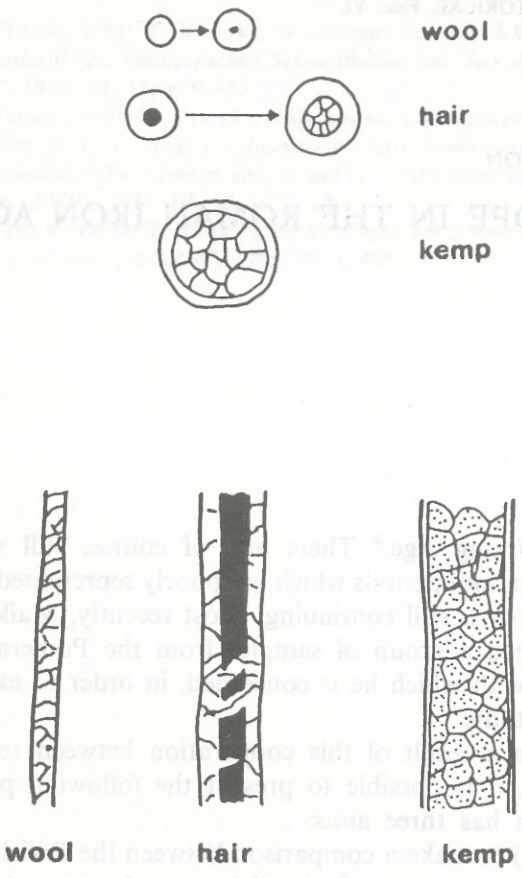


Fig. 1. Types of fibre in the fleece of adult sheep

researchers, however, differ in their methods of sampling and presenting the results.

In Britain, wool from archaeological sites has been classified by Dr M.L. Ryder,[5] whose methods have been followed by J. Hedges, F. Pritchard and P. Walton. In the British system the number of fibres in a sample is kept rigorously to 100. The measurements are grouped in two-micron increments and plotted in histograms (fig. 2a). According to (a) the range of measurements (b) the mean (average measurement) and (c) the shape of the graph, (that is, whether it is symmetrical or skewed), the wool may be allocated to one of the seven fleece-type categories: "fine", "fine/generalised medium", "generalised medium", "shortwool", "medium", "hairy medium" or "hairy".

In Poland, wools from archaeological textiles have been examined by A. Nahlik and J. Maik.[6] In their system, the sample is a minimum of 50 fibres and the results are plotted in a straight-line graph, the measurement grouped by five micron increments (fig. 2b). The line-graph method allows comparison of two or more samples on the same graph. The mean and the *differenz* (a statistic which indicates how much variation there is within a sample) are the criteria whereby samples are compared with each other. There appears to be no standard nomenclature in the Polish system, but Maik has divided the 199 samples he examined from Roman Iron Age Pomerania into three groups, adding a fourth, hypothetical, group to allow for any coarser wools which might exist at other sites. The criteria for the two systems of classification are listed in table 1.

Unfortunately, there is no easy correspondence between the two systems. Maik's groups 1 and 2 roughly correspond to the British fine and fine/generalised medium, while Maik's group 3 approximates to generalised medium and shortwool; group 4 would include medium, and hairy medium

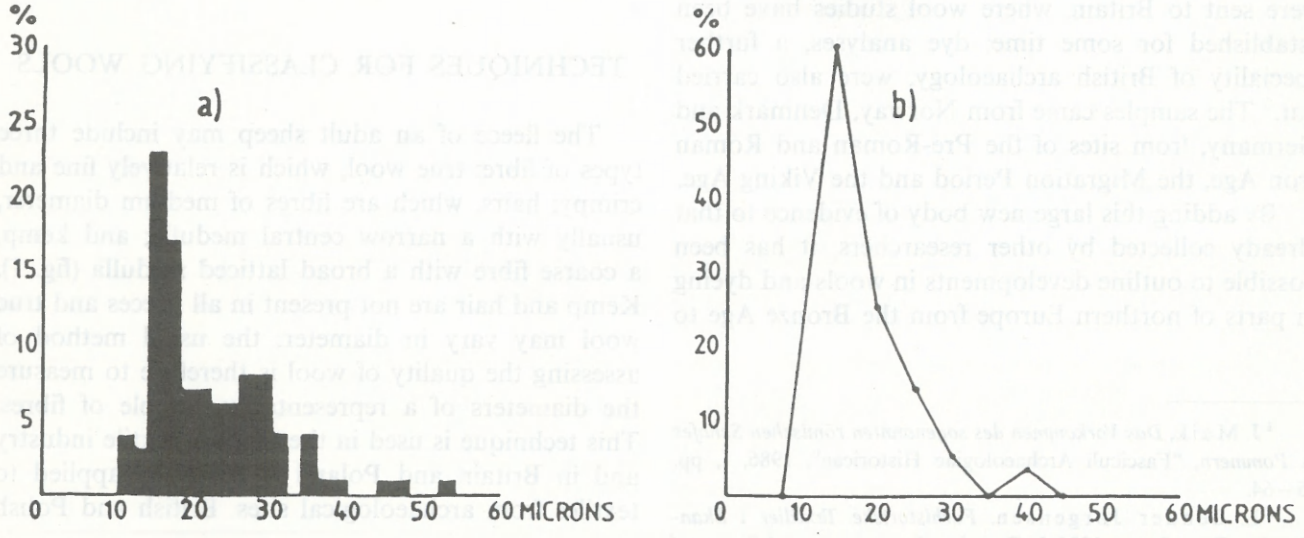


Fig. 2. British (a) and Polish (b) methods of recording the diameters of wool fibres a) Ryder's generalised medium; Maik's group 2, Lesno Grave 1, ZZ (infra) b) Ryder's'fine/generalised medium; Maik's group 1, Odry 1014/73 (pub. by Maik)

[5] M.L. Ryder, *Changes in the Fleece of Sheep Following Domestication, The Domestication and Exploitation of Plants and Animals*, eds P.J. Ucko and G.W. Dimbleby, 1969, pp. 495–521.

[6] J. Maik, *op. cit.*; A. Nahlik, *Tkaniny wełniane Nowogrodu Wielkiego*, Warsaw 1964.

Table 1

Systems for Classifying Wool

M.L. Ryder's Classification	J. Maik's Classification
Fine: maximum diameter 30–40 microns mean approximately 20 microns symmetrical distribution. (Merino)	1. mean less than 18 microns finer than medieval Merino
Fine/generalised medium: maximum diameter 35–45 microns mean approximately 20 microns skewed distribution	2. mean 18–15 microns similar to medieval Merino
Shortwool: maximum diameter 45 microns mean approximately 25 microns symmetrical distribution (modern shortwools, eg Down breeds)	3. mean 25–29 microns corresponds to modern shortwools
Generalised medium: maximum diameter 55 microns mean 20–25 microns skewed distribution (modern Soay)	
Medium: maximum diameter 60 microns mean 30–40 microns symmetrical distribution (primitive longwools, e.g. Romney)	4. mean over 29 microns
Hairy medium: maximum diameter over 60 microns mean 20–30 microns skewed distribution (white-faced hill breeds, e.g. Cheviot)	
Hairy: maximum over 60 (sometimes over 100) microns mean 30–40 microns continuous or skewed distribution (black-faced mountain breeds, e.g. Swaledale)	

Modern representatives of the fleece-type are given in brackets. Adapted from M.L. Ryder, *Changes in the fleece of Sheep...*, pp. 517, 520 and J. Maik, *Das Vorkommen des sogenannten römischen Schafes...*, pp. 60–61.

and hairy types. It is clear, however, from Maik's diagrams that some of the samples from his groups 2 and 3 contain fibres more than 60 microns in diameter, which would place them in the hairy medium category. In comparing wools classified by different systems it is therefore evident that reference must be made either to the original graph (e.g.fig.2) or to a detailed table of measurements (e.g.table 2).

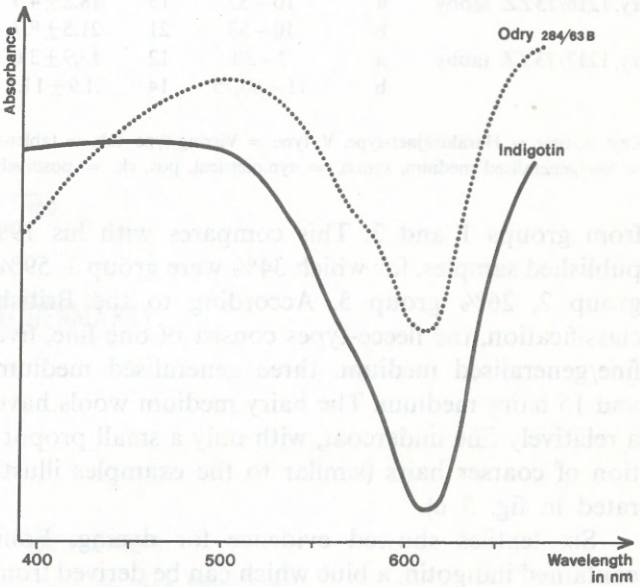
TECHNIQUES FOR ANALYSING DYES

Dye analysis was introduced to archaeology in Britain by Professor M.C. Whiting and has been further developed by Dr G.W. Taylor.[7] The standard tests are to extract any dye present into a series of solvent-systems and to measure the absorption of visible light in the extracts, with a spectrophotometer (in our case a Perkin-Elmer 402 U.V./Visible spectrophotometer). The graph drawn up by this machine will give the characteristic "fingerprint" of the dye. In order to identify the individual constituents of the dye. Thin Layer Chromatography (TLC) is used.[8]

RESULTS OF ANALYSES OF WOOLS AND DYES IN TEXTILES FROM POMERANIA

Maik supplied the author with samples of ten textiles from cemeteries of the Roman Iron Age, one from Gronowo, two from Lesno and seven from Odry. For identification of the type of wool, separate samples were taken from the warp, the weft and any borders or stripes (giving 24 samples in all). For dyes, the whole sample was tested, except in the case of the striped piece from Gronowo, which was divided into three, according to colour: a total of 12 samples. The results of these analyses are given in table 2.

The mean diameters of the wools were 13,9–26.1 microns, confirming that the general quality of the wool is fine. If placed in Maik's categories, the predominant type is group 2, with two examples each



Spectrophotometer graph of woad (indigotin) and dye from textile Odry 284/63B (both in ether)

[7] G.W. Taylor, *Detection and Identification of Dyes on Pre-Hadrianic Textiles from Vindolanda*, "Textile History", vol. 14, 1983, pp. 115–124.

[8] H. Schweppe, *Identification of Dyes in Historic Textile Materials*, [in:] H.L. Needles, S.H. Zeronian, *Historic Textile and Paper Materials: Conservation and Characterisation (Advances in Chemistry Series)*, Washington 1986, pp. 153–174.

Table 2

Textiles from Roman Iron Age Sites in Pomerania – Dyes and Wools

Site, no	Textile	Yarn	Range	Mode	Mean ± S.D.	Distribution	Med.	Pigment	Fleece-type	Maik's categ.	Dye
Gronowo, 3/1	H.-type	dark ?wa	9–51,82,84	19	22.4+11.4	+0.78, pos.sk	3%	46%	hairy medium	2	?tannin
		dark ?we	11-51,62,63	16	21.8±9.2	+1.16,pos.sk.	4%	98%	hairy medium	2	?tannin
		light?we	12–63	20	23.4±9.4	+0.87,pos.sk.	6%	0	hairy medium	2	no dye detected
Lesno, 1a	2/2 ZS	Z	10–46	16	21.0±8.5	+1.19,pos.sk.	0	100% light 12% dense (coarse only)	gen. medium	2	no dye
		S	7–43	12	17.1±8.4	+0.93,pos.sk	2%	100% light 11% dense (coarse only)	f./gen.medium	1	
		selv. wa	11–48	17	21.4±7.3	+0.91,pos.sk.	0	100% light 80% dense	f./gen.medium	2	
Lesno, 1b	H.-type	a	11–52	16	22.2±7.8	+0.92,pos.sk.	3%	2%	gen. medium	2	indigotin
		b	12–46,63,75	20	23.5±9.7	+0.85,pos.sk.	3%	1%	hairy medium	2	
Odry, 284/63a	V.-type	Z	14–45,55,62	21	24.3±7.8	+0.39,symm.	3%	0	hairy medium	2	indigotin
		S	10–50,65,78	17	22.1±9.9	+0.67,pos.sk.	3%	0	hairy medium	2	
Odry,284/63b	V-type	Z	11–55,66	17	21.9+9.1	+1.06,pos.sk.	6%	3%	hairy medium	2	indigotin
		S	12–45,58,60	20	24.9±7.4	+0.35,symm.	3%	0	hairy medium	2	
Odry, 423a	ZS twill	tab.wa	11–40	15	19.0±6.2	+0.82,pos.sk.	0	0	f./gen.medium	2	no dye detected
	with	Z	9–40,71	15	19.9+8.7	+0.56,pos.sk.	3%	0	hairy medium	2	
	tablet	S	11–58,84	16	26.1±12.8	+1.07,pos.sk.	17%	0	hairy medium	3	
	border										
Odry, 423b	ZS twill	tab.wa	10–40,52	15	19.6+6.8	+0.57,pos.sk.	1%	0	f./gen.medium	2	no dye detected
	with	Z	9–47,60	15	19.7±8.7	+0.86,pos.sk.	3%	0	hairy medium	2	
	tablet	S	11–67	16	23.8±11.8	+1.05,pos.sk.	8%	0	hairy medium	2	
	border										
Odry, 423c	ZS twill	Z	9–36,51,60	16	18.7+7.7	+0.84,pos.sk.	2%	0	hairy medium	2	indigotin(traces
		S	10–62	15,16	25.2±11.7	+0.98,pos.sk	8%	0	hairy medium	3	
Odry, 1216/73	ZZ tabby	a	10–32	15	18.2±4.5	+0.51,pos.sk.	1%	0	f./gen.medium	2	?yellow
		b	10–53	21	21.5+8.7	+0.60,pos.sk.	6%	2%	gen. medium	2	
Odry, 1217/73	ZZ tabby	a	7–30	12	13.9±3.6	+0.30,symm.	0	0	fine	1	no dye detected
		b	11–60,75	14	21.9+11.1	+0.77,pos.sk.	7%	0	hairy medium	2	

Key: H.-type = Haraldskjaer-type, V. type = Virring-type, tab. = tablet-women, med. = medullas, gen. medium = generalised medium, f./gen. medium = fine/generalised medium, symm. = symmetrical, pos. sk. = positively skewed, selv. = selvedge

from groups 1 and 3. This compares with his 199 published samples, for which 34% were group 1, 59% group 2, 26% group 3. According to the British classification, the fleece-types consist of one fine, five fine/generalised medium, three generalised medium and 15 hairy medium. The hairy medium wools have a relatively fine undercoat, with only a small proportion of coarser hairs (similar to the examples illustrated in fig. 3 c).

Six textiles showed evidence for dyeing. Four contained indigotin, a blue which can be derived from woad, *Isatis tinctoria* L., a plant of temperate climes, or from the subtropical indigo plant, *Indigofera tinctoria* L. In Europe in the Roman Period, woad is the more likely source. Two textiles showed the granules in the fibre which indicate naturally pigmented wool (brown or grey); in one case the colour had been strengthened with a brown dye, probably a tannin of some sort. Tannins may be obtained from barks, galls and nuts. A trace of a yellow dye, too weak to be identified, was also found in one textile.

THE DEVELOPMENT OF WOOLS AND DYEING IN NORTHERN EUROPE

In order to see the Pomeranian wools and dyes in context, it is necessary to summarise earlier work in the field.

The wool of the earliest sheep of Europe most probably resembled the fleece of the Mouflon, a primitive feral sheep of Corsica and Sardinia.[9] This has a fine underwool, 6–18 microns in diameter, with an outer layer of "kemp", coarse fibres, 100–200 microns (fig. 3a); most of the wool is brown. Bronze Age wool from Denmark is similar to the Mouflon's although the underwool is coarser, 8–34 microns, and the kemp fibres fewer; the colour was still predominantly brown.[10]

[9] M.L. Ryder, *Sheep and Man*, London 1983, pp. 13–17; M.L. Ryder, Changes..., pp. 495–500.

[10] M.L. Ryder, *A Re-Assessment of Bronze Age Wool*, "Journal of Archaeological Science", 1983, 10, pp. 3227–3311; M.L.

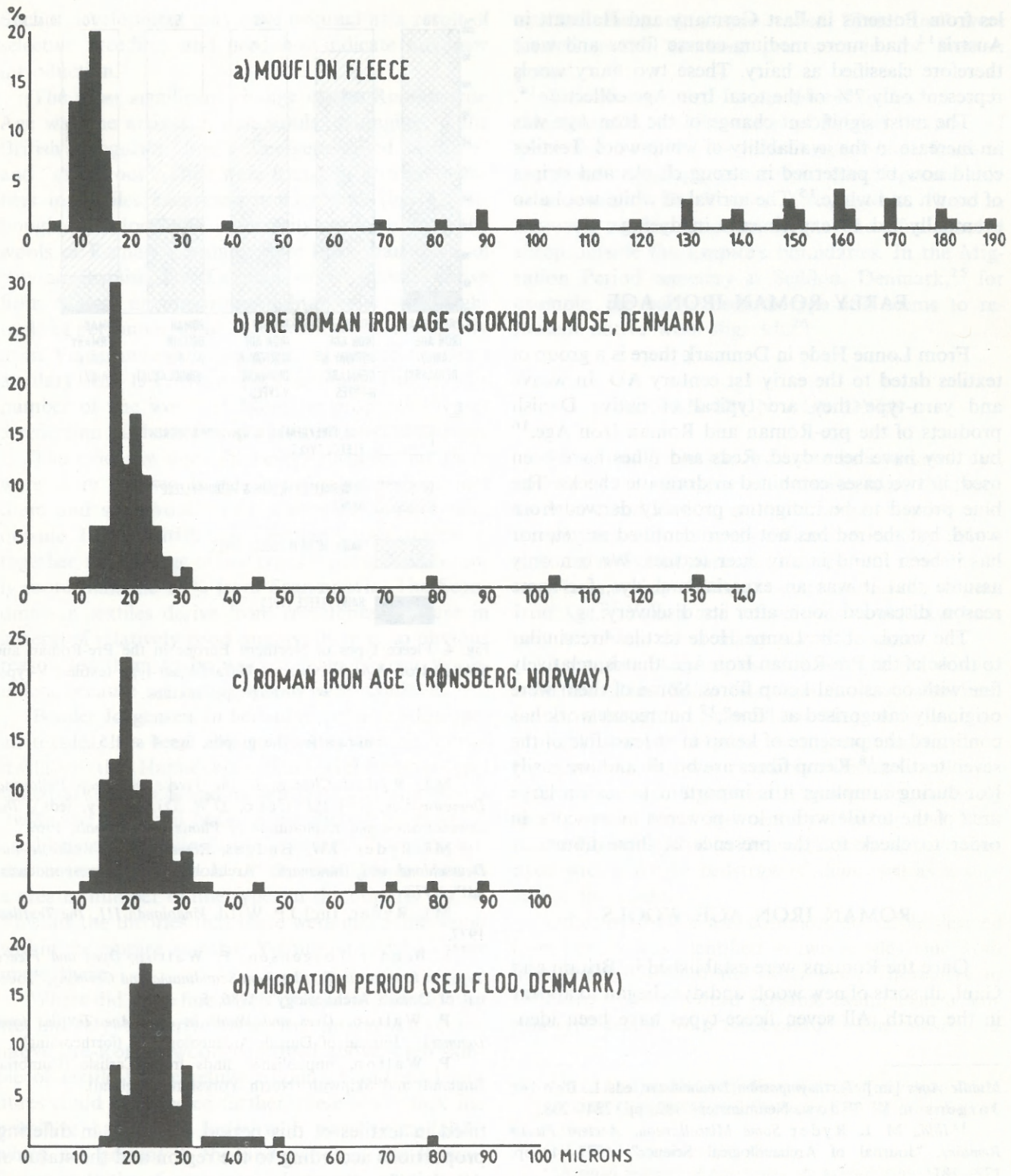


Fig. 3. The Development of the hairy medium fleece type

In the Pre-Roman Iron Age, Danish wools remained much the same, although the underwool continued to coarsen to 9–46 microns; kemp was still present (fig. 3b). Such wools are categorised as hairy medium (although Walton has suggested "Mouflon-type" to indicate that the fleece still has a double coat). Wools of the same type are known from other Iron Age sites, such as Skipwith in northern England[11] and Motte d'Apremont in France.[12] Examp-

Ryder, *Bronze Age Wool*, "Journal of Danish Archaeology", forthcoming.

[11] P. Walton, unpublished.

[12] M.L. Ryder, *European Wool Types from the Iron Age to the*

les from Potrems in East Germany and Hallstatt in Austria[13] had more medium-coarse fibres and were therefore classified as hairy. These two hairy wools represent only 7% of the total Iron Age collection[14].

The most significant change of the Iron Age was an increase in the availability of white wool. Textiles could now be patterned in strong checks and stripes of brown and white.[15] The arrival of white wool also eventually led to experiments in dyeing.

EARLY ROMAN IRON AGE

From Lønne Hede in Denmark there is a group of textiles dated to the early 1st century AD. In weave and yarn-type they are typical of native Danish products of the pre-Roman and Roman Iron Age,[16] but they have been dyed. Reds and blues have been used, in two cases combined in dramatic checks. The blue proved to be indigotin, probably derived from woad, but the red has not been identified as yet, nor has it been found in any later textiles. We can only assume that it was an experimental dye, for some reason discarded soon after its discovery.

The wools of the Lønne Hede textiles are similar to those of the Pre-Roman Iron Age, that is, relatively fine with occasional kemp fibres. Some of them were originally categorised as "fine",[17] but recent work has confirmed the presence of kemp in at least five of the seven textiles.[18] Kemp fibres are brittle and are easily lost during sampling: it is important to scan a large area of the textile with a low-powered microscope in order to check for the presence of these fibres.

ROMAN IRON AGE WOOLS

Once the Romans were established in Britain and Gaul, all sorts of new wools and dyes began to appear in the north. All seven fleece-types have been identified in textiles of this period, although in differing proportions according to the region and the status of the site (fig. 4).

The predominant fleece-type of the Roman Iron Age was still the hairy medium, although by this stage the undercoat had coarsened still further and the kemp had been replaced with narrower hairs (fig. 3c). The appearance of hair seems to be associated with a change from a moulting fleece to one of continuous growth, which would require shearing.[19]

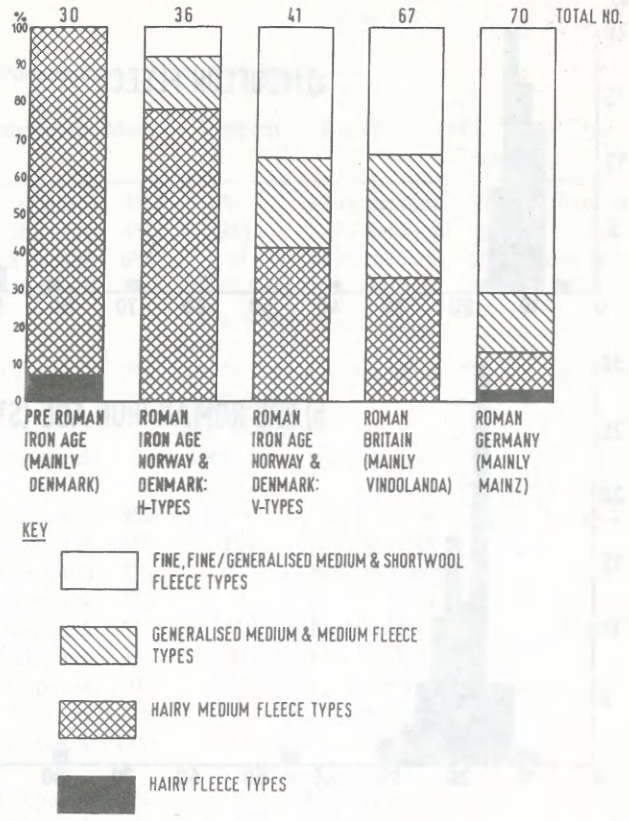


Fig. 4. Fleece types of Northern Europe in the Pre-Roman and Roman Iron Age. H-types = Haraldskjaer-type textiles, V-types = Vinring-type Textiles

Sources for the graphs, figs 4 and 5

M.L. Ryder, *Chaages in the Fleece of Sheep Following Domestication*, [in:] P.J. Ucko, D.W. Dimbleby, (eds.), *The Domestication and Exploitation of Plants and Animals*, 1969.

M.L. Ryder, J.W. Hedges, *Römerzeitliche Wollreste aus Deutschland und Dänemark*, "Archäologisches Korrespondenzblatt", 1973.

M.L. Ryder, [in:] J.P. Wild, *Vindolanda III, The Textiles*, 1977.

L. Bender Jørgensen, P. Walton, *Dyes and Fleece Types in Prehistoric Textiles from Scandinavia and Germany*, "Journal of Danish Archaeology", 1986, 5.

P. Walton, *Dyes and Wools in Iron Age Textiles from Denmark*, "Journal of Danish Archaeology", 6 (forthcoming).

P. Walton, unpublished finds from Carlisle (Cumbria, England) and Skipwith (North Yorkshire, England).

Middle Ages [in:] *Textilsymposium Neumünster*, eds L. Bender Jørgensen, K. Tidow, Neumünster 1982, pp. 224–238.

[13] *Ibid.*; M. L. Ryder *Some Miscellaneous Ancient Fleece Remains*, "Journal of Archaeological Science", 1977, 4, pp. 177–181.

[14] A mixed group of wools from the Rønbjerg textiles, formerly thought to be Pre-Roman Iron Age, have now been dated much later; E. Munksgaard, *A Tandem Accelerator Dating*, [in:] *York Textilsymposium 1987*, eds P. Walton and J.P. Wild, forthcoming.

[15] M. Hald, *Ancient Danish Textiles from Bogs and Burials*, Copenhagen 1980, pp. 5,58.

[16] L. Bender Jørgensen personal communication.

[17] M.L. Ryder, J.W. Hedges, *Römerzeitliche Wollreste aus Deutschland und Dänemark*, "Archäologisches Korrespondenzblatt", 1973, pp. 359–362.

[18] P. Walton, *Dyes and Wools*... op. cit.

[19] M.L. Ryder, *Sheep and Man*... p. 45; M.L. Ryder, *European Sheep Types*..., p. 225.

Such a development may have occured as a result of selective breeding, and need not indicate any new introduction.

The most significant change of the Roman Iron Age was the arrival of fine wools, belonging to the British categories "fine", "fine/generalised medium" and "shortwool". They were found in greatest numbers in textiles excavated in Germany (fig. 4), although this does not necessarily indicate that the wools of Roman Germany were finer than those of Roman Britain. The German wools mainly derive from Mainz, an important military site with high-ranking personnel, while the British wools are mostly from Vindolanda (Chesterholm), a remote northern auxilary fort (J.P. Wild pers. comm.) The greater number of fine wools at Mainz is propably in part a reflection of the better quality of the textiles there.

The evidence does, however, suggest that there were more fine wools (i.e. fine, fine/generalised medium and shortwool types) within the empire than outside. If the British and German wools are taken together, the average of fine types is 53%, considerably more than the 23% from Scandinavia. The Scandinavian textiles derive from cemeteries and are in general of relatively good quality: there is no obvious reason for them to be worked from coarser wools, unless because no better wools were available.

Bender Jørgensen, in her survey of north European textiles, has been able to identify certain fabrics (twills of the Haraldskjaer- and Huldremose-type) which are native Scandinavian products and others (twills and diamond twills of the Virring-type) which are likely to be Gallo-Roman imports.[20] A comparison between the wools of the two groups shows a greater number of fine types in the imports (fig. 4). This fits the theories that there were more fine wools within the empire and that Virring-type textiles were made there.

Where did these fine wools originate? Firstly, they are unlikely to derive from the undercoat of the native Pre-Roman wools described above; each sample of textile was carefully examined and no kemp fibres could be detected further, these wools lack the primitive hairs (fine fibres with narrow medullas) which are present in the underwool of Pre-Roman fleeces.[21] It therefore seems safe to assume that the fine wools of the Roman Iron Age represent a new type of fleece introduced at that time. This is confirmed by historical evidence examined by Dr J.P. Wild[22] and J. Maik,[23] which indicates that fine-woolled sheep of a type called "Tarentine" were farmed in the northern provinces in the Roman period.

This fine-woolled sheep probably had a considerable effect on the sheep of Roman Britain and Germany. Later wools from Anglo-Saxon England continued to include many fine types,[24] presumably as a result of the Roman introductions. There is, however, no firm evidence for any new fine-wooled sheep outside the Empire's boundaries. In the Migration Period cemetery at Sejlflod, Denmark,[25] for example, the hairy medium type still seems to represent native wool (fig. 3d).[26]

ROMAN IRON AGE DYES

Woad (indigotin) has proved to be a common dye, appearing in all types of textiles, from Norway, Denmark and Britain, as did a range of yellow and brown dyes, unfortunately difficult to identify. Woad is not a native of northern Europe, but it seems to have been widely cultivated there during the Roman Iron Age.[27] Yellow and brown dyes would have been easy to obtain from many wayside plants.

A number of examples of madder, a red derived from the plant *Rubia tinctorum L.* have also been found, although in Scandinavia they occur only in probable imports. Madder was grown in Italy and the provinces, but was probably difficult to cultivate in Scandinavia.[28] Significantly, two textiles, probably locally made, from 3rd century Hejrhøj and Migration Period Sejlflod in Denmark, seem to have been dyed with a native bedstraw (*Galium spp*) as a substitute for madder.[29]

Other dyes were less common. A purple derived from lichens was identified in two textiles, one from Vindolanda (30) and the other from Thorsbjerg in Germany[31] with a third possible example in a Virring-type textile from Slusegaard.[32] The prestigious

[20] L. Bender Jørgensen, *Forhistoriske Textilier...*, pp. 345–351.

[21] P. Walton, Dyes and Wools..., table of fleece-types.

[22] J.P. Wild, *Textile Manufacture in the Northern Roman Provinces*, Cambridge 1970, p. 10.

[23] J. Maik, Das Vorkmmen.., pp. 62–63.

[24] M.L. Ryder, *British Medieval Sheep and their Wool Types*, [in:] ed. D.W. Crossley. *Medieval Industry*, CBA Research Report, 40, p. 19.

[25] P. Walton, *Dyes and Wools...*

[26] A small number of fine wools are known from Migration Period Norway, but only in some unusual textiles, from rich graves containing imports.

[27] L. Bender Jørgensen, P. Walton, *Dyes and Fleece-types...*, p. 185.

[28] *Ibid.*

[29] P. Walton, *Dyes and Wools...*

[30] G.W. Taylor, *Detection and Identification of Dyes...*, pp. 119–120.

[31] P. Walton, *Dyes and Wools...*

[32] P. Walton, *Dyes and Wools in Textiles from Slusegaard*, [in:] L. Bender Jørgensen, *Textiles from Slusegaard*, [in:] O. Klindt-Jensen *Slusegaard Cemetery*, vol 3, forthcoming.

Tyrian (shellfish) purple was detected only in a garment from a Roman burial outside Dorchester in southern England.[33] Tyrian purple and lichen purple were specialities of the Mediterranean at this date, although purple-bearing lichens such as *Ochrolechia spp* were also available in the north.[34]

One textile from Veien in Norway, possibly a native product, proved to have been dyed with Polish cochineal:[35] this is a red dye derived from the insect *Porphyrophora Polonica (L)* (formerly *Margarodes Polonicus L.*), a parasite on the plant *Scleranthus perannis L.*, which grows in Central and Eastern Europe and parts of Asia. This dye may have been obtained by trade across the Baltic. As dyes are lightweight commodities which readily enter into trade, the presence of a foregin dye does not necessarily indicate a foregin textile. Dyes do, however, indicate something of the range of trade contacts of northern Europe in the Roman Iron Age.

THE POMERANIAN EVIDENCE

The range of wools in the Pomeranian textiles is much like the overall range for Norway and Denmark (fig. 5). However, the distinction between native product and import, which was noted in the Scandinavian textiles (fig. 4), is not so clear in the Pomeranian group. Fine types are a little more in evidence in the Virring-types than in the locally produced Haraldskjaer-types, but not to the same extent as in Scandinavia. The dyes do not add anything to the arguments for or against import. The sample, however, is so small that it may not be entirely representative and we must hope that future work will provide further evidence.

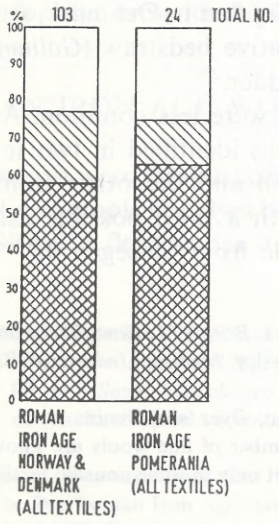


Fig. 5. Fleece types from textiles of the Roman Iron Age from Scandinavia and Pomerania

To return to Maik's original arguments, concerning the arrival of a fine-wooled sheep in Pomerania, the following comments may be made. His suggestion that a fine-woolled sheep was farmed in the northern Roman provinces, is supported by the study of wools from North European sites. The evidence is clear that the finer types of wool predominate in sites within the Empire's boundaries. However, this sheep did not, as he suggests, contribute to the fine wools of Lønne Hede. These have been shown to represent the underwool of native Danish sheep, whose ancestry can be traced back to the Bronze Age.

The present study has also confirmed Maik's view that the general quality of the Pomeranian wools is fine; however, the occasional hairs which occur in many of the wools (67% of the present study), indicate fleeces of the hairy medium type, which, it has been shown, most probably represent the wools of northern Europe, outside the empire. The Pomeranian collection is typical of cemetery sites in including the best grades of the hairy medium fleeces.

Certainly, fine types similar to those of Roman Germany are included in the Pomeranian group, but perhaps only in the same proportions as they do in the Scandinavian group, where they may be explained as imports. At this point, the problem must be handed back to Maik and other textile researchers with specialist knowledge of the Roman period, in the hope that at some stage in the future, imports may be more clearly distinguished from native Pomeranian textiles.

One of the most useful aspects of Maik's paper on Pomeranian wools, was his clear exposition of the methods of studying wool in Poland. Armed with a better understanding of each other's techniques, we now have the potential for exchange of information in this field. It is hoped that, with the aid of further dye analyses, this will lead to a broadening of our knowledge of the sources of raw material for the textile industry in northern Europe.

April 1988

[33] P. Walton, unpublished

[34] G.W. Taylor, P. Walton, *Lichen Purples*, [in:] *Dyes in Historical and Archaeological Textiles*, Vol. 2, 1983, pp. 14–19.

[35] P. Walton, *Dyes and Wools...*