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**Torunn Klokernes**

# Issues in the preservation of manually tanned skin materials

## Introduction

- 1 As the winter temperature in the Eurasian arctic and sub arctic drop far below zero, the properties of the clothing and footwear you are wearing plays an important part for your well being. You need insulation from the cold and lightweight clothing to be able to move without restraint. In addition, it is essential that the material has the ability to transport sweat away from the body. Some skin materials are better at this than others. An example of an excellent material encompassing all these properties is the reindeer skin (*Rangifer tarandus*). These skins, used by the indigenous cultures inhabiting these areas, are utilised as a fur material in winter coats and footwear, and as a tanned depilated skin, yielding other properties such as durability and water repellence. The manipulation of reindeer skin materials, to obtain clothing items with desired properties, is part of a complex traditional knowledge system among indigenous cultures inhabiting the circumpolar area. The processing technology varies according to the properties you need or wish to obtain as well as to the aesthetic qualities of the particular clothing item. The process used to obtain the desired results is often observed in the visual examination of an artefact. This paper seeks to illustrate the complexity of manually tanned skin materials in relation to examination of tanning substance use, while at the same time raising a discussion of issues affecting the interpretation of the artefact material and its condition. Examples are incorporated from skin processing technology and skin material clothing samples from the Sámi culture in Finnmark, Norway and the Evenk culture in Siberia, Russia. I am deeply grateful for the information from and discussions with Sámi and Evenk women and men in these two cultures over the past years.

## The characteristics and the use of skin materials

- 2 In the arctic and sub arctic indigenous cultures, skin processing is primarily performed by women, and the traditional knowledge of skin processing and the production of skin garments are passed on through the female line within a family unit. This is not to say that men do not work with skin materials, but simply that it is primarily the woman's task. Producing clothing and footwear is very time consuming and requires long term planning. Women in indigenous cultures, although to a lesser extent now than in earlier, were required to know how many coats, trousers, leggings, boots, hats and mittens that could be reused from the previous winter and how many new ones which had to be produced for the coming winter.
- 3 The complexity of processing skins reveals itself already in the process of selecting the appropriate skin for specific clothing items. Although choosing the animals which are to be slaughtered, above all, is determined by obtaining the correct and appropriate composition of the herd, and less on choosing animals for skin colour and quality, the slaughtering of an animal with a specific fur colour or pattern may be also be considered. This is feasible in reindeer pastoralist societies but less feasible in a hunter-gatherer society which relies on the seasonal presence of wild reindeer in a specific area.
- 4 A few examples (Fig 1 to 6) will be used to illustrate the diversity of skin materials required in the production of clothing garments and accessories. Skins with hairs attached are used for winter coats and boots, mittens and hats. Festive coats are made from thinner skins of young animals, and winter herding or hunting coats are made from more mature, larger animals.

**Fig. 1. Winter coat from the Sámi culture.**



Photo T. Klokkernes ©.

**Fig. 2. Winter leggings made from reindeer leg skin. Sámi culture.**



Photo T. Klokkernes ©.

**Fig. 3. Bag made from depilated skin. Sámi culture.**



Photo T. Klokkernes ©.

- 5 Depilated tanned skin has, in both cultures, decreased in use for summer clothing and boots, as clothes and footwear made from other materials are available for purchase. The depilated skin garments and footwear that are in use today are primarily used by elderly people, as well as for accessories such as purses, belts, and bags.

**Fig. 4. Open coat from the Evenk culture.**



Photo T. Klokkernes ©.

**Fig. 5. Winter boots, made from reindeer leg skin. Evenk culture.**



Photo T. Klokkernes ©.

**Fig. 6. Boots, made from depilated skin. Evenk culture.**



Photo T. Klokkernes ©.

### **Skin processing stages**

- 6 The initial drying of skins has many similarities both in principle and in practical methodology in the Sámi and Evenk culture. The fresh reindeer skin should be dried outside and not in strong sunshine. Skins with hairs attached should not be stretched too much during the drying process if they are to be used for coats, as this will make the skins more difficult to process. The methods may vary as to how to dry a skin but the purpose is the same: to dry the skin not too fast and not too slow with the aid of various locally available practical implements.
- 7 Due to the increasing industrialisation of the slaughtering process in indigenous communities, and the decreasing availability of fresh skins, the salting of skins, as a preservation method prior to processing, has become more common. Salted skins have gained some recognition, as it makes the skins easier to physically manipulate, but is for the most part not considered beneficial for the final result. Physical manipulation, such as scraping and stretching in various stages of the process are based on the same principle; to shape, stretch, soften, and to work tanning substances into the skin, as well as to remove superfluous tanning material. Tools

and implements used in these processes vary in shape and number. Depilated skin can be observed as a skin either with the full grain preserved, where the hairs have been removed by 'sweating' (a controlled rotting process) or as a skin with a suede surface, where the hairs have been removed with a sharp knife and a subsequent scraping process.

8 Skin materials which are processed in indigenous cultures are normally referred to as being semi-tanned. This is based on the fact that most of their tanning processes are not as efficiently applied as in an industrial tanning procedure.

9 A variety of locally available vegetable tannins is used by indigenous cultures in the Eurasian arctic and sub arctic. The vegetable tannins are in this study confined to the condensed tannin (CT) group and include birch inner bark, willow bark, and alder bark, as well as brown rotted larch wood. Each of the tannins has specific characteristics apart from their colouring properties. Birch bark for example, yields a firmer, stiffer skin and appears to be used mainly on heavier skins or skins whose structure is loose; willow bark yields a softer skin, while alder bark yields a skin with high stretching properties.

10 High vegetable tannin penetration does not seem to be a major purpose of the tanning procedure. In the Sámi culture, especially in the tanning of skin material for footwear, a skin with a raw streak is desirable. This in particular is recognized in the processing of leg skins for boots, where the tannin is applied to the flesh side surface.

11 Various natural and synthetic fats, as well as mixtures of fats, are also applied in skin processing technology, either as tanning agents or as lubricants, to obtain and maintain certain properties in the skin material. The naturally occurring fats that have been described in the interviews include: land animal adipose, liver and brain fats, fish liver fats, and milk fats. The most commonly available vegetable oils are; olive oil, soy oil, sunflower oil, linseed oil and rapeseed oil. In addition there are commercial products such as hand cream, leather fat and unidentified oils and emulsions. The common denominator in fat liquoring and lubrication is that most fats can be used if they produce the desired qualities in the skin material. This research shows that even though different fats have been used and still are in use, these fats have mainly been applied to soften and create skins with water repellence properties. The choice of fats has changed from fats available in the household to the availability of commercial fats (Fig. 7). This can be explained in a number of ways, but it appears to be mainly dependent on a changing way of life in the indigenous cultures.

**Fig. 7. Various types of oils and emulsions used in the processing of skins in the Sámi culture.**

12



Photo T. Klokkernes ©.

- 13 Smoking is an important part of the skin processing technology in many cultures, and is applied to provide colour and water repellence properties to skin materials. Today, as waterproof materials may be bought, this method is in many areas used mainly as a colouring process. Smoking of skins has not been used and is not used today in the Sámi culture, although most informants have heard about its use in other indigenous cultures. Gudmund Hatt's information (Hatt 1914) on the distribution of smoking as a tanning method in arctic and sub arctic indigenous cultures coincides with the observations made in this research.

## Context based examination of manually tanned skin material

- 14 Context based examination means describing features in the artefact in relation to known or suggested tanning materials and processing methods, as well as considering the artefact origin and the history of its use. It involves using literature sources to gain as much information as possible on the investigated artefact, but more importantly it involves seeking information from the tradition bearers in indigenous cultures which apply these methods today.

### Visual indicators of manufacture

- 15 Pre-slaughtering indicators include an animal's skin characteristics and the various influences on skin quality prior to slaughtering. This includes seasonal variations such as hair density, hair coat thickness, hair colour, but also features such as, the thickness of the dermis, and the structural firmness of the dermis.

- 16 The depilation process can give rise to a number of characteristic features visible on the skins surface. This is particularly evident in cultures where “sweating” is used as a depilation method. If the process goes too far, part of the grain layer may loosen and if not performed long enough remnants of epidermis and hairs are left on the surface (Fig. 8). The peeling of the grain’s surface may not be discovered until late in the tanning process. In the leather industry there are a number of terms for these phenomena, such as grain slip, grain peeling, and blistering (Tancous 1986) (Fig. 9). These features are often a combination of factors which have taken place during the pre-processing or processing of skin materials.

**Fig. 8. Remnants of epidermis and hairs are left on the surface after the depilation process.**



Photo T. Klokkernes ©.

**Fig. 9. The peeling of the grain’s surface.**



Photo T. Klokkernes ©.

- 17 Informants in the Sámi culture have pointed out that chemical (in the meaning industrial) removal of hairs renders the hair follicles open, enlarged, and unable to retract adequately,

whereas in manually tanned skin (without the aid of chemicals) the hair follicles retract and thereby produce a less permeable skin (Labba 2005).

18 Other indicators of the processing stages are tool marks, colour profiles and the penetration of the tanning substance. Judged by the observable colouring of the dermis' cross-section, tannin penetration yields information on the use and the quality of the skin. An example is Sámi culture reindeer leg skin which is used for winter boots or winter leggings. Obtaining a raw streak in these skin materials has a purpose of keeping moisture away from the body as well as making the skin stronger. As a result, the skin is merely surface tanned. However, the importance of a humidity barrier (raw streak) in the skin has decreased today as alternative modern materials are used to keep the body dry (Kemi Eira 2006, pers. comm.).

19 Another example is the cracking of the epidermal layer. In some arctic cultures, the cracking of the epidermal layer is part of the mechanical action to obtain a soft and pliable skin. The skin is pulled over the scraper, and a cracking sound is heard as the feature develops (Klokkernes 1994; Otak 2005; Klokkernes and Sharma 2005). It can, in addition be the result of an insufficient tanning process, as well as a result of wear and tear in the artefact. Depending on how advanced the feature is, it can develop further over time as the artefact is used, exhibited and stored in a museum setting, and in its worst consequence small "islands" of hair and epidermis may fall off (Fig.10).

**Fig.10. Extensive surface cracking may lead to the loss of epidermis and hairs from the skin.**



Photo T. Klokkernes ©.

### Visual indicators of use

20 This includes indicators from the use of the clothing item, from maintenance and from the museum period of the artefact. It includes among other things physical and chemical damage, such as wear and tear, insect damage, soiling, fading, cracking, hair loss, and grain damage. Furthermore, elements from the maintenance of the artefacts may be observed, such as patches and stitching.

21 It is possible from a visual examination, to indicate which characteristics, in the processing stages and in the following stages of use including museum handling that have an effect on the artefacts condition. In an overall examination of museum artefacts, it is obvious that the damage profile indicates an ongoing interaction between different characteristic features. This

means that indicative characteristics of all visual observations or deterioration categories can not be viewed separately but must be interpreted in relation to each other and in relation to the context of the artefact.

## Chemical analysis of manually tanned skin material

- 22 I will here draw attention to the challenges of interpreting and identifying substances used in manually tanned skin materials, both in terms of the skin processing technique but also in establishing the condition of the material sample. Examples from the analysis of skin fibre materials where vegetable tannins and fatty substances have been applied will be used. The analyses are HPLC of vegetable tannins, GC-MS of lipids as well as examination of the hydrothermal stability of collagen fibre, using the Micro Hot Table (MHT) technique.

### Issues in the analysis of vegetable tannins

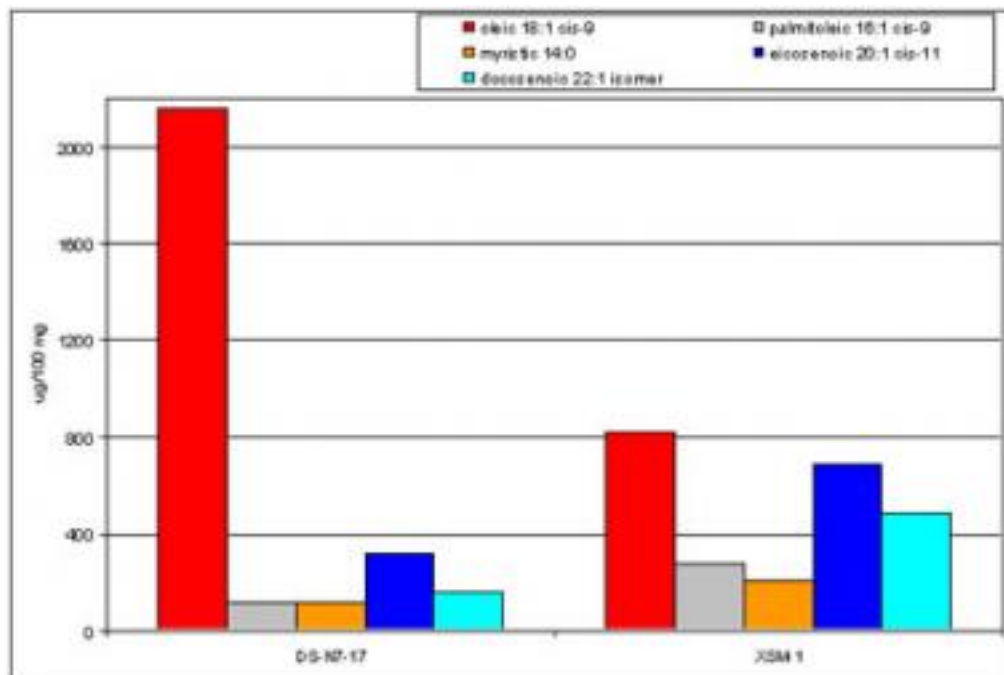
- 23 Interpreting the results from analysis of vegetable tannin content and tannin type in skin materials from indigenous cultures, must be done with care. The individual nature of skin processing yields highly varying results concerning tannin content and it was, in this research, found that significant motive for the use of vegetable tannins may be the addition of colour and a slight softening of the skins surface (Klokkernes, 2007).
- 24 An example of this is the use of brown rotted larch wood in the processing of skins in the Evenk culture. The results show that the tannin content in these skin samples is very low. In the analysis of the phenolic compounds, such as vegetable tannin extracts used in the processing of skin materials, it is generally indicated that loss of tannin content and chemical alterations may also take place prior to or in the preparation process of the phenolic extracts, and prior to the deterioration of the tanned skin material (Julkunen-Tiitto 1985). This is noted in condensed tannins extracted from leaf and needle litter. Similarly the content of phenolic compounds in willow leaf litter decreases over time. The probable cause for this is leaching. Leaching tannins are supposedly absorbed by the ground, as tannins are not subsequently detected in the leachate (Schofield, Hagerman et al. 1998). This may elucidate some of the challenges in describing indigenous cultures vegetable tanning compounds and, specifically, to enquire into the tanning potential or the lack of tanning potential of brown rotted larch wood. If the above arguments are accepted, it can be argued that the tannins of brown rotted larch wood have leached from the wood log, leaving the brown coloured lignin as the main component of the log and that it therefore primarily adds colour during the processing of the skin.
- 25 The properties of the bark material (willow, alder and birch) used in Sámi culture skin processing varies depending upon when the bark is collected, whether it has been taken from young or mature twigs, or whether it is used fresh or dried. This influences the tannin content and the colouring effect of the material. The production of bark extract takes place at high temperatures (boiling point), and may therefore result in the formation of tannin degradation products already at this stage. However, the purpose of the vegetable tanning of depilated skin materials in the Sámi culture is primarily to make the skin stronger and more durable as well as to give the skin the desired colour. Generally it has so far been possible to identify whether the vegetable tannin is of a condensed or a hydrolysable type. In this research the results show that all tannins used in the Sámi and Evenk culture are of the condensed type. Furthermore it has been possible to separate willow bark extract from birch, alder, and larch. Characteristic for the Sámi culture sample material is the presence of a peak at 10.3/ minutes at 280 nm and 240 nm. This peak is not present in reference sample materials where birch, alder and larch extract has been applied. It may be suggested that this peak originates from salicin (C<sub>13</sub>H<sub>18</sub>O<sub>7</sub>), which is a characteristic component of willow barks. Further research is, however, necessary to confirm this assumption.

## Issues in the analysis of fatty substances

- 26 There are several issues which must be considered in the interpretation of fatty acid composition in naturally aged skin materials. Thermal manipulation of fats prior to application is not unusual. In the Evenk culture the informants have described how brain substance and the fatty layer of fur skin animals, such as for example marmot, fox and sable, are heated to obtain good quality oil used in skin processing. Reindeer liver may also be boiled and mashed prior to application. The literature furthermore describes the use of warm fish oil being sprayed onto the skin (Erman, 1838). The manipulation of various fats, oils or emulsions, prior to application, and the transformation and decomposition of fatty substances over time may reduce the number of identifiable fatty acids. At the same time changes occur in the relative percentage composition of fatty acids in the sample material. This makes identification of specific lipids difficult.
- 27 Besides changes due to decomposition, hence the decrease in particularly poly-unsaturated fatty acids, the extractability of the fatty acids may change as the material ages (Bos et al., 1996). At the same time, short chain fatty acids may for example undergo hydrolysis and leach from the sample (Evershed 1993; Malainey, Przybylski et al. 1999). Unsaturated fatty acids may also cross-link as in conventional drying. It is therefore problematic to compare results from the analysis of fresh lipid extracts to results from the analysis of lipid extracts from naturally aged skin samples. An interpretation of the fatty acid composition of the sample material must furthermore be seen in relation to the lipids found naturally in the reindeer skin itself.
- 28 The fatty acid (FA) content of skin material artefacts will always be an approximate value. The samples in this research have been obtained from an area on the garment where wear and tear is expected to be extensive. The skin garment may also have been exposed to additional fatty substances through regular activities such as slaughtering, skin processing spill and cooking, which can disrupt the results. In addition the individual method of skin processing and fat application will cause a variance in the total FA content. Another factor which must be considered is that the skin of the animal may contain more or less fat, based on dietary factors such as grazing quality and access, as well as being based on the time of year the reindeer is slaughtered. Skin from reindeers slaughtered in early fall generally contain more inherent fat than skin from animals slaughtered in late winter or spring, when access to food is lower. This feature, that some skins contain more fat than other skins, is confirmed by the informants (Kemi Eira, 2005, pers. comm.).
- 29 This research shows that the variety of fats which are used in skin processing consists of four major fatty substance groups: dairy fat, fish fat, vegetable fat and mammal fat. In order to be able to distinguish between these four groups, the analytical scheme is extensive. This research merely illustrates some tendencies, based on the available sample material.
- 30 A differentiating characteristic of cod liver oil is the relatively large amount of oleic acid (18:1 cis-9), a comparatively small peak of myristic acid (14:0) and equal amounts of 20:5, 22:1, and 22:6. Furthermore, the amount of 20:1 is less than double that of 22:1 (DeWitt 1963). The relation between docosenoic acid (22:1 isomers) and eicosenoic acid (20:1 cis-11), the C22/C20 ratio, is tested to investigate the possible presence of fish oils. The reference samples DS-N7-17 and XSM-1 encompass these characteristics. Calculating the C22/C20 ratio of the experimental skin sample (XMS-1) treated with cod liver oil, shows a ratio value of 0.7. Using this value as a mean, it can be argued that the reference sample DS-N7-17, with a value of 0.5, does contain fish oil (Fig. 11).
- 31 The fatty acid composition has also been indicated using the UFA/SFA ratio, which expresses the relative distribution of saturated (SFA) and unsaturated fatty acids (UFA) (in %) in a sample. When studying the fatty acid composition over time, it is usually observed that the relative amount of saturated fatty acids (SFA) increases due to the decomposition of the

unsaturated fatty acids (UFA) (Malainey, Przybylski et al. 1999). This is also observed through the UFA/SFA ratio of the historic samples, using the reference samples' UFA/SFA ratio for comparison. As the relative amount of SFA increases, the ratio decreases. This feature has a serious disadvantage, which is that the fatty acid composition becomes less distinct and the similarity between groups of fats increases. This loss of long chain unsaturated fatty acids and the subsequent loss in distinction are also observed as fats are thermally manipulated (Malainey, Przybylski et al. 1999).

**Fig. 11. The correlation between eicosenoic (20:1 cis-11) acid and docosenoic acid (22:1 isomer) in reference sample DS-N7-17 and the experimental sample XSM-1.**



- 32 Investigating tanning substance use through the hydrothermal stability of collagen fibres  
 33 The shrinkage activity of collagen fibres is a complex matter affected not only by the condition  
 of the collagen fibres, the pre tanning and tanning agents and methods utilised, the possible  
 remedial conservation applied to the artefact, but also by the structure of the collagen molecule.  
 This makes the interpretation of the hydrothermal stability of fibre sample from an artefact a  
 complex task, involving many interrelated factors. As for all the analyses performed on the  
 artefact material in this study, the representation is limited to one small location on the artefact.  
 This location is chosen for ethical and practical reasons.
- 34 In the hydrothermal reaction consisting of water, heat, and collagen fibres the hydrogen bonds  
 in collagen structure are broken, which cause the collagen fibre to irreversibly shrink. The  
 procedure is described in Larsen, Vest and Nielsens article from 1993 (Larsen, Vest et al.  
 1993). The shrinkage temperatures ( $T_s$ ) of the sample material, based on the information  
 on tanning substance obtained from informants and from the literature, would in theory be  
 expected to be: 80-85 oC in skin tanned with condensed plant polyphenols (newly tanned).  
 For smoked skin 63-73 oC as in aldehyde tanned skin and for oil tanned skin 50-63 oC. This  
 is based on the general guidelines of suggested shrinkage temperatures, shown in figure 12.

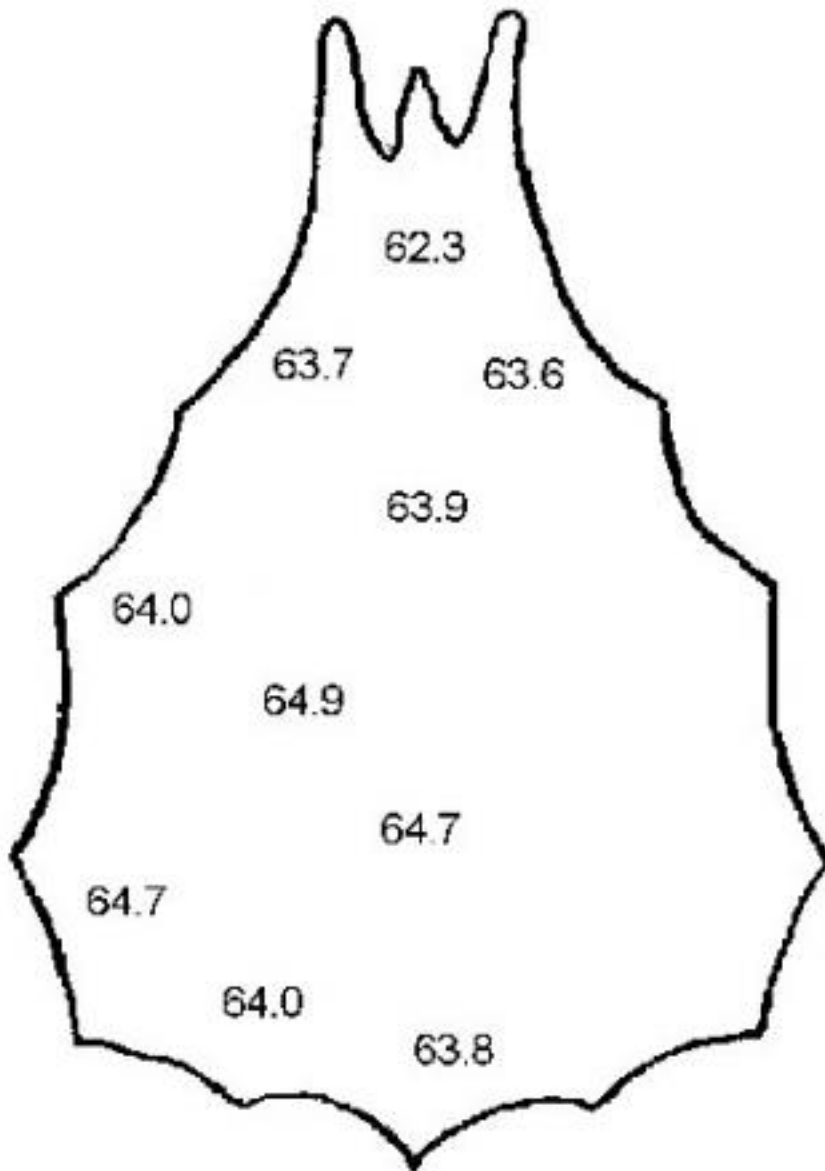
**Fig. 12. Examples of shrinkage temperatures of tanned skin (Sykes 1991).**

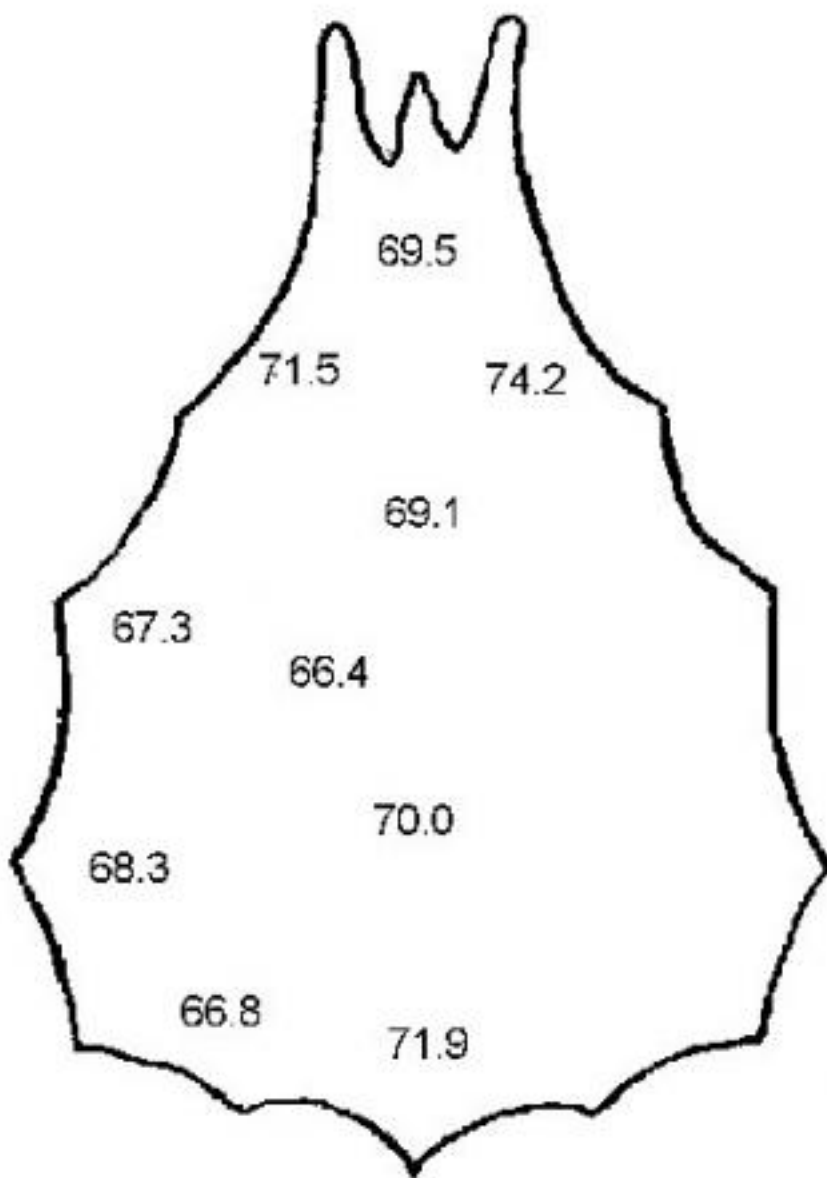
Oil tanned	50 – 63 oC
Formaldehyde tanned	63 – 73 oC
Vegetable tanned	75 – 85 oC
Hydrolysable	75 – 80 oC

Condensed	80 – 85 oC
Alum tawed	50 – 63 oC
Basic aluminium	81 – 90 oC
Basic chromium	95 – 105 oC

- 35 Subsequently, a well tanned skin sample which is considered to be in a good condition, and which is tanned with condensed tannins, would typically have  $T_s$  between 80-85 oC, the main shrinkage interval ( $\Delta T$ ) would be short and the total shrinkage interval ( $\Delta T_{total}$ ) would also be short, approximately 5-10 oC and 15-20 oC respectively. However, there are factors affecting the length of the various intervals, which do not only signify a reduced stability of collagen fibres, but perhaps rather an effect of the tanning procedure, such as heterogeneous tanning of the fibres, the use of multiple tanning materials, the properties of the tanning bath, and sample preparation conditions. These factors are supported in the results, where very few vegetable tanned (CT) depilated reference samples obtain a shrinkage temperature of this level, but rather show a variety of shrinkage temperatures ranging from 69.5 to 82.4 oC. The picture is slightly different for reference samples which are treated mainly with a fatty substance. They show shrinkage temperatures that lie within the general guidelines of 50 - 63 oC. Inconsistencies also arise when skins that are merely surface treated with vegetable tannins of the condensed type, but visually appear to be fully tanned, are analysed. These skins, due to individual preference, may also have been treated with a fatty substance, or they may not have been, which further complicates the interpretation.
- 36 Likewise, another feature which must be included in the interpretation of the results is the possible variation in shrinkage temperature depending on where on the skin the sample is taken. It has been shown that the shrinkage temperature may vary two to three degrees depending on location (Larsen, Poulsen et al. 2002). This issue has been investigated on dried, untreated reindeer skin where  $T_s$  were measured in ten different locations. The analysis showed a difference of 2.6 oC from the lowest to the highest temperature. The lowest  $T_s$  were measured to 62.3 oC and the highest value was measured to 64.9 oC (Fig. 13). The same investigations were made on a depilated reindeer skin manually tanned with willow bark extract (SNF) (Fig. 14). The SNF skin exhibited a greater variation of  $T_s$  in these measurements than the dried, untreated skin. The lowest value was measured to 66.4 oC and the highest value was measured to 74.2 oC. This is a  $T_s$  difference of 7.8 oC (Table 1).

**Fig. 13 and 14. Measurements of shrinkage temperature ( $T_s$ ) on dried, untreated reindeer skin (fig.13, first one), and on depilated skin (SNF) tanned with willow bark extract (fig.14, second one).**





**Table 1. Average shrinkage activity and the Ts difference between different locations on manually tanned skin materials.**

Sample	Ts	$\Delta T$	Tfirst	Tlast	$\Delta T_{total}$	Ts Difference
Dried, untreated reindeer skin	63.9	3.8	61.2	71.8	10.6	2.6
Depilated reindeer skin manually tanned with	69.5	8.0	65.6	82.5	16.9	7.8

willow bark  
extract (SNF)

- 38 Measuring the hydrothermal stability of collagen fibres generally involves removing as much as possible of the fatty substances from the collagen fibres prior to analysis. Fibres containing fatty substances may absorb humidity at a slower rate, as opposed to defatted fibres, and generally yield a higher shrinkage temperature (Ts). Removing the fat will provide a more correct representation of the collagen fibres' condition, but will not to the same degree mirror the artefacts general reaction rate. How fast the water penetrates the collagen fibres varies significantly from artefact to artefact, depending on the amount of fat in the fibre structure, the possible cross linking of lipid molecules and collagen, the condition of the fibres, and the efficiency of the defatting procedure. Defatting procedures (using petroleum ether) for selected samples were conducted to investigate this issue. The samples were chosen from the amount of fatty acids (FA) calculated in the sample, based on the GC-MS analysis. Samples with different FA content were selected (Table 2). Investigating the difference of the shrinkage temperature of the sample before and after defatting showed varied results. The main difference between defatted and not defatted samples appears in the reference samples. The reference sample are; DS-N7-17 with a fatty acid (FA) content of 5.0 % and DS-R10-21 with a FA content of 2.4 %, yielding a Ts difference of 7.0 oC and 2.4 oC respectively. The historic skin samples (IMRS-0510-A, SVD-0429, TM-unr-toolmarks, and MAE-3957-1) were chosen for their varied FA content; exhibit a lower and more even Ts difference. The FA content of the sample does not reflect the Ts difference, as can be observed in table 2.

**Table 2. The Ts difference of skin fibre samples after defatting.**

Museum number	Age	Material type	FA content %	Ts difference
IMRS-0510-A	100 years	SWH	14.8	0.5
SVD-0429	Unknown	DS	3.0	1.3
TM-unr-toolmark	Unknown	SWH	1.4	3.5
MAE-3957-1	75 years	SWH	0.4	1.6
DS-N7-17	Reference	DS	5.0	7.0
DS-R10-21	Reference	DS	2.4	2.4

## Summary

- 39 An issue which have been noted through this research is that generalisation and categorisation in the investigation of manually tanned skin materials is difficult. It raises questions to our understanding and interpretation of both the skin material and the artefact itself and of the culture where the artefact is manufactured. It is important to consider the local and individual variation in skin processing technology. Even though the skin processing method in theory may seem identical, individual preference, quality of the skin and quality of the tanning substance, skill and the experience of the performer may produce large variations in the results from the analysis. This calls for caution when interpreting results from analyses performed on manually tanned skin materials. Furthermore, the treatment and manipulation of the tanning substances prior to skin processing, may change the properties of the tanning substances and thereby have an effect on the interpretation of the results. The research performed in this study is an initial approach to the understanding of the complex nature of manually tanned skin materials manufactured by individual tradition bearers from indigenous cultures in the circumpolar area; it instigates a series of research topics which can be further addressed, in regards to technological, visual, chemical, and physical analysis.

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## Pour citer cet article

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Torunn Klokkernes defended her PhD at the School of Conservation, Copenhagen, Denmark in 2007 – where she also completed her bachelor and master degree in objects conservation. Her research interests are the technology and material science of archaeological and historic artefact materials and issues in the safeguarding of both tangible and intangible aspects of an artefact. The article is based on the PhD thesis: *Skin Processing Technology in Eurasian Reindeer Cultures. A Comparative Study in Material Science of Sámi and Evenk Methods — Perspectives on Deterioration and Preservation of Museum Artefacts*. She currently has her own private conservation practice in Rudkøbing, Denmark.

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***Abstract / Résumé***

The field of conservation relates to material science and technology as a fundamental aspect to understand artefacts' material properties and deterioration. The research performed in this study is an initial approach to the understanding of the complex nature of manually tanned skin materials manufactured by individual tradition bearers from indigenous cultures in the circumpolar area; it instigates a series of research topics which can be further addressed. Contextual interpretation comprises traditional knowledge and practices as well as the empirical information obtained through investigative and analytical methods. This requires collaboration between several areas of knowledge, and raises questions with regard to the interpretation of analytical results in the investigation of these material groups.

**Keywords :** skin processing, indigenous, vegetable tannin, fatty acid, shrinkage temperature, preservation

La conservation use de l'analyse matérielle et des technologies pour mieux comprendre les propriétés des artefacts et leurs mécanismes de dégradation. La présente recherche constitue une approche de la nature complexe des cuirs tannés au sein des cultures indigènes de la région circumpolaire. Elle suscite par ailleurs de nouveaux thèmes de recherches connexes. L'interprétation contextuelle, de son côté, englobe la connaissance des pratiques ainsi que les informations obtenues par des méthodes d'investigation analytique et exige la collaboration entre divers secteurs et disciplines.

**Mots clés :** artefact, traitement du cuir, tannin végétal, préservation, cuir, rétrécissement, acide gras