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# Imported fur in Viking Age Denmark and its importance as a visual marker

## Introduction

Extensive international trade and exchange of goods is one of the major characteristics of the Viking Age, the final era of the Scandinavian Late Iron Age (800-1050 CE) (Roesdahl 1998; Brink and Price 2008). Because contemporary Arab written sources frequently mention fur traded by the Vikings, it has been seen as one of their key commodities. The records describe how species such as arctic fox, beaver, marten, ermine, and sable were hunted in current day northern Scandinavia and Russia and brought by the eastern Vikings (Rus) via the Russian rivers to the growing Arab fur market in exchange for beads, silver, gold and silk (Kovalev 2001; Vedeler 2014). An example of the economic value and signalling power of fur traded by the Rus is given by the Arab traveller, geographer, and historian al-Mas'ūdī, from Baghdad, who wrote in 943 CE: "The black furs are worn by Arab and non-Arab kings... There is no king who does not possess a fur coat or a caftan lined with the black fox fur of the Burtās" (Martin 1986; Fadlan 2012). The value of fur as a visual marker of status is also mentioned by a ninth century European source about the Frankish king Charlemagne: "... he protected his shoulders and chest in winter by a close-fitting coat of otter or marten" (Turner 1880). While the significance of imported fur for the Arab and continental European market is well-described, the quantity and use of fur as a visual marker in Scandinavian homelands – Denmark, Norway, and Sweden – has never been researched in depths and is thus still poorly understood. This project aims to explore that.

Fur and its procurement in Scandinavia has been notoriously difficult to study: the only Scandinavian written sources to Viking fur and fur trade are centuries

later (Sturluson 1889; Adam of Bremen 2000), iconography depicting clothed figures is scarce and stylised (Mannering 2016; Vedeler 2019), and zooarchaeological evidence (Wigh 1998) does not reveal the provenance and use of furs. Furthermore, in archaeological contexts, fur usually degrades rapidly.

However, in rare cases, Scandinavian fur has been preserved and recorded (Bender Jørgensen 1986; Ågren 1995). If preserved, a serious obstacle in fur studies is species identification (Rast-Eicher 2016). Fibre identification by microscopy is extremely difficult and often provides erroneous results (Brandt et al. 2014; Sinding et al. 2015). DNA often does not survive in archaeological contexts, and thus analysis of the more robust proteins has lately become the preferred method for identification of fur (Hollemeier, Altmeyer and Heinze 2008; Hollemeier et al. 2012). The first proteomic identification of beaver fur in elite Viking Age Danish burials was by Brandt et al. 2022). As beaver was not native to Denmark, this is also the first direct evidence that fur was in fact imported into Denmark during this period. Using proteomics, five examples of non-native beaver fur were identified in high status burials, as well as squirrel and marten fur. The beaver fur was most likely used as clothing (fig. 1) and thus suggests that Danish Vikings used luxury fur as visible markers of status. The study also highlighted four gaps in current knowledge, which need to be addressed to fully understand the extent of the Danish fur trade and its role.

## Four gaps in knowledge of fur in Danish Viking Age

First and surprisingly, there is no overview of the extent of Viking Age fur in Denmark or Scandinavia as a whole, and no systematic examination of contexts for fur has yet been performed. Currently, fur has mainly



Fig. 1. Part of a garment with tablet woven-bands and fur from Hvilehøj (NM C4280) (Image: Roberto Fortuna, National Museum of Denmark)

been recorded in elite contexts, and even then it is only described briefly or in footnotes (Bender Jørgensen 1986; Iversen, Näsman and Vellev 1991; Sørensen 2001) with a few, recent exceptions (Mannering 2015 and 2018). Therefore, the extent of Danish Viking Age fur is unknown. Fur may have been degraded, not acknowledged or registered during excavation, or actually absent.

Secondly, we lack knowledge of the diversity of the species that were used for fur. In order to be able to identify fur, proteomic methods and databases need updates. The successful biomolecular identification of species depends on 1) preservation and successful extraction of biomolecules; and 2) on the accessibility of suitable references. In this study (Brandt et al. 2022), key deficiencies in proteome databases were highlighted: currently, several candidate species such as squirrel and otter (Martin 1986; Fadlan 2012) are not available in proteome databases and this limits the ability for complete confidence in the species identification, as species not present in the databases cannot be completely ruled out. As an example, one sample was misidentified as beaver until translation of DNA nucleotide sequences for keratin proteins allowed more potential species to be searched and

led to a final identification as squirrel. Therefore, new species references are required to clarify the range of species utilised.

Thirdly, in most cases, it is not clear if furs are local or non-local. Although at least one non-local species was identified (Brandt et al. 2022), it was not possible to identify its provenance and speculate on the route/s through which it was traded. At the same time, the possibly native squirrel and marten fur could have been imported from distant subpopulations with finer coats. Genomic DNA sequences could have revealed population structure and mapped ancient individuals to geographical regions. In the study, this failed due to poor DNA preservation whereas proteomics allowed a robust identification of species, but with lower resolution not allowing for population structure. New methods are therefore needed to characterise fur as local or non-local and to explore the possibilities of identifying their provenance.

Fourth and finally, there is a lack of understanding of the prestige of fur. In previous research (Brandt et al. 2022), Danish Viking Age fur from wild animals was most likely associated with clothing and not furnishing or accessories (the Swedish picture may



differ, Malmius 2020). It thus seems that fur was mainly used for display (fig. 2). On the contrary, it has been shown that dehaired, tanned skins (leather) were used for everyday objects such as straps, armour, and shoes, and came from domesticated species (Warming et al. 2016; Brandt, Ebsen and Haase 2020; Brandt and Mannering 2021) (fig. 3). To understand if the fur of wild species were generally used for clothing and display, and by whom, a systematic analysis of a larger material corpora is crucial.

### The goals and purposes of the project

By tackling the above four scientific challenges, the project aims to answer to what extent Denmark and Scandinavia were part of the international fur trade and shared ideas of visual status markers. This will be achieved through four distinct, though complementary, objectives:

- 1) Locate and register Viking Age burials with fur and examine the use and context of fur;
- 2) Use proteomic methods and references to identify the species of Viking Age fur;
- 3) Conduct a pilot study to test  $\delta^{13}\text{C}$ :  $\delta^{15}\text{N}$ :  $\delta^{34}\text{S}$  analysis as a tool for characterisation of fur as local or non-local and to explore its potential to identify provenance; and
- 4) Determine if fur was a visual marker of status in Viking Age Denmark.

### Locating Viking Age fur

The project will focus on Danish material from the ninth to the tenth century. Decreasing preservation conditions due to intensified cultivation, ploughing, and drainage of the arable land make new finds of organic materials unsuited for biomolecular research. The failure to extract proteins from fur from the recently excavated Fregerslev grave (Bagge and Hertz 2017) is an example of this. Finds excavated a century ago have experienced less degradation and provide successful biomolecular analysis (Brandt and Mannering 2021; Brandt et al. 2022). Therefore, this project focuses primarily on the rich archive of material in museum collections.

Preliminary examinations of the collections at the National Museum of Denmark (Brandt and Mannering 2021; Brandt et al. 2022) showed that fur was present in burials with no records of it. This project therefore hypothesises that a systematic review of Danish Viking Age burials will reveal a number of fur finds that have never been registered. The collection at the National Museum of Denmark contains at least 149 Viking Age burials with preserved textiles or textile imprints (Bender Jørgensen 1986), indicating



Fig. 2 Garments found in the burial mounds of Bjerringhøj and Hvilehøj reconstructed through the project *Fashioning the Viking Age* (Image: Roberto Fortuna, National Museum of Denmark)

good preservation of organic materials and thus possibly fur. The finds have never been systematically examined for the presence of fur. Northern European trends are studied through visits to three well-known collections: Birka, Sweden (Geijer 1938; 1980; Hägg 1974; 1986), Oseberg, Norway (Christensen, Ingstad and Myhre 1992; Christensen and Nockert 2006), and Hedeby and surrounding chamber graves, Germany (Müller-Wille 1976; Eisenschmidt 1994; Arents and Eisenschmidt 2010; Pedersen 2014).

### An interdisciplinary project

Finds are systematically examined for the presence or absence of fur and documented in terms of preservation conditions. Because graves are selected based on the preservation of textiles, their status can be evaluated based on status markers in clothing, and also grave construction and grave goods, and the 149 selected graves vary considerably in terms of these parameters (Bender Jørgensen 1986). The general correlation between finds of fur, preservation



conditions, and status is discussed to understand if fur is only found in elite graves.

We aim to identify the animal species of fur finds based on optimised proteomic methods including protein sequencing (LC-MS/MS) and peptide mass fingerprinting (PMF) and to expand the protein reference databases by de novo sequencing with species such as squirrel and otter, which are currently not part of the database.

This project also characterises fur as local or non-local and explores possible isotopic clustering of animals that share similar isotope ecologies. Analyses of strontium, carbon and nitrogen isotopes are widely applied to bone and teeth for respectively provenancing and exploring trophic levels, whereas

tissues such as fur and hair are much less studied. The  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios of hair have been shown to inaccurately reflect its provenance due to exchange of Sr with the surrounding environment (von Holstein et al. 2015; Hu et al. 2020; Toxvaerd 2020) and currently the accuracy of Sr baselines is debated (Thomsen and Andreassen 2019; Price 2021).  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  display larger variation between seasons than between the regions of interest (northern Europe and western Russia) (George Darling et al. 2006) and furthermore samples can exchange O with atmospheric water (Holstein et al. 2018). In this project, provenance is explored based on  $\delta^{13}\text{C}$ :  $\delta^{15}\text{N}$ :  $\delta^{34}\text{S}$ , which are all abundant in fur. C and N are well established for diet and can aid provenancing in combination with other isotopes. Sulphur is particularly promising based on a new sulphur isoscape of Europe demonstrating variations in Scandinavia (Bataille et al. 2021), and new unpublished data of variation in the UK suggests that animals hunted in low lying wet areas would be very distinctive.

Based on the evidence from these analyses, a qualitative and comparative analysis of the fur finds and their contexts will be performed, focusing on the evidence of fur being part of clothing and the status of the deceased, the species of fur, and its isotope ecology. Based on this analysis, it will be possible to compare the identified Danish burial contexts with fur with sources about the use of fur in continental Europe and in the Arab world (Hägg 2003; Fadlan 2012) and discuss the possibility of an internationally shared symbolism of luxury fur in clothing.

The project pushes state-of-the-art research by documenting the Viking Age fur trade from tangible archaeological material: it provides the first large-scale systematic documentation of fur in Denmark and characterises it in terms of species and isotope-signature. The project creates a new interpretative framework revealing the (international) role of fur as a visual marker of status and its probable visual effect to legitimise power nationally, but also in an international political setting, as a shared symbol of power during travels, trade, raid, and negotiations. The project develops proteomic methods and references for the candidate fur bearing animal species, for the benefit of the entire proteomics field as well as test isotopic analysis as a tool for studying the origin of fur.

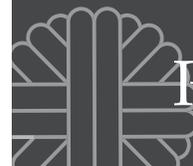
The project is expected to run from 1 September 2024 to 31 April 2028.

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Fig. 3. Part of a pair of female one-piece shoes from Hvilehøj, Denmark (NM C4281 A) made of goat skin (Image: Roberto Fortuna, National Museum of Denmark)



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