Journal of Archaeological Science 96 (2018) 162–174

Contents lists available at ScienceDirect

Journal of Archaeological Science

journal homepage: www.elsevier.com/locate/jas

Dorset, Norse, or Thule? Technological transfers, marine mammal contamination, and AMS dating of spun yarn and textiles from the Eastern Canadian Arctic

Michèle Hayeur Smith[a,*], Kevin P. Smith[a], Gørill Nilsen[b]

[a] Haffenreffer Museum of Anthropology, Brown University, 300 Tower St, Bristol, RI, 02809, USA
[b] Department of Archaeology, History, Religious Studies and Theology, Faculty of Humanities, Social Sciences and Education, University of Tromsø, The Arctic University of Norway, Post Box 6050, Langnes, N-9037, Tromsø, Norway

ARTICLE INFO

Keywords:
AMS dating
Marine mammal oil contamination
Pre-treatment methods for AMS dating
Spun yarn
Textiles
Canadian eastern arctic
Norse Greenland

ABSTRACT

Yarn and textiles recovered from prehistoric Dorset and Thule culture sites in the Eastern Canadian Arctic have raised questions about the extent and timing of indigenous and Norse interaction in the New World, whether the yarn represents technological transfers between Greenland's Norse settlers and the Dorset, or whether these Indigenous Arctic groups had independent fiber technologies before contact with Europeans. However, the extensive use of marine mammals in northern cultural contexts, and the penetration of oils from these animals' tissues into datable terrestrial materials, has posed general problems for reliably dating sites in the Arctic and has raised questions specifically about previous efforts to date these fiber objects. In this paper, we use a recently developed protocol for removing marine mammal organic contaminants entirely from radiocarbon samples, making AMS dating possible and reliable for Arctic research. This study uses those protocols to directly date a suite of woven and spun animal fiber artifacts from five Dorset and Thule archaeological sites in the eastern Canadian Arctic. Directly dating these artifacts with marine mammal oils removed helps to answer questions about Norse contact with Dorset and Thule communities, sheds new light on the topic of indigenous fiber technologies in the North, and raises new questions about European contacts with the people of the North American Arctic prior to sustained efforts at colonization after the 18th century.

1. Introduction

Spun yarn and textiles woven from wool and hair, from contexts pre-dating the early modern period's sustained episodes of European exploration and colonization, have been recovered from a number of sites scattered across the eastern fringe of the North American Arctic. The sites where *spun yarn* has been found – on parts of coastal Baffin Island, Ellesmere Island, and Labrador that face Greenland – led Sutherland (2000, 2002, 2009) to suggest that these could represent evidence of technological transfers between the Norse settlers of the North Atlantic and the indigenous Dorset people of the eastern Canadian Arctic. Others (Holtved, 1944; Schledermann, 1978, 1980; McGhee, 1984; McCullough, 1989; Gulløv, 2008) have similarly argued that *woven textiles* recovered from northern contexts in Arctic Canada and Greenland represent evidence of direct or indirect contact between the Norse and early Thule culture Inuit ancestors moving eastward from homelands in northern Alaska and across the Canadian Arctic to Greenland. These textile objects, therefore, may potentially bear important witness to incidents and processes of interaction that were linked to the earliest contacts between the populations of the Old and New Worlds. Alternatively, however, some or all of these objects may provide new information on the dynamic nature of North American Arctic people as innovators of fiber-based technologies or on the contexts within which new materials are accepted and new technological complexes are adopted across cultural borders.

When the Norse expanded across the North Atlantic, they brought with them a well-developed complex of spinning and weaving technologies, as well as the animals (primarily sheep and goats) whose wool and hair they spun and wove using warp-weighted looms and yarn spun with drop spindles (Hayeur Smith, 2014a, 2014b; 2015; Rogers, 1989; Østergård, 2004, 2005). Occasionally, Greenlandic Norse women integrated hair from Arctic species, such as caribou (*Rangifer tarandus*) and Arctic hare (*Lepus*

* Corresponding author.
E-mail addresses: Michele_Smith@brown.edu (M. Hayeur Smith), Kevin_P_Smith@brown.edu (K.P. Smith), gorill.nilsen@uit.no (G. Nilsen).

https://doi.org/10.1016/j.jas.2018.06.005
Received 23 March 2018; Received in revised form 7 June 2018; Accepted 10 June 2018

arcticus), into their yarn, but elsewhere domesticates provided the raw materials (Østergård, 2004; Walton Rogers, 1989; Sinding et al., 2015; Sinding et al., 2017). Archaeological evidence (including more than 9000 textile fragments analyzed by Hayeur Smith), indicates that spinning and weaving was practiced at nearly every excavated Norse farm in Iceland and Greenland, while the recovery of a soapstone spindle whorl at L'Anse aux Meadows, Newfoundland, implies that yarn production was significant enough to be part of the activities undertaken even at this farthest west known Viking Age Norse exploration base (Wallace, 2003).

From the 1970s onward, a small number of spun yarn pieces, plied but not woven, were recovered at a number of Middle and Late Dorset culture sites on Baffin Island, including Nanook and Tanfield (Maxwell, 1973: 205; 1985: 206), Willows Island 4 (Odess, 1998: 429), Nunguvik (Mary-Rousselière, 2002: Plate 12b; 2009), as well as at Avayalik Island, Labrador (Fitzhugh et al., 2006), and Cape Ray, Newfoundland (Linnamae (1975: 174–175) (Fig. 1). These initially elicited little attention; however, the recovery of woven woolen cloth along with other objects of Norse material culture at the Thule culture Skraeling Island site, in the Canadian High Arctic (Schledermann, 1980: Figure 9), the recovery of similar cloth from the Early Thule Ruin Island site in northwestern Greenland (Holtved, 1944; Østergård, 2004), and an apparent Thule carving of a Norseman from the Okivilialuk site on southern Baffin Island (Sabo and Sabo, 1978; Sabo and Jacobs, 1980), raised important questions about the extent and timing of interactions between indigenous Dorset communities, Thule Inuit pioneers, and voyagers from Greenland's medieval Norse colonies (McGhee, 1984).

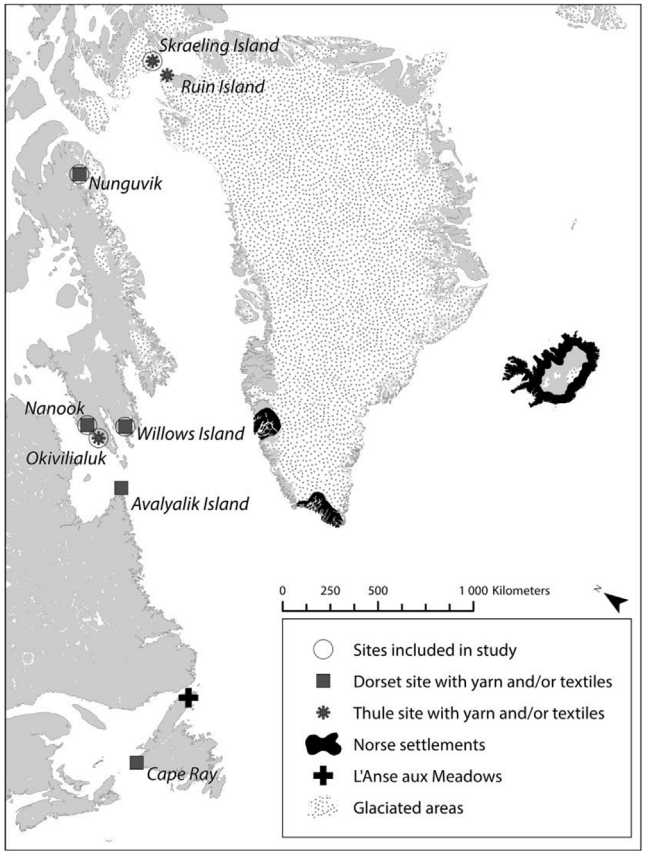

Fig. 1. Dorset and Thule sites with archaeologically documented yarn or textiles and locations of Norse settlements in the western North Atlantic. Map by Johan Eilertsen Arntzen, UiT.

Somewhat later, Walton Rogers (1998, 2004 in Østergård) used optical (microscopic) fiber identification to identify hairs woven into several Greenlandic Norse textiles from the site of GUS (Gården Under Sandet) as having come from a range of North American subarctic and Arctic wild species, including bison (*Bison bison*), brown bear (*Ursus arctos*), and black bear (*Ursus americanus*), although recently these identifications have been questioned by Sinding et al. (2015) on the basis of aDNA analyses. On similar bases, Walton Rogers suggested that domesticated goat hairs were attached to a few pieces of Dorset yarn from Baffin Island. This led Sutherland (2000, 2002, 2009), nearly two decades ago, to propose the intriguing hypothesis that the interchange of these fibers and the production of spun threads in Dorset contexts could reflect techniques taught by the Norse to local Dorset people in the context of long-term interactions during the period of the Norse Greenland colonies' existence, 1000–1450 AD. If the sites where spun yarn was found were Norse trading bases or the residential camps of Dorset Paleoeskimos who had learned to spin and perhaps weave fibers through sustained contact with Norse traders (Sutherland, 2000, 2002, 2009), these would be critically important places for understanding the duration, spatial extent, and nature of Norse contact with indigenous North American cultures.

Fitzhugh et al. (2006) and others (Odess and Alix, 2004; Park, 2004) noted, however, that the radiocarbon dates on spun yarn – often referred to as “cordage” – and related materials from the sites of Nunguvik, Nanook, Willows Island 4, and Avayalik Island – were generally centuries older than the period of Norse exploration in the western Atlantic. This has led to three contrasting arguments to explain these dates.

First, those who argue that the cordage pre-dates the presence of the Norse in the North Atlantic contend that the yarn represents an otherwise unknown, indigenous Dorset fiber technology (Odess and Alix, 2004; Park, 2004; Fitzhugh et al., 2006). Second, Sutherland (2002, 2009) has suggested that the dates may be accurate and that the yarn could be the product of otherwise unknown European contacts with Dorset communities during the 7th-8th centuries AD. Third, Sutherland (2000, 2002, 2009) also argued that the dates may be errantly old through contamination by “older carbon that is not likely to have been temporally associated with the manufacture of the cordage”. Citing McGhee (2000, 188) – who identified four factors producing inaccurate radiocarbon ages in the Arctic: (1) broad age ranges from standard radiocarbon dates due to natural fluctuations in atmospheric radiocarbon levels, (2) use of diverse materials and mixed samples for radiocarbon dating, (3) potential release of ancient carbon from melting permafrost, and (4) the presence of sea mammal oil contamination – Sutherland concluded that it “is not considered useful to publish the dates obtained” (Sutherland, 2009, 294).

The question of *sample contamination* is an enduring one for dating archaeological sites and objects, not only in the Arctic, and is especially vexing with these materials. As Jull et al. (1996), Possnert and Edgren (1997), Rageth (2004) and Hajdas et al. (2014) have argued, and as Hayeur Smith (2014a, 2014b, 2015; Hayeur Smith et al., 2016) has demonstrated specifically for the North Atlantic region, textiles made from the hair and wool of terrestrial herbivores, produced and shed over spans of 1–3 years, should be ideal materials for high-resolution dating. The most likely ways that such materials can become contaminated with ancient carbon are either through the use of petrochemical products in post-excavation conservation treatments (Hayeur Smith et al., 2016) or through in-situ contamination with marine mammal oils during use or after deposition.

In this paper we report an effort to date fibers and textiles in the Canadian Museum of History's permanent collection from archaeological sites in the Eastern Canadian Arctic using a new pre-treatment method developed by Nilsen, in collaboration with Beta Analytic Laboratories, for removing marine mammal contamination from archaeologically recovered materials. By focusing on high-precision AMS dates run on a single class of material (hair/wool)