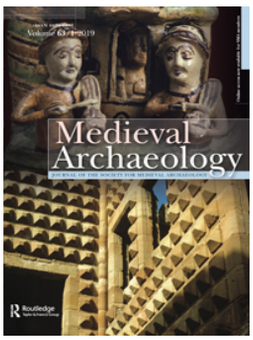

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# 'Tangled up in Blue': The Death, Dress and Identity of an Early Viking-Age Female Settler from Ketilsstaðir, Iceland

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*IN 1938, a woman's burial was uncovered by road builders at Ketilsstaðir in north-eastern Iceland. Recently, her physical remains and associated funerary goods were re-examined by an international, inter-disciplinary team and formed the basis for an exhibition at the National Museum of Iceland in 2015. This paper focuses on the items of dress that accompanied the woman in order to gain insights into the ways her cultural identity was expressed at the time of her death. Here we explore the roles played by material culture in signaling her identity, and the technologies and trade networks through which she was connected, visually, to Scandinavia, the British Isles, and the Viking world at large.*

In the early 10th century, a young woman was buried near the modern farm of Ketilsstaðir in Hjaltastaðahreppur in eastern Iceland (Fig 1). Medieval saga narratives imply that Iceland was populated by immigrants from Norway, as well as Norse colonies in Scotland's northern and western isles and coastlines, and recent preliminary findings suggest that this woman may have been one of these settlers.[4] Medieval sagas and modern DNA analyses suggest that Iceland's early population included settlers who were Norse; others with a mixed biological heritage (eg Hebridean and Irish) arrived as slaves, concubines, servants or freemen. We do not know into which of these categories this settler fell.[5]

In 1938, workers disturbed her burial during road construction at the farm of Ketilsstaðir. Soon after, the grave was excavated by the National Museum of Iceland, revealing the partial remains of a young woman buried with items of Viking-Age Norse clothing and dress.[6] For many years no one questioned her identity or affiliation, assuming that she was a Norse woman based on the objects that accompanied her. Her burial could be considered among the wealthiest from Iceland's settlement period (AD 870–930) due to her relatively abundant gravegoods.

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[4] Initial results of strontium, oxygen, and lead isotope analyses run at Durham University on samples from the woman's teeth have provided values that fall 'within the charactersitic isotopic values of western and southern England, Ireland, Wales, and the Scottish Islands' (Walser 2015, 53)

[5] Smith 1995; Helgason et al 2001; McGovern et al 2007; Vésteinsson and Gestsdóttir 2016, Ebenesersdóttir et al 2018.

[6] Eldjárn 1958; Eldjárn and Friðdriksson 2000; Einarsdóttir 2015.



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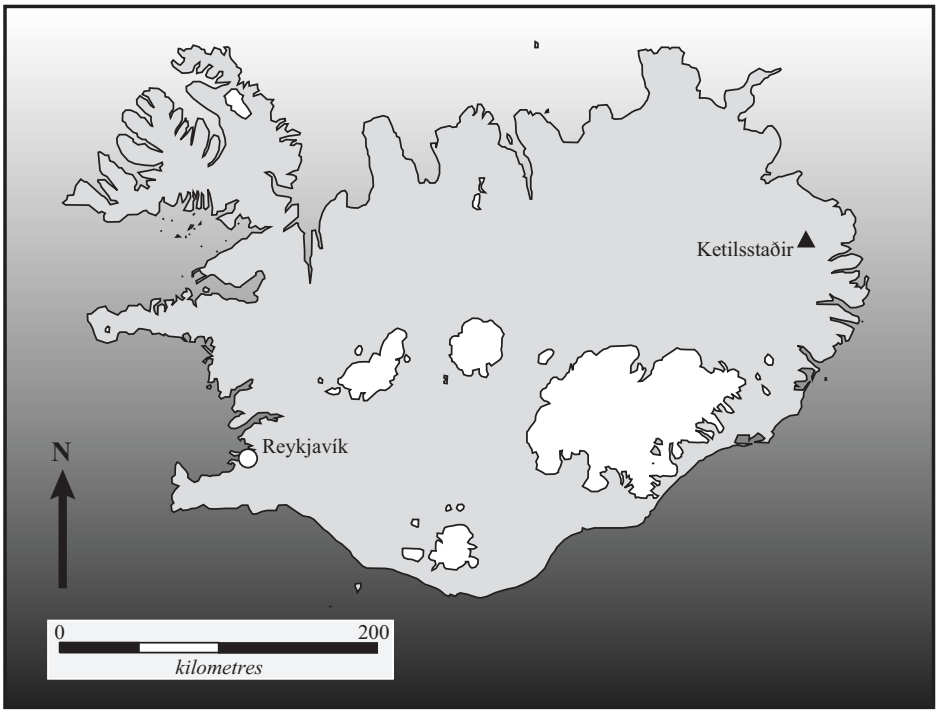


FIG 1
Map of Iceland, showing the location of Ketilsstaðir. *Map by Kevin P Smith.*

In 2014, a jar containing formaldehyde, soft tissue and skeletal remains from a woman's partial face and cheek came to light in the National Museum of Iceland's collections. Closer inspection revealed that textiles from garments were also preserved in direct contact with these skeletal remains. When a review of the museum's records revealed the jar's contents were from Ketilsstaðir, questions about their preservation and the burial itself brought the whole matter to life once again. A full-scale projecth, coordinated through the National Museum of Iceland, looking at all of the material from her grave was undertaken between 2014 and 2015 to examine the identity of this early settler. Osteological analyses were undertaken by Joe W Walser III; isotopic analyses of her teeth and bones are being carried out out by a team at Durham University; aDNA analyses are still underway at deCODE genetics. We analysed her textiles, jewellery and dress, her textiles' strontium-isotope signatures, and the burial's dating.

In this paper, we use items of dress, isotopic evidence for their origins, and AMS dates from the site to build a profile of the image created of this woman at the time of her burial. We regard dress and other material aspects of visual appearance as elements of symbolic systems used to convey social messages about cultural affiliation and identity.[7] We accept that it is impossible to know whether the objects that accompanied this woman in death were ones she chose herself, before her death, or items that her

[7] Eicher 2000; Eicher and Roach-Higgins 1965, 13; Entwistle 2000, 42; Cordwell and Schwarz 1979; Schwarz 1979; Turner 1980; Hayeur Smith 2004; Wobst 1977.

survivors selected to represent her. However, we do assume that deliberate choices were made about how to dress her for burial by people close to her, and that her desires and theirs were interlinked through decisions made about how to represent her — whether to honour her own beliefs about her identity or to use her funeral to make statements, through her, about the survivors' identities.

## DRESS AND THE KETILSSTAÐIR BURIAL

The woman's grave was located 300 m north of the recently abandoned farms of Litlu-Ketilsstaðir and Ketilsstaðir, 2.5 km to the north. No Viking-Age farmhouses are known near the grave site, which may have been located close to the boundary between two early settlements, as Adolf Friðriksson has argued was common in Iceland's Viking Age.[8] Matthías Þórðarson, who conducted excavations at the site in 1938 and 1942,[9] thought the grave could have been surrounded by a small circular wall. The woman had been laid to rest in the grave on her left side in a flexed position.[10] The left side of her face touched one of two oval brooches that lay in the area of her left clavicle and upper ribs. Other gravegoods within the burial included a trefoil brooch, 42 beads, textile fragments, one touchstone and a second possible touchstone or whetstone, fragments of a bone knife handle, a spindle whorl and an unusually shaped piece of blue-grey chalcedony.[11]

Metallic salts created through the oxidation of the copper-alloy brooches and their reaction with surrounding sediments preserved a range of organic remains in close contact with them. These included soft tissue from her left cheek and left eye; her maxilla, mandible and teeth;[12] and portions of the clothing in which she was buried. In Iceland, Viking-Age organic materials are rarely preserved due to their fragile nature, acidic volcanic soils, intense freeze/thaw cycles and disturbance from erosion and wind.[13] Textiles, in particular, rarely survive except in the anaerobic micro-environments of midden layers sealed beneath heavy turf layers in later Icelandic farm mounds, or, as in this case, through proximity to metal items.[14]

When this grave was discovered, the jewellery accompanying the burial provoked great interest. Her oval brooches, of a standardised type found across the Viking world,[15] were used to infer that this was a Norsewoman's grave. These brooches are so widespread in Viking-Age burials that Scandinavian scholars, including Liv Helga Domasnes and Bergljot Solberg,[16] have used them as gender identifiers even in the absence of skeletal indicators of sex. In this case, however, the skeletal remains were never reburied and her bones, few in number and poorly preserved, were analysed several times.[17]

[8] Friðriksson 2013, 500.
[9] Eldjárn 1958, 180; Friðriksson 2013, 500; Einarsdóttir 2015, 17.
[10] Friðriksson 2013, 500.
[11] Eldjárn 1958; Friðriksson 2013, 500.
[12] Einarsdottir 2015, 17.
[13] Friðriksson 2013.
[14] Hayeur Smith 2012; 2014; 2015; 2016.
[15] Hayeur Smith 2004.
[16] Domnasnes 1982, 73; Solberg 1985.
[17] Steffensen 1966; Gestsdóttir pers comm; Walser 2015.

These analyses confirmed that the woman was buried in a manner typical of the North Atlantic Norse during the Viking Age. In particular, the jewellery that accompanied her included both typically Norse items and also pieces with affinities to the British Isles, and beyond.[18] The textile remains preserved by her brooches were assessed in the 1970s and 80s at the Bryggens Museum in Bergen, Norway, and were reassessed by Hayeur Smith in 2013 and again in 2015 as part of the Ketilsstaðir project.[19] These recent assessments provide additional in-depth and integrated analyses of her jewellery and textiles which have generated new, and more nuanced, frameworks for understanding the cultural mechanisms at work in the projection of this woman's identity.

## DRESS AND CULTURAL IDENTITY

Dress, jewellery and permanent body modifications such as tattooing and teeth filing, among others, are used in life and death to create an individual's coherent visual appearance, which is a materialised expression of cultural identity.[20] When cultures come into contact through colonisation or trade, dress codes steeped in tradition can become potent symbols of cultural identity, at times generating symbolic amalgamations, as each group adopts or rejects symbols of the other. Chris Gosden and Chantal Knowles suggest that this occurs at three levels: acculturation, resulting in a form of cultural loss; the maintenance of tradition; or through hybridity.[21] Through the process of *bricolage*, older items of dress can be replaced by newer versions made, in some cases, with different materials.[22] The adoption of new symbols and material culture may allow individuals in a complex social landscape to access or emulate the symbolic world of a dominant ethnic or class-defined group by emulating their lifestyles or fashions. However, cultural interaction can also intensify the production of local items newly imbued with 'traditional' value as a means of expressing cultural distinction or resistance.

In the North Atlantic colonies, cultural norms and social structure legitimised through religious and legal systems rooted in Iron-Age Scandinavian practices reflected the concerns and reinforced the authority of the islands' Norse elite, yet these regions' colonists included men and women of native British and Norse descent from colonies in Scotland and Ireland. When Iceland was settled in the last decades of the 9th century AD, these immigrants colonised an unoccupied island where a local North Atlantic Norse identity could emerge through processes of self-directed cultural demarcation, assimilation and hybridisation, rather than with influences derived from integration with, or reaction to, the traditions and practices of earlier, locally resident communities.[23] The grave from Ketilsstaðir provides an interesting example of these processes at work.

[18] Hayeur Smith 2004.
[19] The early analyses are presented in unpublished reports held at the Bryggens Museum (Bryggens Museum 1975; Pedersen 1982). Hayeur Smith's 2015 work was funded by a National Science Foundation research project, award no 1303898; 'Weaving Islands of Cloth: Gender, Textiles, and Trade Across the North Atlantic from the Viking Age to the Early Modern Period'.
[20] Tranberg Hansen 2004, 370.
[21] Gosden and Knowles 2001, 5.
[22] Berlo 1992, 116; Rovine 2009, 44.
[23] Smith 1995.

FIG 2
Depiction of the woman from Ketilsstaðirś dress, with pleated linen undergarment, blue apron and oval brooches. *Illustration by Greg Rebis.*

## ANALYSES OF DRESS AT KETILSSTAÐIR

### JEWELLERY

Viking-Age Scandinavian women typically wore long garments, consisting of a *serk* — a long chemise (often made of pleated linen) with long sleeves — fastened at the neck with a brooch.[24] Paired oval brooches were worn on the chest, attached to the straps of a sleeveless apron on top of the *serk* (Fig 2).[25] How this apron, or *smokker*, was constructed has been a matter of debate. Arguments have been made for its construction in two panels with open sides, for a single piece of cloth open to one side, or as a single piece sewn like a short tube.[26] Thor Ewing has suggested that the *smokker* opened

[24] Hägg 1974, 108.
[25] Ibid.
[26] Ewing 2006, 27.

in the front to reveal an embellished undergarment, an argument that was first suggested by Flemming Bau based on comparative examples found in Scandinavian art work, while Agnes Geijer thought it was formed by one or two rectangular panels wrapped around the body, with loops through which the straps and brooches could be fastened.[27]

These garments were made from different types of textiles — coarse wools to fine oriental silks used as embellishments — according to the social statuses of their owners and their access to trade networks, and the tasks and social contexts in which they were worn.[28] A wrap or shawl could be worn over this outfit; evidence from Hedeby (Schleswig-Holstein, Germany) indicates that well-to-do women often wore an ankle length coat over their dress.[29] Cloaks were also worn and could be lined with fur, embroidered with silver thread, or added to with ribbons or posaments for decorative effect around the edges.[30]

Typically, a string of beads or a pendant, along with other useful implements — knives, scissors and sometimes keys — hung between the two oval brooches worn in pairs on these garments.[31] These brooches, often gilded and decorated with silver bosses and wire, are ubiquitous in Scandinavian Viking-Age burials and are generally considered the most gendered item of female dress across the Viking world.[32] Their designs are so standardised that identical brooch types can be found in areas as distant from one another as Iceland and Russia. Hayeur Smith proposed that these brooches were symbols of marital status, not unlike wedding rings today. They are generally found with adult women whose gravegoods imply a moderately high social status within society, most likely as married women who ran an independent household.[33] Medieval documents recounting tales and stories from the Viking Age offer descriptions of female dress with similar brooches,[34] raising reasonable questions about why they were such important signifiers of women's status in life and in death.

In Viking-Age inhumation graves, these brooches are invariably recovered on women's chests indicating that this was their intended place in women's attire. Here they would have resembled a stylised and accentuated pair of breasts. This visual statement was re-inforced by multiple bosses that make allusion to nipples. The goddess Freyja, who oversaw all issues relating to female reproduction and fertility, was given the epithet 'sow' (or 'bitch') by Christian missionaries in Iceland.[35] The similarity between the appearance of these brooches and the belly of a lactating pig or other animal with more than two nipples is striking.[36] The bosses on the brooches have no functional roles, making it likely that they served symbolic purposes expressing notions of femininity, fertility and lactation and associations with female divinities such as Freyja, through their emphasis of stylised female sexual traits. There are frequently nine such

[27] Ewing 2006, 27; Bau 1981; Geijer 1938.
[28] Larsson 2008, 182.
[29] Ewing 2006.
[30] Jesch 1991, 17.
[31] Hägg 1991; Jesch 1991, 17.
[32] Domnasnes 1982, 73; Owen and Dalland 1999, 147.
[33] Hayeur Smith 2004, 72–4; 2000, 230.
[34] See Ahmed Ibn Fadlan in Canard (trans) (1996, 248).
[35] Ellis Davidson 1990, 116.
[36] Hayeur Smith 2004, 72–3.

FIG 3
P 52 brooches from Ketilsstaðir, (K 12435 a,b). (a) 1180 mm × 730 mm; (b): 11. 4 cm × 7.6 m. *Photograph by Michéle Hayeur Smith.*

bosses — a recurring number in Viking-Age religious art and mythology — on each of these brooches.

The woman from Ketilsstaðir wore a pair of these oval brooches over her main gown (Fig 3). A remarkably similar pair of brooches was found in the grave of a wealthy Norse woman from Castletown, Caithness (Scotland).[37] The brooches from Ketilsstaðir are neither as finely crafted nor as well preserved as those from Castletown, which still retain elements of their gilding. The right brooch from Ketilsstaðir is missing its central boss and is somewhat damaged, perhaps as the result of the road-builders' activities. However, close examination reveals that it was constructed in two parts, like most brooches of this style, with lattice work on a top shell adorned with nine bosses, four of which were cast as part of the top shell, and five that were fastened to it with small rivets inserted through small holes in circular settings cast into the upper shell. Four of these rivets are still present in the left brooch, although the bosses are not. XRF analysis of an oval brooch from Kneep, Isle of Lewis, Outer Hebrides (Scotland), revealed that these attached bosses were often made of an alloy of lead and tin, much like a soft solder.[38] Silver foil may have covered them, producing a colourful contrast with the gilded surface of the brooch itself. These contrasts were further enhanced by finely made twisted silver wires that passed in and out of small perforations in the upper shell and ran along precast channels between the bosses on the upper surface.[39]

Both of the Ketilsstaðir brooches are of the P52 variety,[40] a style that Ingmar Jansson dated to the late Birka period, which began in the late 9th century and

[37] Curle 1914, 314; Greig 1940.
[38] Welander et al 1987, 160.
[39] Ibid, 161; Hayeur Smith 2004.
[40] 'P52' refers to a typology established in the early 20th cetury by archaeologist and antiquarian Jan Petersen, who sought to organise Scandinavian archaeological material from the Viking Age (see Pedersen 1928).

FIG 4
Trefoil brooch from Ketilsstaðir (K 12436) (380 mm × 320 mm). *Photograph by Ívar Brynjólfsson, courtesy of the National Museum of Iceland.*

continued into the 10th century.[41] Typically, four of the bosses on P52 brooches are adorned with horses' heads, a motif commonly associated with the cult of the Vanir deities, including Freyja. Therefore, several elements on these brooches have potentially potent Norse mythological references: the number of bosses — as noted above — the horses' heads, other zoomorphic features that adorn them, and their feminised, mammiform shape. Together, these features referenced aspects of Norse belief systems that celebrated associations between the Norse gods — specifically the Vanir — female fertility and women's lives.

Other items of jewellery found in the Ketilsstaðir burial include a trefoil brooch adorned with acanthus motifs, originally classified as of P91-style by Jan Pedersen (Fig 4).[42] These three-tongued brooches were adapted from Carolingian baldric mounts modified with Norse motifs to suit Scandinavian tastes.[43] Two examples of this type, Maixner's P8.1, are known from Norway and one has been reported from Hedeby.[44] Jane Kershaw suggests a Norwegian origin for this brooch, with acanthus motifs, rather than animal art, reflecting the adoption of non-local designs within Scandinavia during the late 9th century.[45] The size of this relatively small brooch is 380 mm wide and 320 mm long.

The inclusion of this brooch, along with 42 beads of varying origins, are elements that highlight the distant connections of the Viking Age. Yet, while they reference

[41] See Jansson 1985, 186.
[42] Eldjárn and Friðriksson 2000
[43] Kershaw 2013, 79.
[44] Maixner 2005.
[45] Eldjárn 1958; Maixner 2005; Kershaw 2013, 80, pers comm.

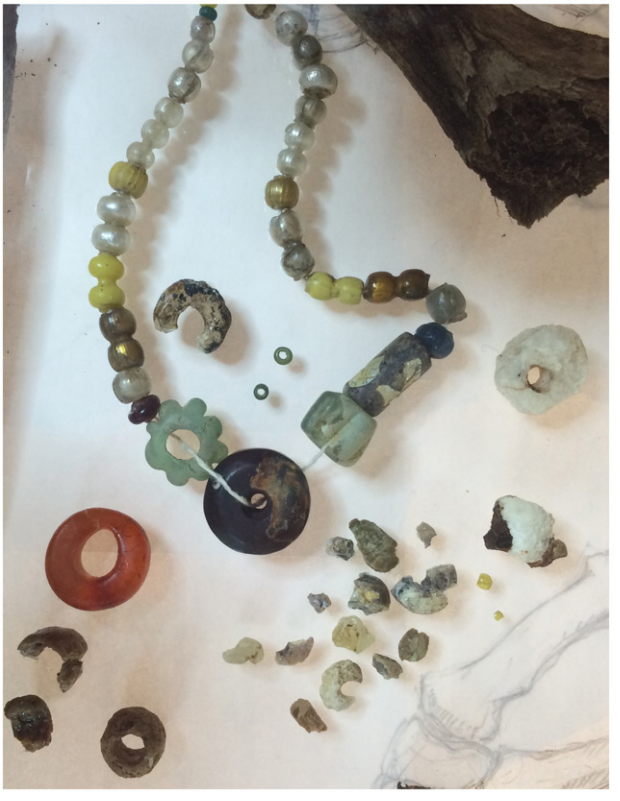

FIG 5
Beads from Ketilsstaðir (K 12437) (widest bead visible is 220 mm × 150 mm). *Photograph by Michéle Hayeur Smith.*

materialised links between this woman's grave and distant lands, they do not necessarily imply travel beyond the landing places in Iceland where merchants or voyagers returned with, or sold, goods from continental Europe. It is perhaps more likely that their integration into her jewellery assemblage reflects decisions made locally about the meanings or appearance of goods that could be acquired from abroad, rather than conscious attempts to reference the origins of these items, even though the search for production sites consumes archaeologists' interests.

The 42 complete beads and fragments recovered from the burial are all assumed to have been imported into Iceland, as no evidence of Viking-Age glass-bead production has yet been found in Iceland (Fig 5). The majority of the beads accompanying the woman are small segmented beads of types frequently found joined together in groups of two, three or four segments. Nineteen of these were silver coloured, four were bronze coloured (which probably initially looked like gold) and four were yellow. These segmented beads, found throughout the Viking world and in Scandinavian trade centres,[46]

[46] Sode et al 2010.

are thought generally to have been imported from the Eastern Mediterranean.[47] She was also accompanied by two yellow-glass ridged beads, two large round, bluish-green glass ridged beads, a small blue-glass bead, one tubular glass bead, one large black bead made from jet or lignite and a single large amber bead.

None of these materials are found naturally in Iceland. Jet came from the area around Whitby (Yorkshire, England), lignite came from southern Scotland,[48] and, although much of the amber used in the Scandinavian Viking Age was traded from the Baltic region, production debris and finished work from Viking-Age York also suggest that some jewellery may have been produced from amber found on British beaches.[49]

The number and ubiquity of beads in Icelandic burials is relatively unusual compared to continental Scandinavian Viking-Age practices. Although they are more common in the graves of women than men, beads are found across Iceland in burial contexts suggestive of virtually every social or economic rank represented by other offerings indicating wealth or status. There may be as few as one bead and nothing more, or full, multi-coloured necklaces like the one from Ketilsstaðir.[50] In contrast, beads are extremely rare in Norwegian burials.[51]

The colours represented in this woman's necklace may have been individually important, but perhaps its multi-coloured appearance was more stylistically or symbolically significant: all known women's necklaces from Icelandic Viking-Age burials combine beads of varying shapes, colours and styles rather than emphasising homogeneity or single colour families. Yet, the presence of beads made from materials such as jet, lignite, and amber may also reflect beliefs that specific beads and stones could carry amuletic properties.[52] Amber references Freyja's famous necklace, the *Brisingamen*, described in some instances as being made of golden amber or from gold itself. Snorri Sturluson's *Prose Edda* states that Freyja was associated with all beautiful things such as precious jewellery, and that the tears she wept for her lost husband were gold.[53] The presence of amber, and perhaps also the gilded beads, may therefore provide significant links between the Ketilsstaðir woman's adornment and attributes of Freyja, goddess of love, fertility, women's magic and death.

Jet or lignite beads, bracelets and rings are also found across the North Atlantic, in Scottish burials, and on the Faroese Viking-Age farm of Toftanes.[54] According to Stummann Hansen, while the material originates in Whitby near York, production debris unearthed in the excavations of Viking Dublin suggest that jewellery made from jet or lignite may have been produced in areas distant from the sources of the raw material.[55] Jet and lignite may also have carried amuletic properties. Signe Horn Fugelsang suggested that amuletic properties lay behind the inclusion of a set of jet beads in a woman's grave in Sunnmøre, Norway, where they were found together with a jet

[47] Callmer 1977; Hreiðarsdóttir 2013a,b; 2014; Hickey 2014. Production of these beads in areas under the control of the Byzantine Empire and/or the Islamic Caliphate is supported by multiple lines of evidence, including elemental composition (Smit et al 2012). The Ketilsstaðir beads have not yet been analysed chemically.
[48] Hayeur Smith 2004.
[49] Mainman and Rogers 2000.
[50] Hayeur Smith 2004, 90; Hreiðarsdóttir 2013a,b.
[51] Solberg 1985, 247.
[52] Hayeur Smith 2004, 89; Ellis Davidson 1990, 6.
[53] Dillman 1991, 65.
[54] Stummann Hansen 1995, 127.
[55] Grieg 1940; Stummann Hansen 1995, 127.

serpent, a woman-shaped amber bead and 66 glass beads.[56] Roberta Gilchrist notes that jet was associated with protective powers from Roman times into the Middle Ages and Lindsay Allason-Jones inferred a special significance for women, since the majority of jet objects in Roman graves were interred with women.[57] The Castletown burial from Caithness, whose brooches were mentioned above, also contained a lignite bangle among its gravegoods.[58]

The piece of chalcedony in, or near, the hands of the Ketilsstaðir woman potentially also points towards beliefs in the symbolic or amuletic properties of stones. Its blue shade is a colour commonly associated with death and burial in Norse contexts, and chalcedony itself is known as *draugasteinn* or 'ghost stone' in Icelandic.[59] Although the age and derivation of this term are ambiguous, pieces of chalcedony are occasionally found in Viking-Age graves in Iceland and Norway, and white stones, often chalcedony or quartz, are found in early Christian graves across northwestern Europe, a practice that Gilchrist links both to pre-Christian apotropaic practices and amuletic interpretations of Christian texts.[60]

## THE TEXTILES

Four different types of textile were identified in the Ketilsstaðir burial with certainty, and a fifth type is likely. Other textiles were quite likely once present, but are now unidentifiable as the textile remains representing them were small, fragmentary and had poorly defined textile structures. Textiles that could be clearly identified include a linen tabby, a wool diamond twill fragment, a tablet-woven band, a 2/2 twill and a possible herringbone twill.[61]

Analyses undertaken on these textiles included on-site macroscopic and microscopic analyses using a digital microscope; fibre and dye identifications carried out by the McCrone Group; fibre identifications and dye analyses done at the University of Rhode Island's Department of Textile Conservation; analysis of strontium isotopes on two samples from the wool textiles, undertaken at the National Museum of Denmark and University of Copenhagen; and radiocarbon dating done by Beta Analytic Laboratories (Miami, FL, USA).

The *serk*, a long undershirt or gown, is represented by a mineral-preserved tabby textile stuck to a woven wool fragment. It is also visible on the underside of the left brooch as mineralised cloth adhering to the underside of the oval brooch's copper-alloy shell and to the corroded iron pin that held the garment in place (Fig 6). Fragments from this mineral-preserved piece (K12438-2) were sampled, and while the fibres themselves had undergone considerable degradation, it was possible to determine that three of these were cellulose fibres, suggesting that her undergarment was made of linen, as was customary in Scandinavia.[62]

[56] Blindheim 1978, 59–82, in Fugelsang 1987, 20.
[57] Gilchrist 2008, 139; Allason-Jones 1996, 15–17.
[58] Stummann Hansen 1995, 482.
[59] Wolf 2007.
[60] Nordén 1928; Gilchrist 2008.
[61] Mainland Scandinavian textiles have been the topic of numerous detailed and invaluable scholarly works. These include, among others, Andersson Strand (2003; 2011); Bender Jørgensen (1986; 1992; 2003); Christensen and Nockert (2006); Geijer (1938); Hägg (1974; 1991); Hagen (1994); Kjellberg (1979; 1982); Kjellberg and Hoffman (1991) and Vedeler (2007) and will be referred to in this section.
[62] Ewing 2006, 28.


FIG 6
Linen fragment, which formed part of the long undergarment. This linen undergarment mineralised to the inside of the oval brooch (K 12438–2). *Photograph by Michéle Hayeur Smith.*

This garment may have been imported, because evidence for the cultivation of flax is scarce in Iceland, and, so far, has not been documented archaeologically for the Viking period. However, the place name Línakradalur (literally 'linen field valley') in northern Iceland appears in the 12th/13th-century Book of Settlements (*Landnámabók*), as part of the land claimed by a wealthy settler, Skinna-Björn Skeggjason, during the first generation of Iceland's settlement, which suggests that attempts may have been made to cultivate flax during the medieval period.[63] The place name Línakradalur also appears in the Icelandic family saga *Þórðar saga hreðu* (set in the 10th century, but written in the early 14th century),[64] as well as in two of the so-called 'contemporary sagas' (*Íslendinga saga* and *Þorðar saga kakala*), which were written in and describe events in 13th-century Iceland.[65] The sagas' use of the name imply that 13th-/14th-century Icelanders associated the naming of Línakradalur with the time of Iceland's settlement.[66] While this does not confirm that linen was ever grown in Iceland, it makes it uncertain that the Ketilsstaðir woman's gown had to have been made from imported linen. The cloth was woven with Z-spun warp yarns and Z-spun wefts.[67] Although a full thread count of these textile fragments was not

[63] Pálsson and Edwards 1972, 81.
[64] Attwood 1997, 376.
[65] Thorsson 1988, 427, 499.
[66] The place name Línakradalur is still used in modern Iceland for the same flat-bottomed, marshy valley in Vestur-Húnavatnssýsla that is referenced in the medieval texts.
[67] Fibres can be spun clockwise or counter-clockwise. When spun clockwise these are referred to as z-spun and when spun counter-clockwise as s-spun. Viking-Age textiles of this period from Norway and Iceland are generally ZZ spun. In Iceland, ZS-spun textiles rapidly became predominant in the 11th century for textile production and this system remained in use until the late 18th century.


FIG 7
Wool apron (K 12438-4a) (diamond twill-originally dyed blue) with lighter tablet woven band. *Photograph by Ívar Brynjólfsson.*

possible because they were too fragile and small, a thread count of 18 in one system suggests a finely woven fabric.

Over this long shift she wore an apron or pinafore (*smokkr*), fastened in place by her oval brooches. This apron was made of wool, and was decorated at the top with a wool tablet-woven band (Fig 7).[68] The apron itself, represented by fragment K12438-4a, was wool diamond twill, ZZ-spun with a thread count of 9/5. Pieces of an additional item (K12438-1), initially thought to belong to the same *smokkr*, were found under the shell of the left oval brooch, retaining its domed shape. Given its location, it is obvious that this piece was connected in some way to K12438-4a and to its tablet-woven band. However, further analysis suggested that while K12438-4a was a part of the *smokkr* made with a diamond twill, K12438-1 was probably a herringbone twill, ZZ spun and with a thread count of 11/11. Together, these identifications suggest that the Ketilsstaðir woman's *smokkr* may have been made in two parts, and possibly from two different panels with two different types of twill, suggesting that dress practices in Iceland may have been exercises in *bricolage* — with those who prepared bodies for burial piecing together what was available, or dressing the dead to carry a message. Alternatively, the herringbone twill could have been the remains of a shawl or additional garment.

Diamond and patterned twills, of the 2/2 type, are both extremely rare in the Icelandic Viking-Age textile corpus: only two other diamond twilled textiles are known from Iceland, at the sites of Snaehvammur and Gamla Berjanes.[69] Patterned twills are also found in Scottish Viking-Age material, largely as textile imprints produced on the inside shells of Viking-Age oval brooches as part of the casting process.[70] According to Lise Bender Jørgensen, the full diamond twill — sometimes called the 'Birka type' — is

[68] Tablet weaving is a weaving technique where wood or bone tablets or square cards are used to create a 'shed' (a temporary separation between upper and lower warp yarns through which the weft is woven).
[69] Hayeur Smith 2017.
[70] Bender Jørgensen, in Welander et al 1989.

a worsted twill of extremely fine craftsmanship found most frequently in the Baltic areas of Scandinavia and in western Norway.[71] This type is well represented at Birka and at other early Scandinavian trade centres, including Hedeby and Kaupang (Norway).[72] Western Norway is thought to have been a centre of diamond-twill production, since one-third of Merovingian and Viking period graves found there have textiles of this type.[73]

Three qualities of diamond twill have been identified in the western Norwegian corpus: medium quality cloth with ≤30 warp threads per centimetre; fine cloth with 30–40 warp threads; and a very finely woven cloth with more than 40 warp threads.[74] Lise Bender Jørgensen argued that only the very finest versions made their way to Birka and that the high quality and uniformity of the Birka-type could only have originated in what she defines as 'a more advanced type of society, possibly even something comparable to a weavers' guild'.[75]

The material from Ketilsstaðir is an example of the lowest of these quality grades. However, strontium-isotope analysis (described below) documents that the Icelandic diamond twill from Ketilsstaðir was made from wool that was locally sourced in Iceland. When this new knowledge is combined with previous theories by Bender Jørgensen suggesting that this type of cloth was produced in urban settings,[64] it implies that this method of weaving was probably brought to Iceland from western Norway, where it originated. This western Norwegian connection is interesting given that this is also one of the main areas from which many medieval Icelanders traced their ancestry.

The presence of ZZ-spun yarns in both the linen undergarment and the diamond twill (K12438-2) also suggest a Norwegian origin for these garments. From the late 9th century to the early 11th century, the garments that accompanied Icelandic Viking-Age burials were largely ZZ-spun, using single yarns, although occasional pieces of cloth were spun ZS. ZZ-spinning was the standard approach used across Scandinavia from AD 200 onwards, and the shift to ZZ-spinning, along with the production of 2/2 twills, has been linked to the adoption of the warp-weighted loom during the Roman Iron Age (1st through 4th centuries AD).[76]

While ZS-spun fibres are found on some Viking-Age Scandinavian sites, Norwegian and Gotlandic textile traditions remained more conservative with a persistent use of older spinning methods and the continued production of ZZ-spun twills.[77] In Iceland, ZZ textiles, similar to their Norwegian counterparts, dominate assemblages from AD 870–1050, but were replaced by ZS-spun twills quite rapidly after the 10th century. Textiles made with ZS-spun yarn remained the standard in Iceland until the early 18th century, when horizontal looms were introduced to the island.

It is unlikely that the shift or desire to spin Z or S had much to do with technological concerns, since spinners and weavers had used the same tools in Northern Europe since AD 200 to spin equally well in one direction or the other.[78] One possible

[71] Bender Jørgensen 1986, 358.
[72] Bender Jørgensen, in Welander et al 1989, 167.
[73] Bender Jørgensen 1992, 138.
[74] Bender Jørgensen 1986, 360.
[75] Ibid.
[76] Bender Jørgensen 1992, 126.
[77] Ibid, 39.
[78] Ibid, 122.

explanation for this shift in Icelandic spin direction is linked to the ethnic origins of the spinners who produced the yarn and brought different textile traditions to Iceland.[79] Mitochondrial DNA studies on modern Icelanders and on Viking Age and medieval Icelandic skeletal remains have demonstrated a significant native British component among Iceland's female settlers.[80] Preliminary results from isotopic analyses done at Durham on the Ketilsstaðir woman's tooth, reported by Walser in 2015, suggest that she too may have come from the British Isles.[81] It is possible that these women, some free — kinswomen or spouses within colonising families — and others perhaps unfree, brought their spinning techniques to Iceland from the British Isles, where ZS-spun cloth appears to be have been commonly produced.

Lise Bender Jørgensen and Penelope Walton Rogers note that textiles from British urban sites were generally ZS-spun from the 9th to 10th centuries, but textiles from Norse-style graves from Scotland, Ireland and the Isle of Man were ZZ-spun.[82] Both authors concluded that 9th- and 10th-century British urban sites produced textiles that were different than those used to bury the dead in rural settings, and argued that the urban cloth types were comparable to those from continental Europe, where ZS cloth prevailed.[83] A somewhat similar pattern may be found in Iceland. Burials from the Landnám period (late 9th and 10th centuries AD) overwhelmingly produce ZZ-spun textiles, while excavations at 9th-/10th-century settlement sites such as Hofstaðir and Bessastaðir produced an equal if not greater proportion of ZS-spun textiles.[84] This may reflect particular attitudes about the dead that included dressing them in old or discarded cloth, or perhaps that specific types of cloth were associated with identities linked to Scandinavian, or specifically Norwegian, roots.

Fibres from the apron (K12438-4a) tested positive for indigotin, implying that it had been dyed blue with woad (*Istatis tinctoria*) (see Fig 7).[85] The presence of blue clothing at Ketilsstaðir replicates a common theme in female Viking-Age burials from Scandinavia and Iceland. In Iceland, 65% of female burials with preserved textiles include ones dyed blue, compared with only 31% of male burials.[86]

The tablet-woven band (weft-faced with both warps and wefts plied Z2S) that decorated the apron's upper margin had a light-cream-coloured central band flanked by two brown bands on either side (K12438-4b). Tablet-woven bands were common features of Viking-Age dress, and those added to the garments of wealthy men and women could be quite ornate. However, the tablet-woven band from Ketilsstaðir was not ostentatiously decorated although it has a faint wave-like motif — one of the simpler motifs that can be produced with tablet weaving. In Iceland, as in other parts of the North Atlantic, tablet-woven bands were frequently used as starting borders for fabric woven on the warp-weighted loom. The ubiquity of this approach as a way of starting woven

[79] Hayeur Smith 2015, see also Minar 2001.
[80] Helgason et al 2001, 733; Ebenesersdóttir et al 2018.
[81] See Walser 2015, 53.
[82] Walton Rogers 1989, 334; Bender Jørgensen 1992, 40.
[83] Ibid, 41.
[84] Lucas 2009, 318–20.
[85] Testing for blue dyes requires testing for indigotin by soaking yarn in a warm alkaline sodium hydrosulfate solution in a small test tube to reduce the insluble colouring agent. The addition of ethyl acetate to the reducing solution and vigorous shaking of the test tube allows the indigotin to move into the upper ethyl acetate layer where it re-oxidises and turns blue.
[86] Hayeur Smith 2017.


FIG 8
Possible strap (K 12438–3), also dyed blue. *Photograph by Ívar Brynjólfsson.*

panels has often been, in fact, used in textile analysis as proof of the use of this type of loom.[87] The tablet-woven band from Ketilsstaðir has one selvedge edge, as is normal for tablet-woven bands used as starting borders. If it were a decorative band sewn to the garment it would have had two selvedged edges delineating the band, along with evidence of stitching holes where it had been fastened to the garment. This suggests that the apron was woven and integrated into the band during its production. Unlike the apron, however, the band did not test positive for indigotin and it would have stood out, therefore, against the blue of the apron's body.

Another textile fragment (K12438-3) from Ketilsstaðir, also bearing the imprint of one of the brooches (see Fig 8), differed considerably from the apron in terms of weave and was initially thought to be part of a cloak or shawl. However, the imprint of the oval brooch on this piece and the fact that its two sides had been folded under suggests, instead, that it was one of the straps holding up the apron. Such straps were threaded through loops attached to the back of the apron, then wrapped over the shoulder and through comparable loops on the apron's front. Fragments of such straps are commonly found preserved on the inside of oval brooches and are occasionally found wrapped around the pin on the underside, as was the case here, where its coarser twill was mineralised along with the linen tabby. This strap was a 2/2 wool twill made with ZS-spun yarns and an unbalanced thread count of 9/7, woven in the style that became associated with classic Icelandic *vaðmál* (a 2/2 twill produced in Iceland to legally regulated standards) a century or two later.[88] This piece also tested positive for indigotin, supporting its identification as one of the straps holding up the apron.

### STRONTIUM-ISOTOPE ANALYSIS

In order to investigate their local or non-local provenance, we conducted strontium-isotope analysis on two of the wool textile fragments. These samples came from the blue 2/2 twill strap (K12438-3) and the patterned twill apron (K12435-3 and

[87] Hoffman 1957; Hoffman 1974.
[88] Dennis et al 1980; Hayeur Smith 2015, 13.

K12435-4a) (Tab 1). These analyses, using the so-called strontium tracing isotope system, are the first of their kind applied to ancient Icelandic textiles.[89]

The two wool samples were treated with a series of pre-cleaning procedures specifically developed to retrieve the primary strontium-isotope ratios of the wool.[90] These included a total of three leaching steps, one consisting of a wash with HCl, and another with HF. Additionally, as the samples had not been previously investigated for their possible content of natural dyestuffs, a third pre-cleaning step (with ammonium peroxodisulfate $(NH_4)_2\ S_2O_8$, abbreviated in the following by APDS) was added to the chemical protocol to ensure removal of any organic dyestuff. In between these steps the residual samples were rinsed with de-ionised water (MilliQ$^{TM}$). Hence, the ancient wool thread samples underwent a deep pre-treatment with a series of several steps before they were dissolved in a mixture of $HNO_3$ – $H_2O_2$. Subsequently, strontium was separated by ion-chromatography column chemistry with Sr-Spec resin and finally measured on a Thermal Ionization Mass Spectrometer.[91]

In order to interpret the strontium-isotope ratios of the wool thread samples, it was first necessary to establish the bioavailable strontium-isotopic range — the so-called isoscape/baseline — for Iceland. Iceland is located at the neovolcanic zone of the Mid-Atlantic Ridge and its geology is characterised by volcanic activity and bedrock primarily composed of young crust ($\leq$0.7 million years old). Archaeological provenance investigations of human remains based on the strontium-isotope system have previously been conducted in Iceland. In one of these, T Douglas Price and Hildur Gestsdóttir conducted strontium-isotope analysis of four modern sheep teeth from various areas within Iceland to constrain the bioavailable strontium-isotopic range. The sheep originated from Jaðar to the north, Brú to the south, Ormarsstaðir to the east and Kjóafell to the west. The strontium-isotope ratios of these four modern sheep ranged from $^{87}Sr/^{86}Sr$ = 0.7059 to 0.7069.[92]

In our present investigation, we sampled and measured the strontium-isotope compositions of seven new baseline samples, including modern wool/hair fibres, soil, plants and surface water (Tab 1). Our measurements yielded values for $^{87}Sr/^{86}Sr$ ranging from 0.7054 (surface water) to 0.70839 (plant leaves). The four samples from modern wool/hair of sheep/goat yielded between $^{87}Sr/^{86}Sr$ = 0.70605 to 0.70674. Hence, our modern sheep wool/hair fibres' strontium-isotope baseline values correspond very well to previously measured strontium-isotope baseline values for modern Icelandic sheep's teeth[93]. Our surface-water sample yielded the lowest strontium-isotope value among the baseline samples, which may be explained by the fact that the surface water had been highly influenced by the basaltic bedrock through its course from inland sources. In contrast, the relatively high strontium-isotope values in the plants could reflect a combination of sea spray and windblown microdust silicate particles.

In conclusion, our samples delineate an Icelandic baseline range from $^{87}Sr/^{86}Sr$ = 0.7054 to 0.70839. However, as Iceland's baseline in near-coastal sites potentially could

[89] Frei 2014.
[90] Ibid, Frei et al 2010; 2009.
[91] For details, see Frei (2014). See also Frei et al (2009; 2010).
[92] Price and Gestsdóttir 2006.
[93] Ibid.

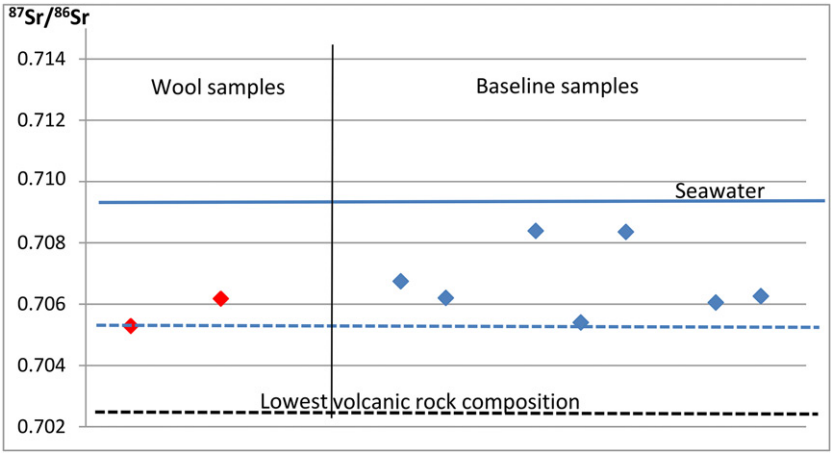


FIG 9
Diagram depicting the strontium-isotope values of the wool samples from the textile fragments from the Ketilsstaðir female burial (red diamonds), and the baseline samples measured in this study (blue diamonds). The horizontal blue line indicates the strontium isotopic composition of the seawater, which can be considered the upper limit of the baseline in Iceland. The horizontal blue dotted line indicates the lowest baseline value measured within our dataset. The horizontal black dotted line indicates the lowest volcanic rock composition measured in Iceland by Taylor et al (1997). Both wool samples from the textiles fragments from the Ketilsstaðir female burial seem to be made of wool of local origin. *By Karin Frei.*

be highly affected by sea spray, we have chosen to present a conservative baseline with the upper limit set by the sea-water value of $^{87}Sr/^{86}Sr = 0.7092$ (Fig 9).

The strontium-isotope results of the two archaeological wool thread samples (residues) from Ketilsstaðir present quite a narrow range of $^{87}Sr/^{86}Sr = 0.70529$ to 0.70618 (Tab 1 and Fig 9). Both samples present low radiogenic values that point to a local origin. The wool sample from the apron has a strontium-isotopic composition that lies even below the baseline range. Previous geological investigations reveal that strontium-isotope ratios for Icelandic volcanic rocks range as low as $^{87}Sr/^{86}Sr = 0.7026$.[94] Even though the wool from the apron apparently falls out of our present preliminary baseline, the low radiogenic values of the local geology point to the conclusion that this wool is also of local origin. Thus, both wool samples seem to be of local origin and made of wool from sheep that grazed on Icelandic soils.

## DATING THE KETILSSTAÐIR BURIAL

While the form of her burial and the objects buried with her indicate that the woman from Ketilsstaðir was interred before Iceland's conversion to Christianity around AD 1000, they provide little guidance beyond this. Across much of Iceland, well-dated volcanic ash ('tephra') layers provide tight dating of events within the first centuries of Iceland's settlement. However, in 1938, when the Ketilsstaðir woman's grave was excavated, the tephrochronological method was just being developed and no records exist to re-associate her grave with tephra layers.[95]

[94] Taylor et al 1997.
[95] Þórarinsson 1943.

TABLE 1
Strontium isotope results of wool from the Ketilsstaðir female burial and baseline samples from Iceland.

| Lab. Nr. | Sample | Procedure | Material | Weight mg. | $^{87}Sr/^{86}Sr$ | 2 SE (abs) |
|---|---|---|---|---|---|---|
| KF 848 | Ketilsstaðir, 12438-4a, Apron | Residue $HNO_3 - H_2O_2$ | Wool | 21.48 | 0.70529 | 0.00005 |
| KF 849 | Ketilsstaðir, 12438-3, Strap | Residue $HNO_3 - H_2O_2$ | Wool | 21.62 | 0.70618 | 0.00004 |
| *Baselines from modern samples* | | | | | | |
| KF 696 | Modern Icelandic sheep wool (cleaned) | Residue $HNO_3 - H_2O_2$ | Wool | | 0.70674 | 0.00002 |
| KF 697 | Modern Icelandic goat wool (uncleaned) | Residue $HNO_3 - H_2O_2$ | Wool | | 0.70620 | 0.00004 |
| KF 698 | Plant | | Leaves | | 0.70839 | 0.00001 |
| KF 699 | Surface water | | Water | | 0.70540 | 0.00003 |
| KF 700 | Soil | Leachate | Soil | | 0.70835 | 0.00005 |
| KF 899 | Modern Icelandic sheep wool (coastal) | Residue $HNO_3 - H_2O_2$ | Wool | | 0.70605 | 0.00002 |
| KF 900 | Modern Icelandic sheep wool (inland) | Residue $HNO_3 - H_2O_2$ | Wool | | 0.70626 | 0.00018 |

In the absence of typological, iconographic or tephrochronological bases for dating the grave, we ran AMS radiocarbon dates on two samples of wool from the woman's clothing, and on tissue from one of her teeth to estimate the time of her death, and to assess whether the clothes were contemporary with her burial, or were heirlooms interred with her as part of the ritual of clothing the dead. One of the textile samples (K12438-3) was removed from the strap; the second (K12438-4a) came from her apron. The dental collagen sample (K12433/4), provided by the National Museum of Iceland, was extracted at Durham University from a tooth that formed while the woman was 2–3 years old.

The samples were pre-treated to eliminate secondary carbon components (rootlets, humic acids, dyestuffs, formaldehyde, etc) from the wool matrix by washing in hot HCL, after which they were bathed in an alkaline (NaOH) solution to remove secondary acids, followed by a final acid rinse to neutralise the solutions before they were dried.[96] No solvent extractions were performed on these samples, as their records indicated that the textiles had never been conserved with petroleum-based conservation chemicals. After pre-treatment, the samples were processed to obtain dates and carbon and nitrogen isotope ratios ($^{13}C/^{12}C$ and $^{15}N/^{14}N$) for assessing the roles of maritime components in the diets of the woman and the sheep from which the wool was obtained.

The woman's apron (K12438-4a) produced a $^{13}C/^{12}C$ ratio of −23.1‰ and a conventional radiocarbon age of 1220 ± 30 bp (Beta-383363), while the sample from her strap (K12438-3) provided a $^{13}C/^{12}C$ ratio of −20.5‰ and a standard radiocarbon age of 1200 ± 30 bp (Beta-380903).[97] The tooth collagen sample (K12433/4) yielded a 13C/12C ratio of −19.9‰ and a conventional radiocarbon age of 1190 ± 30 bp.[98]

These three conventional radiocarbon dates were calibrated using OxCal v4.2.3,[99] and the r:5 IntCal13 atmospheric curve,[100] under the initial assumption that the sheep from which the wool was gathered had a primarily terrestrial diet and the limiting assumption that the woman, too, had had a largely terrestrial diet during the years when her tooth formed.[101] The calibrated ranges for these three samples, at one and two standard deviations with internal probabilities, along with their carbon and nitrogen-isotope ratios, are presented in Table 2.

A significant portion of the probability curves for these samples' calibrated ages is significantly earlier than the historically accepted date for Iceland's settlement, c AD 870–74. Across much of Iceland, a distinctive volcanic ash sequence, the 'Landnám Tephra Layer' (LTL), provides a robust geochronological horizon marker for the initial settlement of the country. Initially dated to 871 ± 2 AD in Greenland's GRIP ice core,[102] subsequent

[96] All three samples were submitted to Beta Analytic's laboratories in Miami, Florida, for AMS radiocarbon dating.

[97] Beta Analytic's conventional radiocarbon ages are reported as RCYBP following the modern reference standard of 95% the activity of the National Institute of Standards and Technology's Oxalic Acid (SRM 41990C), calculated using the Libby $^{14}C$ half-life of 5568 years. Measured $^{13}C/^{12}C$ ratios are calculated relative to the PDB-1 standard, with the conventional radiocarbon age representing the measured radiocarbon age corrected for isotopic fractionation using the delta $^{13}C$ value.

[98] Smith 2015, 40–1.

[99] Bronk Ramsey et al 2013.

[100] Reimer et al 2013.

[101] Walser 2015.

[102] Grönvold et al 1995.

TABLE 2

AMS radiocarbon dates and calibrations, along with carbon and nitrogen isotope ratios for the Ketilsstaðir burial. AMS date from the woman's tooth is presented both as originally received and calibrated under the assumption of a terrestrial diet, and also as modelled for a mixed marine/terrestrial diet, as described in the text. *By Kevin P Smith.*

| **Sample identification** | **Laboratory number** | **$\delta^{13}$C ‰** | **$\delta^{15}$N ‰** | **Radiocarbon age (BP)** | **1 sigma calibrated** | **2 sigma calibrated** |
|---|---|---|---|---|---|---|
| Apron K12438-4a | Beta-383363 | −23.1 | +1.9 | 1220 ± 30 | 726–738 cal AD (7.3%)<br>768–779 cal AD (7.9%)<br>789–870 cal AD (53.0%) | 692–748 cal AD (20.9%)<br>762–887 cal AD (47.7%) |
| Strap K12438-3 | Beta-380903 | −20.5 | +1.7 | 1200 ± 30 | 775–779 cal AD (3.4%)<br>788–873 cal AD (64.8%) | 715–744 cal AD (6.2%)<br>765–895 cal AD (87.8%)<br>928–940 cal AD (1.4%) |
| Tooth K12433/4 | Beta-407926 | −19.9 | +10.7 | 1190 ± 30 | 778–793 cal AD (11.0%)<br>800–878 cal AD (57.2%) | 722–740 cal AD (2.9%)<br>766–899 cal AD (89.0%)<br>924–945 cal AD (3.5%) |
| Tooth K12433/4 | Beta-407926 recalibrated as mixed marine/ terrestrial | −19.9 | +10.7 | 1190 ± 30 Estimated 12.9% marine carbon | 888–968 cal AD (68.2%) | 780–790 cal AD (2.0%)<br>805–845 cal AD (6.5%)<br>853–988 cal AD (86.9% |

identification of this tephra sequence in a second ice core (GISP2) suggested a minor revision to 877 ± 4 AD and, later, to 877 ± 1 AD.[103] To date, only three archaeological sites, all in extreme south-western Iceland, have produced cultural remains that clearly extend beneath this tephra layer — Húshólmi, Reykjavík and perhaps Hrísbrú.[104] In a recent reassessment of archaeological sites with tephra-controlled settlement dates, Magdalena Schmid, et al suggest that evidence for immediately pre-LTL settlements is found only in the south-western corner of the island and that large-scale settlement only commenced in other parts of the island after AD 877.[105]

At least five of the 14 known sites tephra-dated to the interval AD 877–938 are located in eastern Iceland. On this basis, we assume here that the earliest date for settlement and burial at Ketilsstaðir would have been just before or after AD 877 and therefore that only the most recent ends of the probability curves for the ages of the textiles and human remains from Ketilsstaðir are relevant for dating her grave. This suggests either that she was born before Iceland's settlement and her garments made from Icelandic wool were made very soon after Iceland's settlement, or that all three dates are depressed by a systematic factor, such as the marine reservoir effect.[106]

Terrestrial animals such as sheep, when grazed or foddered seasonally on coastal resources, can absorb limited amounts of old carbon by ingesting seaweed and water with $^{14}C$ derived from the oceanic carbon reservoir rather than terrestrial/atmospheric sources. To assess whether the sheep that produced the wool used for this woman's clothing had partially marine or fully terrestrial diets, we compared the ratios of two nitrogen isotopes ($^{15}N/^{14}N$ or $\Delta^{15}N$) and two carbon isotopes ($^{13}C/^{12}C$ or $\Delta^{13}C$) from the dated samples against reported values for these same ratios from living marine and terrestrial animals and archaeologically recovered faunal remains. The carbon-isotope values provide an index of terrestrial (lower $\Delta^{13}C$ values) versus marine (higher $\Delta^{13}C$) components in the diet, while $\Delta^{15}N$ values provide information on the trophic level of the organism.

Figure 10 plots our $\Delta^{13}C$ and $\Delta^{15}N$ values for the textile samples from Ketilsstaðir against comparable values for terrestrial and marine organisms. The $\Delta^{13}C$ and $\Delta^{15}N$ values for both of the textile samples are consistent with their production from the wool of sheep fed exclusively on a diet of terrestrial C3 grasses, and provide no evidence of foddering on seaweed.[107] Therefore, the systematic depression of the samples' dates due to the incorporation of marine carbon can be rejected as an explanation for these samples' early age estimates. Frei's strontium-isotope analysis of the woman's textiles indicates that they were woven from the wool of locally grazed Icelandic sheep. Assuming that settlers arrived with their sheep in eastern Iceland no earlier than c 880, the two dates from this woman's clothing suggest that they were woven from wool shorn in the interval AD 880–95.

Although the AMS date from the woman's tooth initially suggested that she was born before AD 900,[108] the $\Delta^{13}C$ and $\Delta^{15}N$ values from the crown of her tooth (−19.9‰ and

[103] Baillie and McAneny 2015; Sigl et al 2015.
[104] Schmid et al 2016; Schmid et al 2017; Roberts et al 2003, 224–5.
[105] Schmid et al 2017.
[106] Bowman 1995, 24–7; Cronin 2010, 35.
[107] For $\Delta^{13}C$ and $\Delta^{15}N$ values of Icelandic seaweed see Steinarsdóttir et al (2009).
[108] Smith (2015) initially reported calibrated results for this tooth on the assumption that the woman had a fully terrestrial diet at the time this collagen formed. Recalibration using the best practice models published by Cook et al (2015) provides a better basis for assessing this sample's age.

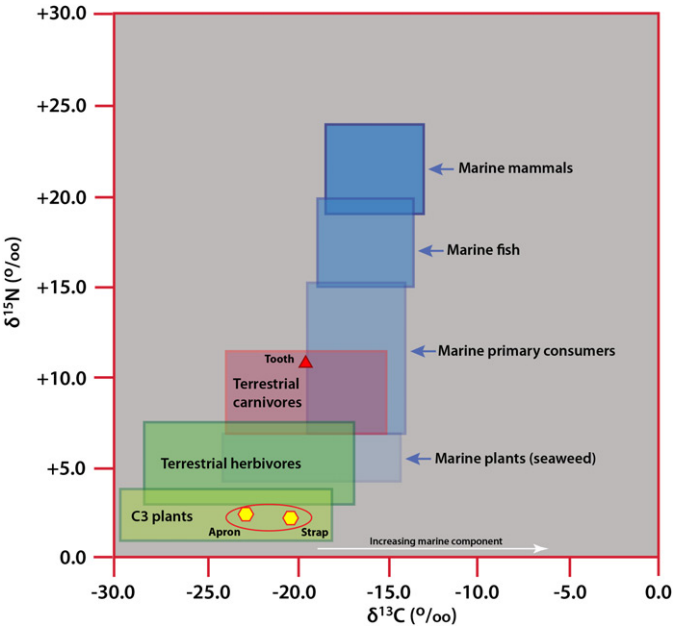


FIG 10
$\Delta^{13}C$ and $\Delta^{15}N$ values for the Ketilsstaðir woman's textiles (hexagons) and tooth (triangle). Values for both textiles analysed (apron and strap) match isotopic signatures for production from sheep grazing exclusively on terrestrial C3 plants (eg grasses) rather than from a mixed diet of terrestrial plants and seaweed (values from Steinsdóttir et al 2009). *Illustration by Kevin P Smith.*

+10.7‰, respectively) imply that she had had a mixed diet of marine and terrestrial animal products. In order to obtain an accurate calibration of the AMS date on this sample, we estimated the amount of marine carbon incorporated within the sample by applying Gordon Cook et al's linear extrapolation approach,[109] and Jette Arneborg et al's $\Delta^{13}C$ values of −12.5‰, for purely marine diets and −21‰, for purely terrestrial ones in the Norse North Atlantic as end points.[110] Integrating the carbon and nitrogen isotope ratios into Cook et al's formula, we calculated from this sample of collagen that the Ketilsstaðir woman's diet incorporated roughly 12.9% carbon from marine sources. This value indicated that recalibration of this date was required to reflect the input of carbon from both marine and terrestrial reservoirs.

Recalibrated as a mixed marine/terrestrial sample, using Philippa Ascough et al's ΔR value of 106 ± 10 $^{14}C$ yr for Iceland during the Viking Age,[111] this date was then incorporated into a Bayesian model incorporating a date of 877 ± 5 for the start of settlement in eastern Iceland (Fig 11).[112] This remodelling of the AMS date from the Ketilsstaðir woman's tooth

[109] Cook et al 2015.
[110] Arneborg et al 1999.
[111] Ascough et al 2007, 955. We recognise that this estimate of ΔR was developed for northern Icelandic marine contexts, but as the same current that mixes surface waters off nothern Iceland continues around Iceland's eastern coast, and as this value of ΔR also closely matches the mean value of ΔR for modern Icelandic surface waters (106 ± 89 years), we have applied Ascough et al's (2007) estimate in modelling the Ketilsstaðir woman's skeletal age as the best available estimate for ΔR in the absence of values locally developed for eastern Iceland in the Viking Age.
[112] Bayesian analysis, using phase and sequence parameters, done using OxCal v4.3.3, Bronk Ramsey (2017).

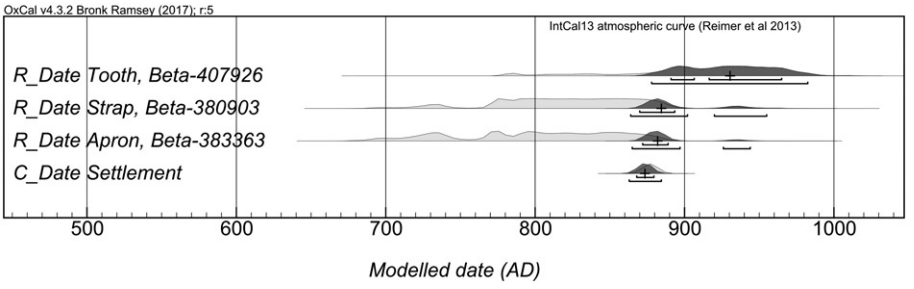


FIG 11
Calibrated AMS dates on textile samples (Beta-383363, apron and Beta-380903, strap) and tooth collagen (Beta-407926) from the Ketilsstaðir burial. The light grey probability distribution shows the full range of the calibrated dates prior to Bayesian analysis; the dark grey zones show predicted probability distributions under Bayesian analysis, constrained by prior assumptions that settlement began in eastern Iceland ca AD 877 ± 5. Brackets beneath these show the 1$\sigma$ (68.2%) and 2$\sigma$ (95.4%) ranges, with small crosses marking median ages within the Bayesian probability distributions. *By Kevin P Smith.*

suggests that she was born c 878–982 cal AD, with a 68.2% probability that the date of her birth was actually between 891 and 965 cal AD. This suggests some interesting considerations. If, theoretically, the median value for this recalibrated date (cal AD 930) approximates the time of her birth, and if she died at age 17–25,[113] then she would have been buried in the middle of the 10th century (c 945–955), meaning that the clothes she was buried in could have been woven well before she was born, and as many as 50–60 years before she was dressed in them for her burial. However, the spread of the dates on her clothes and her tooth, even under the limiting boundaries of Bayesian analysis, allow equally that she could have been born as late as the last quarter of the 10th century — nearly a century after her garments were woven — or as early as the last quarter of the 9th century, in which case they could have been just 10–20 years old, and her jewellery current, when she was clothed for her last event.

While the early 10th-century date, when recalibrated, does not allow any closer certainty about how old her garments were when she was buried in them, it is consistent with all other indications that she died during Iceland's Viking Age. Preliminary stable oxygen and strontium-isotopic data from her teeth may imply that she was born outside of Iceland, perhaps in the Hebrides or the northern islands of Scotland, and emigrated to Iceland at an early age.[114] In a recent review of strontium-isotopic evidence from dated Viking-Age Icelandic human remains, Orri Vesteinsson and Hildur Gestsdóttir concluded that although land was settled rapidly across Iceland during the late-9th century, immigration continued — at a slower pace — into the late-10th century.[115] The date on the young Ketilsstaðir woman's tooth is consistent with her arrival at any time during this period, yet the AMS dates on the clothes in which she was buried strongly suggest that she was either a very early immigrant, or a valued member of a community in eastern Iceland who dressed her for death in clothes that had been woven there, using the wool of sheep from local flocks, at the start of its settlement.

[113] See Walser 2015.
[114] See Walser 2015, 53. Fine-grained incremental isotopic analyses of her tooth enamel being carried out at Durham University are certain to provide more information on the timing and trajectory of these changes, may produce different interpretations of them and allow tighter resolution of this AMS date.
[115] Vésteinsson and Gestsdóttir 2016.

## DISCUSSION

### ORIGINS OF THE ITEMS OF DRESS

Viewing dress as a system of symbols to display social messages of cultural identity and affiliation, the woman from Ketilsstaðir's outfit presents an interesting amalgamation of northern dress styles and traditions, reflecting hybridity and acculturation. Significant aspects of her garments reflect standard Scandinavian dress traditions: the P52 oval brooches, the long *serk*-style undergarment, the linen which may have been imported, and her patterned twill apron with its tablet-woven starting border made from local Icelandic wool in a Norwegian style. Her amber bead, which probably came from the Baltic region, and even the ways these items were arranged on her body, suggest strong links to Norway and the dominant cultural groups emerging across the island during Iceland's Landnám period, c AD 870–930.

Other items are foreign, such as the glass beads of southern Mediterranean or Byzantine origin, all of which clearly link her to the world of the Viking Age. Recent research on Viking-Age material culture demonstrates Iceland's integration into trade networks that brought objects from as far away as Baghdad and central Asia.[116] The woman from Ketilsstaðir had access to these trade networks, either through travel — by herself or by members of her extended networks — or through contact with others who interacted with distant entrepôts and settlements in the British Isles or Scandinavia. Still other aspects of her dress link her to the British Isles, such as the weaving techniques employed in making her apron's straps and the jet or lignite bead from Whitby or southern Scotland.

But were these elements of her funerary ensemble made and put together by her, in anticipation of her death, buried with her because they were what she wore in life, or assembled by those who dressed her for the grave to communicate what she represented to them, or even what they were representing about themselves and their community? The dates we obtained on her apron imply that it and its straps were woven from the wool of sheep that had been raised and shorn in Iceland before AD 900 — within the first 20 years of Norse settlement in eastern Iceland. However, while the date obtained from her tooth could possibly imply that she died at approximately the same time as her clothes were made; it is statistically more likely that the woman from Ketilsstaðir died later in the 10th century.[117] If so, the garments she wore in death could well have been woven before she was born, and the choice to bury her in them — whoever made that decision — had to have been a very conscious one that was less likely to have been based on poverty (given the wealth represented by her jewellery) than on their value as heirlooms or emblems linking her to the period and multi-ethnic process of settlement itself.

Previous suggestions that this woman was born outside of Iceland, perhaps in the northern British Isles, but came to Iceland as a child are supported by these new analyses of her textiles and dress, which have also added important detail and nuance to our understanding of her identity. Regardless of her origins, her last steps were taken in Iceland,

[116] Zori and Byock 2014.

[117] Within the probability distributions constrained by the Bayesian model, using a date of AD 877 ± 5 for the start of settlment in eastern Iceland, the probability that the woman of Ketilsstaðir died between 880 and 910 is approximately 20%, while the probability that she died between 910 and 980 is closer to 75%.

where she was buried in Scandinavian style, with a mixture of objects reflecting both of the regions where she had lived. These objects and the style of her burial, therefore, clearly reflect the subtle dynamics that were being acted out between members of the dominant Scandinavian cultural stratum and others, potentially of British or Anglo-Saxon origin, within Iceland during the 9th and 10th centuries. While Iceland's saga tradition tends to portray non-Scandinavian settlers in subordinate roles, and primarily as Christians, this woman's burial in pure Scandinavian style and dress reflects a much more complex status and, perhaps, life history.

### COLOUR SYMBOLISM

In choosing items to display with her body, we note that her community's choices were not haphazard. Blue was used to dye key elements of her clothing, she had five blue beads, and the stone placed in or near her hands was chalcedony of an unusual light-blue colour. Blue is a common colour in Viking-Age burials. Penelope Walton Rogers identified textiles dyed deep blue with indigo or woad in Norwegian and Danish Viking-Age cemeteries.[118] In Iceland, too, blue is a colour commonly associated with death and burial.[119] Blue is a colour mentioned frequently in saga literature, and the philologist Kirsten Wolf has argued that blue and black semantically overlapped, with the term *blár* used to refer to a range of colours from the black of ravens to a range of lighter and darker blues.[120] In the Norse worldview these were not only the colour of ravens, but of Hel, the goddess of the realms of the dead, and of Óðin, not only king of the gods but also a master of death. In the *Laxdaela Saga*, among others, blue is worn by those intent on killing, and wearing a *blár* headdress was an expression of grief.[121] While cloth may have been dyed blue simply because woad grows well across Scandinavia and northern Europe, Walton Rogers suggests that blue may have been a colour reserved for burial and death,[122] and the differential placement of blue clothes in women's burials, relative to men's, supports this conclusion.

The blue items, and even the black jet bead, may therefore fall into a single culturally linked colour category; while the yellow-glass beads, the amber and the gold/bronze segmented beads probably refer to the colour gold. Wolf argues that gold (*gullr)* is often described as being red, although in Old-Norse Icelandic literature 'golden' was the primary term used to describe yellow.[123] Associations with *gullr* are less dark and foreboding than blue, and are associated in the Eddas with more beautiful things, such as 'The goddess Sif's hair more beautiful than gold' or the gold-adorned lady in *Helgakviða Hjörvarðssonar*.[124]

It is clear that, in terms of jewellery, gold was the preferred metal of the elite during and before the Viking Age; however, it was rare in Iceland, where silver formed a more integral part of the economy, with everything assessed in terms of its value in silver.[125] Nevertheless, most jewellery was made of bronze and gilded gold,

[118] Walton Rogers 1988, 19.
[119] Hayeur Smith 2015, 1.
[120] Ibid.
[121] Wolf 2009.
[122] Walton Rogers 1988, 19.
[123] Ibid.
[124] Ibid.
[125] Skre 2001.

allowing symbols of power and wealth to be cheaply mass-produced. The yellow beads, the segmented ones that would originally have been golden-coloured, as well as the amber bead and the silver segmented beads may all, therefore, refer to ideas about wealth.

## WHO WAS THE WOMAN FROM KETILSSTAÐIR?

Before this analysis it was assumed that this woman probably was a Norwegian immigrant, but it appears that her identity was more complex than this. Her burial reflects strong Scandinavian influences, with evident ties to Norway — which are not surprising given that later Icelanders linked their ancestors' colonisation primarily to emigration from Norway. The mortuary programme used for her burial was also similar to Viking-Age practices in western Norway,[126] although modest in scale, as is typical across most of Iceland.[127] Her dress styles, too, were modelled on Norwegian ones but with differences expressed in the details and the way in which the garments were made.

Her typically Norwegian textile styles were produced in Iceland with local (wool) and imported (woad) dyestuff. These link her to Iceland's dominant Norse stratum while other items, such as the ZS-spun 2/2 twill used as a strap to hold up her apron, and her jet beads, do not. In this, the burial from Ketilsstaðir is very similar to Scottish ones. The lead author has argued that the closest parallels to Icelandic burials were to be found in the British Isles,[128] where the choices in gravegoods placed inside the burial and the inclusion of insular material culture made them different from their Norwegian counterparts.[129] Across Iceland, the inclusion of hybrid Norse/native British artefacts, including Hiberno-Norse trefoil brooches or typically insular objects such as small bells, strap ends and belts, Irish ringed pins and jet or lignite jewellery mixed with Norwegian finds, creates a burial display unique to the North-Atlantic Norse colonies.[130]

The burials from Castletown in Caithness and Kneep on the Isle of Lewis are North-Atlantic hybrids similar to Ketilsstaðir. The grave in Castletown was of a woman found with a lignite or jet bracelet and contained the same brooch type as Ketilsstaðir, along with an additional bone pin, similar to examples from both Iceland and Scotland, to hold her garments in place.[131] The burial from Kneep is another example of these typical North-Atlantic inhumations, with a fully extended body accompanied by a pair of P51 oval brooches with mineralised textiles, 44 coloured and segmented glass beads, an antler comb, iron knife, whetstone, bone needle case, iron sickle and a Hiberno-Norse ringed pin,[132] as well as a matching buckle and strap end of bronze and leather decorated with nine studs that has a direct parallel at Kroppur, Iceland.[133] The burial of the woman from Ketilsstaðir belongs within this North-Atlantic continuum.

Did she come to Iceland as a freeborn person, or as a slave or concubine favoured by her Viking Norwegian master and given gravegoods appropriate for a well-to-do

[126] Brown 1971; 2013, 360–61; O'Shea 1984.
[127] Eldjárn and Friðriksson 2000, 610.
[128] Hayeur Smith 2004, 54.
[129] Hayeur Smith 2004.
[130] Fanning 1983; Welander et al, 1987.
[131] Batey 1995, 149; Hayeur Smith 2004.
[132] Ibid, 55.
[133] Welander et al 1987; Hayeur Smith 2004, 43.

Norwegian woman? Were her clothes older than she was herself? Were they heirlooms reflecting her diverse cultural makeup, or were they woven for her, or even by her — for use in life or in which to be buried?

Even without being able to answer these questions definitively, what can be said is that her dress and visual appearance suggest that she died as a well-to-do woman affiliated with the dominant Norse stratum in the new colony, and that she may have come from one of the Norse colonies in the Hebrides or Scotland, where settlers with a comparable dual background were found. Her dress shows strong ties to Norway as do her textiles, and her adornment connects her to the world of the Viking Age. Items such as the jet/lignite bead may have come from northern England or Scotland — possibly the place of her birth — while her textiles point toward an interesting amalgamation of strictly Norwegian textile traditions that could be imports or items made in Iceland but modelled on Norwegian prototypes, as Frei's strontium-isotopic work on her textiles demonstrates. Other features point toward weaving traditions from the British Isles. The woman from Ketilsstaðir displayed, in death, all of these interconnections and her burial now re-affirms Iceland's place and connections within the Viking-Age world, into which she was born, lived and died.

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*Résumé*

**«Emmitouflée de bleu»: la mort, les articles vestimentaires et l'identité d'une femme du début de l'ère viking à Ketilsstaðir, en Islande** *par* Michèle Hayeur Smith, Kevin P Smith *et* Karin M Frei

En 1938, des ouvriers de voirie ont découvert une sépulture de femme à Ketilsstaðir, dans le nord-est de l'Islande. Plus récemment, sa dépouille et le mobilier funéraire qui l'accompagnait ont été réexaminés par une équipe internationale et interdisciplinaire, et présentés dans le cadre d'une exposition qui a eut lieu au

Musée national d'Islande en 2015. Cet ouvrage examine les articles vestimentaires de cette femme pour obtenir des indices sur la manière dont son identité culturelle était exprimée au moment de sa mort. Nous explorons ici le rôle de la culture matérielle comme symbole de son identité, ainsi que les technologies et les réseaux d'échange par le biais desquels elle était reliée, sur le plan visuel, à la Scandinavie, aux Îles britanniques et plus largement au monde viking en général.

*Zussamenfassung*

**"Verwickelt in Blau": Tod, Gewand und Identität einer Siedlerin der frühen Wikingerzeit aus Ketilsstaðir, Island** *von* Michèle Hayeur Smith, Kevin P Smith *und* Karin M Frei

Im Jahr 1938 stießen Straßenbauer bei Ketilsstaðir in Nordostisland auf die Grabstätte einer Frau. Vor kurzem wurden ihre körperlichen Überreste und die Grabbeigaben von einem internationalen, multidisziplinären Team erneut untersucht und bildeten 2015 den Grundstock für eine Ausstellung im isländischen Nationalmuseum. Dieser Artikel konzentriert sich auf zwei Kleidungsstücke um einen Einblick darin zu erhalten, wie ihrer kulturellen Identität zum Zeitpunkt ihres Todes Ausdruck verliehen wurde. Wir beschäftigen uns hier damit, welche Rolle die materielle Kultur beim Signalisieren ihrer Identiät spielte, und über welche Technologien und Handelsnetzwerke das Erscheinungsbild dieser Frau mit Skandinavien, den Britischen Inseln und der Welt der Vikinger insgesamt verbunden war.

*Riassunto*

**'Avviluppata nel blu': morte, abbigliamento e identità di una donna immigrata del primo periodo vichingo da Ketilsstaðir, Islanda** *di* Michèle Hayeur Smith, Kevin P Smith *e* Karin M Frei

Nel 1938 a Ketilsstaðir, nel nordest dell'Islanda, gli operai che costruivano una strada portarono alla luce la sepoltura di una donna. Recentemente una squadra internazionale interdisciplinare ne ha riesaminato i resti e il corredo funerario associato che hanno costituito la base di una mostra al Museo nazionale dell'Islanda nel 2015. Questo studio si concentra sull'abbigliamento della donna per far luce sui modi in cui fu evidenziata la sua identità culturale al momento della morte. Indaghiamo qui sui ruoli avuti dalla cultura materiale nell'indicarne l'identità e sulle tecnologie e le reti commerciali che la collegavano, visivamente, alla Scandinavia, alle isole britanniche e al mondo vichingo in generale.