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# The Roles of Pit Houses and Gendered Spaces on Viking-Age Farmsteads in Iceland

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*THE SMALL SEMI-SUBTERRANEAN buildings (*jarðhús*) with slab-built ovens that have been found on many Viking-Age farmsteads in Iceland (late 9th–11th century) have been subject to wide-ranging interpretations, from short-lived, expedient dwellings to saunas, women's workrooms, the houses of Slavic settlers and in one case a cult building. This paper tests these hypotheses by making a thorough revaluation of pit-house dates, architectural forms, internal structural features and artefacts, and presents new geoarchaeological evidence from the pit house at Hofstaðir, NE Iceland. This lends strong support to the interpretation that they were women's workrooms, primarily for the production of woollen textiles. Their abandonment in the later 10th and 11th centuries may be interpreted in the light of changing religious beliefs and social structures, the growing importance of homespun cloth as a valuable export commodity, and the rise in status of the women who made it.*

In Viking-Age and medieval Iceland, the main arenas for everyday living, economic activities and social interactions were the buildings and outdoor spaces in the homefields of dispersed farmsteads. In addition to the main dwelling house (Icelandic *skáli*), each homefield contained a number of smaller outbuildings (*útihús*), as well as outdoor activity areas located between the buildings.[2] Several kinds of outbuildings have been excavated, including cattle byres, hay barns, sheep houses, smithies, structures of unknown function that have been interpreted as storage buildings and, more rarely, corn-drying kilns, lavatories and buildings containing hearths or cooking pits that appear to be specialised cooking buildings.[3] On Viking-Age farmsteads, it is also common to find one or more semi-subterranean buildings, known as *jarðhús* in Icelandic (literally 'earth houses') — a term that has variously been translated as 'pit houses', 'sunken huts', or 'sunken-featured buildings' (Fig 1). These buildings vary somewhat in their form, internal features, and the degree to which they are sunken,[4] but the buildings that concern us here are the most common type — small rectangular or near-square buildings that have a stone-built hearth or oven (*ofn*) against a wall or in a corner, which have usually been called 'pit houses'.

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[2] Outdoor activity areas have rarely been excavated, but open-area excavations at the Viking-Age farms of Vatnsfjörður and Sveigakot have revealed hearths, cooking pits, smithying areas and sheet middens; Milek 2011; Vésteinsson 2008.

[3] Berson 2002; Edvardsson and McGovern 2007; Hermanns-Auðardóttir 1989; Lucas 2009.

[4] Vésteinsson 2008.



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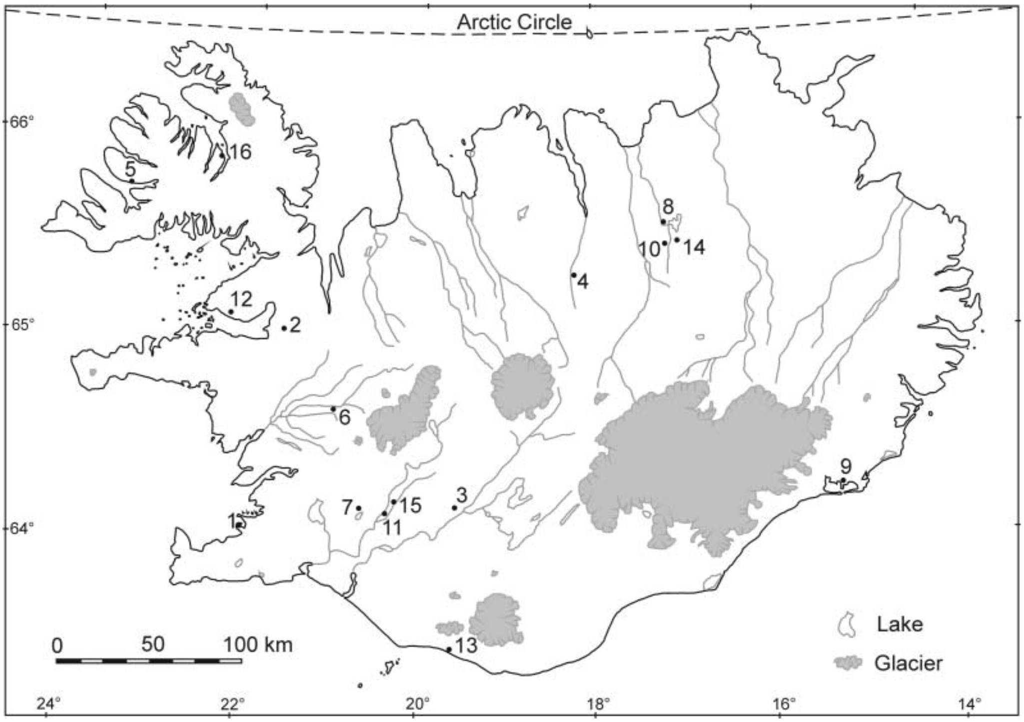


FIG 1

Map of Iceland, showing the locations of all pit houses excavated to date. **1** Bessastaðir. **2** Eiríksstaðir. **3** Gjáskógar. **4** Granastaðir. **5** Grelutóttir. **6** Háls. **7** Hjálmsstaðir. **8** Hofstaðir. **9** Hólmur. **10** Hrísheimar. **11** Hvítárholt. **12** Ljótólfsstaðir. **13** Stóraborg. **14** Sveigakot. **15** Tjaldbúð. **16** Vatnsfjörður. © *K Milek.*



Pit houses on Icelandic farmsteads date to the late 9th–11th century (Tab 1; Fig 2). Different types of semi-subterranean buildings continued to be used into later medieval and post-medieval periods at seasonal trading sites such as Gásir, in N Iceland,[5] but pit houses on farmsteads went out of use by the 12th century, suggesting that on a country-wide scale household activities underwent widespread reorganisation during the late 10th–11th century. An understanding of this restructuring of socio-economic space on farms, and the possible relationship between this farm-level reorganisation and wider social and economic changes occurring in Iceland, relies on a good understanding of how pit houses were used, and by whom. However, as will become clear below, interpretations of these buildings have been very wide-ranging and often mutually exclusive. Following a brief review of the interpretations that have been put forward to date, this paper presents the results of an interdisciplinary study of Icelandic pit houses, including a reassessment of the archaeological evidence and new geoarchaeological and microrefuse data from the pit house excavated at Hofstaðir, in NE Iceland, in order to shed new light on the activities that took place in these buildings and their roles as social and economic spaces for Viking-Age households.

[5] Harrison et al 2008; Roberts 2005.

TABLE 1
Dating evidence for pit houses in Iceland.

| Site/Building | Tephro-chronology[6] | Datable artefacts[7] | $^{14}C$ lab reference | $^{14}C$ sample context | Material dated[8] | $^{14}C$ age (bp) | $\delta^{13}C$ (±0.2‰) | Calibrated date (AD) 1 σ range[9] | Calibrated date (AD) 2 σ range[9] |
|---|---|---|---|---|---|---|---|---|---|
| Bessastaðir H20[10] | >V-871 | VA b | SFUICE-1 | House 19 above | • | 1020±30 | n/a | 991–1026 | 902–1148 |
| | | >AD 915 | SFUICE-2 | House 19 above | ◆ | 1020±40 | n/a | 974–1040 | 897–1153 |
| | | | SFUICE-3 | House 19 above | ◆ | 1080±30 | n/a | 899–1011 | 894–1018 |
| Gjáskógar[11] | <H-1104 | VA sw in house above | | | | | | | |
| Granastaðir 3[12] | >V-871 | VA sw | Kl-3254 | Floor | ■ | 1070±49 | n/a | 899–1018 | 827–1116 |
| | | | Kl-3235 | Behind turf wall | ■ | 1170±90 | n/a | 772–974 | 678–1016 |
| Grelutóttir I[13] | | | U-2899 | Corner oven | ■ | 1015±70 | n/a | 901–1152 | 884–1206 |
| Grelutóttir II[13] | | | U-2900 | Corner oven | ■ | 1070±65 | n/a | 895–1021 | 779–1151 |
| Háls 6A[14] | >V-871 | VA b in fill | Beta-147719 | Infill | ■ | 1150±90 | –27.6 | 779–978 | 675–1024 |
| | | | Beta-147718 | Floor | ■ | 1180±40 | –26.2 | 779–891 | 716–971 |
| Hjálmsstaðir[15] | >V-871 | VA sw | | | | | | | |
| Hofstaðir G[16] | >V~940 | VA c | SUERC-3432 | Midden infill | □ | 1040±40 | –21.5 | 906–1026 | 893–1118 |
| | <H-1104 | | SUERC-3433 | Midden infill | ○ | 1030±35 | –21.1 | 982–1027 | 896–1148 |
| | | | Beta-124004 | Midden infill | ○ | 1170±40 | –21.4 | 780–937 | 725–976 |
| | | | SUERC-8618 | Midden infill | ○ | 1110±40 | –21.0 | 894–980 | 783–1018 |

[6] < structure pre-dates tephra layer; > structure post-dates tephra layer. Dates of tephra layers are prefaced by the standard letter used to designate the volcano of origin. ~ represents an estimated date. The dating of V-871, the so-called *landnám* tephra layer, follows the analysis of the GRIP ice core by Grönvold et al 1995 but note that the analysis of the GISP2 ice core by Zielinski et al 1997 gives an alternative date of 877±4. The dating of the geochemically similar Veiðivötn-Dyngjuháls tephra layer to c AD 940 follows Sigurgeirsson et al 2008, but recent work suggests that this tephra, which may soon be named V-Sv, formed in AD 930–40 (Anthony Newton pers comm). The identification of H-1104 follows Þórarinsson 1968.

[7] > terminus post quem date. 'VA sw' Viking Age spindle whorl(s); 'VA b' Viking Age bead(s); 'VA c' Viking Age comb(s); 'VA gp' Viking Age gaming piece(s). The typology and dating of beads follows Callmer 1977 and Hreiðarsdóttir 2005. The dating of combs follows Ambrosiani 1981, Flodin 1989, MacGregor et al 1999 and Wiberg 1977, 1979 and 1987. According to Høigård-Hofseth 1985, Øye 1988 and Smith et al 1999, in the N Atlantic region similar spindle whorl forms are found throughout the Viking and medieval periods.

[8] ■ birch charcoal; • barley grain; ◆ chickweed seed; ○ cattle bone; □ pig bone; [] sheep/goat bone.

[9] Radiocarbon dates were recalibrated by the author using OxCal 4.1 by Bronk Ramsey 2009 using the IntCal 09 calibration curve with atmospheric data from Reimer et al 2009.

[10] Nelson and Takahashi 1999; Garðar Guðmundsson pers comm.

[11] Eldjárn 1961. Note that Vilhjálmsson 1989 suggests this tephra layer observed at Gjáskógar was redeposited after AD 1104.

[12] Einarsson 1995; Einarsson 1992.

[13] Ólafsson 1980; Guðmundur Ólafsson pers comm

[14] Two anomalously old dates from Háls 6A have been omitted since they are considered by the excavator to derive from birch twigs in peat ash; Kevin Smith pers comm.

[15] Ólafsson 1992.

[16] Lucas 2009.

TABLE 1
*Continued*

| Site/Building | Tephro-chronology[6] | Datable artefacts[7] | $^{14}$C lab reference | $^{14}$C sample context | Material dated[8] | $^{14}$C age (bp) | $\delta^{13}$C (±0.2‰) | Calibrated date (AD) 1 σ range[9] | Calibrated date (AD) 2 σ range[9] |
|---|---|---|---|---|---|---|---|---|---|
| Hofstaðir cont'd | | | SUERC-8619 | Midden infill | ○ | 1110±30 | –20.9 | 895–976 | 880–1014 |
| | | | SUERC-8623 | Midden infill | ○ | 1130±35 | –21.1 | 886–973 | 781–990 |
| | | | SUERC-8624 | Midden infill | ○ | 1080±35 | –21.2 | 899–1012 | 893–1019 |
| | | | SUERC-3429 | Midden infill | ○ | 1160±35 | –21.2 | 782–945 | 777–972 |
| | | | Beta-149404 | Primary collapse | ○ | 1130±40 | –21.5 | 881–980 | 780–991 |
| Hólmur[17] | >V-871 | VA sw | T-13781 | Overlying layer | ■ | 1245±40 | –28.2 | 687–855 | 676–880 |
| | | | Beta-109905 | Floor | ■ | 1070±40 | –30.4 | 900–1018 | 891–1024 |
| | | | Beta-143634 | Corner oven | ■ | 1200±60 | –27.6 | 715–894 | 681–971 |
| | | | Beta-143635 | Corner oven | ■ | 1450±70 | –27.4 | 547–655 | 430–679 |
| Hrísheimar C, H[18] | >V-871 | | AA-49627 | Midden infill | ○ | 1150±35 | –20.7 | 784–968 | 779–976 |
| | <V~940 | | AA-49628 | Midden infill | ○ | 1135±45 | –21.0 | 870–982 | 778–993 |
| | | | AA-49629 | Midden infill | ○ | 1135±45 | –20.2 | 870–982 | 778–993 |
| Hvítárholt I[19] | | | K-1244 | Floor/hearth? | ■ | 890±100 | n/a | 1039–1217 | 905–1286 |
| Hvítárholt V[19] | >V-871 | | | | | | | | |
| Hvítárholt X[19] | | VA gp, b in house above | | | | | | | |
| Stóraborg 36[20] | | VA b in fill | | | | | | | |
| Sveigakot MT2[21] | < V~940 | | | | | | | | |
| Sveigakot T1[22] | | | Beta-146583 | Midden infill | ○ | 1040±40 | –22.7 | 906–1026 | 893–1118 |
| | | | Beta-146584 | Midden infill | ○ | 1010±40 | –21.5 | 983–1146 | 900–1155 |
| | | | SUERC-27399 | Late phase floor | ○ | 1060±30 | –20.8 | 905–1019 | 896–1024 |
| | | | SUERC-27401 | Early phase floor | [] | 1100±30 | –21.2 | 897–985 | 887–1014 |
| Vatnsfjörður 10[23] | | VA sw in layers above | | | | | | | |

[17] Einarsson 2008.
[18] Edvardsson 2003, 2005; Edvardsson and McGovern 2007; McGovern and Woollett 2003; Mike Church and Thomas McGovern pers comm
[19] Magnússon 1973; Tauber 1968. Tauber's $^{14}$C dates are attributed to a "semi-subterranean building, perhaps a bathhouse, beside building of K-1243", and it can therefore be deduced that the material came from Pit House 1, the only pit house excavated in 1963, when sample K-1243 was taken.
[20] Snæsdóttir 1992.
[21] Urbańczyk 2006; Orri Vésteinsson pers comm.
[22] Vésteinsson 2001, 2002, 2003, 2004; Orri Vésteinsson pers comm.
[23] Gísladóttir 2008a.

## FORMER INTERPRETATIONS OF THE FUNCTIONS OF PIT HOUSES

When the first pit houses in Iceland were found by Thorsteinn Erlingsson and Þór Magnússon, they interpreted the buildings as *baðstofa* (literally 'bathrooms') based on the presence of ovens and heated stones, which could have been used to create steam.[24] This interpretation was heavily influenced by the unique description of a sunken building used as a steam sauna in the 13th-century *Eyrbyggja saga*,[25] and there is no other literary or historical evidence to suggest that bathing was done in a specialised building. In her review of references to *baðstofa* and bathing in medieval Icelandic texts, Nanna Ólafsdóttir argued convincingly that the term *baðstofa* referred to a living room rather than a specialised bathroom, and that 'bathing' in the modern sense of a full-body bath or steam bath probably never occurred in these rooms.[26] While many archaeologists now dismiss the bathhouse theory in light of the artefacts and animal bones commonly found in pit houses,[27] others have continued to propose that bathing could have been one of their functions.[28]

One of the earliest explanations for the small size and semi-subterranean character of pit houses, and the one which is still favoured by many archaeologists, is that they were the first, temporary dwellings built by the earliest settlers. Kristján Eldjárn proposed this following his excavation at Gjáskógar, where he found the pit house below a later, larger dwelling house.[29] Other archaeologists have argued that pit houses are associated with the earliest settlement phases, and that their small size, simple design and semi-subterranean character would have made them relatively quick and easy to build compared to the larger ground-level dwellings.[30] The argument follows that they were only occupied for a short period of time, and were later put to more peripheral use, or abandoned altogether, while their function as a dwelling was replaced by oblong, ground-level longhouses.[31]

Re-evaluation of the evidence related to the stratigraphic phasing and short duration of use of pit houses follows below, but it should be noted from the outset that the internal organisation of pit houses differs markedly from the main residential buildings: they are not simply smaller, temporary versions of longhouses. The most striking difference between them is the form of the fireplace and its location. While the large ground-level dwellings have long, central, open hearths, the pit houses being considered here have fireplaces against one wall or in a corner and these are almost always enclosed ovens made from upright stone slabs. Since the type of heating facility and its location have a profound effect on how space in a building is used, the presence of enclosed corner ovens has led some scholars to suggest that pit houses were unlikely to have functioned as the main dwelling, or else were dwellings for groups of people who had different ideas about how their living space should be organised and used.

It is this latter idea — that pit houses may have been the dwellings of a distinct cultural group — that has recently been at the forefront of the pit-house debate. Przemysław Urbańczyk, noting similarities in the design of Icelandic pit houses and Slavonic semi-sunken houses with corner stone ovens, suggested that Icelandic pit houses were built by a first generation of Slav settlers before they were culturally assimilated by the dominant Norse population.[32] He argued that Icelandic pit houses were so similar to Slavonic

[24] At Eiríksstaðir and Ljótolfsstaðir: Erlingsson 1899, 57–93. At Hvítárholt: Magnússon 1973.
[25] Pálsson and Edwards 1989, 78; and see Guðmundsson 1889 for interpretations drawn from this description.
[26] Ólafsdóttir 1974.
[27] Eg Einarsson 1992.
[28] Ólafsson 1992.
[29] Eldjárn 1961; Eldjárn 1974.
[30] Einarsson 1992; Friðriksson and Vésteinsson 1997; Vésteinsson 2000.
[31] Vésteinsson 2000, 168.
[32] Urbańczyk 2002a; Urbańczyk 2003b.

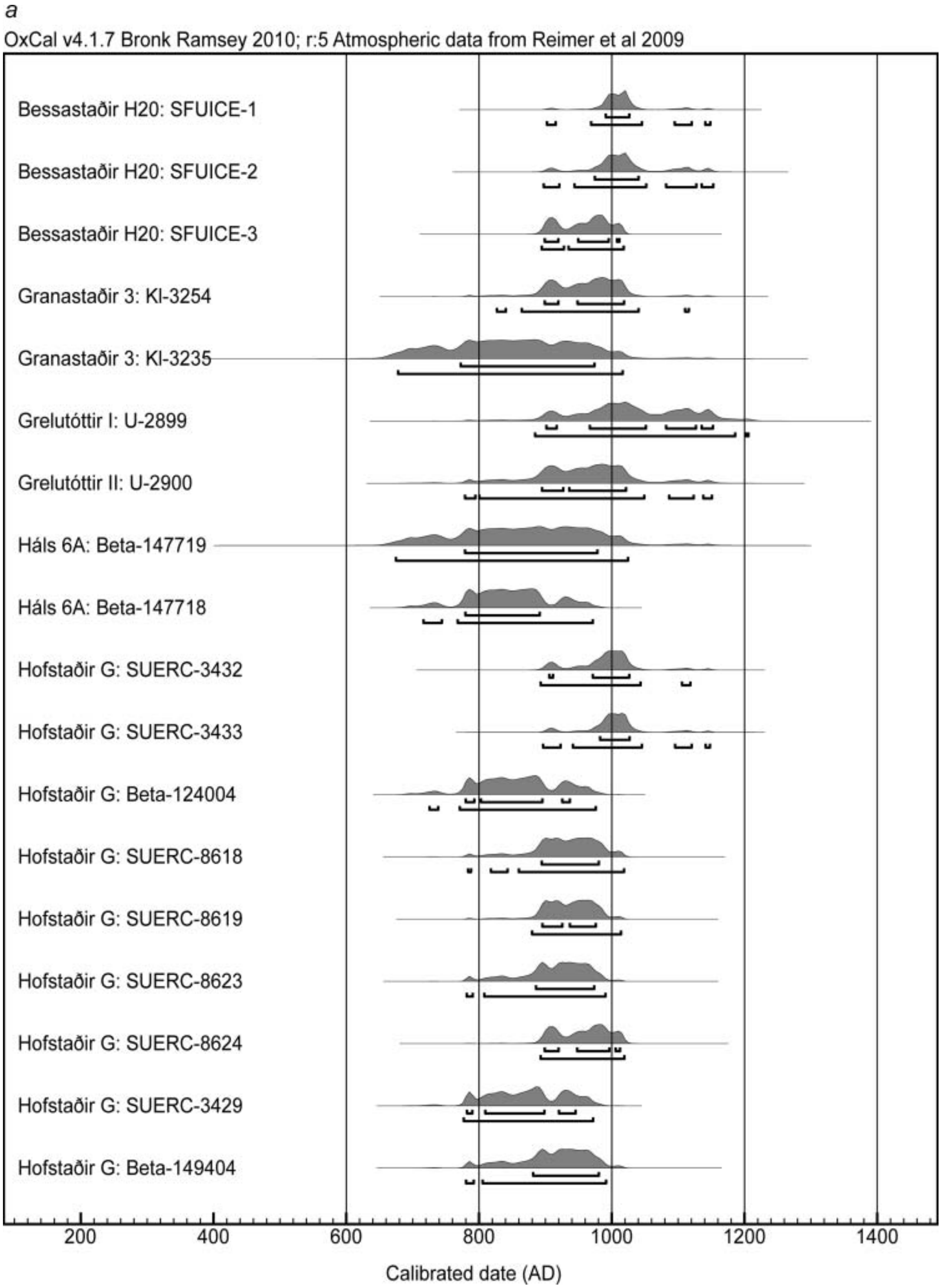


FIG 2
Radiocarbon dates for pit houses in Iceland.

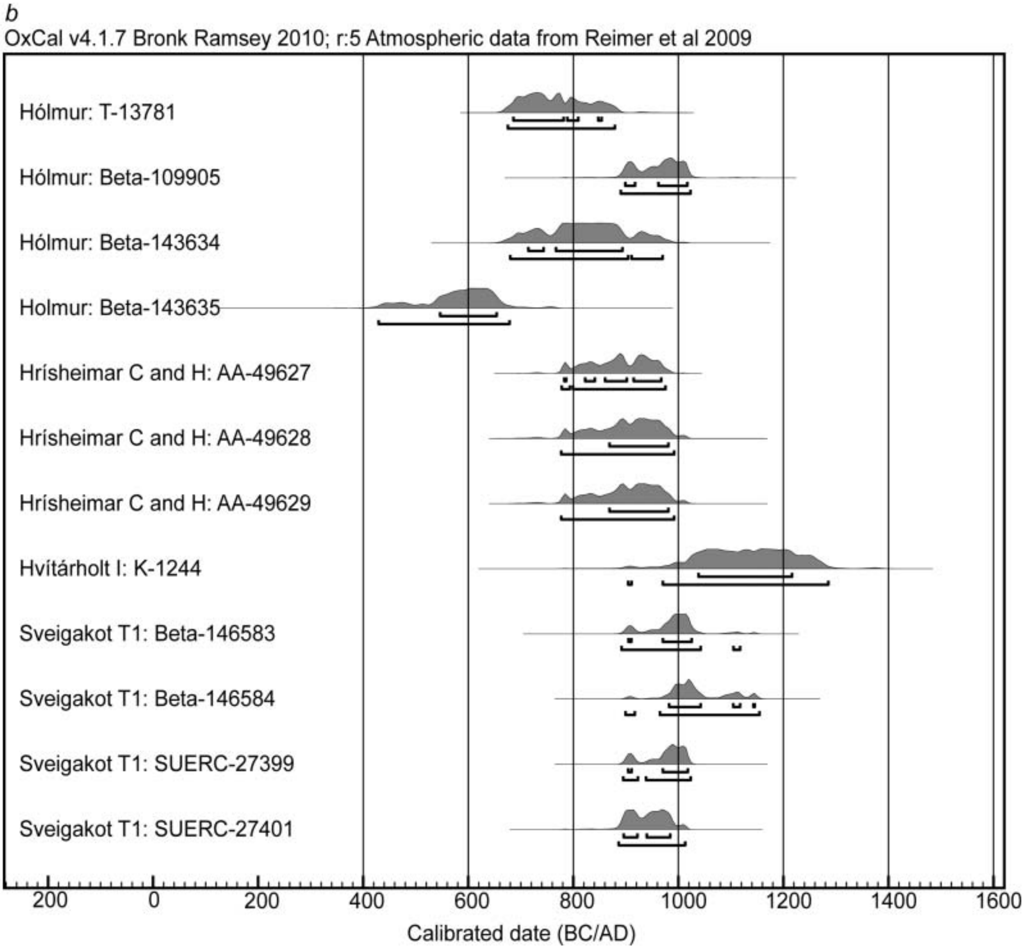


FIG 2
*Continued.*



houses, and so different from contemporary Germanic pit houses (German *Grubenhäuser*, Danish *grubehuse*, Norwegian and Swedish *grophus*), which are rarely found with corner ovens, that they must have been built by Slavs or people who had grown up among Slavs and were accustomed to building and living in such dwellings.

Although Icelandic pit houses do share many characteristics with Slavonic sunken-floored houses, particularly those of the Prague-type culture of central and south-eastern Europe, the Slavonic versions date to the 6th–8th centuries, were squarer than Icelandic pit houses and have common features in them that are absent in Icelandic pit houses, such as hearthside vessels set into the floor.[33] Moreover, since semi-subterranean buildings with stone-built corner ovens were also common in northern Germany and Scandinavia during

[33] Donat 1980; Gojda 1991, 85–7; Ježek et al 2002; Kobyliński 1997, 100; Kuna 2005; Ruttkay 2002; Takács 2002.

the Migration and Viking periods, where they were used as workshops for craft production,[34] this building type would not have required Slavic immigrants to reach Iceland. Since Slavs and southern Scandinavians were in contact well before the Viking Age, and these contacts intensified with trade across the Baltic during the 8th–9th centuries, Slavonic sunken-floored buildings with corner ovens may indeed have been the forerunners of the Scandinavian ones.[35] It is for this reason that the building type is often classified as a 'Slavonic-type sunken-floor hut' when found on Scandinavian excavations, although Sten Tesch has argued convincingly that this term should not be used because their form is more similar to the buildings found in the Germanic sphere of their distribution on the continent.[36] Bjarni Einarsson has also drawn attention to the Sami Iron Age (AD 1–1700) pit houses in Finmark, some of which have a hearth in one corner.[37] Whether the influence for this building type came from the north or the south, by the late 9th century when Iceland was being settled this building type was part of a repertoire of buildings being used throughout Scandinavia. While it is feasible that there were some Slavs among the population that settled Iceland, pit houses are such a common feature on Icelandic Viking-Age farms that if this building type were attributed to Slavic immigrants, it would indicate the presence of a Slav on at least 50% of farms. Considering that there has so far been a lack of Slavonic material culture in Iceland, and there are no Slavonic place names or personal names mentioned in the literary sources, it is unlikely that more than a few Slavs found their way to Iceland in this period.

The idea that Icelandic pit houses may have functioned as women's work places was first put forward by Guðmundur Ólafsson following his excavation of the pit houses at Grelutóttir and Hjálmsstaðir, which contained several spinning and weaving implements.[38] He concluded that the pit house functioned primarily as a *dyngja*, the term used in one late 9th-century poem and the 13th- and 14th-century Icelandic sagas and Norwegian farm inventories as the place where women spun wool, wove textiles, sewed and nursed small children.[39] Barbara Crawford and Beverley Ballin Smith came to the same conclusion in their review of Icelandic pit houses, and attributed the same term to the sunken building they excavated at the Biggings, on Papa Stour, Shetland.[40] However, the Old Norse (ON) written sources do not actually mention the physical appearance of the *dyngja*, other than the fact that they were either a separate building or a separate room in the house, that they had windows and furniture for sitting, and were warm.[41]

Bjarni Einarsson proposed that the pit house at Hólmur, in SE Iceland, was a *blót* house where pagan cult activities took place.[42] In its form and associated artefacts the building at Hólmur is similar to other pit houses, and his interpretation of the building as a cult building is based on its context: its close proximity to a putative Viking-Age grave and other deposits that he interpreted as the remains of ritual activities. However, the building was stratigraphically *below* the cultural layers that Einarsson associated with cult

[34] Eg Kosel in Schleswig-Holstein, Uldal in Jutland, Vindinge and Margrethehåb in Zealand, Helgö, Lilla Köpinge, Löddeköpinge, Stora Köpinge, Tankbåten, Valleberga, Vä and Sanda in mainland Sweden, Övra Wannborga on Öland, Valum and Stedje in Norway; Åqvist 1992; Christensen 1990; Fallgren 1994; Göthberg 2000, 87; Hinz 1989, 80–3; Meier and Reichstein 1984; Mortensen 1997; Pilø 2005, 115; Rieck 1982; Schmidt 1994, 38; Tesch 1993.

[35] Schmidt 1994, 161; Duczko 1997.

[36] Tesch 1993, 130–1.

[37] Einarsson 1992.

[38] Ólafsson 1980; Ólafsson 1992.

[39] Guðmundsson 1889, 244–5; Jochens 1995, 138; Magerøy 1958; Magnússon 1886.

[40] Crawford and Ballin Smith 1999.

[41] Bek-Pedersen 2008, 174; Guðmundsson 1889, 244; Magerøy 1958; Magnússon 1886.

[42] Einarsson 2008.

activities.[43] Moreover, the interpretation of this pit house as a pagan cult building was heavily influenced by ON written references to *blóthus*, *hof* or *hörgur*, where activities associated with offerings and sacrifice took place,[44] but the texts provide no physical descriptions of cult buildings and there is no suggestion that they were semi-subterranean.

These five different interpretations of Icelandic pit houses suggest that buildings of a very similar form had wide-ranging functions or that the interpretations need to be re-evaluated in light of new archaeological evidence. In the following sections, a multi-disciplinary, comparative approach is used to interpret how pit houses were used.

## DISTRIBUTION AND ARCHAEOLOGICAL CONTEXTS

A total of 24 pit houses have now been found on 16 different Viking-Age sites in Iceland, with up to five pit houses found at a single site. Although their distribution is concentrated in the W, SW and NE parts of the country, where the majority of excavations have taken place, it is clear from the distribution map (Fig 1) that they are not restricted to any one region, or to coastal or inland areas, and they appear to have been common throughout Iceland. Of the 26 farm sites in Iceland where longhouses have been at least partially excavated, and that can with certainty be dated to the Viking Age, 13 have pit houses, while the farmsteads that apparently lack pit houses have been only partially excavated. The recently discovered pit houses at Vatnsfjörður, Sveigakot and Hrísheimar had been infilled and were therefore invisible on the ground surface; they would never have been found if the excavators had not been using open-area excavation methods, which are a fairly recent introduction to Icelandic archaeology. Until more Viking-Age farmsteads are fully excavated, the evidence suggests that most 9th- to 11th-century farmsteads in Iceland probably included a pit house.

The majority of pit houses —15 out of the 24 — were located on farm sites with large dwelling houses that were probably contemporary. Only rarely is there demonstrable stratigraphic evidence that pit houses predated the construction of the larger dwellings. At Sveigakot, the earliest dwelling on the Viking-Age farm was indeed a semi-subterranean building, P1, but this contained a series of ephemeral, shifting, centrally located hearths.[45] At Hrísheimar the earliest structure, S, did not contain a hearth at all, but was in the form of a rectangular depression with its long sides lined by two rows of inward-slanting postholes — probably a small A-frame hut or even a tent-like structure.[46] Only two pit houses with the slab-built ovens, the one at Gjáskógar and Hvítárholt X, are directly surmounted by a large dwelling house, and the one at Hvítárholt could easily have been contemporary with one of the other large dwelling houses on the site, of which there were three. The Viking-Age middens that infill pit houses Hofstaðir G, Sveigakot T1 and Hrísheimar C and H provide dates that span the late 10th–11th centuries, and can only verify that the pit houses were definitely abandoned by that date, not that they were constructed as temporary dwellings by Iceland's first settlers (Tab 1). The typologies and radiocarbon ($^{14}C$) dates of material recovered from occupation deposits in pit houses consistently overlap with those of the longhouses on the same site. At Hjálmstaðir, Hrísheimar, Ljótólfsstaðir and Stóraborg, where no large dwelling houses contemporary with the pit houses were investigated, the sites had only been partially preserved or excavated. The evidence therefore points to pit houses as a common component of Viking-Age farms, where they were one of several possible types of outbuildings.

[43] Einarsson 2008, 161, fig 12.
[44] Einarsson 2008, 149–55.
[45] Gísladóttir 2008b.
[46] Edvardsson and McGovern 2007.

There are three apparent exceptions to the rule that pit houses were located on farms: Gjáskógar, Háls and Hólmur.[47] Gjáskógar and Háls were upland sites and, based on the pit houses' association with slag and charcoal, their excavators proposed that they were periodically inhabited by one or two people from nearby farms who were sent out to these sites during the iron-extraction season in order to exploit the available woodland to produce the charcoal needed to smelt bog iron. The pit house at Hólmur, which is also associated with a deposit of slag and iron bloom, is likely to have functioned in the same way.

## PIT HOUSE FORMS, ASSOCIATED FEATURES AND FINDS

### CONSTRUCTION METHODS

Of the 24 pit houses excavated in whole or in part, 21 have sufficiently detailed records to make it possible to compare their size, form and internal features (Tab 2, Figs 3–8). The pits were dug down 0.3–1.4 m from the original ground surface, and in a couple of cases had been built into a slope so that one end of the structure was deeper than the other (Eiríksstaðir and Hrísheimar H). Granastaðir 3 is so far the only pit house to have a narrow turf-built revetment wall on the inside of the cut (Fig 3c).[48] However, at Vatnsfjörður, where the pit house had to be dug into underlying gravels, strips of turf had been placed along the edges of the cut, possibly to prevent the gravel from slumping, and at Hvítárholt I and Ljótólfsstaðir stone slabs were propped up against the walls, presumably for the same purpose (Fig 4f).[49]

In the vast majority of cases, turf walls were not found in association with pit houses, suggesting that timber walls were the norm. Háls 6A and Hrísheimar C, the only exceptions, had turf walls on the ground surface, ringing the edges of the pits.[50] The turf ring wall surrounding Hofstaðir G could not have functioned as a structural wall because it was set back 0.5–1.0 m from the edge of the pit; the pit house was essentially a sunken timber building ringed by a sheltering turf wall (Fig 8a).[51] This timber-walled construction method is in contrast to the walls of the main dwelling houses and other outbuildings on Icelandic farmsteads, which are invariably constructed of turf c 1.5 m thick, sometimes with a stone lining at their base. The tendency for pit houses to have timber walls was therefore a deliberate choice, and it must be related in some way to the function of the building. Since timber walls are much less insulating than turf, but make it possible to have windows, I propose that windows for light and/or air circulation were needed for the tasks carried out in the buildings.

Since most of the pits were 0.5–1.0 m deep, the structures were semi-subterranean and it can be assumed that their walls rose 1.5 m or more above the edges of the pits. At Granastaðir 3, Sveigakot T1 and MT2, and Hrísheimar H access into the pit was gained via a short ramp, for which a cut had been made in one corner of the house.[52] However, in 81% of cases there was no cut for the entrance and access into the pit must have been gained via wooden steps descending from a ground-level door. The ring wall around

[47] Einarsson 2008; Eldjárn 1961; Smith 1995; Kevin Smith pers comm. Note that Gjáskógar and Háls become farms in the high medieval period.
[48] Einarsson 1992; Einarsson 1995.
[49] Erlingsson 1899, 58; Magnússon 1973, 16.
[50] Kevin Smith pers comm; Edvardsson and McGovern 2007.
[51] Lucas 2009.
[52] At one stage Sveigakot T1 and MT2 were connected by a short corridor that ramped upwards between them; Urbańczyk 2006, 37.

TABLE 2
Dimensions of and features associated with pit houses in Iceland.

| **Site and pit house** | **Dimensions** | | | **Features**[53] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Dimensions (m)** | **Internal area ($m^2$)** | **Depth from ancient ground surface (m)** | **Entrance** | **Corner/side fireplace** | **Platform(s) along wall(s)** | **Stacked stone construction** | **Stone pavement** | **Drain** | **Stakeholes in floor** |
| Bessastaðir 20[54] | – | – | – | – | – | – | – | – | – | – |
| Eiríksstaðir[55] | 3.0 × 3.0 | 9.0 | 0.3–0.5 | | 1 | 2 | | 1 | | ✓ |
| Gjáskógar[56] | 3.4 × 5.5 | 18.7 | – | | 1 | | | 1 | | |
| Granastaðir 3[57] | 2.9 × 3.6 | 10.4 | 0.92 | 1 | 1 | 2 | | 1 | | 50 |
| Grelutóttir I[58] | 2.5 × 4.2 | 10.5 | 1.20 | | 1 | 3 | 1 | | | |
| Grelutóttir II[58] | 2.4 × 3.9 | 9.4 | 1.20 | | 1 | 3 | 1 | 1 | | 5 |
| Háls 6A[59] | 2.8 × 3.8 | 10.6 | 0.45 | | 1 | | | 1 | | – |
| Háls 6B[59] | – | – | – | – | – | – | – | – | – | – |
| Hjálmsstaðir phase 2[60] | 2.9 × 5.0 | 14.5 | 0.60 | | 1 | 3 | | 1 | | 33 |
| Hjálmsstaðir phase 1[60] | 2.9 × 5.0 | 14.5 | 0.80 | | 1 | 1 | | 1 | | 200 |
| Hofstaðir G[61] | 3.4 × 5.0 | 17.0 | 1.10 | | 1 | 1 | | | | 77 |
| Hólmur[62] | 2.0 × 2.2 | 4.4 | 0.75 | | 1 | | | | | 14 |
| Hrísheimar C[63] | 2.7 × 3.0 | 8.1 | 0.4–0.5 | | 1 | | | | | 87 |
| Hrísheimar H[64] | 2.6 × 5.0 | 13.0 | 0–0.50 | 1 | 1 | | | | 1 | |
| Hvítárholt I[65] | 2.6 × 3.8 | 9.9 | 0.90 | | 1 | | | 1 | 1 | 8 |
| Hvítárholt IV[65] | 2.4 × 3.1 | 7.4 | 0.60 | | 1 | 2 | | | | 15 |
| Hvítárholt V[65] | 2.2 × 3.9 | 8.6 | – | | 1 | 1 | | | | 5 |
| Hvítárholt VII[65] | 2.8 × 3.8 | 10.6 | 0.90 | | 1 | 1 | | | | 4 |
| Hvítárholt X[65] | 2.4 × 3.8 | 9.1 | >0.4 | | 2 | | | | | 4 |
| Ljótólfsstaðir[66] | 3.7 × 4.3 | 15.9 | – | | 1 | | | | | – |
| Stóraborg 36[67] | 2.0 × 2.4 | 4.8 | 0.70 | | 1 | 2 | | | | 12 |
| Sveigakot MT2 phase 5[68] | 2.5 × 5.0 | 12.5 | 0.60 | 1 | 1 | 1 | | | | 7 |
| Sveigakot T1 phase 5[69] | 2.8 × 3.6 | 10.1 | >0.3 | 1 | 1 | | | | | |
| Sveigakot T1 phase 4[69] | 2.8 × 3.6 | 10.1 | >0.3 | 1 | 1 | 1 | | | | |
| Sveigakot T1 phase 3[69] | 2.8 × 3.6 | 10.1 | >0.3 | 1 | 1 | 1 | | | | |
| Sveigakot T1 phase 2b[69] | 2.8 × 3.6 | 10.1 | >0.3 | 1 | 1 | | | | | |
| Tjaldbúð[70] | 3.2 × – | – | 1.4 | – | – | – | – | – | – | – |
| Vatnsfjörður 10 phase 2[71] | 2.0 × 3.4 | 6.8 | 0.30 | | 1 | 1 | | | | |
| Vatnsfjörður 10 phase 1[71] | 2.0 × 3.4 | 6.8 | 0.30 | | 1 | | | | | |

[53] Only the most significant features are listed; ✓ present (only presence/absence data available); ? possibly present; – no data available (incompletely excavated or recorded).
[54] Garðar Guðmundsson and Sigurður Bergsteinsson pers comm.
[55] Guðmundur Ólafsson pers comm; Erlingsson 1899; Ólafsson 1998; Ólafsson 2001; Þórðarson 1964.
[56] Eldjárn 1961.
[57] Einarsson 1992; Einarsson 1995.
[58] Ólafsson 1980.
[59] Kevin Smith pers comm; Smith 1995.
[60] Ólafsson 1992.
[61] Friðriksson and Vésteinsson 1997; Lucas 2009; Simpson et al 1999.
[62] Einarsson 2008.
[63] Edvardsson and McGovern 2007.
[64] Edvardsson 2003; Edvardsson 2005.
[65] Magnússon 1973.
[66] Erlingsson 1899.
[67] Snæsdóttir 1992.
[68] Urbańczyk 2006; Vésteinsson pers comm; note that MT2 had 11 phases of floors, only the fifth of which definitely had a slab-lined oven against one wall, and that this phase number might change in the final publication.
[69] Urbańczyk 2002b; Urbańczyk 2003a.
[70] Ólafsson 2005.
[71] Milek 2011.

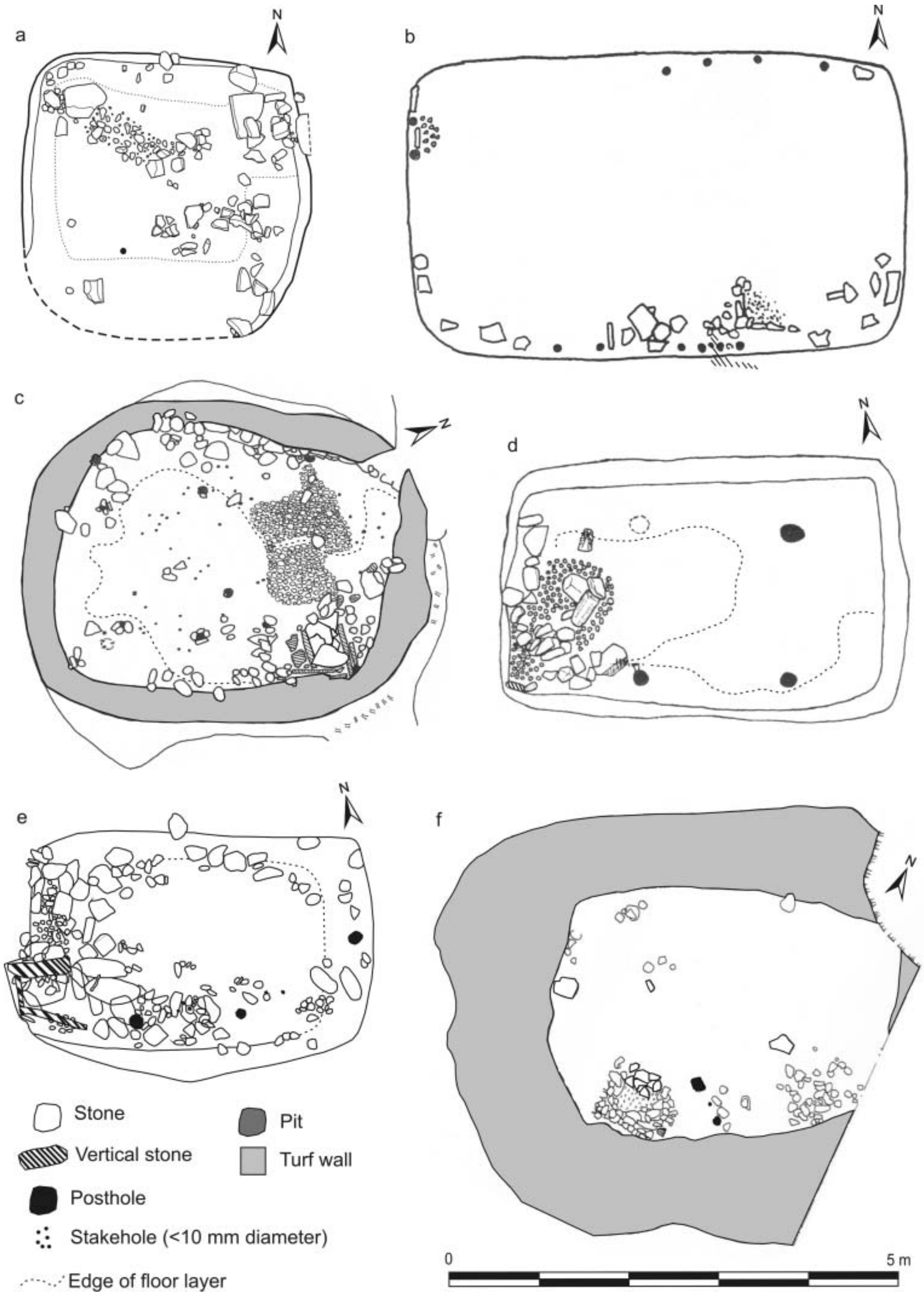


FIG 3

Plans of Viking-Age pit houses in Iceland. (a) Eiríksstaðir. *Drawing by K Milek after an original by Guðmundur Ólafsson, © Guðmundur Ólafsson.* (b) Gjáskógar. *Eldjárn 1961, © Árbók hins íslenzka fornleifafélags.* (c) Granastaðir 3. *Einarsson 1992, © Bjarni Einarsson.* (d–e) Grelutóttir I and II respectively. *Drawings by K Milek after Ólafsson 1980, © Guðmundur Ólafsson and Árbók hins íslenzka fornleifafélags.* (f) Háls 6A. *Drawing by K Milek after an original by Kevin P Smith, © Kevin P Smith. Used with permission.*

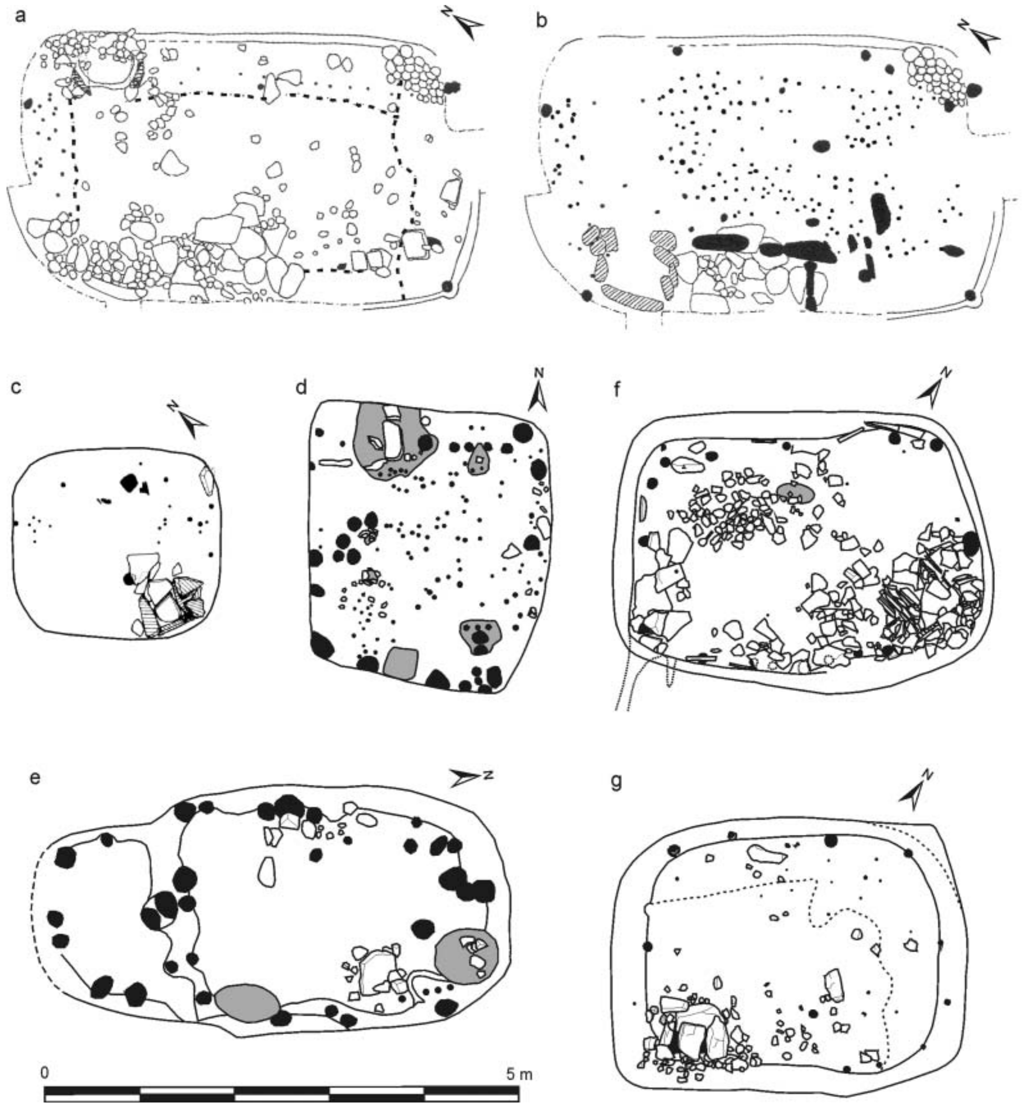


FIG 4

Plans of Viking-Age pit houses in Iceland. (a–b) Hjálmstaðir phases 1 and 2 respectively. *Drawings by K Milek after Ólafsson 1992, © Guðmundur Ólafsson and Árnesingur.* (c) Hólmur. *Einarsson 2000 © Bjarni Einarsson.* (d–e) Hrísheimar C and H respectively. Note that the turf wall around C, mentioned in Edvardsson and McGovern 2007, is absent from this drawing. *Drawings by K Milek after Edvardsson 2005, © Ragnar Edvardsson and Fornleifastofnun Íslands.* (f–g) Hvítárholt I and IV respectively. *Drawing by K Milek after Magnússon 1973, © Þór Magnússon and Árbók hins íslenzka fornleifafélags. Used with permission.*



Hofstaðir G did not have a gap for an entrance, so access must have been gained by walking *over* the low turf wall via steps, through a door in a timber wall and down another flight of steps or a short ladder into the pit.

Compared to the longhouses, pit houses were small buildings, varying in shape from rectangular to square. Most had an internal area of 8–16 sq m, and the smallest pit houses, at Hólmur and Stóraborg, reached sizes of only 4.4 and 4.8 sq m respectively

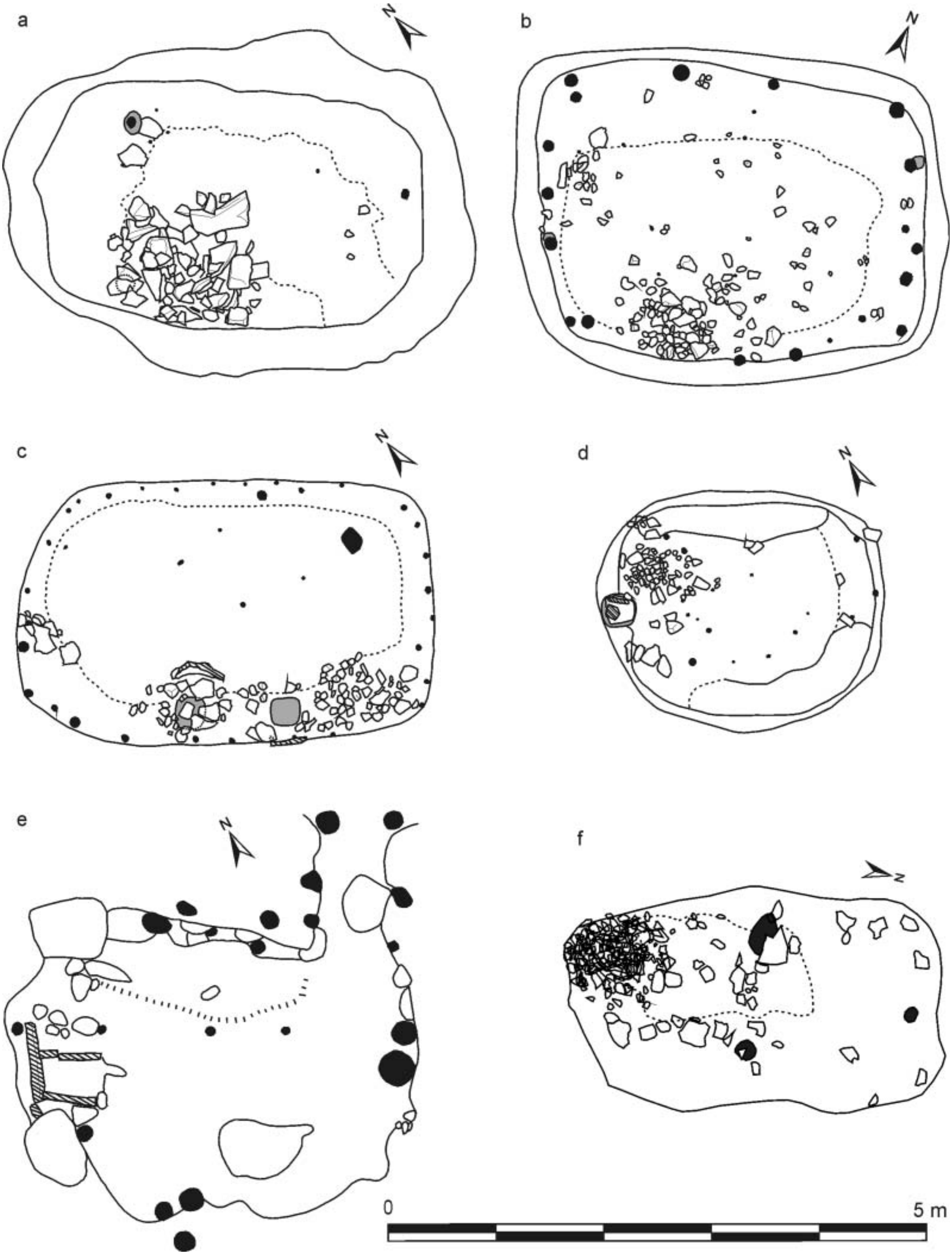


FIG 5

Plans of Viking-Age pit houses in Iceland. (a–c) Hvítárholt V, VII and X respectively. *Drawings by K Milek after Magnússon 1973, © Þór Magnússon and Árbók hins íslenzka fornleifafélags.* (d) Stóraborg. *Snæsdóttir 1992, © Mjöll Snæsdóttir and Árbók hins islenzka fornleifafélags.* (e) Sveigakot T1 phase 3. *Drawing by K Milek after Urbańczyk 2002b © Fornleifastofnun Íslands.* (f) Vatnsfjörður 10. *Milek 2011, © K Milek and Fornleifastofnun Íslands. Used with permission.*

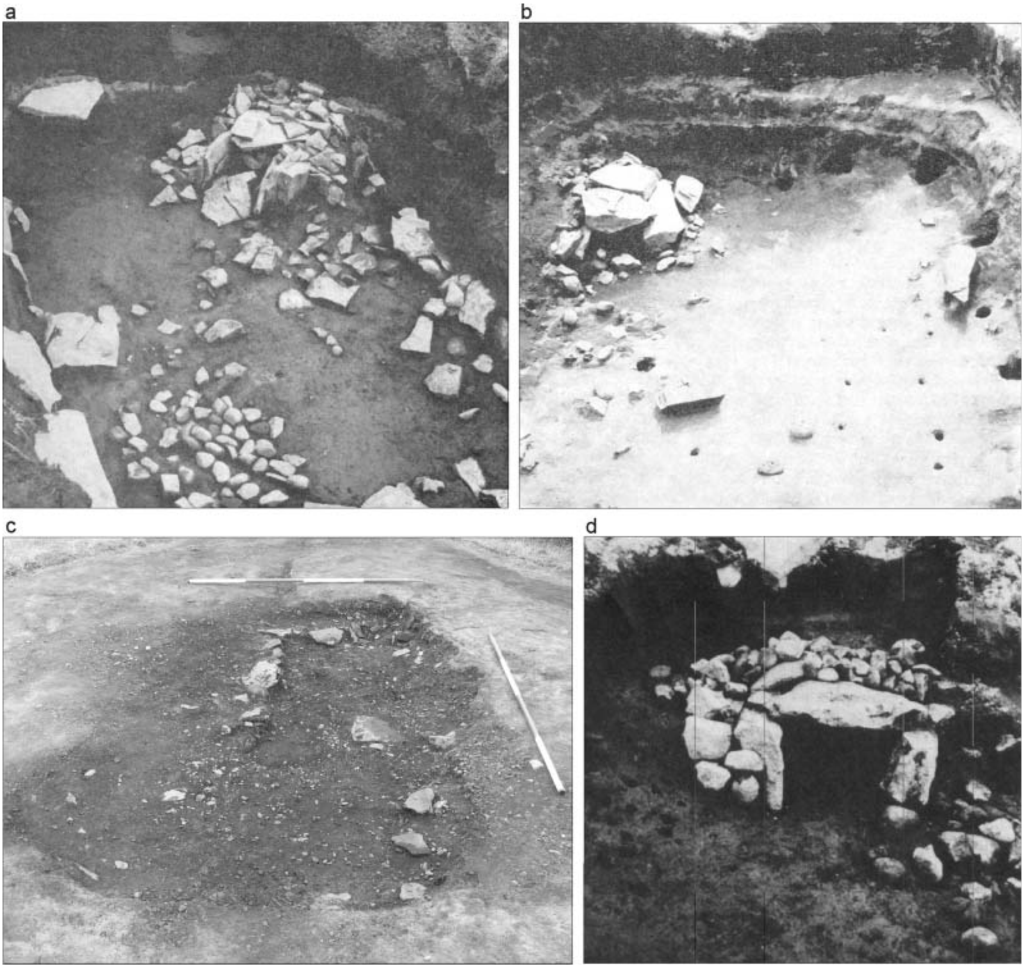

FIG 6

Examples of Icelandic pit houses and their corner ovens. (a–b) Hvítárholt I and IV respectively, with heated stones and pinholes visible. *Magnússon 1973, © Þór Magnússon and Árbok hins íslenzka fornleifafélags.* (c) Vatnsfjörður 10 phase 2, with a stone-edged platform on the left side, a black charcoal-rich floor layer on the right side and the base of the oven in the far right corner. The oven had collapsed and the flat stones that had lined its sides were removed with other post-abandonment layers. *Milek 2011, © K Milek and Fornleifastofnun Íslands.* (d) Oven of Hjálmsstaðir phase 1. *Ólafsson 1992, © Guðmundur Ólafsson and Árnesingur. Used with permission.*

(Tab 2; Fig 7). If these buildings were ever used as dwellings it could only have been for a very small number of people — one or two at the most. As will become clear below, variations in the sizes and shapes of pit houses does not appear to relate to the internal features or functions of the buildings.

In most cases the interior edges of the pits were lined with posts set in postholes or on postpads, which would have supported sill beams and the wooden staves or panels used to construct the timber walls. Interior posts were also common, and several pit houses appear to have an interior space divided into three aisles, the boundaries of which were marked by posts. The buildings must have had pitched roofs, but end posts for the support

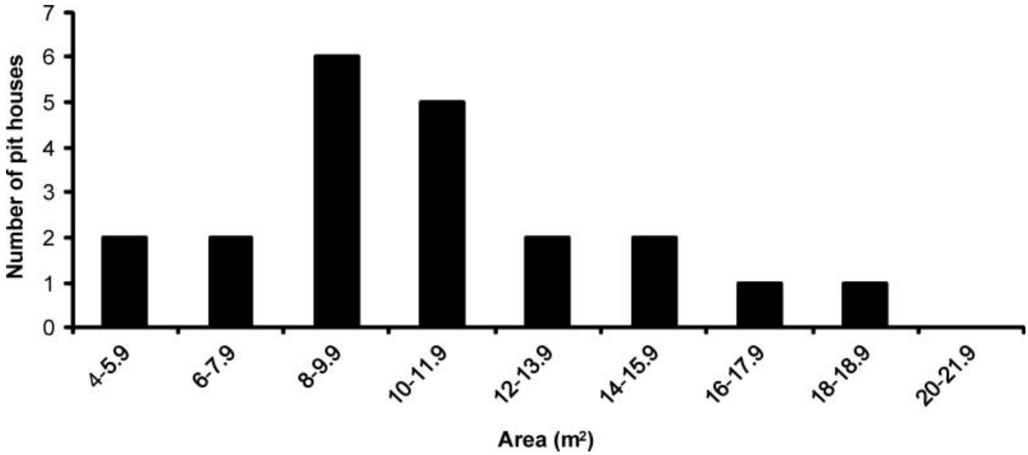


FIG 7
Sizes of pit houses in Iceland. © *K Milek.*

of ridgepieces can only be identified with certainty in six buildings (Grelutóttir II, Hrísheimar H, Sveigakot T1 and MT2, Hvítárholt I and IV and Vatnsfjörður 10). The floors of most pit houses were sealed by turf collapse layers, indicating that the roofs were commonly turf covered.

STAKEHOLES

In addition to postholes, 74% of the pit houses whose floors were fully excavated also contained narrow holes, 10–30 mm in diameter, called 'stakeholes' or 'pinholes' (Icelandic *pinnahólur*) in the literature. These were sometimes present in extraordinarily high numbers: Hofstaðir G had 77, Hrísheimar C had 87, Granastaðir 3 contained at least 50, and the earlier phase of the pit house at Hjálmsstaðir had no less than 200. These small holes were not evenly spaced across the floor, but tended to occur in clusters. When these small holes first began to appear in pit houses, they were interpreted as the remains of supports for platforms or benches along the walls.[72] Considering their erratic and clustered distribution, however, this interpretation seems unlikely.

As Mjöll Snæsdóttir and Guðmundur Ólafsson suggested,[73] these small holes were probably created by an activity that involved narrow rods being pressed into the floor. Few artefacts found in the Viking-Age archaeological record are of a size or shape that could conceivably have made such holes. One possibility is the rod-shaped iron lamp stands with tapered shafts that would have been set upright in an earthen floor.[74] Alternatively, based on images of women spinning in medieval manuscripts,[75] Guðmundur Ólafsson argued that the narrow holes could have been made by a distaff used to hold raw wool fibres during spinning.[76] Most Viking-Age distaffs that have been identified in the archaeological record are wooden, only 0.3–0.4 m in length, and had either been held

[72] Magnússon 1973; Ólafsson 1980.
[73] Snæsdóttir 1992; Ólafsson 1992.
[74] Eg in the burials at Oseberg and Heinnum, Buskerud, Norway; Graham-Campbell 1980, 14, pl 25.
[75] Eg Kirkerup Church, Roskilde, c 1300; Björn 1974, 34; Wiklund and Diurson 1976, 57; Østergård 2004, 46.
[76] Ólafsson 1992.

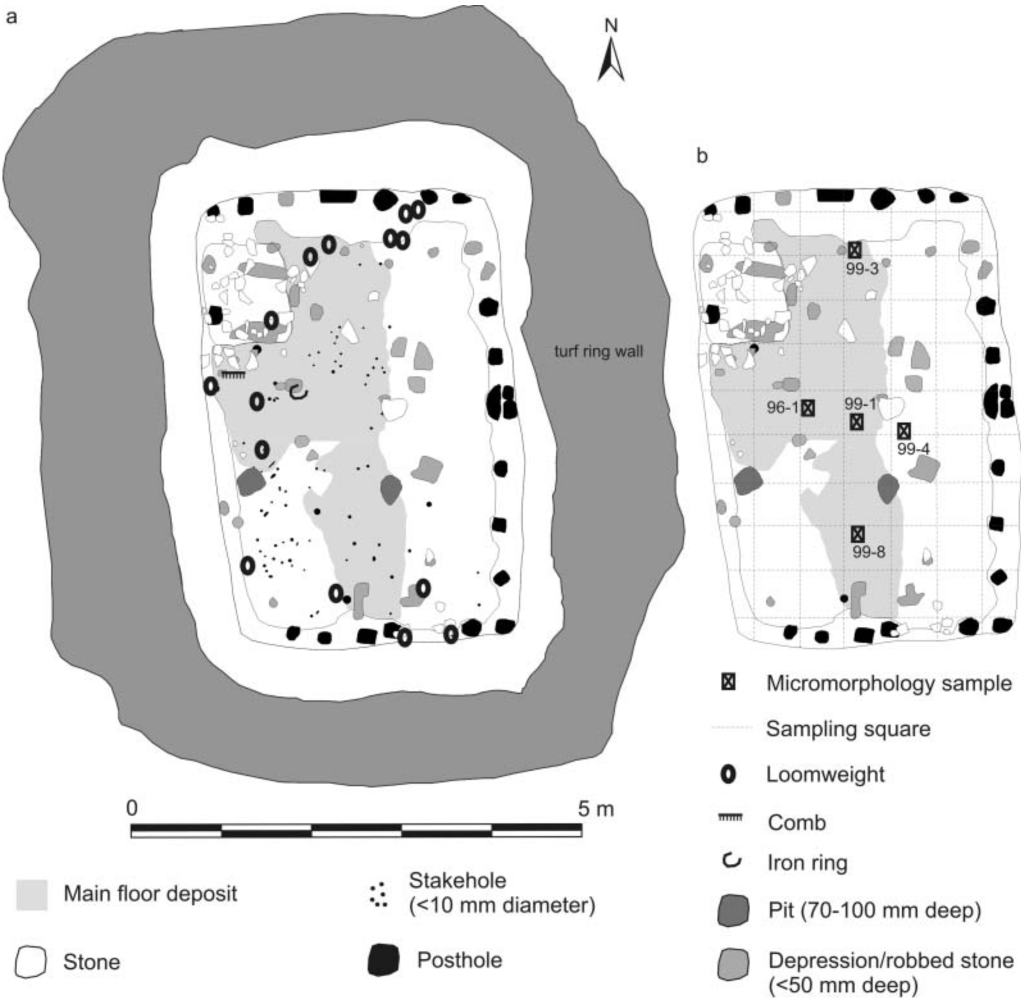


FIG 8

Plans of pit house G at Hofstaðir in Mývatnssveit. (a) Distribution of artefacts on the floor of Hofstaðir G. (b) Locations of micromorphology samples and the bulk sample grid. *Drawings by K Milek after Lucas 2009, © K Milek and Fornleifastofnun Íslands.*



in one hand or tucked under an arm or belt.[77] However, many 0.75–1.04 m-long staffs have been found in women's graves in Scandinavia, made of either iron or wood, with 10–20 mm thick square shafts that taper to a point at one end. It has recently been argued based on archaeological and literary evidence that these were staffs of sorcery used by female magic-workers,[78] and that this special use was derived from the everyday use of these objects as distaffs and the belief apparent in ON mythological poetry that magic and fate could be spun.[79] If long distaffs were indeed in common use in Viking-Age

[77] Eg at York, Oseberg, Hedeby and Bryggen. Andersson 2003, fig 63; Gardeła 2008, fig 2.1; Øye 1988, fig II.3; Walton Rogers 1997, fig 804.
[78] Gardeła 2009; Ingstad 1995; Lundström and Adolfsson 1995; Price 2002; Stenberger 1979, 713.
[79] Gardeła 2008; Heide 2006; Milek 2006.

Scandinavia, this would support Guðmundur Ólafsson's suggestion that distaffs pressed into the floor created the small stakeholes so common in pit houses.

## FURNISHINGS

In 62% of pit houses it was possible to identify furnishings. Raised platforms constructed of earth or turf, preserved up to a maximum height of 0.3 m, were found at Grelutóttir I, Stóraborg, Hvítárholt V and VII, Sveigakot MT2 and T1, and Vatnsfjörður 10. In other pit houses, 0.5–1.5 m-wide areas along the edges of the pit where floor deposits were absent, thin or loose, have been interpreted by the excavators as the likely locations of wooden platforms or other types of floor coverings (Figs 3–6). Like the platforms in the side aisles of the longhouses, these areas were probably used for sitting and working, and they could also have been slept on by one or two people.

Other internal features include the small stone-paved areas found in seven pit houses, presumably used to manage muddy floor surfaces or to act as foundations for wooden furnishings. Stacked stone constructions of unknown function were found on the E gable walls of both of the Grelutóttir pit houses (Fig 3d–e). Two pit houses had pits in them: the one the NE corner of Hrísheimar H was interpreted as a barrel pit and the one in the SW corner of Hofstaðir G was lined with clay (Figs 4e and 8a).[80]

## OVENS

All of the pit houses in this study contained a fireplace against a wall or in a corner. Nearly all of them were constructed using a particular technique, never seen in longhouses, in which three standing vertical stone slabs created a box surmounted by a horizontal lintel stone (Fig 6). There is also some evidence in the form of collapsed stone slabs, linear grooves, or curb stones on the inner side of the fireplaces that some of them had had a door.[81] Fireplaces lined and capped with stone slabs would have been effective at containing heat, raising the temperature of the fire within them and containing sparks. They would have effectively functioned as ovens or stoves and would have been particularly suitable for such functions as roasting and baking, and radiating heat, and therefore keeping pit houses warm and dry without the risk of sparks that comes with an open fire. Since this type of fireplace was restricted to pit houses, we may assume that its function intimately related to the function of these buildings.

## OCCUPATION DEPOSITS

The occupation deposits in pit houses provide further evidence for what they had been used for and their duration of use. The floor layers varied in thickness, depending on whether they were measured in the centre of the building or near the edges, where there may have been wooden platforms or floor coverings. Where the accumulations were thickest, they were recorded as being between 20 and 100 mm thick.[82] Moreover, several pit houses had multiple occupation phases. In parts of Hvítárholt V, for example, there were two floors, one on top of the other. The Hjálmsstaðir pit house also had two distinct occupation phases, each with a separate oven and a thick floor deposit, and there were two distinct phases of floors at Vatnsfjörður 10, the second of which was associated with

[80] Edvardsson 2005; Lucas 2009, 97.
[81] Eg Magnússon 1973, 17.
[82] 20 mm: Gjáskógar, Hofstaðir G; 40 mm: Grelutóttir I, Hjálmsstaðir phase 2, Hvítárholt I; 50 mm: Stóraborg, Vatnsfjörður 10; 60 mm: Eiríksstaðir, Granastaðir, Hjálmsstaðir phase 1; 70 mm: Hólmur, Tjaldbúð; 100 mm: Grelutóttir II.

a sitting platform and postpads that had been placed over earlier postholes. Overlapping postholes and postpads in both Vatnsfjörður 10 and Hofstaðir G indicate that the buildings experienced at least two episodes of post replacement and repair, and they must therefore have been occupied for a number of years — probably for several decades.[83] The most extreme case of long-term occupation was Sveigakot T1, which had four distinct occupation phases, each with different floor deposits, fireplaces and sitting platforms.[84] Sveigakot MT2 is also exceptional, in that it had 11 occupation phases, only one of which, phase 5, was associated with a slab-lined oven against one wall.[85] In most cases, therefore, the thickness of the accumulated floor deposits and the complexity of the lives of the structures are comparable to the larger dwelling houses and suggest that their occupation was neither short-term nor temporary.

The floor deposits were dark brown, black or dark grey in colour, and were mainly composed of organic matter and finely comminuted wood-charcoal fragments, often with grey wood ash more prominent in and around the fireplaces. Unfortunately, archaeobotanical analysis has not yet been conducted on these floor or oven deposits, with the exception of a brief assessment of the floors in Hofstaðir G, which produced one charred barley grain (*Hordeum sativum*) and one seed of the vegetal weed *Spergula arvensis*.[86] It is therefore impossible to generalise about the types of charred plant remains produced in pit houses.

Significantly, the occupation deposits of over 80% of pit houses contained large numbers of fist-sized stones that were blackened and/or fire-cracked from being heated in a fire. Stones heated in this way are thought to have been used to roast meat in cooking pits or to heat liquids; in Iceland they were used for the latter as late as the 16th century.[87] Since cooking pits were only found near one pit house (Hólmur, where they might not be contemporary), the heated stones commonly found in pit houses were almost certainly used to heat liquids.

Small fragments of bone and burnt bone were also commonly found in pit house floor deposits (Tab 3). They were recorded in 67% of cases, but considering that bone was not systematically collected or recorded during older excavations, the number of pit houses containing bones could well have been higher. It is impossible to know whether meat and fish were actually cooked in pit houses, but the presence of bones does suggest that they were consumed in the buildings and the bones discarded in the fire.

### ARTEFACTS

Few artefacts have been found in the floors of pit houses, suggesting that most usable objects were removed when the buildings were abandoned (Tab 3). The most common artefacts are perforated stone weights used to stretch the warp threads of upright looms, found in 76% of pit houses. Several houses contained only one stone weight, which alone is not enough to suggest that a loom had once been in the building, but most contained three or more, and at Hólmur four loomweights were found directly adjacent to the house in addition to the one that was found in the floor.[88] In Hrísheimar C, seven loomweights were found lying in a row, and in Sveigakot MT2 9 loomweights were lying in two close

[83] Lucas 2009, 94–5.
[84] Urbańczyk 2002b; Urbańczyk 2003a.
[85] Urbańczyk 2006. Note that as this paper goes to press Sveigakot is still undergoing post-excavation analysis and this phase number might change in the final publication.
[86] Guðmundsson 2009, 328.
[87] Foote and Wilson 1970, 164; O'Kelly 1954; Shetelig and Falk 1937, 310.
[88] Einarsson 2008.

TABLE 3
Finds in pit houses in Iceland.

| Site and pit house[89] | Finds[90]: Loomweight | Spindle whorl | Whalebone board | Whalebone weaving sword | Wool comb teeth | Iron shears | Iron knife | Stone lamp | Steatite pot fragment | Stone disc | Polishing stone | Whetstone | Bone comb | Iron slag | Heated/fire-cracked stones | Animal bones/teeth | Burnt animal bones |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bessastaðir 20 | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Eiríksstaðir | 3 | 1 | | | | | | | | | | | | | | | ✓ |
| Gjáskógar | 2 | | | | | | | | | | | | | | ✓ | ✓ | ✓ |
| Granastaðir 3 | 2 | 3 | | | | | | | | | | | | | ✓ | ✓ | ✓ |
| Grelutóttir I | 1 | | | | | | | | | | | | | | ✓ | | ✓ |
| Grelutóttir II | 13 | | | | | | 1 | | | | | 1 | | | ✓ | | |
| Háls 6A | | | | | | | 1 | | | | | | | ✓ | ✓ | ✓ | ✓ |
| Háls 6B | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Hjálmsstaðir phase 2 | | 1 | | | | | 1 | | | | | | | | ✓ | | |
| Hjálmsstaðir phase 1 | | 1 | | | 1 | | | 1 | | | | | | | ✓ | ✓ | |
| Hofstaðir G | 19 | 2 | | | | | | | | | | | 1 | | ✓ | ✓ | ✓ |
| Hólmur | 2 | 1 | 2 | | | | | | 1 | 1 | 1 | | | | ✓ | ✓ | ✓ |
| Hrísheimar C | 7 | 1 | | | | | | | | | | | 1 | ✓ | ✓ | ✓ | ✓ |
| Hrísheimar H | 3 | | | | | | 1 | | | | | | | | ✓ | | ✓ |
| Hvítárholt I | 3 | | | | | | 1 | | | | | 2 | | ✓ | ✓ | | ✓ |
| Hvítárholt IV | | | | 1 | | | | | | | | | | | ✓ | ✓ | |
| Hvítárholt V | | | | | | | | | | | | | | | ✓ | | |
| Hvítárholt VII | 1 | | | | | | | | | | | | | | ✓ | | |
| Hvítárholt X | 1 | | | | | 1 | 1 | | 3 | | | | | | ✓ | | |
| Ljótólfsstaðir | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Stóraborg 36 | 1 | | | | | | 1 | | | | | | | | ✓ | | |
| Sveigakot MT2 ph 5 | 9 | 1 | | | | | | | | | | 1 | | ✓ | | ✓ | ✓ |
| Sveigakot T1 ph 5 | | | | | | | | | | | | | | 2 | | ✓ | ✓ |
| Sveigakot T1 ph 4 | | | | | | | | | | | | | | | | ✓ | |
| Sveigakot T1ph 3 | | 1 | ? | | | | | | | | | | 1 | | | ✓ | ✓ |
| Sveigakot T1 ph 2b | | | | | | | 1 | | | | | | | | | ✓ | |
| Tjaldbúð | 1 | 1 | | | 1 | | | | | | | | | | | ✓ | ✓ |
| Vatnsfjörður 10 ph 2 | 1 | | | | | | | | | | | | | | ✓ | ✓ | ✓ |
| Vatnsfjörður 10 ph 1 | 2 | | | | | | | | | | | | | | ✓ | ✓ | ✓ |

[89] For references see Table 2.
[90] Only the most significant and diagnostic finds are listed. Iron nails, stone strike-a-lights and glass beads are omitted, since they cannot contribute to an understanding of the function of the buildings. ✓ present (only presence/absence data available); ? possibly present; – no data available (incompletely excavated or recorded).

rows, indicating the likely locations of dismantled upright looms. Equally convincing are Grelutóttir II and Hofstaðir G, which contained 13 and 19 loomweights respectively.[91]

The second most common artefacts are spindle whorls, which were found in 43% of pit houses. Most pit houses contained only one, but Hofstaðir G and Granastaðir 3 contained two and three spindle whorls respectively. Viewed in conjunction with the small stakeholes that could have been made by distaffs, it would seem that spinning was an activity that commonly took place in pit houses. Other tools that would have been used for textile production included a whalebone weaving sword, which was found in Hvítárholt IV, iron wool-comb teeth, which were found in Tjaldbúð and the early phase at Hjálmsstaðir, and a pair of iron shears (scissors), which were found in the floor of Hvítárholt X.

Besides the implements used in woollen textile production, the only objects found in pit houses that are diagnostic of a particular activity are the steatite pot fragments, found in Hólmur and Hvítárholt X. Other objects commonly found in pit houses are iron nails, knives, whetstones and jasper fire-starters, which unfortunately provide little additional information about how these buildings were used. Stone lamps, such as the one found in the early phase at Hjálmsstaðir, though much rarer in comparison, indicate the need for light but are not indicative of a specific activity. Looking at the assemblage as a whole, therefore, it is notable that heated stones and objects used for textile production dominate the finds assemblages from pit houses.

## A GEOARCHAEOLOGICAL AND MICROREFUSE STUDY OF PIT HOUSE G AT HOFSTAÐIR, NORTH-EAST ICELAND

### RATIONALE AND METHODOLOGY

Although artefact distributions have traditionally played an important role in the interpretations of building functions and activity areas, worldwide ethnoarchaeological studies have shown that few artefacts enter the archaeological record in the precise location where they were used. Objects may be discarded when they are broken or no longer useful, but discard usually takes place outside buildings, often in designated rubbish heaps.[92] Objects that are accidentally dropped on living floors are usually removed if they are large enough to be seen, especially if they are large, sharp or noxious.[93] Larger objects also tend to be kicked or swept to one side of heavy traffic areas, causing them to accumulate in corners or against the edges of walls or furnishings, leaving only the smallest objects in situ where they were used.[94] Discard practices do tend to change when a building is about to be abandoned, which may result in more rubbish accumulating on floors, but during the abandonment process the objects left behind tend to be the ones that were too heavy or not valuable enough to move, or the ones intentionally left in the building as part of a 'closing deposit'.[95] It is therefore important to keep in mind that although the *presence* of artefacts on the floor of a building may be suggestive of the activities that took place there, the *precise locations* of artefacts larger than 10–20 mm may be a less reliable source of information about the spatial organisation of activity areas than those of finer residues. For this reason, it is beneficial to study floor deposits using several different

[91] Edvardsson and McGovern 2007; Lucas 2009; Ólafsson 1980; Urbańczyk 2006.
[92] Arnold 1990; Deal 1985; Gifford 1980; Murray 1980.
[93] DeBoer and Lathtrap 1979; Hayden and Cannon 1983; LaMotta and Schiffer 1999; O'Connell 1987.
[94] Bartram et al 1991; Wilk and Schiffer 1979.
[95] Hayden and Cannon 1983; LaMotta and Schiffer 1999; Lange and Rydberg 1972; Simms 1988; Stevenson 1982.

analytical techniques, including the distributions of microscopic residues and chemical properties, when trying to ascertain the locations of activity areas.[96]

The settlement remains at Hofstaðir, close to Mývatn, in NE Iceland, were excavated by an international team under the direction of the Icelandic Institute of Archaeology, latterly by Gavin Lucas, now at the University of Iceland.[97] The use of artefact distributions to characterise the function of Hofstaðir G encountered the usual difficulties. There were few artefacts on the floor of the building, and most of them were loomweights: ten recovered with the occupation deposit, context 9, and a further five that had rested on the floor and were recovered with the overlying collapse deposit, context 8.[98] These loomweights were scattered close to the N, W and S edges of the building (Fig 8a), but if these findspots represented their locations of use, there would have been a loom leaning against each of these walls, which cannot have been the case — at least not at the same time. It is most likely that a loom leaned against the northern wall of the pit house, where most of the loomweights were clustered, four of them in pairs, and where there was a row of shallow depressions that might represent the imprint of a loom's feet.[99] The only other objects in the floor were a bone comb, a small iron loop and a basalt stone interpreted as a hammerstone, all of which were found close to the robbed-out fireplace in the NW corner, but provide little insight into the function of the building. A few objects also came from the primary collapse of the building, and are probably associated with the use of the building, including two spindle whorls, an iron hook and a whetstone.

In order to improve the understanding of how Hofstaðir G was used, I conducted a detailed geoarchaeological and microrefuse study on its floor deposits. When the pit house was excavated the floor layer was exposed in opposing quadrants, and the resulting sections were used for collecting undisturbed block samples for micromorphological analysis (Fig 8b).[100] After being impregnated with resin and thin sectioned, the micromorphology samples were analysed on petrographic microscopes at ×5–250 magnification, which made it possible to quantify the mineral, organic and artefactual components of each microstratigraphic layer in the floor sediment, to detect differences in compaction across the floor, and to detect any truncation episodes or post-depositional processes such as leaching or bioturbation.[101]

Once fully exposed, the floor deposit was collected on a 0.5 m grid totalling 64 sampling squares (Fig 8b);[102] 300 ml bulk samples were taken for the quantification of organic content, pH, electrical conductivity (a proxy for soluble salt content), magnetic susceptibility and multiple elements.[103] The remaining sediment in each grid square, if any, was used for microrefuse analysis; the volume was measured, it was wet-sieved and the contents analysed to the 1 mm size fraction in order to determine the numbers of



[96] Stein and Teltser 1989.
[97] Lucas 2009.
[98] Ibid, 99.
[99] Ibid, 100.
[100] Micromorphology samples were taken by the author in 1999 following the methods outlined in Courty et al 1989. Note that before the pit house was identified, micromorphology samples were taken from a sondage through the midden infill and floor deposits (sample 96-1). See Simpson et al 1999 for details on sample 96-1.
[101] Thin sections taken in 1999 were made and analysed by the author at the McBurney Geoarchaeology Laboratory, University of Cambridge, following the procedures detailed in Murphy 1986.
[102] Bulk sampling was conducted by Orri Vésteinsson and Garðar Guðmundsson.
[103] After air-drying for one week, samples were sieved in order to remove constituents over 2 mm and pulverised using a mortar and pestle. Organic content was estimated using loss-on-ignition at 550°C, following the procedure of Nelson and Sommers 1996. pH and EC were tested using a 2:5 soil:deionised water suspension measured with a pHep 3 electronic pH meter and a DiST WP3 EC meter. Magnetic susceptibility was measured using a Bartington MS2 magnetic susceptibility meter with a low frequency sensor. Multi-element analysis by ICP-AES was conducted by ALS Chemex on the 180 μm fraction following procedure ME-ICP41 with nitric acid-aqua regia digestion.

bone, burnt bone and artefact fragments per litre of sediment. The geochemical and microrefuse values were plotted on the plan of the house using ArcView GIS and analysed to determine if activity areas were identifiable from concentrations of particular microresidues.

## FIELD DESCRIPTION OF THE OCCUPATION DEPOSITS

The floor deposit in Hofstaðir G was given two context numbers in the field, 9a and 9b, which reflected the variation in its character and composition.[104] The central floor deposit (9a) was pitch-black, compact and greasy, 10–15 mm thick in the central aisle, increasing to 80–100 mm around the fireplace in the NW corner (Fig 8a). The disturbed fill of the fireplace was a mixture of charcoal-rich soil and grey ash, underneath which the natural soil was reddened by heat. On the eastern edge and the SW corner of the pit house the floor was thin and patchy (2–5 mm thick) and consisted of a smear of fine charcoal with some thin patches of cream-yellow-green material that appeared to be decomposed organic matter (9b). The boundary between contexts 9a and 9b in the eastern third of the pit was closely associated with a postpad and several postpad depressions, suggesting that the space in the eastern third of the building had been covered with a wooden bench or platform.[105] A thin iron pan had formed under the floor deposits on the E side and SW corner of the pit house, becoming thicker on the eastern edge of the building where it coated the insides of the postholes. Upon the removal of the floor layer, 77 small depressions, most c 10 mm in diameter, were found across the floor everywhere except for the eastern side of the building. These resemble the small stakeholes found in many pit houses, as discussed above.

## MICROREFUSE ANALYSIS

The distribution of burnt and unburnt bones in the floor deposits of Hofstaðir G revealed interesting patterns (Fig 9). The largest unburnt bones were 4–10 mm in size and all were fish bones. These were concentrated within two sampling squares on the eastern edge of the central floor deposit, directly opposite the fireplace. It is most likely that these bones were dropped while fish were being eaten or hammered to soften them prior to consumption. Since larger objects tend to accumulate against physical barriers, either because they get kicked aside or because they are protected there from trampling and further breakage (the so-called 'fringe effect'),[106] it is also possible that the fish bones accumulated in this location because they had come to rest at the edge of a piece of furniture.

Bone fragments under 4 mm in size were concentrated within and around the fireplace, suggesting that this was the focal point for the processing and/or consumption of fish and meat. The high concentration of burnt/calcined bones in and around the hearth is the result of intentionally tossing them into the fire to dispose of them and/or to feed the fire. The largest burnt bones, up to 20 mm in size, were mainly within the fireplace, but there was also a small concentration 1 m south of the fireplace. The same sampling square also exhibited an elevated magnetic susceptibility value (Fig 10; see discussion below), and viewed together it is highly likely that this represents the location of a dump of burnt bones, soil and ash resulting from cleaning out or dismantling the fireplace. The highest concentrations of 1–4 mm burnt-bone fragments were immediately east of the

[104] Lucas 2009, 96.
[105] Ibid, 95.
[106] Wilk and Schiffer 1979.

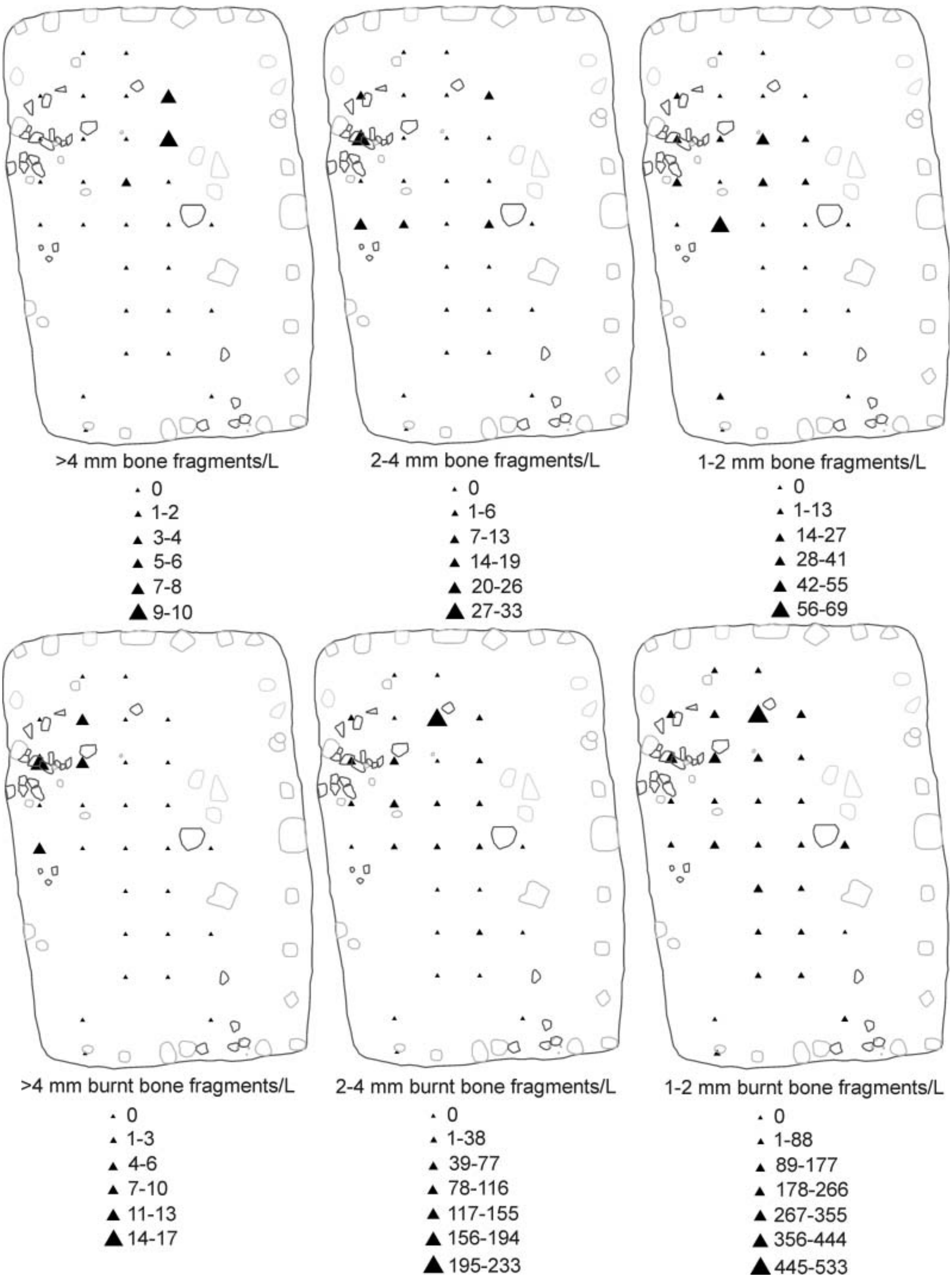


FIG 9

Distributions of unburnt bones and burnt bones on the floor of Hofstaðir G. Sampling squares without a symbol represent those for which there was too little floor sediment to do microrefuse analysis.

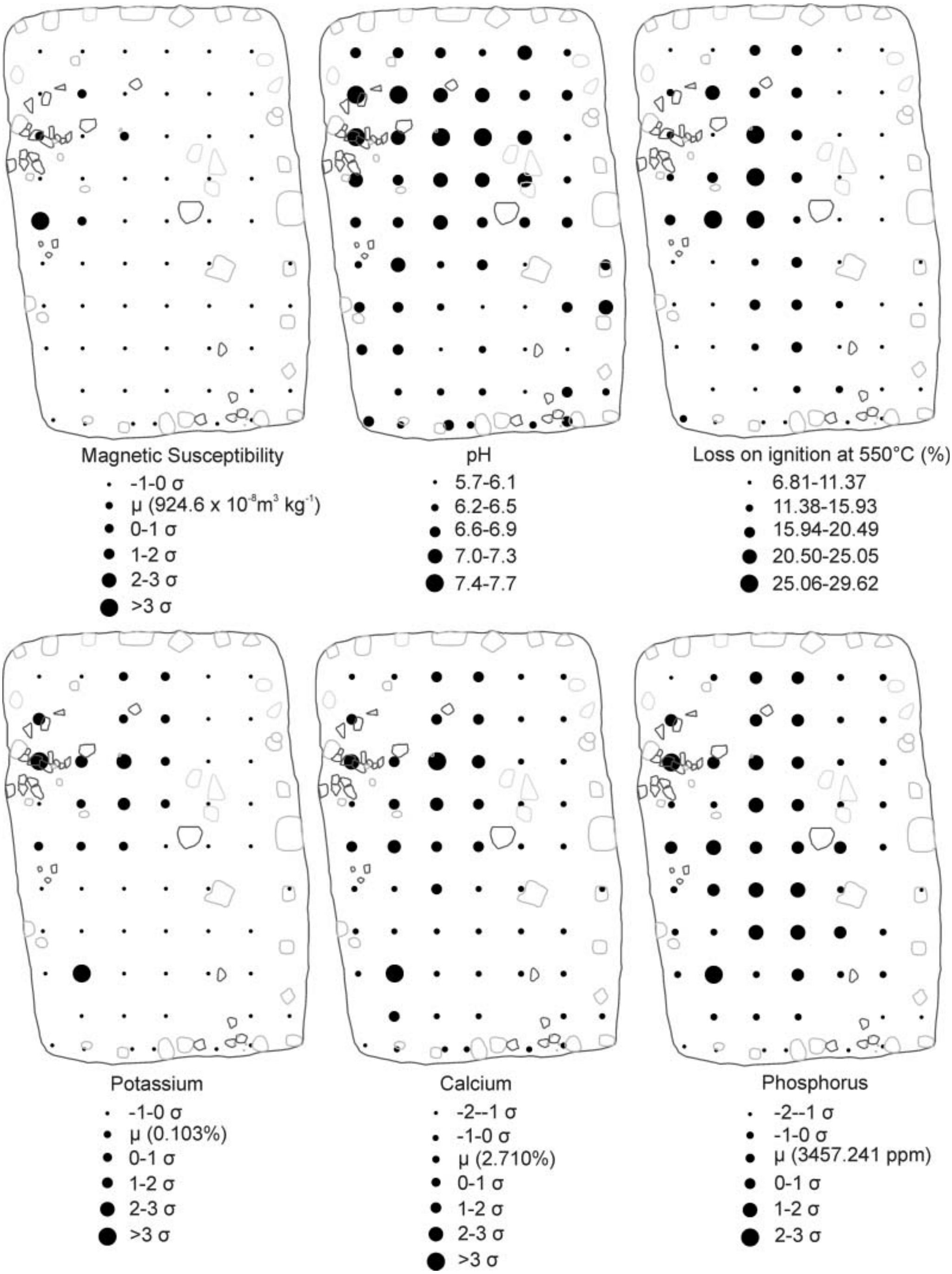


FIG 10

Distributions of magnetic susceptibility, pH, loss-on-ignition, potassium, calcium and total phosphorus values on the floor of Hofstaðir G. Magnetic susceptibility and elements are displayed as standard deviations from the mean. The author may be contacted for the original dataset. © *K Milek*.

fireplace in a location also marked by elevated potassium and calcium (Figs 9–10), elements commonly associated with wood ash,[107] suggesting that this was where ash and burnt bones were swept out of the fireplace. Within the central aisle of the building there was an even spread of minute burnt bones under 2 mm in size, which must have reached the southern half of the building by being trampled, swept or intentionally dumped there with ashes from the fireplace — a common practice in Iceland in the 19th–20th century.[108] The minute size of the bones in the central floor area suggests this was a zone of heavy trampling,[109] a view supported by the micromorphology of the sediments in this area (see below).

## GEOARCHAEOLOGICAL ANALYSES

The field descriptions of the occupation deposits in Hofstaðir G were strongly supported by subsequent geoarchaeological analyses, but this analytical work also permitted the identification of activity areas that had not been observed in the field. The sediments within and around the dismantled fireplace had elevated magnetic susceptibility values as a result of heating the underlying soils. The sediments in and around the fireplace also contained high concentrations of the elements commonly associated with wood ash, including phosphorus, calcium, potassium and magnesium (Fig 10).[110] The high pH of the sediments in the fireplace is linked to the alkaline elements calcium, potassium and magnesium, and especially to the fine-grained calcium carbonate that had been visible in the field as grey, silty wood ash.

In a 1 m-wide area around the hearth and the central aisle of the building loss-on-ignition revealed elevated levels of organic matter (Fig 10). There were also high levels of nutrients commonly taken up by and stored in plants (phosphorus, barium, strontium, copper, zinc), which will show elevated values wherever plant tissues or their ashes have been deposited (Figs 10–11). Although loss-on-ignition at 550ºC cannot distinguish between charred and uncharred organic matter, the four micromorphology samples from around the hearth and the central floor area showed that both charred wood and uncharred herbaceous plant material were major components of floor deposit 9a (Fig 13a–d).

The microstratigraphy visible in thin section showed that context 9a had at least two phases characterised by different concentrations of charcoal and herbaceous plant material (Fig 12; Tab 5). The uppermost phase, context 9a.1, was characterised by minute horizontal lenses under 1 mm thick, which contained 40–70% compacted, highly fragmented charcoal under 1 mm in size (Fig 13a–b), which had given context 9a its distinctive black colour in the field. Context 9a.1 also contained 2–5% amorphous organic matter — plant material so highly decomposed that its cell structure was no longer apparent and it could not be identified — and it is this organic matter that was responsible for the 'greasy' consistency of the floor layer. Some organic matter was intimately mixed with the fine mineral material and charcoal in the floor, but some of it was still in situ, visible as narrow, pale-brown strands (Fig 13b). Minute bone fragments constituted 0.5–2% of the floor deposit, often horizontally or sub-horizontally oriented and occurring in microlenses, which indicates that they had come to rest on a compact, gradually accruing surface (Figs 13a–b).

[107] Evans and Tylecote 1967; Pierce et al 1998.
[108] Milek 2012.
[109] Gifford-Gonzalez et al 1985; Nielsen 1991.
[110] Evans and Tylecote 1967; Pierce et al 1998.

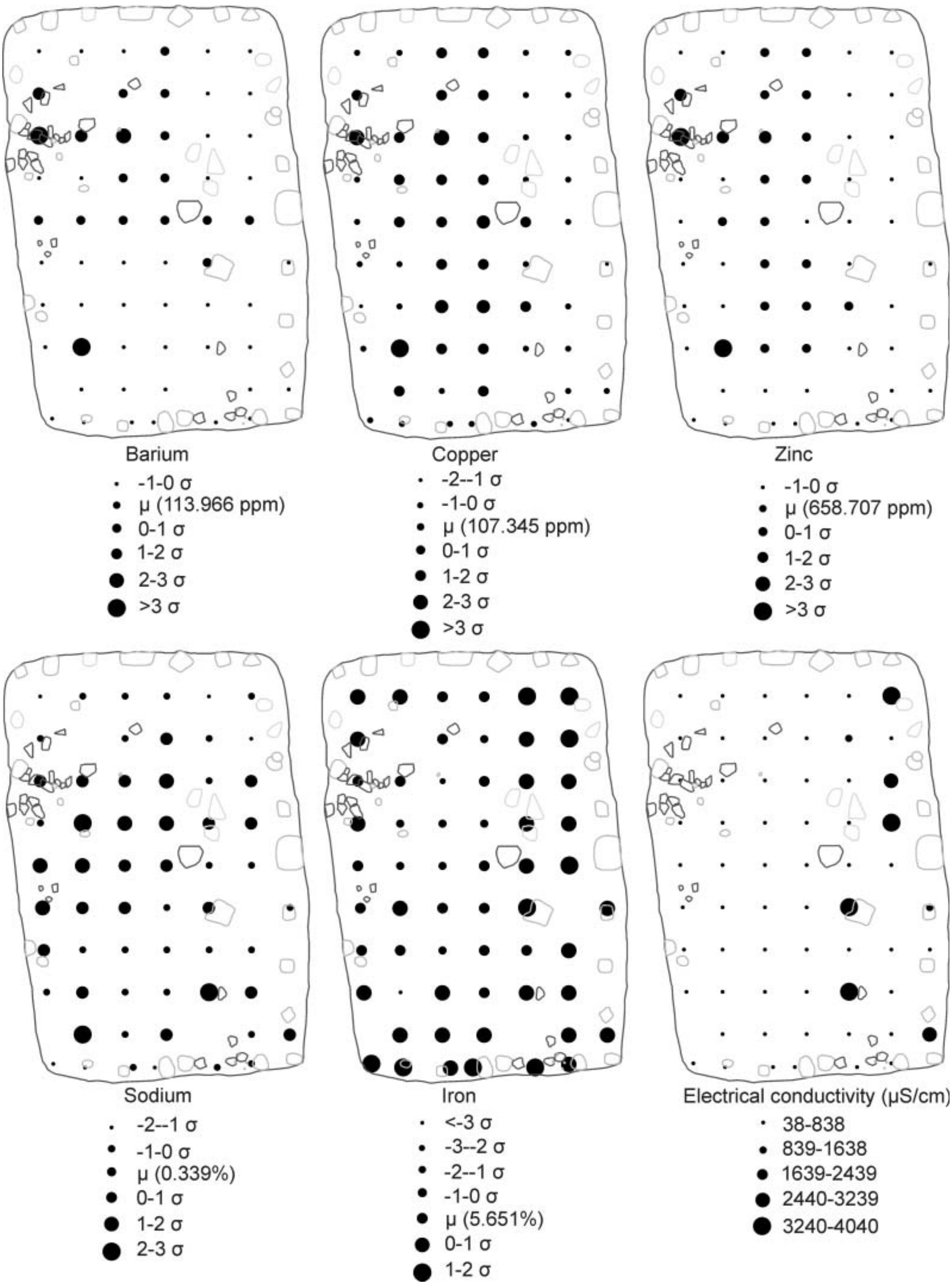


FIG 11

Distributions of barium, copper, zinc, sodium, iron and electrical conductivity (a proxy for soluble salts) on the floor of Hofstaðir G. Elements are displayed as standard deviations from the mean. The author may be contacted for the original dataset. © *K Milek.*

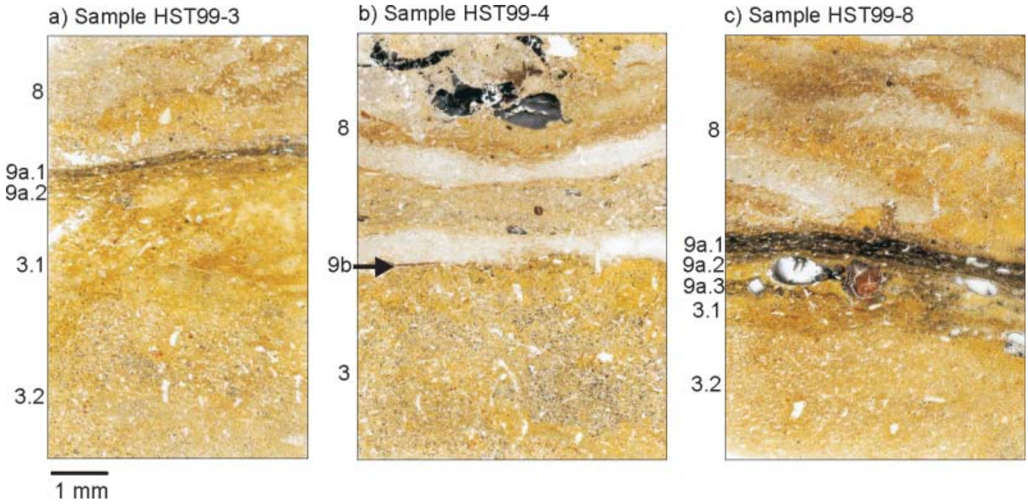


FIG 12

Three thin sections from the basal deposits of Hofstaðir G. Context numbers are divided into microstratigraphic units where necessary. Context 8: turf roof collapse containing lenses of light grey tephra, 9a: thicker floor deposits in the central aisle and around the hearth, 9b: thin floors in the side aisles, 3: natural soils underlying the cut of the pit house. © *K Milek*.

Compaction by trampling was evident in the high level of fragmentation of the bone and charcoal in the central aisle, though some of the silt-sized charcoal may also have been airborne soot that settled on the floor surface. Compaction by trampling was also evident in the low porosity of the floor layers relative to the turf roof collapse above them (context 8) and the natural soils below them (context 3), and in the presence of horizontal planar voids, which are created by vertical pressure and are common in silt-textured or loamy floor sediments (Tab 4).[111] Context 9a.1 had an extremely sharp lower boundary, probably created by a truncation event. The shovelling out of accumulating floor deposits, for example, was a common practice in turf houses in Iceland until the mid-20th century.[112]

Below this, black floor context 9a.2, which was 4–8 mm thick, contained less silt-sized charcoal and higher concentrations of amorphous organic matter (Fig 13c–d, Tab 4). Where this layer had not been heavily bioturbated by soil fauna, long strands of herbaceous plant matter were still visible, often accompanied by the rod-shaped phytoliths typical of grass stems. Activities that could have resulted in the deposition of this organic matter could have included the processing of plant foods, and it is interesting to note that the charred barley grain (*Hordeum sativum*) and charred weed seed (*Spergula arvensis*) found in the floor were interpreted as indicative of food preparation in the pit house.[113] It is also possible that grass or straw was intentionally strewn on the floor to 'sweeten' it and keep it dry. If so, the shovelling out of this organic-rich layer and the subsequent increase in charcoal and ash deposition would suggest a change in floor maintenance practices during the life of the house.

[111] Davidson et al 1992; Milek 2012.
[112] Milek 2012.
[113] Guðmundsson 2009, 328, 334.

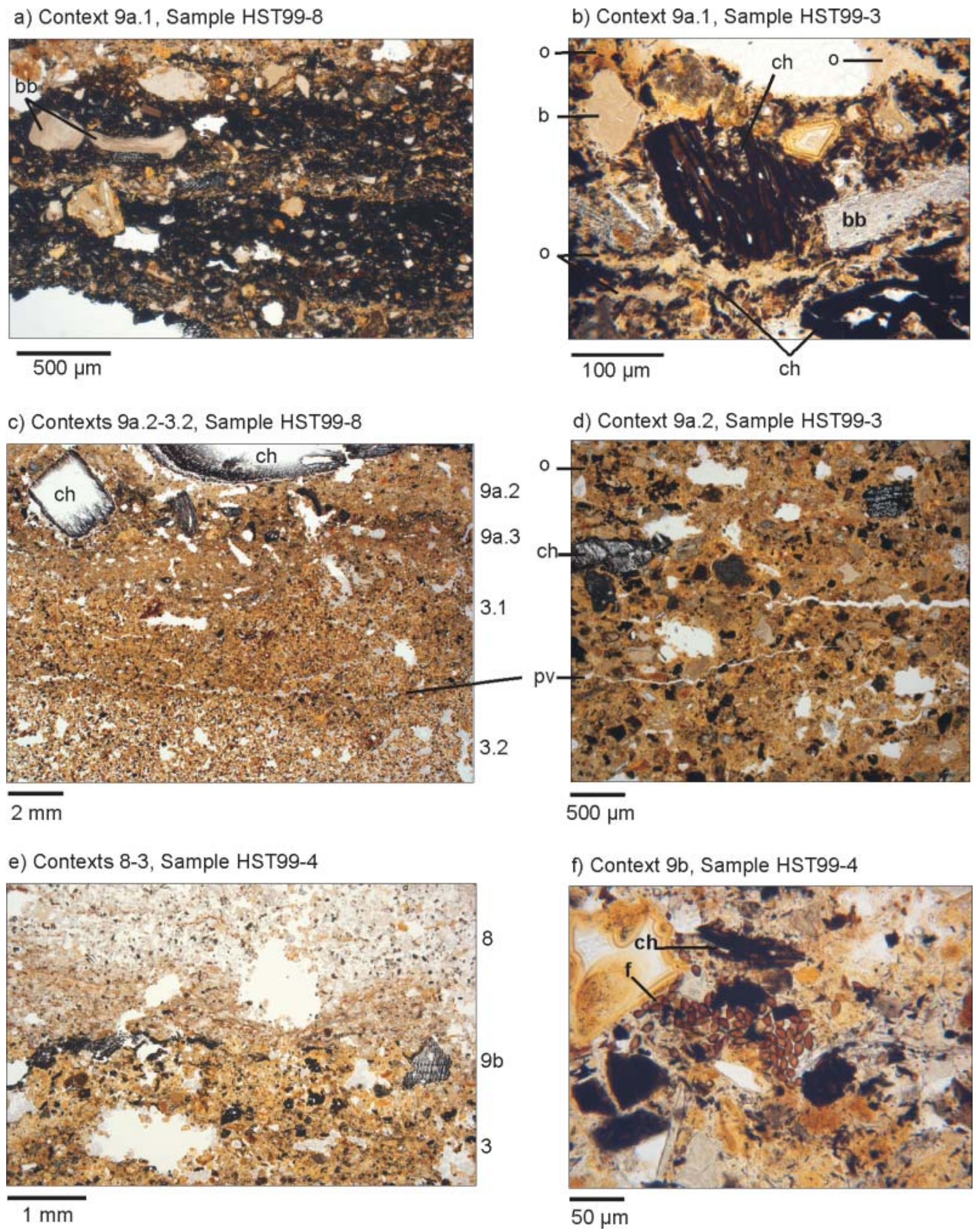


FIG 13

Photographs of thin sections from Hofstaðir G. b: bone, bb: burnt bone, ch: charcoal, f: fungal spores, o: amorphous organic matter, pv: planar voids. © *K Milek*.

TABLE 4

Summary descriptions of three micromorphology samples from Hofstaðir G

Floor context 9a was split into microstratigraphic layers where necessary. Overlying turf collapse 8 and underlying natural soil 3 are shown in contrast.[114]

| | | Structure | | Porosity[115] | | | | Groundmass | | | | | Organic and Biomineral Components[115] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | Context number | Microstructure[116] | Orientation of components[117] | Planar voids | Simple packing voids | Compound packing voids | Channels and vughs | Texture classification[118] | c/f Ratio (10 µm)[119] | c/f Related distribution[120] | Nature of fine material[121] | Birefringence fabric[122] | Phytoliths | Diatoms | Amorphous organic matter (dark brown-black) | Amorphous organic matter (light-brown to red-brown) | Fungal sclerotia | Fungal spores | Charcoal (< 1 mm) | Charcoal (1–10 mm) | Bone | Burnt bone |
| 3 | 8 | G, C | H | | ■■ | ■■■ | ■■■■■ | SCL | 40/60 | P | OB, S | U | ■ | + | ■ | ■ | + | | | | | |
| 3 | 9a.1 | C | H | ■ | | | ■■ | SL | 50/50 | P | PB, D | U | ■ | | ■ | ■■ | ■ | + | ■■■■■ | ■ | ■ | ■ |
| | 9a.2 | C | H | ■ | | | ■■■ | SCL | 30/70 | P | OB, S | U | ■■ | ■ | + | ■ | | + | ■■ | | | + |
| 4 | 9b | C, G | | | | ■■■ | ■■■■ | SCL | 30/70 | P | OB, S, D | U | ■■ | ■ | ■ | ■ | | ■ | ■■ | | | |
| 8 | 9a.1 | C | H | | | | ■■■■ | SL | 65/35 | P | PB, D | U | ■ | | ■ | ■■ | | | ■■■■■■■■■ | ■ | ■ | ■ |
| | 9a.2 | C | H | + | | | ■■■ | CL | 30/70 | P | PB, OB, S, D | U | ■■ | ■ | + | ■■■■ | + | + | ■■ | ■■■■■ | + | |
| | 9.3 | P, C | R | + | | | ■■■■ | CL | 50/50 | P | PB, OB, D | U | ■ | + | + | ■■ | | | ■■■■ | ■■■ | | + |
| 8 | 3.1 | C, P | R | ■■ | ■ | ■ | ■■ | VFS | 80/20 | P | OB, S | U | ■ | | + | ■■ | | | | + | | |
| | 3.2 | C | R | | ■■■■ | ■ | ■■■■ | VFS | 80/20 | C, E | OB, S | U | ■ | | + | ■ | | | | | | |

114 Descriptions follow the international terminology of Bullock et al 1985 and Stoops 2003.

115 + present in trace amounts, ■ <2%, ■■ 2–5%, ■■■ 5–10%, ■■■■ 10–20%, ■■■■■ 20–30%, ■■■■■■ 30–40%, ■■■■■■■ 40–50%, ■■■■■■■■ 50–60%, ■■■■■■■■■ 60–70%

116 G: Ultrafine granular structure; C: Channel structure; P: Platy structure (horizontal planar voids). Listed in descending order of frequency.

117 H: Horizontal; R: Random. Refers to orientation of elongated components such as charcoal, bone and/or plant fragments.

118 SCL: Silty clay loam; SL: Silt loam; CL: Clay loam; VFS: Loamy very fine sand.

119 Course/fine ratio, where the boundary between coarse and fine components is 10 µm.

120 P: Porphyric (coarse grains embedded in fine organo-mineral material); C: Chitonic (fine material forms coatings around grains); E: Enaualic (intergrain microaggregates of fine material).

121 OB: Orange-brown; PB: Pale-brown; S: Speckled (clay-sized black particles); D: Dotted (silt-sized black particles). As viewed in plane polarised light.

122 U: Undifferentiated birefringence fabric (no clay or calcium carbonate in the fine groundmass is visible in crossed polarised light).

In a couple of samples, contexts 9a.2 and 9a.3 also contained a significant number of large charcoal fragments (1–10 mm), reaching concentrations of 20–30% in the southern part of the central floor deposit (Fig 13c, Tab 4). So far from the fireplace, these charcoal fragments could only have been the result of dumping.

Most of the SW corner of the pit house, where the floor layer was very thin and patchy (9b), had levels of organic matter and associated elements that were far below the mean (Figs 10–11). However, one 0.5 × 0.5 m sample square had highly elevated values of phosphorus, calcium, potassium, magnesium, barium, strontium, copper, zinc and sodium, which are closely associated with organic matter and its ash. Since the organic matter content is low here, it is likely that these elements entered the soil in solution with dissolved wood ash, and either accumulated in the pores or impregnated the fine soil material. There is a possibility that such a solution could be produced by the post-depositional percolation of rain water through the ashy midden sediments that infilled the pit, although it seems unlikely that this would have occurred only within a single 0.5 × 0.5 m sampling square. The anomaly was more likely to have been created during the life of the building, for example by the spillage of intentionally mixed wood ash and water (ie alkaline lye), which was used historically for cleaning and bleaching.[123] Near this chemical anomaly, next to the W wall of the pit house, was a 100 mm-deep pit filled with a grey-blue, clayey soil, which must have been saturated by water long enough at one point for reducing conditions to mobilise and leach away the iron. Such localised gleying suggests the location of a liquid-holding container made of a permeable substance such as wood, possibly indicating the location of a sunken basin.

The eastern side of Hofstaðir G, which the excavators thought a wooden platform covered, had a unique geochemical signature in the form of electrical conductivity values 1000 times higher than other parts of the house (Fig 11). In order to determine which salts were responsible for these elevated levels of electrical conductivity, statistical correlation analyses were conducted and the distribution map of electrical conductivity values was visually compared to all of the element distributions (Tab 5; Figs 10–11).[124] Only the elements sodium, aluminium and iron were positively correlated with the enhanced soluble salt content on the eastern side of the pit house. Iron and aluminium, the dominant elements in the local andisols and the main components of the iron pan that was underlying the thin floors, are unlikely to derive from human activities. However, the high sodium levels on the eastern side of the pit house must be a result of activities taking place in this area. It is also possible — even likely — that the electrical conductivity levels were enhanced by the presence of elements not detectable by ICP-AES, such as nitrogen and chlorine, which have common salt-forming ions: ammonium ($NH_4^+$), nitrate ($NO_3^-$), nitrite ($NO_2^-$), and chloride ($Cl^-$).

The only substances with significant salt content that could conceivably have been present on a Viking-Age farm in Iceland are seawater, precipitated sea salt, seaweed and urine, and it is proposed that one or more of these substances must have been present in significant quantities on the eastern side of the pit house. Some 85% of the salt-forming ions in solution in seawater are sodium ($Na^+$) and chloride ($Cl^-$), but it also contains smaller quantities of sulphate ($SO_4^{2-}$), magnesium ($Mg^{2+}$), calcium ($Ca^{2+}$), potassium ($K^+$) and bicarbonate ($HCO_3^-$). When seawater evaporates, the solid salts that are precipitated include sodium chloride, potassium chloride and calcium sulphate (gypsum). Sea salt,

[123] Taylor and Singer 1956.

[124] Although most data frequency distributions approximated the normal distribution curve, some frequency distributions were positively skewed, and for this reason both parametric tests (Pearson's correlation coefficient ($r$)) and non-parametric tests (Spearman's rho ($r_s$)) were employed. The results of the analyses were nearly identical and only Spearman's rho is presented in Table 5.

TABLE 5
Spearman's rho correlation coefficients ($r_s$) for electrical conductivity (EC) and element values from floor context 9 in Hofstaðir G.

| | **Al** | **Ba** | **Ca** | **Fe** | **K** | **Mg** | **Na** | **Ni** | **P** | **Sr** | **Zn** | **EC** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Al** | 1 | −.654** | −.825** | .973** | −.782** | −.701** | −.518** | .121 | −.824** | −.756** | −.734** | .453** |
| **Ba** | −.654** | 1 | .838** | −.611** | .794** | .620** | .422** | .157 | .827** | .924** | .864** | −.252 |
| **Ca** | −.825** | .838** | 1 | −.848** | .953** | .892** | .677** | .084 | .877** | .922** | .832** | −.327* |
| **Fe** | .973** | −.611** | −.848** | 1 | −.810** | −.767** | −.592** | .106 | −.832** | −.750** | −.720** | .428** |
| **K** | −.782** | .794** | .953** | −.810** | 1 | .810** | .584** | .127 | .867** | .904** | .857** | −.292* |
| **Mg** | −.701** | .620** | .892** | −.767** | .810** | 1 | .844** | .096 | .710** | .733** | .619** | −.247 |
| **Na** | −.518** | .422** | .677** | −.592** | .584** | .844** | 1 | −.100 | .457** | .518** | .357** | .067 |
| **Ni** | .121 | .157 | .084 | .106 | .127 | .096 | −.100 | 1 | .097 | .083 | .250 | .023 |
| **P** | −.824** | .827** | .877** | −.832** | .867** | .710** | .457** | .097 | 1 | .910** | .930** | −.458** |
| **Sr** | −.756** | .924** | .922** | −.750** | .904** | .733** | .518** | .083 | .910** | 1 | .880** | −.328* |
| **Zn** | −.734** | .864** | .832** | −.720** | .857** | .619** | .357** | .250 | .930** | .880** | 1 | −.400** |
| **EC** | .453** | −.252 | −.327* | .428** | −.292* | −.247 | .067 | .023 | −.458** | −.328* | −.400** | 1 |

N = 58
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

whether obtained by evaporating seawater or by burning seaweed, could have been used as a preservative for meat, fish or butter.[125] In addition, sea water and the lye created by mixing seaweed ash with water could be used for activities such as cleansing, bleaching or dyeing, which requires salt as a mordant. However, neither seaweed nor seawater were readily available at the inland site of Hofstaðir.

Urine, on the other hand, would have been abundant and could easily have been stored in barrels. Chemically, urine is composed of nitrogen-rich urea (2%), ammonia (0.05%) and uric acid (0.03%), in addition to c 2% dissolved salts, of which the most common are chloride, potassium, sulphate, phosphate and sodium. Micromorphology sample HST99-4, taken near the western edge of context 9b in the eastern third of the pit house, did not contain any optically visible salts. This means that the ions or ionic compounds responsible for the high electrical conductivity values were not present in the form of crystals such as sodium chloride or calcium sulphate (gypsum), common precipitates of seawater. Rather, they must have been bonded with fine mineral or organic materials in the matrix of the soil, where they remained optically invisible. This suggests that they were derived from urine rather than sea salts, for solutions that contain many different ions, including urine, rarely form defined salts after the evaporation of the water.

In thin section it was possible to see that the thin, patchy smears of dark-coloured floor sediment on the eastern side of the pit house were mainly composed of 2–5% charcoal fragments under 1 mm in size, but there were also localised concentrations of brown fungal spores (Tab 4; Fig 13e–f). Fungal sclerotia and spores were present in trace amounts in all the thin sections examined, but this is the only place where the fungal spores reached a frequency of 0.5–1%. Concentrations of fungal spores indicate conditions favourable for the growth of fungus, which again could be linked to nitrogen enrichment and the presence of urine. The storage and spillage of urine on the eastern side of the pit house would also account for the cream-yellow-greenish staining of the floor in this area, which had been noted in the field.

Why would urine have been stored on the eastern side of the pit house? Although seemingly noxious to our 21st-century sensibilities, urine was used as a cheap and readily available cleansing and dyeing agent for wool and woollen textiles from at least the Roman period until the early 20th century in continental Europe, the British Isles and Iceland.[126] While fresh urine is slightly acidic (pH 6.0), when it is left standing for some time the urea is converted by the bacterium *Micrococcus ureoe* into ammonia and carbon dioxide, and the resulting 4% ammonium carbonate solution is a strong alkali. The reaction of grease (lanolin) in wool with the alkali in the urine, which can be promoted by agitating the liquid, creates a frothy, soap-like scum that effectively removes greasy dirt, insects and ectoparasites.[127] The practice of washing wool is not mentioned in medieval Icelandic literature, but in 19th- and 20th-century Iceland it was common practice to use gently heated stale urine and water to wash sheep fleeces.[128] In addition, wool cloth could be fulled by soaking it in a mixture of stale urine and hot water, which shrunk and tightened the cloth, making it stronger and warmer and better suited for coats and hoods.[129] I therefore propose that the soluble salts concentrated on the eastern side of the pit house were from spilt urine that may have been stored and used in this area for the purpose of cleaning, fulling and dyeing wool. The heat-blackened and fire-cracked stones found in Hofstaðir G could also have been used for heating urine and water for this purpose.

[125] Shetelig and Falk 1937, 311; Foote and Wilson 1970.
[126] Buckland and Perry 1989; Shetelig and Falk 1937, 332, 336; Stead 1981; 1982; Walton Rogers 1997, 1720.
[127] Buckland and Perry 1989.
[128] Jochens 1995, 135.
[129] Ibid, 140.

RECONSTRUCTION OF THE USE OF SPACE IN HOFSTAÐIR G

Although Hofstaðir G was a small, single-roomed building, the integrated macroscale and microscale evidence suggests that the space within was organised into five distinct activity areas: 1) a heavily trampled central corridor where herbaceous organic matter and hearth refuse accumulated, which had been cleaned out (truncated) at least once; 2) a weaving area with a standing loom against the northern wall; 3) an area around the oven in the NW corner where fish and meat were eaten and where stones were heated; 4) a 'wet' area in the SW corner, where there had been a washing basin; and 5) a raised wooden platform on the eastern side of the pit house used for sitting, possibly sleeping one or two people, and where urine barrels were at least sometimes stored for washing, fulling and possibly dyeing wool (Fig 14). The clusters of stakeholes in the floor everywhere except for the areas occupied by the wooden platform and the oven could have been made by distaffs and/or lamps being pressed into the floor. The detailed study of Hofstaðir G highlights the possibility that pit houses could have been used for all stages of woollen textile production, from the initial cleaning of fleeces to weaving and dyeing. Moreover, meals must have been consumed in pit houses where burnt bones were found, and it is



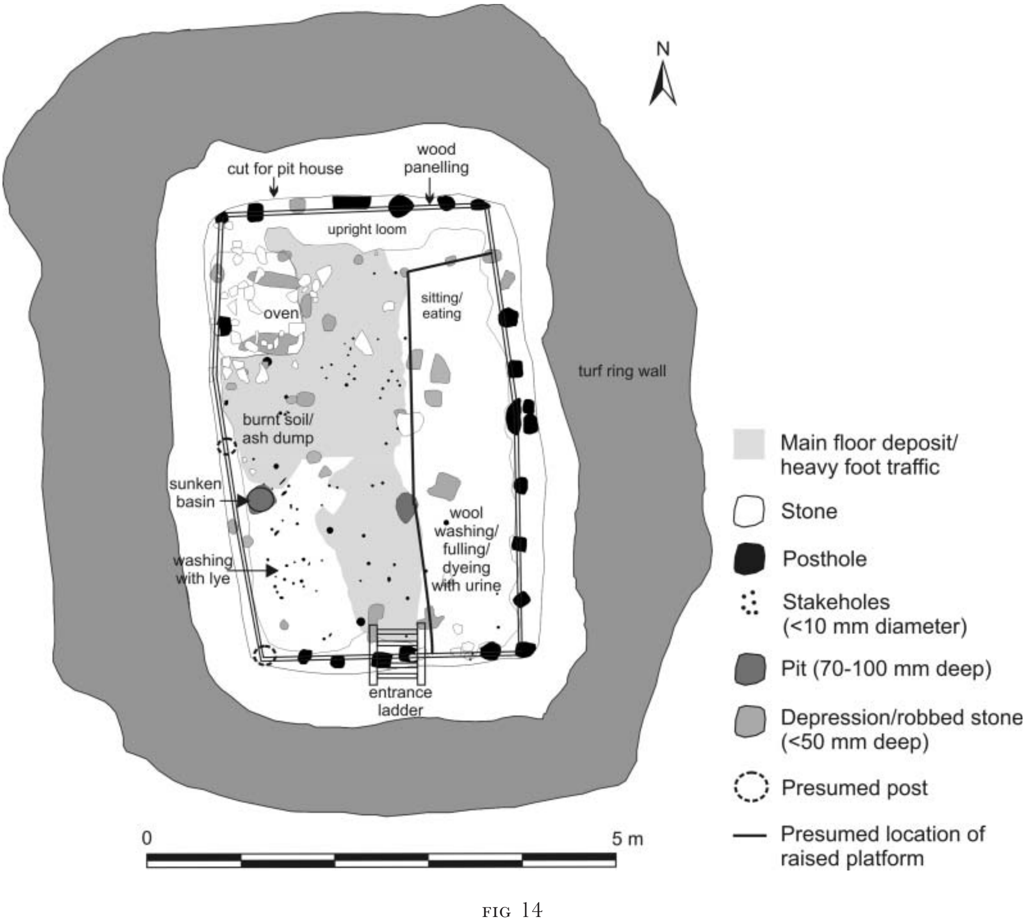


FIG 14

Interpretive plan of Hofstaðir G. *Drawing by K Milek after an original by Gavin Lucas, © K Milek and Fornleifastofnun Íslands 2009.*

possible that one or two people could have slept on the platform, though this seems unlikely if and when it was used for the storage of urine.

## DISCUSSION

Although multi-functional to the extent that meals were consumed in them, this survey of pit houses and the detailed study of the occupation deposits in Hofstaðir G have shown that woollen textile production was probably the primary function of the pit houses on Viking-Age farmsteads in Iceland. Viewed in this light, the use of enclosed ovens rather than open hearths might well have been a measure to reduce the risk of flying sparks that could have damaged the valuable commodity.[130] Due to the small size of pit houses, and the fact that most have only one sitting platform, it is unlikely that more than one or two people could have used these buildings as sleeping places. The small size of the buildings would also have had an impact on the size of the looms in them. No warp-weighted looms survive in the archaeological record, but if Viking-Age looms were similar in size to the ethnographic examples preserved in Iceland, the Faroes and Norway, the horizontal beams could have been anywhere from 1.90 to 2.40 m long,[131] and in the smallest of the pit houses such a loom would have taken up most of a wall.

The fact that the walls of pit houses were constructed of timber rather than turf, which would have made it easier to have hinged windows, could have been connected to the need for good light for the various activities involved with the production of woollen textiles. The semi-subterranean character of the buildings would have helped to reduce the entry of floor-level draughts, and would have helped to keep them warmer, but the sunken character of the buildings seems to have had little other functional purpose. Unlike linen-weaving, for which the threads must remain damp in order to remain workable,[132] a humid environment was not advantageous for the weaving of woollen textiles. However, as the only buildings on Viking-Age farmsteads with timber walls and sunken access, the semi-subterranean character of pit houses must have meant and communicated something about the functions of the buildings. Since Viking-Age pit houses in mainland Scandinavia were commonly used for weaving as well,[133] Icelandic pit houses represented the continuation of a very long-standing cultural tradition that the appropriate space for textile production was a semi-subterranean building.

Both the archaeological and the literary evidence point to the fact that women primarily carried out textile production in Viking-Age Iceland. In furnished burials in Scandinavia and the N Atlantic region, the most common implements found in women's graves relate to textile production, including wool combs, spindle whorls, loomweights, weaving swords, weaving tablets, needles, glass linen smoothers and whalebone smoothing boards.[134] Although some of these implements have also been found in a few male graves in Scandinavia, this is extremely rare, and in Iceland every furnished burial containing textile implements was sexed as female on the basis of skeletal evidence or the presence of oval brooches.[135] In the ON poems that mention spinning and weaving, females

[130] It is notable that of the 11 occupation phases documented in Sveigakot MT2, the one that contained the slab-built oven was also the one with the 9 loomweights; Urbańczyk 2006.
[131] Hoffmann 1964.
[132] Bender Jørgensen 1986; Zimmermann 1982.
[133] Bender Jørgensen 1986; Mortensen 1997.
[134] Jesch 1991, 19.
[135] Friðriksson 2000.

exclusively conduct these activities.[136] In the 13th- and 14th-century sagas, there are also numerous references to women weaving, sewing and making clothing, indicating that this work was in the women's domain in the immediate post-Viking period, and in Iceland it remained so until the introduction of the horizontal loom in the 19th century.[137] The evidence therefore points to the pit houses on Viking-Age farmsteads in Iceland as the women's workrooms, or *dyngjur*, that are mentioned in ON literary sources as the places where textiles were made.

Women of all status, from housewives and their daughters to servants and slaves, would have been involved in textile production, and it is likely that this work was predominantly done in pit houses. These buildings must have represented an integral and distinctively female space on Viking-Age farmsteads in Iceland, and should perhaps be seen in opposition to smithies and ironworking activities, which archaeological and literary sources associate solely with men.[138] Indeed, the 10th-century poem by Þorbjörn hornklofi makes it clear that *dyngjur* were exclusively places for women and children, and in the Icelandic sagas bad things tended to happen when men overheard conversations taking place in the *dyngja* that they were not supposed to hear.[139] Pit houses should be viewed as strongly gendered spaces, and the fact that all pit houses in Iceland were abandoned in the later 10th or 11th century points to a dramatic and meaningful shift in the organisation of these gendered spaces and the household production of homespun wool.

From the 12th century onwards the space for women's textile work can be found deep inside the main dwelling houses. On 12th- and 13th-century farms, such as the later phases of Sveigakot, Stöng, Þórarinsstaðir and Sámstaðir, the size and organisation of space in the main dwelling houses had changed. Many of the same elements associated with textile production, including corner ovens, heated stones, small stakeholes in the floor, loomweights and other implements associated with spinning and weaving, had been relocated to rooms that had to be accessed via the central livingrooms.[140] If the distribution of spinning and weaving implements is anything to go by, these activities had certainly taken place in the central livingrooms of longhouses before this date, so timber walls and windows were not absolute requirements. However, the universal abandonment of pit houses and the construction of new rooms for textile production deep in the main dwelling house by the turn of the 12th century must point to wider social and economic changes in Icelandic society.

It might not be a coincidence, for example, that during the late 10th and 11th century, when pit houses were being abandoned, Iceland was converting to Christianity. I propose that the lack of a good functional reason for the semi-subterranean character of pit houses may relate to a more symbolic significance of the building form, one that related to pagan religious beliefs and women's magic. In ON mythological sources, the fates of men were frequently determined by *nornir*, female supernatural beings who lived below ground, next to the roots of the mythical world tree, Yggdrasil, and in the poem

136 Eg *Rígsþula*, *Völundarkviða*, *Darraðarljóð*, *Helgakviða Hundingsbana I*, *Knútsdrápa* by Óttarr the Black; Bek-Pedersen 2008; Jesch 1991, 152; Larrington 1996, 114–15, 102, 248; Magnusson and Pálsson 1960, 349–51; Page 1995, 124, 150, 155.

137 Damsholt 1984; Jesch 1991, 192, 197; Jochens 1995, 134–60; Þorláksson 1991.

138 No smith's tools have been found in Icelandic burials so far, but they were present in c 10% of male burials in Norway, and all the smiths in ON literature were men or male dwarfs; eg *Rígsþula*, *Völundarkviða*, *Volsunga saga*; Barndon 2006; Byock 2004; Faulkes 1987, 101; Friðriksson 2000; Larrington 1996, 105–7, 249; Petersen 1951, 72.

139 Bek-Pedersen 2008, 174, 177.

140 Eldjárn 1949; Rafnsson 1977; Roussell 1943; Vésteinsson 2001. Note that the assertion by Bek-Pedersen 2008, 173, that in Iceland the *dyngja* was usually a separate room within the house, rather than a pit house as it was in mainland Scandinavia, can only be applied to houses from the 12th or 13th century onwards.

*Helgakviða Hundingsbana I* they manipulated fate by twisting threads.[141] In the poem *Darraðarljóð*, in *Njal's saga*, valkyries in a *dyngja* wove the battle-fate of warriors on a gruesome loom that had men's entrails for threads and loomweights fashioned from heads.[142] In addition, the art of *seiðr*, the magic performed by women and occasionally 'unmanly men' in ON literary sources, seems to have involved the symbolic spinning of a mind emissary or snare, probably with the aid of a real or symbolic distaff of the kind found in some female burials and interpreted as staffs of sorcery.[143] Another common motif in the saga literature is supernaturally protective or harmful shirts and banners that female magic workers wove and embroidered.[144] If these written sources are true reflections of worldviews and practices in Viking-Age Iceland, there may very well have been a cognitive association between pagan religious beliefs, women's magic and the semi-subterranean spinning and weaving spaces on farmsteads. If pit houses were perceived as real or potential places of women's magic, which appear to have been associated at times with the practices of spinning and weaving, this other-worldly character of the spaces could also explain why they were originally set apart from the main dwelling house. Once Icelanders began converting to Christianity around AD 1000 and over the course of the following century, separate, semi-subterranean spinning and weaving spaces would have been rendered redundant, or were perhaps considered polluted by pagan beliefs and practices, and this could be why textile production shifted to the main dwelling house. It is clear from Christian commentators on the continent that practising magic at the loom was still occasionally done by women in the 11th century, but it was considered a sin and efforts were being made to stamp out the practice.[145]

Although in Iceland as a whole the timing of the adoption of Christianity and the abandonment of pit houses seem to have roughly coincided, it is clear that there was not a simple or direct correlation between Christian conversion and the abandonment of pit houses at the level of individual households. At Hofstaðir, for example, the abandonment of the pit house marked the start of an intensified phase of cult activity: the extension of the feasting hall and the ritual slaughtering of cattle.[146] In addition, in some cases the very act of closing and sealing the pit house seems to have been done within the context of pagan beliefs. Most abandoned pit houses were used as dumping grounds for household wastes such as ashes and animal bones — undoubtedly a practical measure of rubbish disposal, but one that also infilled the pits and made them invisible. At Vatnsfjörður, where the pit was only 0.3 m deep, an animal building was constructed directly on top of the pit house soon after it was abandoned. A stone pavement was placed in the entrance of the new building, a central stone pavement was laid along the original long axis of the pit house, two large flagstones were placed over the ruins of the corner oven, and ten cakes of refined iron bloom were laid as a foundation deposit before the eastern turf wall of the new building was constructed.[147] Representing around 35 kg of unused iron, this was a very valuable deposit. It was suggested above that pit houses and textile production (female

[141] *Gylfagninning* ch 15, Faulkes 1987, 18–19; *Helgakviða Hundingsbana I,* verses 2–4, Larrington 1996, 114–15, 278; Aðalsteinsson 1999, 47; Bek-Pedersen 2007; Bek-Pedersen 2011; Gardeła 2008; Heide 2006.
[142] *Njál's Saga* ch 157; Magnusson and Pálsson 1960, 349–51.
[143] Gardeła 2008; Heide 2006; Price 2002.
[144] Eg *Orkneyinga saga* ch 6, 11, 14, 17, 55, Pálsson and Edwards 1978; *Eyrbyggja saga* ch 18, Pálsson and Edwards 1989; *Vatnsdæla saga* ch 19, Jones 1944; *Njáls saga* ch 157, Magnusson and Pálsson 1960; Bek-Pedersen 2009; Meaney 1981, 78–9.
[145] Eg *Corrector* of Burchard of Worms, c AD 1010, Meany 1981, 185.
[146] Lucas and McGovern 2008; McGovern 2009, 236–49.
[147] Milek 2010, 57–60; Birch 2011. The interpretation of Structure 9 as an animal house is based on its organic-rich floor deposit, the identification of dung in micromorphology samples, and the extensive use of flagstones on the floor.

work) might have had a perceived counterweight in smithies and iron production (male work). If so, the choice of iron as a foundation deposit could have been perceived as a way of neutralising a female space as the pit house was being covered over by an animal building.

In addition to the conversion to Christianity, which must have had a profound effect on many aspects of daily life, historical sources point to other significant social and economic changes that were occurring in Iceland during the 11th century: the abandonment of the institution of slavery,[148] and the growing importance of homespun wool (*vaðmál*) as a commodity for barter, export and the making of legal payments.[149] So important did homespun wool become for the Icelandic economy that lengths (ells) of wool replaced silver bullion as the standard against which all other products were valued.[150] In AD 1096, for example, when Bishop Gizurr persuaded Icelanders to accept the tithe tax to support the new Icelandic church, people had to assess their property in lengths of homespun wool, and ells of cloth were the currency specified for most payments.[151] The economic importance of homespun wool for barter, the payment of taxes and as a commodity that could be exchanged by farmers for imported barley, timber, bronze objects, schist whetstones, glass beads, antler combs and other foreign goods must have also increased the economic power and the status of the women who produced it — including women who had formerly been slaves and who may have been working, eating and sleeping in pit houses. The movement of woollen textile production from pit houses to workrooms deep inside the main dwelling houses may therefore be linked to the increased status of this important work and a desire to keep a protective eye on the workspace, the product and the women who were making it.

## CONCLUSION

This interdisciplinary study of pit houses on Viking-Age farmsteads in Iceland, which included for the first time a detailed analysis of the microrefuse, geochemistry and micromorphology of floor sediments, has provided a unique insight into the functions of these buildings. Far from being short-lived, temporary dwellings, specialised saunas or the houses of Slavs, this revaluation of the archaeological record has shown that pit houses were long-lasting, integral social and economic spaces, as they must have been in mainland Scandinavia, and that there may have been at least one on every Icelandic farmstead until this type of building was abandoned altogether in the late 11th or 12th century. Key to the interpretation of the function of these buildings was the geoarchaeological evidence from the pit house at Hofstaðir, which demonstrated that these semi-subterranean buildings functioned primarily as work rooms for all stages of woollen textile production, from the washing of raw wool through the spinning of yarn and the weaving of cloth. The geoarchaeological work lent strong support to the interpretations derived from the survey of the artefactual evidence from pit houses: that the buildings were dominated by textile-working implements and stones for heating liquids. These new insights into the role of pit houses as centres for textile production on farmsteads also dovetail well with what we now know about their unique architectural features: the timber walls that enabled the installation of windows, and the enclosed corner ovens that could heat small buildings without endangering them with sparks. Perhaps more interestingly, the geoarchaeological work

[148] Agnarsdóttir and Árnason 1983; Foote 1977; Karlsson 2000, 52–3; Karras 1988.
[149] Ingimundarson 1992; Jochens 1995, 134, 141–60; Thorláksson 2000, 185.
[150] Jochens 1995, 141–60; Jóhannesson 1974, 331; Gelsinger 1981, 17–44.
[151] *Íslendingabók*, ch 10, Grønlie 2006, 11–12; *Grágás*, Dennis et al 1980, 32, 36–7, 246–47.

presented here adds new layers of detail, including the fact that urine and lye may have been used for cleaning, fulling and possibly dyeing wool in pit houses. Since all the literary and burial records indicate that textile production was exclusively women's work, we must regard pit houses as strongly gendered spaces with an important role on Viking-Age farmsteads as the place where women interacted socially and worked on all stages of the production of homespun wool cloth, a valuable commodity that was essential for daily life and as a means of exchange, trade and payment of taxes.

To understand why these textile workrooms were kept separate from the main dwelling house, and why they were semi-subterranean, we must seek more than functional explanations. The recent excavation of the pit house at Vatnsfjörður, which revealed a ritualised 'closing' event, as well as the deliberate infilling of many pit houses after their abandonment, were interpreted here in light of new research on women's magic and its association with the actions of spinning, weaving and twining threads in ON literary sources. The conclusion is that pit houses were not only strongly gendered spaces, but were likely to have been symbolically charged and were probably linked — at least cognitively, if not actually — with pagan practices. The shift in textile production to rooms deep inside the main dwelling house by the 12th–13th century is probably associated with the fact that spinning and weaving had by this time become a valued economic activity. As a means of paying the tithe and as the most important trade item in Iceland during the high medieval period, homespun wool was an immensely valuable commodity. The meaning and significance of the shift in the location of textile production is almost certainly related to the value placed on this work space and the women who used it, including the end of slavery and the freeing of slave women who might have been working and sleeping in pit houses.

Such a far-reaching and detailed interpretation of social space on Icelandic farmsteads would never have been possible without the integration of a very wide range of evidence gathered from the archaeological record, the geoarchaeology laboratory and the ON written sources. By providing important new insights into the gendered organisation of space on Viking-Age households, and highlighting new ways of looking at domestic buildings that we used to think of as mundane work spaces, this study is a clear demonstration of how much further we can take our understanding of the archaeological, scientific and written evidence when we line them up as equal partners, compare them against each other, and allow them to shed light on each other.



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*Résumé*

**Le rôle des habitations semi-souterraines et des espaces sexués dans les fermes de l'Âge des Vikings en Islande** *par* Karen Milek

Les petites habitations semi-souterraines (jarðhús), renfermant des fours à dalles, retrouvées dans de nombreuses fermes de l'Âge des Vikings en Islande (fin du 9e au 11e siècle) ont donné lieu à des interprétations très variées : habitats temporaires de courte occupation, saunas, ateliers de femmes, maisons de « colons » slaves, voire même, dans un cas précis, bâtiment de culte. Ce papier met à l'épreuve ces hypothèses en ré-évaluant totalement la datation des habitations semi-souterraines, leur forme architecturale, les structures internes et artefacts, et présente de nouveaux éléments géoarchéologiques provenant de l'habitation semi-souterraine de Hofstaðir, dans le nord-est de l'Islande. Ceci vient renforcer la théorie selon laquelle il s'agirait d'ateliers de femmes, destinés surtout à la production de textiles en laine. Leur abandon à la fin du 10e et au 11e siècle pourrait s'interpréter à la lumière d'une évolution des croyances religieuses et des structures sociales, de l'importance croissante de l'étoffe de laine en tant que marchandise d'exportation très rentable, et de l'amélioration du statut des femmes qui la fabriquait.

*Zusammenfassung*

**Die Rolle von Grubenhäusern und geschlechtsspezifischen Räumen auf Bauernhöfen der Wikingerzeit in Island** *von* Karen Milek

Die kleinen, halb unterirdischen Gebäude (jarðhús) mit aus Platten gebauten Öfen, die man auf vielen Bauernhöfen der Wikingerzeit in Island gefunden hat (spätes 9.-11. Jh. n. Chr.), wurden auf viele unterschiedliche Weisen gedeutet, von der kurzfristigen, zweckmäßigen Wohnstätte bis hin zur Sauna, zum Arbeitsraum für Frauen, zur Behausung slawischer Siedler und in einem Fall Kultstätte. Dieser Artikel überprüft diese Hypothesen, indem er eine gründliche Neubewertung der Datierung, architektonischen Formen, inneren Strukturmerkmale und Artefakte der Grubenhäuser vornimmt, und er stellt neue geoarchäologische Funde aus dem Grubenhaus in Hofstaðir, Nordostisland, vor. Diese Funde unterstützen die Interpretation, dass es sich um Arbeitsräume für Frauen gehandelt hat, hauptsächlich für die Herstellung von Wolltextilien. Dass sie im späteren 10. und im 11. Jh. n.Chr. verlassen wurden, könnte man im Lichte sich verändernder Glaubensüberzeugungen und gesellschaftlicher Strukturen, der zunehmenden Bedeutung von selbst gewebtem Tuch als wertvollem Exportartikel und des wachsenden Status' der Frauen, die es erzeugten, interpretieren.

*Riassunto*

**La funzione dei seminterrati e degli spazi a uso di un solo sesso negli agglomerati agricoli islandesi dell'era vichinga** *di* Karen Milek

I piccoli seminterrati (jarðhús) con forni fatti di lastre in pietra trovati in molti agglomerati agricoli islandesi dell'era vichinga (tardo IX secolo - XI secolo) hanno dato adito a interpretazioni di ogni genere: abitazioni temporanee di tipo opportunistico, saune, luoghi di lavoro femminili, abitazioni di coloni slavi e, in un caso, un edificio adibito al culto. Queste ipotesi sono qui messe alla prova attraverso una scrupolosa verifica della datazione dei seminterrati, delle forme architettoniche, degli aspetti delle strutture interne e dei manufatti, e viene presentata la nuova documentazione geoarcheologica ottenuta dal seminterrato di Hofstaðir nell'Islanda nordorientale. Essa contribuisce fortemente ad avvalorare l'ipotesi che si trattasse di edifici destinati ai lavori femminili, principalmente alla produzione di tessuti in lana. Il fatto che siano stati abbandonati nel tardo X secolo e nell'XI può essere attribuito alle credenze religiose e alle strutture sociali in fase di trasformazione, alla crescente importanza dei tessuti fatti a mano come beni preziosi di esportazione, e all'ascesa nel rango sociale delle donne che li producevano.