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Historical Ecology on Sandoy, Faroe Islands: Palaeoenvironmental and Archaeological Perspectives

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We present palaeoenvironmental, geomorphological, archaeological, and place-name data which allow a holistic assessment of the history of landscape change on Sandoy, Faroe Islands, especially in terms of the changes that occurred in response to the colonization of the island by humans. In contrast to other situations in the North Atlantic region, there is considerable continuity in the patterns and processes of landscape evolution across the initial

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settlement horizon. Many of the characteristic features of post-settlement North Atlantic landscapes—absence of trees, widespread blanket mires, high rates of soil erosion—were already in place when the first people arrived. Although human impact on Sandoy appears to have been light, conversely, the unusual environment forced major alterations of the subsistence economy imported by the colonists. Settlement-era archaeological records suggest that, from the start, patterns of resource use differed substantially from the regional norm, and these differences became amplified over time as the Faroese economy created a locally sustainable cultural landscape.

KEY WORDS: Norse; human adaptation; palaeoecology; archaeology; *landnám*.

INTRODUCTION

Throughout the North Atlantic region, human colonization has caused great changes to the natural environment. In many areas, the arrival of people, their agricultural systems, and their livestock, rapidly and radically transformed the flora, fauna, and soil system. This affected other interrelated aspects of the landscape, especially patterns of erosion and sedimentation, sometimes creating serious vulnerabilities to climate change and drawing down the natural capital represented by pre-settlement soils, vegetation, and wild animals. Perhaps the most dramatic example of human impact is that of Iceland, where colonization by the Norse in the ninth century A.D. led to deforestation and widespread soil erosion (e.g., Dugmore and Buckland, 1991; Hallsdóttir, 1987; Ólafsdóttir, 2001; Simpson *et al*., 2001, 2004). In Greenland, the long-term consequences of early human impacts may have resulted in local settlement abandonment or even prejudiced the survival of the inhabitants by limiting adaptive options and reducing the resilience of key natural and human systems (Barlow *et al*., 1997; McGovern, 1997). In the case of the Faroes, the degree to which humans modified the environment is poorly known. Existing palaeoecological work is limited in its spatial coverage and mostly confined to pollen analysis, so that many factors—the extent and species composition of pre-settlement woodland, the impact of people on soils, even the date of the first colonization (some time in the second half of the first millennium A.D.)—remain either disputed, or entirely unknown.

This paper attempts to establish how people and their activities fit into the processes and patterns of landscape evolution on the Faroese island of Sandoy. In the past, Sandoy has been largely overlooked by palaeoecologists, with the exception of a study on the early Holocene record of Gróthúsvatn (Hannon *et al*., 2001). Here we look at the interrelated factors of erosion, sedimentation, and vegetation change, principally through investigations of the sedimentology, palynology, and palaeozoology of two contrasting lakes. The palaeolimnological work is supported by detailed analyses of a number of peat, soil, and fluvial sequences, and by geomorphological mapping. Archaeobotanical and zooarchaeological data from an excavation of Norse to early medieval middens at Undir Junkarinsfløtti in Sandur, together with place-name and historical evidence, provide data on the changing patterns of resource use by the settlers and their descendants. Comparisons with similar situations elsewhere in the region suggest ways in which the imported Norse farming economy was modified to suit the peculiarities of the Sandoy environment.

STUDY AREA

Sandoy, with an area of ca. 120 km^2, lies close to the center of the Faroese archipelago (Fig. 1). Like all of the islands, the bedrock of Sandoy consists of stratified Tertiary basalts and associated tuffs, dipping

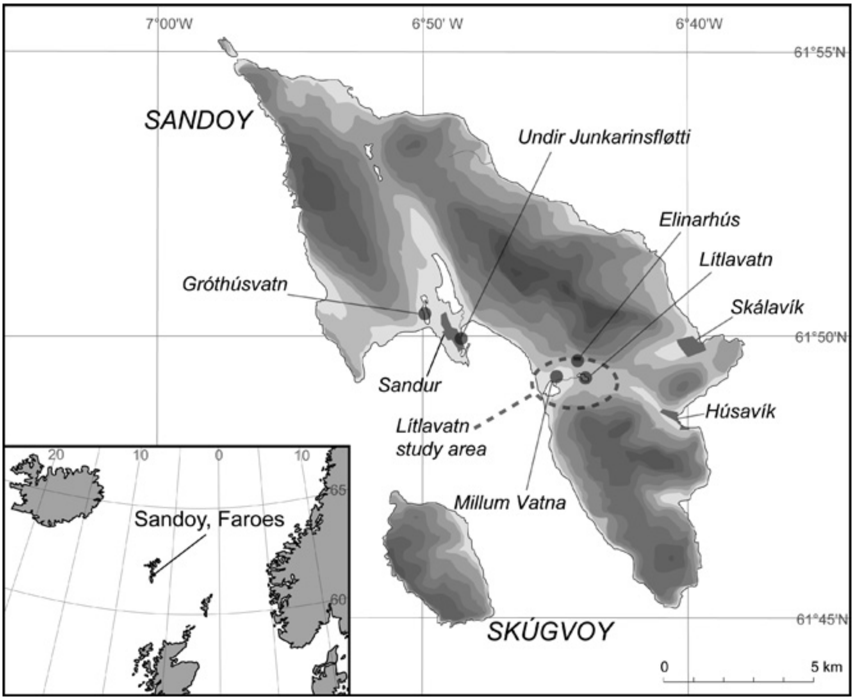

Fig. 1. Location map showing the island of Sandoy and sites discussed in the text. Grey shading indicates topography at 50 m intervals; the highest peak on Sandoy is 479 m above sea level. Inset shows the location of the Faroes.

gently eastwards (Rasmussen, 1982). The geology strongly determines the topography, which is generally rugged, with high cliffs especially on the western coasts and west-facing hillsides. In the context of the Faroes, Sandoy has unusually large tracts of low-lying, relatively flat land, including the bay and extensive valley at Sandur, and the large area of blanket peat around Lítlavatn.

The present settlements are all coastal villages located near beaches suitable for landing boats. In the Sandur area, three primary holdings are thought to have been established by the Norse settlers, later subdivided into the several smaller farms forming the basis of the modern village. One of these primary holdings has been the subject of archaeological excavation, producing radiocarbon dates which are currently the earliest settlement dates in the Faroes.

Each village on Sandoy is surrounded by an area of manured and periodically cultivated infields, used for hay-making and the cultivation of barley (*Hordeum* sp.), and potatoes (*Solanum tuberosum*). Away from the infields, the vegetation is mostly a mix of grassland and, on peat, mat grass-crowberry-heather (*Nardus stricta-Empetrum nigrum-Calluna vulgaris*) moor (Fosaa, 2001). The rural economy is largely based on sheep farming, although cattle were economically very important in the recent past (Guttesen, 2001).

MATERIALS AND METHODS

Sediment sequences from two lakes on Sandoy were sampled using a 10 cm diameter Russian-type corer from a boat, close to the center of each lake. Gróthúsvatn (Figs. 1 and 2; Table I), situated in the coastal lowlands near the town of Sandur, has a relatively intensively managed catchment at the present day, while Lítlavatn (Fig. 3) lies at 60 m above sea level in what is today an outfield area used for rough grazing. Both lakes are small, shallow (2 m), and nutrient-poor, with sediments consisting of organic muds with a variable component of clastic silicates and diatom frustules. A deep peat sequence at Millum Vatna (Fig. 4) was sampled in a similar way, while shallow blanket peats (e.g. Fig. 5) were sampled at nine locations within the Lítlavatn catchment using monolith tins.

Pollen extractions followed the standard technique outlined by Bennett and Willis (2002), omitting steps 2, 4, 5, 6, and 9 in their schema, using *Lycopodium* tablets as a source of exotic markers, and silicone oil as a mounting medium. Samples were counted to a total of 300 (Lítlavatn lake sequence and shallow peat sequences) or 500 (Gróthúsvatn, Millum Vatna) terrestrial pollen grains, excluding spores, aquatics, and alien taxa.

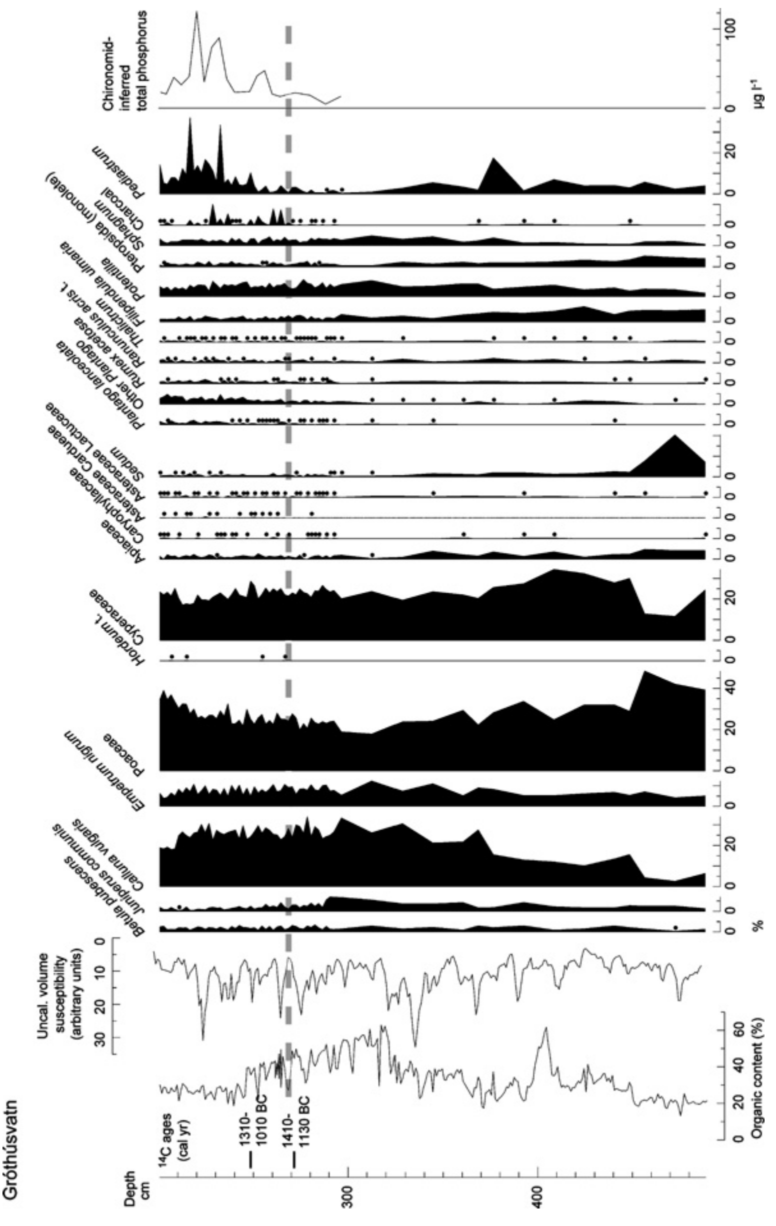

Fig. 2. Selected taxa pollen diagram for Gróthúsvatn, Sandoy. Depths are measured below the water surface; the sediment-water interface is at 183 cm depth. The thick dashed line here, and in Figs. 3 and 4, indicates approximately the level above which the data indicate anthropogenic activity. Black dots indicate the presence of pollen at frequencies below 0.5%.

Table I. Radiocarbon Dates From the Gróthúsvatn, Lítlavatn, Millum Vatna, and Lít-6 Sequences

Code	Site and sample	Sample type	$\delta^{13}C$	^{14}C yr B.P. (1σ error)
SUERC-1829	Gróthúsvatn 248–249 cm	Gyttja	−27.2	2955 ± 40
SUERC-1830	Gróthúsvatn 271–272 cm	Gyttja	−27.3	3050 ± 40
SUERC-1821	Lítlavatn 36–37 cm	Gyttja	−27.5	2980 ± 45
SUERC-1826	Lítlavatn 67–68 cm	Gyttja	−26.8	2125 ± 40
SUERC-1827	Lítlavatn 110–111 cm	Gyttja	−25.0	4200 ± 35
SUERC-1828	Lítlavatn 210–211 cm	Gyttja	−22.1	7430 ± 45
SUERC-1831	Millum Vatna 45–46 cm	Peat (humic fraction)	−28.2	1375 ± 35
SUERC-1832	Millum Vatna 113–114 cm	Peat (humic fraction)	−27.8	1595 ± 35
SUERC-167	Lít-6	Peat (humic fraction)	−27.4	4425 ± 25

Loss-on-ignition (Dean, 1974) and, in some cases, magnetic susceptibility (Dearing, 1999) analyses were also performed, the latter using a Bartington Instruments MS-2 meter and MS2b sensor.

Fossil remains of the head capsules of chironomid larvae were analyzed from the Gróthúsvatn and Lítlavatn sequences following the methodology outlined by Lang *et al.* (2003). Total phosphorus reconstruction was carried out following Brooks *et al.* (2001), using a 44-lake training set from the English Midlands and Wales (UK).

The archaeological data presented here come primarily from a site on Sandoy, at Undir Junkarinsfløtti in Sandur (Fig. 1). The site consists of a series of middens, wall lines, and buried structures, dated to the ninth–early thirteenth centuries A.D., and partly exposed by coastal erosion of the sandy soil of the modern infield. The middens were first identified in 2000 after slumping caused by a prolonged dry period and an initial trial-trenching exercise recorded a series of bone- and ash-rich middens over 2 m thick. Two radiocarbon determinations (Table II) from the two lowest midden deposits produced dates in the ninth–tenth century A.D. The early dating of the lowermost midden material was reinforced by the discovery of a bronze brooch of tenth century A.D. date in the same layer (Arge, 2001). A larger-scale sampling exercise was undertaken in 2003 to enlarge the small sondage excavated in 2000 with a view to extracting zooarchaeological and archaeobotanical remains. The details of the investigation are presented by Church *et al.* (2005) with summary findings outlined here. All of the archaeological deposits were dry-sieved at 4 mm for the extraction of zooarchaeological remains and artefacts. Bulk samples were taken from every context (*total* sampling: Jones, 1991) from which archaeobotanical and smaller zooarchaeological remains were extracted.

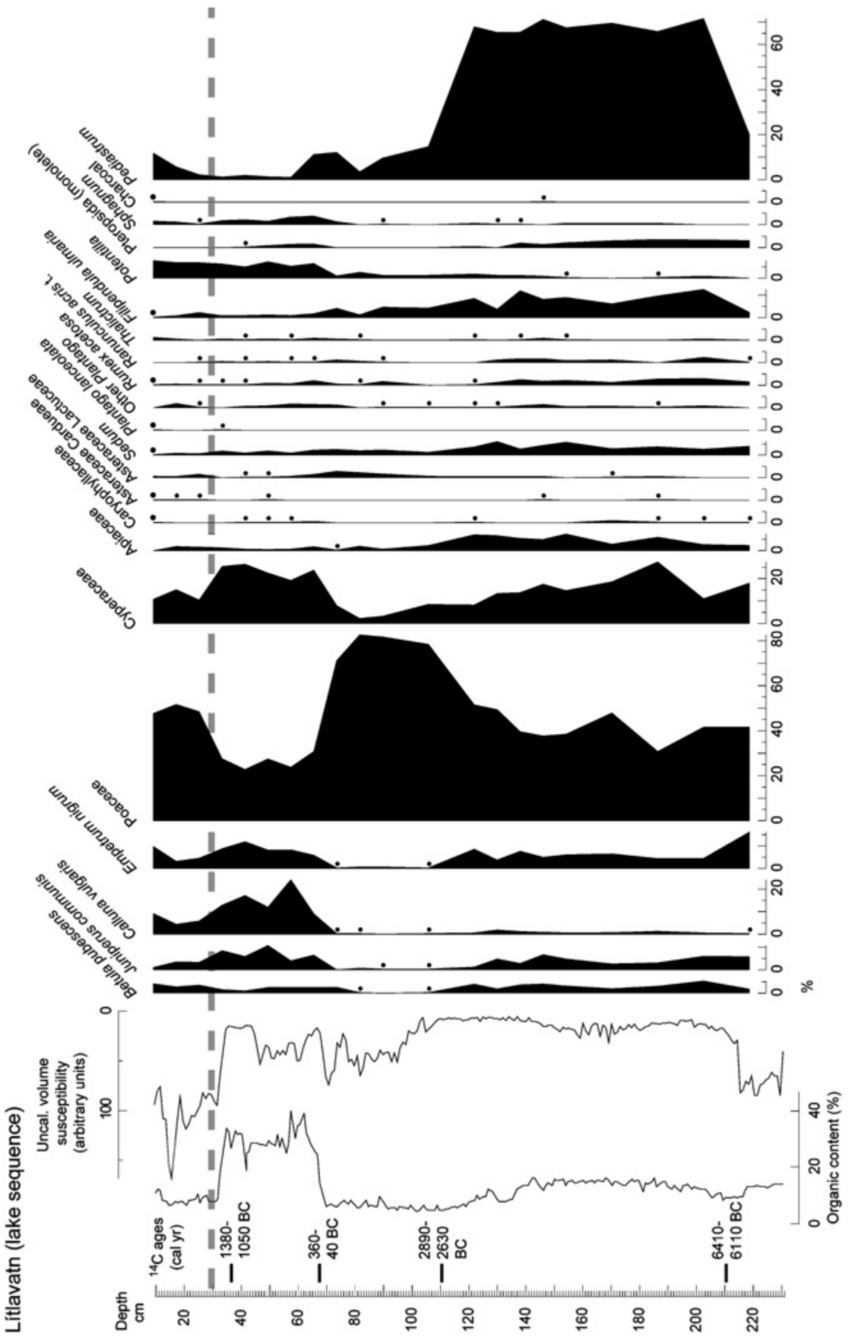

Fig. 3. Selected taxa pollen diagram for Lítlavatn (lake sequence). Depths are measured below the sediment surface.

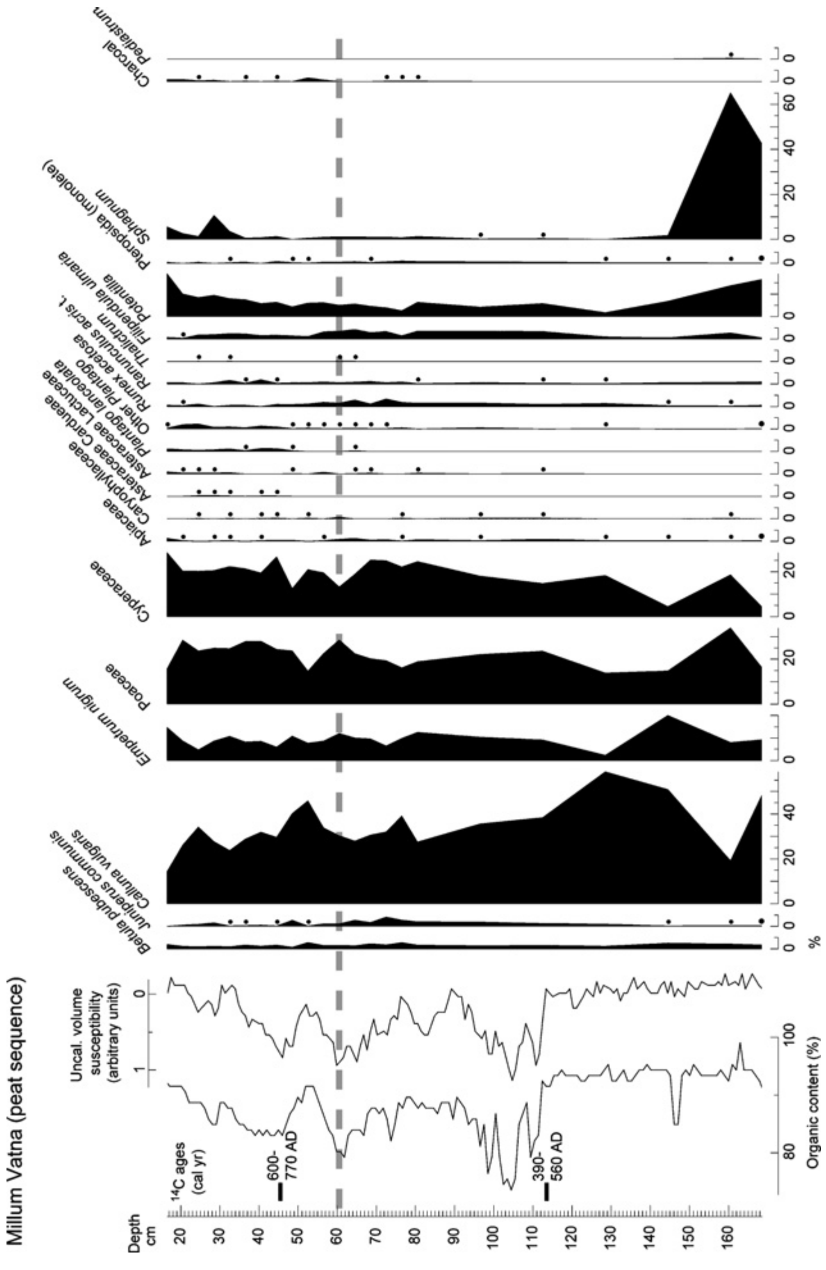

Fig. 4. Selected taxa pollen diagram for Millum Vatna. Depths are measured below the peat surface.

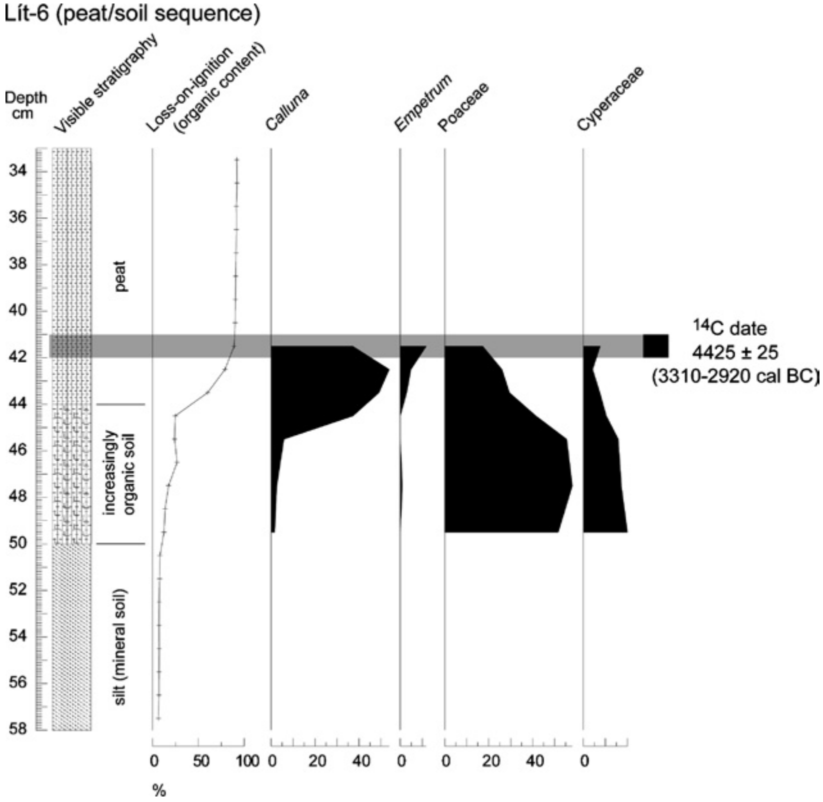

Fig. 5. Selected taxa pollen diagram for Lít-6, a typical short peat/soil sequence from the area of blanket peat around Lítlavatn. Depths are measured below the peat surface. The loss-on-ignition curve shows a rapid increase in organic content between 45 and 41 cm as mineral soil gives way to peat, mirroring a shift in the pollen from herbaceous communities to ericaceous taxa. The radiocarbon date, from the lowermost level with a high organic content, is a conservative estimate of the age of peat initiation at this site. Similar measurements on eight other sequences from the Lítlavatn area consistently yielded pre-*landnám* ages for peat initiation.

All radiocarbon calibrations were performed using the computer program OxCal (Bronk Ramsey, 2003), with the INTCAL98 calibration data set (Stuiver *et al.*, 1998).

VEGETATION

The paleoenvironmental analysis of the lake and peat sequences outlined above allows an assessment of the environment of the Faroes as it would have appeared to the first settlers.

Table II. Radiocarbon Dates From Undir Junkarinsfløtti, Sandur

Code	Context	Sample type	δ^{13}C	^{14}C yr B.P. (1σ error)
SUERC-3422	3	Barley grain	−24.6	925 ± 40
SUERC-3417	16	Barley grain	−25.9	900 ± 35
SUERC-3418	16	Barley grain	−26.4	925 ± 40
AAR-6927	19	Sheep bone	−19.8	950 ± 35
SUERC-3423	22	Cow bone	−20.9	990 ± 35
SUERC-3424	22	Pig bone	−21.2	1035 ± 35
SUERC-3400	23	Barley grain	−23.9	1000 ± 40
SUERC-3401	23	Barley grain	−26.8	980 ± 40
SUERC-3402	23	Barley grain	−26.3	940 ± 45
SUERC-3403	23	Barley grain	−24.0	995 ± 35
SUERC-3410	23	Pig bone	−21.4	965 ± 40
SUERC-3411	23	Pig bone	−21.0	1075 ± 40
SUERC-3415	23	Pig bone	−21.4	935 ± 40
SUERC-3416	23	Pig bone	−21.6	1005 ± 35
SUERC-3425	23	Cow bone	−21.0	980 ± 40
SUERC-3426	23	Pig bone	−22.7	1095 ± 40
AAR-6929	23	Cow bone	−19.9	1115 ± 35
AAR-6928	24	Sheep bone	−20.4	1190 ± 40

The Pre-settlement Vegetation of Sandoy

The age of the blanket peat on Sandoy has been determined by radiocarbon dating of the oldest peats in the short peat/soil sequences, which typically yielded dates of 3000–5000 ^{14}C B.P. (approximately 1000–4000 cal B.C.; Fig. 5). The mid-Holocene expansion of peatland communities dominated by *Empetrum nigrum* and *Calluna vulgaris* is also registered in the Gróthúsvatn pollen record, and less clearly in the Lítlavatn sequence where periodic reworking obscures the pollen data. Thus peat accumulation began long before the first arrival of people, presumably through the well-established process of progressive leaching of nutrients and acidification as the soils matured through the Holocene (e.g., Crawford, 2000; Charman, 2002). This result stands in contrast to many situations in the North Atlantic region where human agency has been implicated in peat initiation (e.g., Bennett *et al.*, 1997; Bunting, 1996; Charman, 1992; Moore, 1975, 1993; Solem, 1989).

Today the Faroes are treeless, apart from a few plantations. Although tree birch (*Betula pubescens*) macrofossils are occasionally found in pre-settlement peats on other islands (Malmros, 1994), previous pollen data have shown no indication that woodland was ever abundant. Tree birch percentages in pre-*landnám* samples are typically small in the various pollen spectra from Sandoy (usually 0.7–3.9% total land pollen). These values alone would be consistent with either a very low density of local woodland, or long-distance dispersal from Britain or the European mainland (cf. Randall *et al.*, 1986; Brayshay *et al.*, 2000; Tyldesley, 1973). However, a single sample from a short peat/soil profile in the Lítlavatn catchment, Lít-7, contains 16.3% *B. pubescens* pollen. This very high value suggests that birch is likely to have been present at least intermittently on Sandoy during the Holocene, while the absence of large amounts of its pollen in the other sequences suggests that it was never widespread or abundant, perhaps occurring only in localities protected from salt spray. No other tree taxon has yet been found in such abundance in the pollen record as to suggest local presence.

Overall, immediately pre-settlement pollen assemblages suggest a reasonably diverse landscape, with a mosaic of grasses and sedges, juniper scrub, and ericaceous heath and mire communities. There is also evidence that tall herbs such as *Angelica sylvestris* (wild angelica) and *Filipendula ulmaria* (meadowsweet), typical of ungrazed situations (e.g., Bennett *et al.*, 1992), were relatively abundant.

Vegetation Change After the Settlement

The clearest record of post-settlement vegetation change on Sandoy is the pollen record from Gróthúsvatn (Fig. 2). Identification of the settlement horizon in the record is complicated by the difficulty of dating the sediments. Radiocarbon ages of the total carbon fraction from 1 cm^3 of gyttja from both Gróthúsvatn and Lítlavatn appear (on the basis of biostratigraphic correlation with other dated sequences from the Faroes; Hannon *et al.*, 1998, 2001; Hannon and Bradshaw, 2000; Jóhansen, 1975, 1982, 1985) to be affected by redeposition of older organic matter from the lake catchments, giving dates that are too old. Similarly, redeposition of tephra hinders the application of tephrochronology as an alternative dating tool. Biostratigraphic correlation with the more reliably dated Millum Vatna sequence, and other well-dated sites from across the Faroes, suggests that the base of the Gróthúsvatn sequence is older than ca. 5000 B.P., and allows the tentative identification of the settlement horizon at ca. 260–270 cm depth in the sequence. Here, the presence of pronounced and broadly synchronous changes in several taxa following a long period of essentially stable assemblages suggests a major perturbation, while the presence of charcoal above this level is a strong indication that the perturbation is anthropogenic.

Above 260–270 cm, significant changes in the pollen assemblages are recorded, including a gradual decline in *Juniperus communis* (juniper), similar to that found at Tjørnuvík (Hannon *et al.*, 1998; Hannon and Bradshaw, 2000); a steady rise in *Plantago*, especially *P. lanceolata* (ribwort plantain), similar to those found at Hovi and Tjørnuvík (Jóhansen, 1971, 1975, 1985); and a gradual increase in the abundance of Poaceae (grasses) with a corresponding decline in *Calluna vulgaris* (heather), especially above 215 cm. These changes suggest the progressive removal of *Juniperus* by grazing or collection for its various uses (Malmros, 1990, 1994; Small, 1992); a spread of anthropochorous weeds like *Plantago* spp. responding to soil disturbance; and the replacement of ericaceous (heath) taxa by grasses through some combination of the favouring of plants such as *Nardus stricta* (mat-grass) by grazing on the outfields (Fosaa, 2001; Jóhansen, 1985; Nolan *et al.*, 1995; Stevenson and Thompson, 1993;), and the displacement of heath communities in the infields by cultivation. Very occasional finds of cereal-type grains suggest cultivation of crops; all grains found so far are attributable to *Hordeum*-type.

The changes in the pollen assemblages at Gróthúsvatn are not sudden, as, for example, at the settlement horizons at Mosfell or Þrandarholt in Iceland (Hallsdóttir, 1987), or at Dallican Water in the Shetlands (Bennett *et al.*, 1992). A major difference in the case of the Faroes is that, in the absence of significant tracts of woodland, deforestation with all its knock-on effects on other vegetation communities is simply an impossibility. However, pollen data from infield sites in the Faroes, for example Hovi and Tjørnuvík (Edwards *et al.*, 2005; Hannon *et al.*, 1998; Hannon and Bradshaw, 2000, Jóhansen 1971, 1975, 1985), also show a more sudden change than at Gróthúsvatn. A possible explanation is that Gróthúsvatn, being a shallow lake, is likely to experience mixing and redeposition of its sediments through wind action, effectively blurring the sediment sequence. Counting against this argument is the observation that pollen data from the peat sequence at Millum Vatna likewise indicate a gradual change in, for example, *Juniperus* across the settlement horizon. It may be the case that impacts were sudden where land management was intensive, as at the infield sites at Hovi and Tjørnuvík, but more progressive in the outfield areas, which are more strongly represented in the Gróthúsvatn and Millum Vatna sequences.

At Lítlavatn, redeposition of pollen obscures the pattern of vegetation change, although *P. lanceolata* becomes more common towards the top of the sequence. At Millum Vatna a similar, gradual increase in *P. lanceolata*, associated with small amounts of charcoal, also occurs towards the top of the sequence. At this site radiocarbon dating supports the identification of the settlement horizon as approximately coincident with these changes. It is not clear whether other changes in the Millum Vatna sequence, for example the increasing ratio of Poaceae to *Calluna*, are natural or anthropogenic (cf. Stevenson and Thompson, 1993), given that peat sequences often recruit much of their pollen from a very small area (Bunting, 2003) and hence are capable of recording small-scale, natural shifts in the vegetation mosaic. *Juniperus* pollen appears even in the next-to-uppermost sample analyzed, but it was apparently not abundant at this site even before *landnám*.

In short, the pollen records from Sandoy suggest that anthropogenic changes to the vegetation were both subtle and gradual. Neither Gróthúsvatn nor Millum Vatna shows evidence for abrupt change. Furthermore, the data suggest that the changes to the vegetation composition were fairly insubstantial, at least on a landscape scale, with no great structural change such as the removal of dense woodland, or the initiation of peat over large areas, as seen in other areas of the North Atlantic. At most, soil disturbance encouraged an expansion of ruderal herbs, grasses expanded slightly in response to grazing, and juniper bushes gradually disappeared from the landscape, along with the rare stands of tree birch. An important qualification to this conclusion is that the pollen records generated so far are either integrative over large areas, or situated in the least heavily exploited, and possibly least fragile areas of the landscape. Human impact was presumably, in the past as now, concentrated on relatively small areas. Comparison with the results of Jóhansen (1982, 1985) from Hovi, and of Jóhansen (1985) and Hannon and Bradshaw (2000; also Hannon *et al.*, 1998, 2001) at Tjørnuvík, and palaeoentomological work in Tjørnuvík and Toftanes (Buckland *et al.* 1998, Vickers *et al.*, 2005), suggests that change in at least some infield areas and farmyards was likely to have been more substantial and more abrupt. As yet, little is known about vegetation change at moderate to high altitudes in the Faroes (although cf. Edwards *et al.*, 2005), where the lower productivity of the vegetation might lead to a greater sensitivity to human disturbance.

EROSION, SEDIMENTATION, AND AQUATIC ENVIRONMENTS

A typical response of landscapes to human settlement is an increase in erosion (Edwards and Whittington, 2001). This often occurs via destruction of the vegetation that binds the topsoil together, whether by cultivation, deforestation, overgrazing, or trampling. The history of erosion on Sandoy is being reconstructed through a study of limnic and fluvial sediments, alluvial fans, and soils and peats.

Palaeolimnology

Loss-on-ignition and magnetic susceptibility data for Lítlavatn and Gróthúsvatn provide continuous records of erosion in their catchments, revealing very different sedimentation histories for the two lakes. The magnetic susceptibility record for Gróthúsvatn (Fig. 2), which can be viewed as a proxy for soil erosion in the catchment (Dearing, 1999), indicates little mineral input and no significant long-term trends. At Lítlavatn (Fig. 3), by contrast, the magnetic susceptibility data show large pulses of mineral sediment inwash, including one at the base of the sequence, one at 70–115 cm, and another at 0–35 cm. (Loss-on-ignition data for the two lakes generally accord with the magnetic susceptibility data, although occasionally abundant diatom frustules account for deviations.) A partial explanation of the differences between the two sedimentary records is that, although the catchments of the two lakes are approximately the same size (ca. 470 and 460 ha respectively; Fig. 6), the surface area of Lítlavatn is about half that of Gróthúsvatn, so a volumetrically equal flux of sediment through both catchments will be more evident in the deposits of the smaller lake. In Gróthúsvatn, the transport of bedrock- or soil-derived mineral material into the lake is further limited by the presence of a small basin just upstream of the lake on its main tributary stream, which acts as a sediment trap, and by a fen at the northern end of the lake which filters out some of the remaining sediment. Nonetheless, the conclusion to be drawn from the Lítlavatn record is that substantial erosion had occurred well before the arrival of people; in fact, according to the biostratigraphy, actually before the mid-Holocene expansion of *Calluna*. Erosion rates increase again towards the top of the sequence, probably in the post-settlement period, perhaps relating to Little Ice Age climatic change (see below). The data thus show that erosion on a significant scale, at least in the uplands, was part of the natural landscape of Sandoy well before the first settlement, although human activity may have revitalized the process.

Changing rates of erosion may have had substantial impacts on terrestrial flora and fauna, providing niches for pioneer taxa, although this remains to be demonstrated (perhaps the rise of *Plantago lanceolata* at 2500 B.P. is an indication of increased natural disturbance, not the immigration of this taxon; cf. Jóhansen, 1989). There is evidence that changes were also occurring in the lake ecosystems. At Gróthúsvatn, total phosphorus estimates based on changes in chironomid assemblages in the upper part of the sequence indicate a substantial rise in the nutrient status of the lake following *landnám*. This conclusion is supported by an increasing abundance of the alga *Pediastrum* (Fig. 2), closely tracking the total phosphorous reconstruction. Together, these data suggest that an increase in lake productivity accompanied the settlement, perhaps due to mobilization of nutrients by grazing and manuring, or to soil erosion.

At Lítlavatn, the change in sedimentation regime in the mid-Holocene is accompanied by dramatic declines in productivity by diatoms,

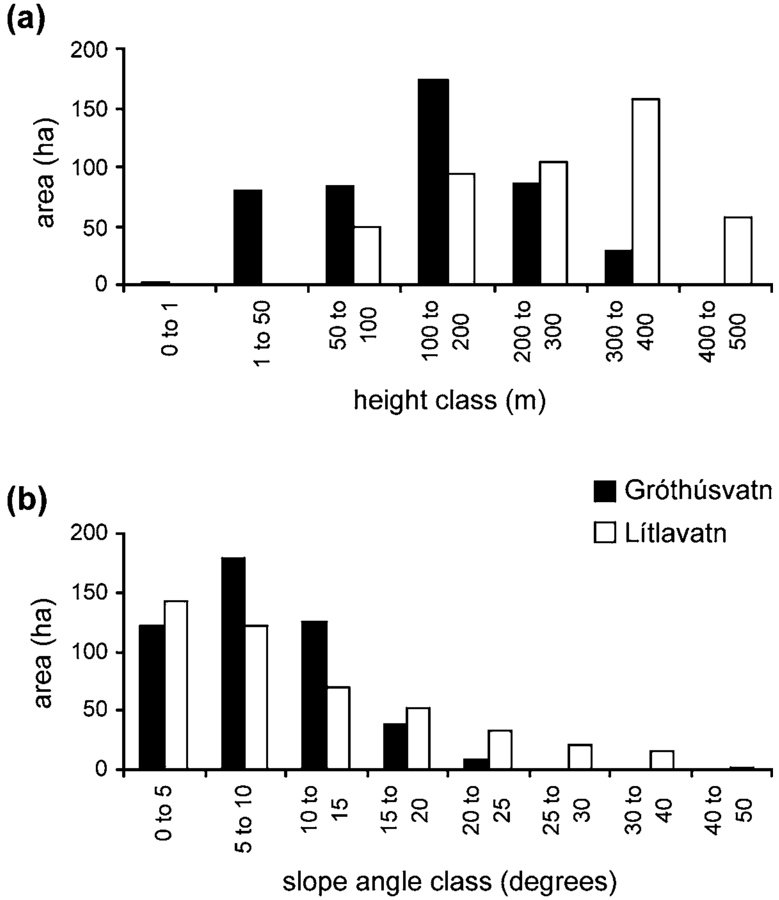

Fig. 6. Frequency histograms to compare the topographic characteristics of the hydrological catchments of Gróthúsvatn and Lítlavatn. (a) Area of land at different altitudes (height classes) in the two catchments. The Lítlavatn catchment is, on average, considerably higher than that of Gróthúsvatn. (b) Area of land of different slope angles in the two catchments. The Lítlavatn catchment includes more steeply-sloping land, on which soils are more readily eroded. These differences help to account for the fact that the two lakes record markedly different sedimentological histories. The histograms were generated using data from quantitative analysis of digitized topographic data.

Pediastrum, and chironomids. Contrary to the increasing productivity at Gróthúsvatn, sustained high levels of clastic input seem to have inhibited the productivity of this lake, a situation that could only be exacerbated if levels of erosion increased still further following settlement.

Geomorphology

A regionally representative stratigraphic sequence has been identified on Sandoy from observation and sampling of over 50 sediment profiles across the landscape. The sequence at this stage is based on field observation, with laboratory and dating analysis still ongoing, but broad trends can be identified within the context of a Holocene chronology. The sequence begins with peat accumulation overlying a basal early Holocene minerogenic soil and/or glacial diamicton and/or bedrock. The peat cover is extensive and generally absent only from heavily eroded and high altitude areas. In lowland areas and on slopes, the peat is overlain by minerogenic sediment formed by an influx of sands and gravels, represented in the profiles either as a single unit or as a series of laminations of coarse sand and gravel interdigitated with finer organic silts. This unit is an indication of extensive geomorphic change and landscape instability, represented by increased slope erosion and re-deposition by wind and water. This sand/gravel unit is in turn overlain by an organic silty soil, indicating a change in slope processes with less energetic remobilisation of sediment. This stratigraphic sequence is representative of many of the recorded profiles on both Suðuroy and Sandoy.

Based on chronological information from past palaeoecological research from the Faroes (cf. Jóhansen, 1985; Hannon *et al.*, 2001; Humlum and Christiansen, 1998; Wastegård, 2002), the sequence indicates that in the mid-Holocene, the Faroe Islands were more geomorphologically stable than today, with a wet climate facilitating extensive peat formation. The peat developed to cover much of lowland Sandoy. In the later Holocene (2000–4000 cal. B.P.) these lower slopes destabilized; the identification of the mechanisms and processes of this destabilization is still underway, but in the absence of people and large herbivores this shift is likely to be a result of climate change that crossed a geomorphic threshold, although the changing patterns of large colonies of nesting birds, particularly puffins, may also be relevant. This environmental change disrupted parts of the extensive lowland peat cover, leading to the creation of a more varied "mosaic" of vegetation and landscapes. At the same time, peat continued to develop across the island (cf. Humlum and Christiansen, 1998). The first settlers thus encountered a markedly dynamic landscape in which vegetation disturbance, changing patterns of runoff, gullying, soil and peat erosion, and alluviation were all well-established processes.

Since the settlement a top unit of organic silt has developed across much of Sandoy, indicating a change in geomorphic activity, a phase of sediment mobilization perhaps related to the combined effects of Little Ice Age climate change and human impact. Changes in atmospheric circulation in the early fifteenth century led to increased storminess in the North Atlantic (Dugmore *et al.,* in press; Meeker and Mayewski, 2002), and more frequent and/or more intense rainfall, combined with periods of lower temperature and human impact on vegetation and soils, could have enhanced processes of erosion and transport, leading to the deposition of this silt layer.

ARCHAEOLOGY

A composite section of most of the archaeological deposits at the key site of Undir Junkarinsfløtti is presented in Fig. 7, running from the sterile sand overburden (Context 2) down to the lowest midden deposits (Contexts 23 and 24), overlying the pre-settlement soil interface with the glacially-derived subsoil (Context 25). The deposits are characterized by

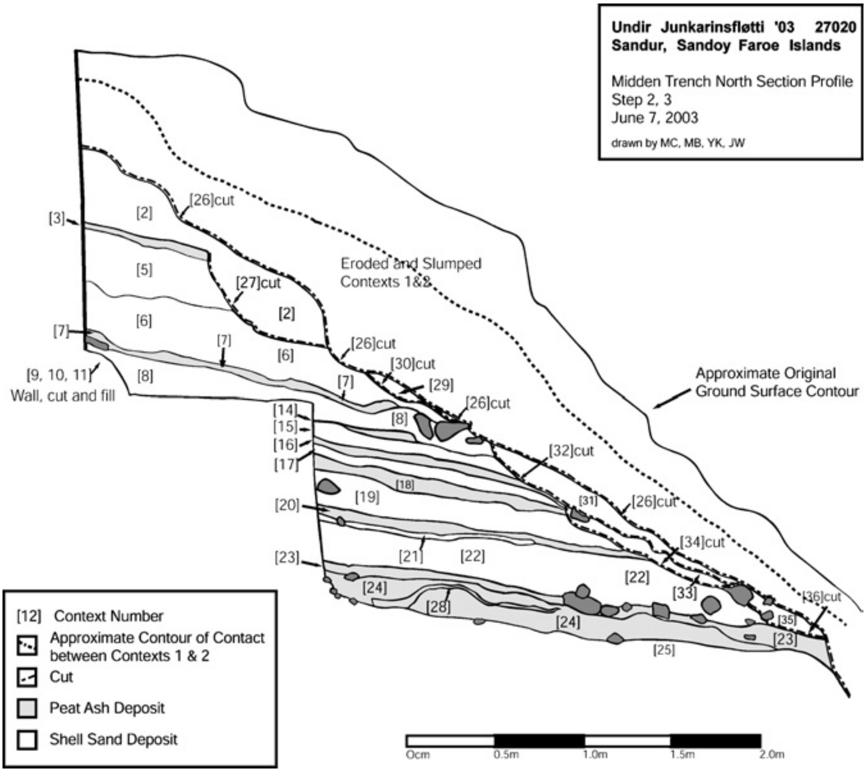

Fig. 7. Composite section drawing from Undir Junkarinsfløtti, Sandur.

concentrations of burnt and unburnt animal bone, limpet shells, and flecks of wood charcoal in a matrix composed of shell sand, peat ash, and fist-sized fire-cracked stones. The deposits excavated in 2003 appear to represent refuse dumped from structures uphill (Woollett *et al.*, 2004). Further excavations just uphill from the eroding edge in 2004 have revealed a substantial Late Norse stone structure partially filled with midden just above the level of the 2003 midden deposits.

Table II presents the radiocarbon determinations obtained from the site and Fig. 8 presents the calibrated dates. The site has been separated into three phases based on the archaeological stratigraphy, radiocarbon dates and artefacts. UJF1 represents the earliest deposits (Contexts 21–28) dated to ninth–twelfth centuries A.D., UJF2 includes Contexts 15–20 dating to eleventh–twelfth centuries A.D., and UJF3 includes Contexts 3–14 and dates to the eleventh–early thirteenth centuries A.D. The formation of the overlying post-thirteenth century A.D. sterile sand cover (Context 2) is consistent with climate changes that mark the onset of the Little Ice Age in the early thirteenth century (Dugmore *et al.*, in press).

Plant Resource Use

Archaeobotanical materials from the three phases at Undir Junkarinsfløtti are scarce and consist of carbonized plant macrofossils of cereal grains, a little cereal chaff, various plant parts from wild species, a few small pieces of charcoal, burnt peat and some turf (Table III). The presence of abundant charred peat and turf fragments and low concentrations of charcoal indicate that peat and turf were the primary fuel sources. Some of the wild species, such as *Calluna vulgaris* and small culm bases/rhizomes, were probably introduced by the use of peat and turf as fuel (Church, 2002; Dickson, 1998). Peat procurement was thus a key component in the Faroese Norse economy, and its extraction would have had a visible impact on the landscape.

The cereal remains are dominated by six-row hulled barley (*Hordeum vulgare* var. *vulgare*), the staple cereal of the Norse period in the North Atlantic, with a few grains of oat (*Avena* sp.). Oat grains cannot be identified to species without their floret bases, which did not survive at the site, and so it impossible to determine whether the oats were introduced as a weed of the barley, or cultivated. The barley would have been grown in the infield area, although there is a possibility of grain being imported to the islands. The ubiquitous presence of chickweed (*Stellaria media*) in all three phases indicates relatively nitrogenous soil conditions (Sobey, 1981). If the chickweed was a weed of the barley crop (though the plant is associated

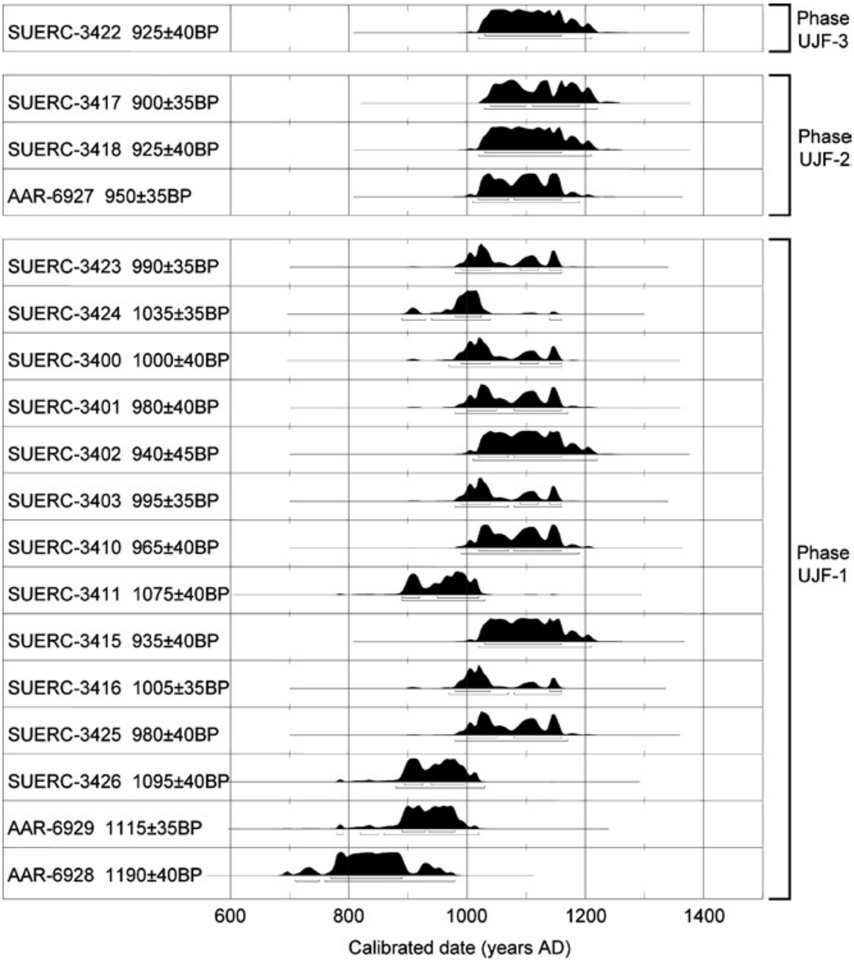

Fig. 8. Calibrated radiocarbon dates from Undir Junkarinsfløtti. The phasing of the site is based on stratigraphic observation and artifactual dating as well as the radiocarbon dating (Church *et al.*, 2005).

with other plant communities as well as cultivated land; Fosaa, 2000, 2001), this may represent field rotation between pastoral and arable agriculture on a seasonal or spatial basis, or the deliberate incorporation of dung into the soil as a fertilizer and stabilizer. The remaining wild species represent a mixture of taxa from cultivated ground, wet pasture, and moorland. These plants, from mutually exclusive ecological niches (Grime *et al.*, 1988), would have been introduced to the domestic hearths by the burning of peat and

Table III. Summary Archaeobotanical Remains From Undir Junkarinsfløtti, Sandur

		Phase UJF1^{a}	Phase UJF2^{b}	Phase UJF3^{c}	Total site^{d}
Charcoal					
Betula sp. timber fragment		7F(1.02)			7F(1.02)
Calluna vulgaris (L.) roundwood (2–4 mm)		p	p	p	
Calluna vulgaris (L.) roundwood (4+ mm)		1F(0.04)			1F(0.04)
Coniferae indet. timber fragment			2F(0.03)		2F(0.03)
Juniperis sp. roundwood		1F(0.03)			1F(0.03)
Larix sp. timber fragment		6F(0.15)	2F(0.04)	2F(0.05)	10F(0.24)
Picea sp. timber fragment		1F(0.02)			1F(0.02)
Pinus sp. timber fragment		1F(0.03)			1F(0.03)
Quercus sp. timber fragment		4F(0.09)			4F(0.09)
Burnt peat/turf fragments		154.5 g	53.2 g	128.6 g	336.2 g
Grain					
Hordeum sp. (C)	Barley grain	17	30	7	54
H. hulled (C)	Hulled barley grain	13	12	3	28
H. hulled symmetric (C)	Hulled barley straight grain	3	1	3	7
H. hulled asymmetric (C)	Hulled barley twisted grain	7	5		12
Avena sp. (C)	Oat grain	1	1		2
Cereal indeterminate (C)	Cereal grain	32	51	8	91
	Total grain	73	100	21	194
Chaff					
Hordeum sp. (RI)	Barley rachis		1	2	3
H. *vulgare* L. (RI)	Six row barley rachis	1			1
Cereal/monocotyledon (>2 mm.) (CN)	Cereal/monocotyledon culm node	1			1
Cereal/monocotyledon (>2 mm.) (CB)	Cereal/monocotyledon culm base			1	1
	Total chaff	2	1	3	6
Wild plants					
Brassica/Sinapis spp. (S)	Cabbage/Mustard	1			1
Calluna vulgaris (L.) Hull. (LF)	Ling heather			2F	2F
Carex spp. (trigonous) (N)	Sedge	3	1		4
Danthonia decumbens L. (C)	Heath-grass			1	1
Montia fontana L. (S)	Blinks	1		2	3

Table III. Continued

		Phase UJF1[a]	Phase UJF2[b]	Phase UJF3[c]	Total site[d]
Poaceae undiff. (medium) (C)	Grass		1	1	2
Poaceae undiff. (small) (C)	Grass	1	2	1	4
Polygonum spp. (N)	Knotgrass	1			1
Ranunculus repens L. (A)	Creeping buttercup			6	6
Ranunculus spp. (A)	Buttercup	1		1	2
Rumex acetosa L. (N)	Common sorrel	1		1	2
Rumex crispus/obtusifolius L. (N)	Curled dock	2	1	5	8
Rumex spp. (N)	Dock	1		1	2
Spergula arvensis L. (S)	Corn-spurrey	1		9	10
Stellaria media (L.) Villars (S)	Common chickweed	6	10	7	23
Viola sp. (S)	Violet	1			1
Cereal/monocotyledon (<2 mm) (CN)	Cereal/monocotyledon culm node	3	3	2	8
Cereal/monocotyledon (<2 mm) (CB)	Cereal/monocotyledon culm base	4	5	2	11
Indeterminate (>2 mm) (R)	Indeterminate rhizome	1		2	3
Indeterminate (<2 mm) (R)	Indeterminate rhizome	1	1	4	6
Indeterminate (trigonous) (S/F)	Indeterminate trigonous seed/fruit	1		1	2
Indeterminate pericarp fragment (P)	Indeterminate pericarp fragment		1		1
Indeterminate seed/fruit (S/F)	Indeterminate seed/fruit	8	5	11	24
Moss fragments (carbonised) (LF)	Moss leaf fragment (carbonised)			1F	1F
	Total wild	38	30	57	125
	Total quantifiable components	113	131	81	325
	Grain/litre	1.7	1.6	0.4	1.2
	Quantifiable component/litre	2.6	2.1	1.4	2.0

Note. Key to plant parts: Charcoal: F = fragment; p = present; figures in brackets give total mass in grams. Grain: (C) = caryopsis. Chaff: (CB) = culm base (>2 mm diameter); (CN) = culm node (>2 mm diameter); (RI) = rachis internode. Wild plants: (A) = achene; (C) = caryopsis; (CB) = culm base (<2 mm diameter); (CN) = culm node (<2 mm diameter); (F) = fruit; (LF) = leaf fragment; (N) = nutlet; (P) = pericarp; (R) = rhizome; (S) = seed. Nomenclature follows Stace (1997).

[a] Number of samples in phase = 5; Total volume of samples = 44 L.

[b] Number of samples in phase = 6; Total volume of samples = 63 L.

[c] Number of samples in phase = 7; Total volume of samples = 58.5 L.

[d] Number of samples in phase = 18; Total volume of samples = 165.5 L.

turf as fuel. This mixing is a common feature of archaeobotanical assemblages in the North Atlantic (Church and Peters, 2004) and negates detailed analysis of crop weed ecologies.

The few charcoal remains included heather and juniper roundwood, presumably representing native growth (Fosaa, 2000); the few birch timber fragments are probably native; and various coniferous timber species of larch (*Larix* sp.), pine (*Pinus* sp.), and spruce (*Picea* sp.) would have arrived on the island as driftwood. Driftwood was commonly used by Norse societies where native trees were scarce (Dickson, 1992; Kristjánson, 1980; Malmros, 1994), and its exploitation was regulated by legislation in early medieval Iceland (Dennis *et al.*, 2000; pp. 321–343).

Animal Resource Use

The substantial, well-preserved 2003 archaeofauna from Undir Junkarinsfløtti (Table IV) provides some of the first zooarchaeological evidence for early economic strategies in the Faroes.

Figure 9 shows the distribution of major taxa in the three phases of the archaeofauna. In each case, bones of domestic and marine mammals make up a small portion of the collection (*ca.* 2–5%) compared to the large amount of bird, fish, and shellfish remains. Birds (mainly puffin, *Fratercula arctica*) come to outnumber fish bones in the upper layers, while shellfish (mainly limpets, *Patella vulgaris*) also increase in the upper layers.

Figure 10 shows the three major contexts from Junkarinsfløtti alongside contemporary archaeofauna from Iceland and Greenland. In Iceland, many *landnám*-era collections are also dominated by wild species, particularly birds, but even at first settlement (Herjolfsdalur: Amorosi *et al.*, 1996; Sveigakot: McGovern *et al.*, 2001; Tjarnargata 4: Perdikaris *et al.*,

Table IV. Summary Archaeofauna From Undir Junkarinsfløtti, Sandur

	UJF 1	UJF2	UJF 3	Total
Domestic mammals	76	118	241	435
Whales	1	2	0	3
Seals	1	6	7	14
Birds	1,068	1,167	2,148	4,383
Fish	2,400	573	1,157	4,130
Shellfish	183	268	1,029	1,480
NISP	3,729	2,134	4,582	10,445
Medium (dog-pig-sheep sized) terrestrial mammal	98	176	289	563
Large (cow-horse sized) terrestrial mammal	16	3	11	30
Unidentified fragments	980	1128	2151	4,259
TNF	4,823	3,441	7,033	15,297

Note. NISP: number of identified specimens; TNF: total number of fragments.

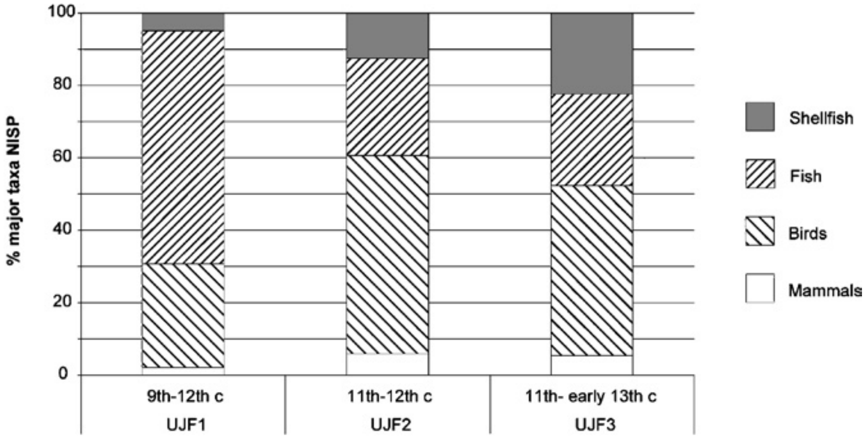

Fig. 9. Distribution of major taxa in the three phases of the 2003 Undir Junkarinsfløtti archaeofauna. The 'mammals' category mostly consists of domestic mammal taxa, but includes a small contribution from whales and seals which is not visible when plotted at this scale.

2002) domestic mammal bone percentages are normally 15% or above. Wild species quickly decline in importance after the settlement, with domestic mammals making up 40–70% of collections (Sveigakot, Hofstaðir, Hrísheimar, Selhagi: McGovern *et al.*, 2001; Svalbarð: Amorosi, 1992) by the tenth–eleventh century A.D. While the Greenlandic Norse colonists (sites W48: McGovern *et al.*, 1983; W51: McGovern *et al.*, 1996; E17a: McGovern *et al.*, 1993; and GUS [Gården Under Sandet], Enghoff, 2003) made considerable use of seals and caribou throughout their occupation of Greenland, their archaeofauna still show 15–40% domesticates (McGovern, 1985; Outram, 1999, 2003). The emphasis on wild species in general, and birds in particular, from the ninth to twelfth/thirteenth centuries at Undir Junkarinsfløtti is therefore unusual in the regional context. It has been argued that sea bird colonies in southern Iceland represented a store of natural capital that was quickly drawn down by the settlers, helping to sustain them until their imported stock could multiply (Vésteinsson *et al.*, 2002). At Undir Junkarinsfløtti, by contrast, exploitation of sea birds was sustained over the long term.

Domestic stock-raising practices apparently changed only slightly on Sandoy from the Norse to Medieval periods. Figure 11 presents the changing proportions of domestic mammal bones from the 2003 Undir Junkarinsfløtti collection. The relative proportion of cattle decreases between the earliest and subsequent phases, a pattern widely observed in most North Atlantic *landnám* sites where early hopes for high status, cattle-rich holdings seem to have been regularly frustrated by the realities of island

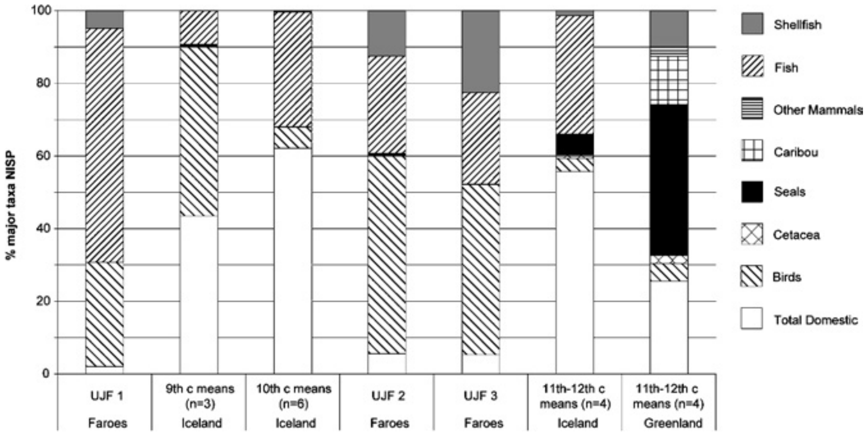

Fig. 10. The archaeofauna of Undir Junkarinsfløtti in comparison with approximately contemporary archaeofauna from Iceland and Greenland (indicative averages of data from sites listed in the text).

farming. The large number of newborn (neonatal) cattle bones (20–50% of all cattle) strongly suggests the same sort of dairy economy already documented in Iceland, Greenland, and the Northern and Western Isles of Scotland (Bond, 2002; McGovern, 1985; McGovern *et al.*, 2001).

With the exception of a single bone in UJF2, all identified caprines in the Undir Junkarinsfløtti collection are sheep. In *landnám*-era Iceland and Greenland, goats were far more common. In Iceland goats only declined

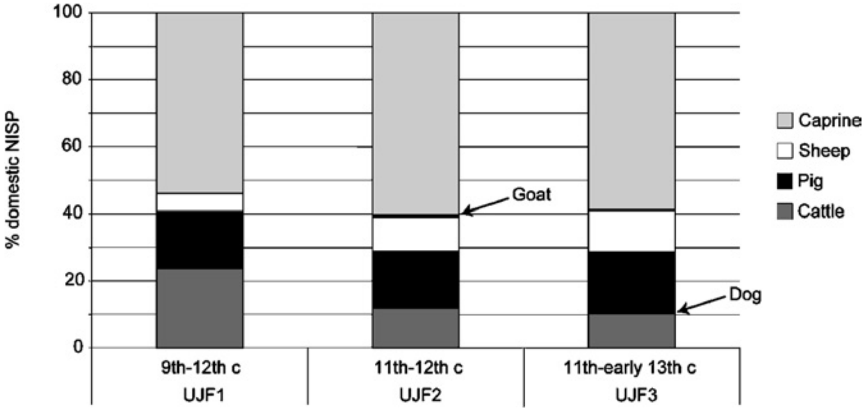

Fig. 11. Changing proportions of domestic mammal bones from the 2003 Undir Junkarinsfløtti archaeofauna. Small percentages of goat and dog bones in two samples are arrowed.

to their modern 'trace' levels in the early thirteenth century A.D., and in Greenland goats remained nearly as common as sheep in many collections down to the end of the colony in the fourteenth–fifteenth century A.D. As goats are more effective at metabolizing twigs and leaves than sheep, their early reduction in the Faroes may be tied to the absence of significant woodland. Reconstructed age distributions suggest that sheep were managed for milk as much as for wool.

Pigs make up a substantial part of the Undir Junkarinsfløtti archaeofauna throughout the sequence. The presence of substantial numbers of pigs is commonplace in *landnám* sites in Iceland and Greenland (McGovern *et al.*, 2001), but pigs rarely survived as a major element in the domestic economy much beyond the mid-eleventh century A.D. It is not known exactly when pigs become extinct in the Faroes, but there is no mention of pigs or pig-breeding in the special Faroese enactment Seyabrævi ("Sheep letter") of A.D. 1298, which describes only the traditional, historically known sheep-breeding of recent times (Brandt, 1996). Economic pig-keeping requires either woodland or marshland for pannage, neither of which was present in the Faroes, or a source of fodder for penned, sty-kept animals (Ward and Mainland, 1999). Place-name evidence (see below) supports the notion that pigs were closely herded and controlled. Fish offal has been suggested as a readily available source of fodder for pigs (McGovern, 1985), but stable carbon isotopic measurements on pig bones from both UJF1 and UJF2 indicate a wholly terrestrial diet. The role of pig keeping in the domestic economy of the ninth–thirteenth century Sandoy remains unclear, but the persistence of pig keeping indicates an overall farming strategy different from either contemporary Iceland and Greenland or the sheep-dominated herding of recent centuries.

LANDSCAPE ARCHAEOLOGY AND PLACE-NAME EVIDENCE

Sandoy is littered with archaeological sites and place-names that can provide insights into the human use, impact on, and adaptation of the wider landscape. These archaeological features are concentrated within the infields but are usually post-Medieval and modern in age, obscuring the earlier remains. By contrast, the outfield areas preserve much older features (Arge, in press). Here, the area around Lítlavatn (Fig. 1) will be taken as an example to demonstrate the layers of inference possible.

Today, the area mainly represents the outfield of the villages of Skálavík and Húsavík, and land use is characterized by sheep farming and peat extraction. Post-Medieval and modern structures relating to sheep farming occur all over the landscape along with extensive peat cuttings.

More ephemeral turf features, such as a series of low degraded walls west of Lítlavatn, probably relate to animal husbandry in earlier periods. To the north of the lake is a small ruin complex and associated enclosure called Elinarhús (Elin's House). The name of the site is traditionally associated with Elin, a servant of Servin, a mid-seventeenth century farmer in Húsavík. Elin is said to have stayed here when she was looking after the grazing cattle in the summer months. The upstanding remains represent the final phase in the site's history, as degraded and robbed wall-lines of earlier structures occur below the latest phase of construction. Therefore, the site is multiperiod and could have served multiple uses over the centuries.

Throughout the area are place-names associated with animal husbandry (e.g., Okasagil relates to the herding of cattle). In several areas, the place-name *-byrgi* is found, sometimes associated with a structure. A byrgi is an area enclosed either by topography or artificial structures, which may have been used for different purposes, including collecting animals. The *-byrgi* place names are particularly concentrated on the relatively flat ground to the west of Lítlavatn. Another place name related to farming practices is Hoygarshellurnar ("the paving of the hay-enclosure"). Oral tradition suggests that most of the low turf walls and enclosures relate to sheep-farming, but place names are also present indicating ancient pig-farming (e.g., Svínsstøuheyggjurin ["the mound by the site where pigs are collected"] and Svínstíaheyggjarnir ["the mounds by the path along which the pigs are driven"]). Both these place-names relate to areas with no archaeological remains, but in the outfield of the village of Skarvanes, approximately 1.5 km southwest of Lítlavatn, lies Stíggjurin á Svínhúsinum, which indicates a building, no longer extant, connected to pig-farming. It seems likely, therefore, that many of the place-names have a long antiquity and relate to economic strategies in place during the Norse and early medieval periods when pig keeping was still part of the farming economy.

The movement and gathering of people through the landscape is also indicated by a number of place-names. For example, in the area above Elinarhús to the north of the lake lies Byrgisgøta ("the path of the *byrgi*"). This sheep-path is always dry, even following heavy snow, and it would have been an important routeway in the past. Sornur, located on the west coast of the island where the waters from Stóravatn leave the lake, indicates where the inhabitants from the island of Skúvoy came ashore to cut peat from the Lítlavatn area. Oral tradition suggests that the area near the river Tífaldará between Lítlavatn and Stóravatn known as Millum Vatna ("between the lakes") was used for the *thing* assembly for the island. The site lies approximately at the center of the island and at the border between the lands of Skálavík, Húsavík, and Sandur. Ancient outdoor *thing* assemblies are traditionally thought to have occurred at many other sites elsewhere in the

Faroes. However, there is no archaeological or literary record to support this tradition.

DISCUSSION

The data reported here lead us to some initial conclusions concerning the impact of people on the environments of Sandoy. The landscape we see today is much more similar to the natural, pre-settlement landscape than in most other areas around the North Atlantic. Already prior to the settlement there was no woodland, with at most a few scattered stands of trees. Blanket peat had spread across large areas of the landscape, driven by purely natural processes, with grass-sedge communities dominating on mineral soils. Erosional processes were already very important in the landscape.

When the first settlers arrived, many components of the landscape system continued to operate in much the same way as before. There were no forests to remove; tall herbs and juniper were heavily reduced, but this seems to have had little effect on the remaining vegetation. Blanket bog was not encouraged by human activity, as elsewhere in the region—on the contrary, grazing slightly reduced the dominance of ericaceous shrubs in favour of grasses, and over time much peat has been removed for use as fuel or fertilizer, the resulting peat cuttings being obvious in the landscape today. Infield vegetation and soils were modified by cultivation for crops, including at least the *Hordeum* registered in the Gróthúsvatn pollen record and plant macrofossils from Undir Junkarinsfløtti, and also, we assume, for hay. Micro-charcoal is not abundant in our records, suggesting that burning was not a major factor in landscape management—unlike for earlier periods in Norway (Kaland, 1986) and the Western and Northern Isles of Scotland (Edwards, 1996), or in Norse Greenland (McGovern and Jordan, 1982). Human impacts seem to have been concentrated in and around the village areas, in contrast to the more spatially extensive impacts of Viking age settlements in Iceland and Greenland.

So it appears that the Sandoy landscape was modified by human impact to a surprisingly small degree in view of some attributes that might lead us to expect otherwise; namely, steep slopes, high rainfall, freeze-thaw activity in the uplands, low vegetational productivity, and an environment that had evolved to a dynamic equilibrium in the absence of grazing herbivores. There are at least four possible reasons for this ‘tough’ environmental response to the settlement.

The first is that the natural vegetation was insensitive to human impact. The major elements of the pre-settlement vegetation—grasses, sedges, and ericaceous shrubs—are all capable of tolerating grazing, and indeed often profited from the decline in woodland when herbivores were introduced to other North Atlantic islands (e.g., Bennett *et al.*, 1992; Hallsdóttir, 1987). Only the tall herbs, and small populations of juniper and tree birch, seem to have suffered from grazing. The significance of this is that the vegetation was not *structurally* altered. An illustrative contrast is Iceland, where birch woodland was the typical lowland vegetation prior to the arrival of humans. Some combination of grazing, land clearance, and exploitation for fuel and timber quickly led to widespread deforestation (e.g., Hallsdóttir, 1987). The removal of the dominant species in the ecosystem had substantial secondary effects on many aspects of the environment: its hydrology and pedology were altered, with consequences for soil erosion and transport (Simpson *et al.*, 2001); understorey fauna and flora were replaced by open heath and grass/sedge communities (e.g., Hallsdóttir, 1987). From the point of view of the settlers, their resource base was fundamentally altered, and the whole character of cultural landscape perception, routes of movement, available settlement areas, and viewshed were changed forever by the creation of an open, largely unwooded landscape. As Vésteinsson *et al.* (2002) argue, many Icelandic valley bottoms became attractive for settlement only after the clearance of the woodlands. In the Faroes, the dominant taxa in the pre-*landnám* ecosystem happened to be resistant to human impact; a brittle collapse and fundamental reorganization of the ecosystem, as seen in Iceland, was thereby avoided.

Secondly, intensive land use was limited in spatial extent by the topography and climatic conditions of the island. Cultivation did make profound changes to the vegetation and soils (Adderley and Simpson, 2005), but only in the well drained, gently to moderately sloping (Arge, 1991), fertile areas around settlements. At higher elevations, on very steep slopes, and on waterlogged soils and peat, cultivation was not a practical option, so impacts were limited both in kind and in degree.

Thirdly, Sandoy's soil system was relatively robust in the face of human impact. The extreme opposite case is that of Iceland, where andisols built up during the Holocene mainly by the accumulation of fine volcanic sediments, held together by a fragile vegetation cover. Once the vegetation was damaged or removed and the soils exposed to the wind, erosion occurred catastrophically in many areas (e.g., Ólafsdóttir, 2001). By contrast, Faroese soils, including those of Sandoy, are dominated by silt- and sand-sized silicates that are generally more resistant to transportation and erosion. Those areas of the landscape that were susceptible to erosion, such as the Lítlavatn catchment, had already begun to erode in the mid-Holocene. Consequently, the first settlers encountered an environment which was in a state of dynamic equilibrium, energetically stable, without the potential for a vast threshold-driven collapse of a metastable soil system, as in Iceland.

While the three preceding explanations rest on inherent properties of the landscape, the fourth concerns the way in which humans managed the landscape. Human settlement and economy on Sandoy, and perhaps in the Faroes generally, seem to have taken a very different path from those of Iceland and Greenland. Barley and hay cultivation were comparatively successful on Sandoy, thanks to the benign climate and fertile soils (made all the more fertile by careful manuring and/or crop rotation; Adderley and Simpson, 2005). In Iceland and Greenland, barley production was far more difficult, such that by the mid-thirteenth century the Norwegian *King's Mirror* could state that most Greenlanders "had never seen bread" (Larson, 1917). Consequently, domestic stock took on an all-important role in providing for household provisioning and meeting rent, tithe, or tribute obligations, and ninth–thirteenth century Icelanders and Greenlanders were increasingly forced to rely on land-extensive pastoralism, often involving unsupervised grazing by substantial flocks of sheep and goats (Perdikaris and McGovern, in press). Meanwhile, the medieval Faroese enjoyed improving yields from their increasingly fertile, intensively cultivated barley fields, set in an increasingly structured and controlled social landscape. If Faroese farmers did choose to limit the size of their domestic flocks and herds, managing them closely in the context of an evolving *partir* system, and retaining pigs as part of a more diverse economy, they may have needed to provision themselves with a sustained (and clearly sustainable) harvest of sea birds, supplemented by marine fish. The available palaeoeconomic evidence strongly indicates the early adoption of a distinctively Faroese approach to economy and land management which had profound implications for the subsequent evolution of both environment and society.

CONCLUSIONS

1. Many key elements of the modern Sandoy landscape—the absence of trees, the large areas of blanket mire, and high rates of erosion in the uplands and on slopes—were already well established by the time the first settlers arrived on the island.
2. A number of changes occurred in the environment following the settlement, including a decline in certain plant species (*Juniperus, Calluna*) and an expansion of others (Poaceae, *Plantago*), probably through a combination of grazing and cultivation; active processes of erosion were accelerated; peat was extracted for fuel and other wild resources, especially birds, were exploited; and structures and paths were constructed.

3. By comparison with other North Atlantic situations, especially Iceland, Greenland, and Atlantic Scotland, the change in the landscape brought about by settlement was slight.
4. In many respects, the pre-settlement landscape already resembled that of an anthropogenically "perturbed" North Atlantic island. Some potential human impacts, such as deforestation, were impossible, and others, such as those leading to enhanced soil erosion, merely amplified extant processes.
5. Archaeological data suggest that the economy of the colonists and their descendants departed substantially from the trajectory followed in contemporary Iceland and Greenland. Perhaps sustained by an increasingly successful barley crop, the early Faroese appear to have de-emphasized animal husbandry and sustainably exploited sea bird colonies for centuries, rather than rapidly drawing down and expending their natural capital. While there is still much to learn about the interacting palaeoeconomy and palaeoecology of the Faroe Islands, it is clear that the historical ecology of this Viking-age settlement, isolated by the North Atlantic, provides an important and exceptional case of successful sustained management of land and resources.

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