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Impacts and Timing of the First Human Settlement on Vegetation of the Faroe Islands

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Stratigraphically precise AMS-radiocarbon-dated plant remains, pollen, charcoal, and microtephra analyses from the Faroe Islands were used to establish the timing and effects of the first human settlement. The first occurrence of cultivated crops from three locations dated from as early as the sixth century A.D. and was older than implied from previous archaeological and historical studies, but consistent with earlier palaeoecological investigations. The effects of settlement on the vegetation were rapid and widespread. The transformation of the flora of this fragile ecosystem was best expressed by the large assemblage of ruderal, post-settlement plants recorded as macrofossils. The earliest known introduction of domestic animals (sheep/goat) was ca. A.D. 700. Their arrival on these relatively small islands probably contributed to the widespread change in vegetation and the loss of restricted native woody cover. Settlement was the critical disturbance that transformed an ecosystem that was already stressed by climatic change, as sensed by regional marine sediments. The settlement dates conform to a pattern of older dates developing from throughout the north Atlantic region.

INTRODUCTION

The timing, scale, and consequences of human impact on the environment vary greatly around the world, and influence local attitudes as to what is considered “natural” in the environment. This varied history of human impact also influences the extent to which anthropogenically altered ecosystems are regarded as being worthy of preservation (Birks, 1996; Bradshaw *et al.,* 1998). Paleoecological and archeological techniques, used together, generate information about settlement and its environmental impact to help assess the length of time that ecosystems have been modified by human interference (Dodson and Intoh, 1999; Head, 1999). In this paper we use these techniques to study settlement history in the Faroe Islands. The islands today support extensive heathlands, peatlands, and low-growing scrub vegetation, often browsed by sheep, and there is debate over the extent to which current vegetation is a consequence of human impact (Hansen and Jóhansen, 1982; Jóhansen, 1985). There is also discussion over the timing and scale of the first human settlements (Jóhansen, 1985; Buckland, 1990; Arge, 1991; Hannon *et al.,* 1998). We address the scale, type, and temporal dynamics of the impact of human activity on the vegetation, and assess whether or not settlement caused the rapid destruction of a fragile ecosystem. We consider all the major agencies that can lead to significant changes in vegetation in this region, namely climate change, fire, grazing animals, and volcanic eruptions. Where possible, we compare our vegetational reconstructions to independent data sets with the aim of assessing the effect of people on a vulnerable landscape.

The early-middle Holocene vegetation of the Faroe, Shetland, and Scottish islands (Fig. 1) has also been under debate, particularly the role of trees (Birks and Madsen, 1979; Bennett *et al.,* 1992). Pollen data alone can be difficult to interpret owing to the possibility of long-distance transport and low pollen production in extreme environments. Plant macrofossil data are less ambiguous in this context, and our study includes the most detailed macrofossil analyses yet undertaken from this region. Macrofossil data also yield far greater taxonomic detail of the vegetation than do pollen data. Of particular interest is the composition and structure of the presettlement vegetation. What role was played by trees and how open were the vegetation types? Our main study site is the coastal settlement of Tjørnuvík, although radiocarbon dates for the settlement horizon are presented from two additional Faroese sites to support our conclusions. Our working hypothesis is that settlement and the introduction of sheep caused an abrupt change in the vegetation of a fragile island ecosystem.

STUDY AREA

The Faroe Islands (Fig. 1) have a total area of about 1399 km^2 and lie between 61° 20′ and 62° 24′N and 6° 15′ and 7°

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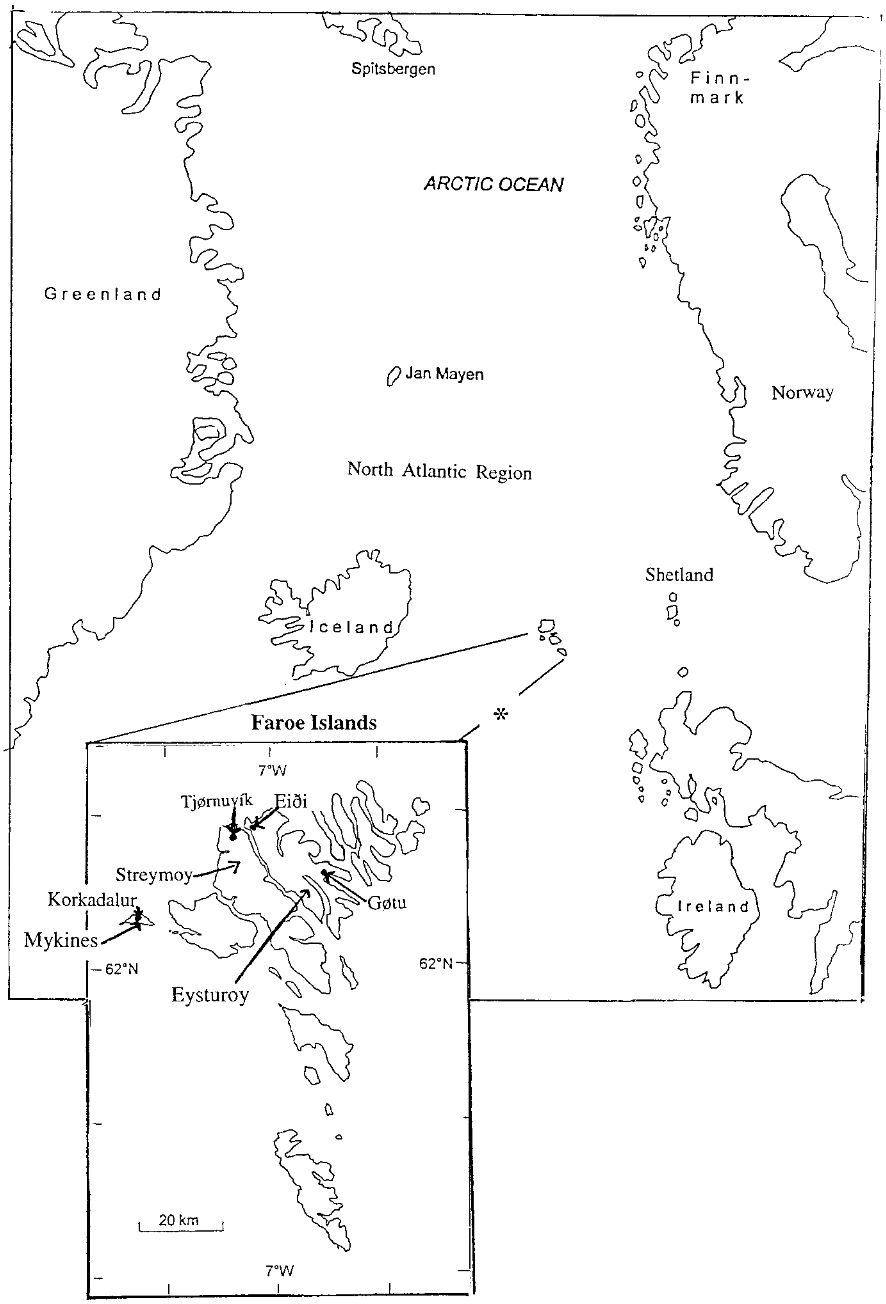

FIG. 1. Map of the North Atlantic region with the Faroe Islands (inset). The coring sites at Tjørnuvík, Ei∂i, and Korkadalur are marked with arrows. The location of the marine core 94-13 is also indicated (*).

41′W in the North Atlantic Ocean (Guttesen, 1996). They consist of 18 islands, most of which are steep-sided, basalt plateaux of Tertiary age, generally between 600 and 800 m altitude. The closest land is Shetland (300 km), then Iceland (425 km), while the nearest mainland is Norway (Fig. 1). Summers are cool, mean August temperature is 10.5°C, and winters are mild, with a mean January temperature of 3.2°C. Precipitation depends on topography and position and ranges between 900 and 2000 mm yr^{-1}. Prevailing winds are from the southwest and are strongest on the exposed western isles. Days without wind are rare. Wind speeds frequently exceed 10 m/s and gales are frequent, as the Faroe Islands lie on one of the major cyclonic tracks of the North Atlantic Ocean (Guttesen, 1996).

Today, about 400 flowering plants and 27 species of pteridophytes occur, of which 310 are considered indigenous species. Of the 90 species immigrating since settlement, 30 have become naturalized and the other 60 commonly occur as weeds

(Hansen and Jóhansen, 1982). Most of the taxa are perennial herbaceous plants.

FIELD AND LABORATORY METHODS

Site Selection

Our main study site was the valley marsh at Tjørnuvík at the head of a short, northeast-facing fjord on the island of Streymoy, ca. 5 m altitude (Fig. 1). The surrounding slopes are steep and have little soil cover. Basalt crops out on the valley sides. There is a small village to the west with adjoining hay fields. A storm beach seals off the deposit from the sea. The valley contains a rare, ancient burial site, consisting of 12 graves (Dahl and Rasmussen, 1956). We chose the site because it had the most complete record of human settlement from an earlier investigation (Jóhansen, 1985).

The second site used to date settlement was a former lake basin on the northern island of Eysturoy beside the modern village of Ei∂i and adjacent to an early village site (Arge, 1991) (Fig. 1). The third site was a blanket bog in Korkadalur valley, Mykines. Korki- is the old gaelic name for *Avena* (Matras, 1980). All sites were cored in June 1995.

One-meter, overlapping cores were taken from the deepest part of the basins using a 7-cm Russian corer. Cores were wrapped in black plastic, placed in plastic guttering, sealed, and refrigerated.

Pollen and Macrofossil Analysis

Pollen samples were taken every 5 cm and prepared using standard techniques (Berglund, 1986). Once the core sections covering the settlement horizon had been identified by the first occurrence of Gramineae pollen >37 μm, these sections were frozen and cut into 3- to 4-mm slices using an electric, serrated rotating blade, which was continuously cleaned to avoid contamination. The slices were placed in plastic bags and kept frozen. Prior to sub-sampling for pollen analysis, the frozen slices were scraped on both sides to remove any surface contamination. *Lycopodium* tablets were added to the pollen samples to allow the calculation of total pollen concentration. The pollen diagram was drawn using TILIA (Grimm, 1991). Nomenclature follows Flora Europaea (Tutin *et al.*, 1964–1980).

As doubts had been raised about the earlier (Jóhansen, 1985) paleoecological identification of settlement and the reliable separation of cereal pollen from those of large wild, coastal grasses (Arge, 1991), we gave these matters special attention. Gramineae pollen are best separated using a combination of size statistics and sculpturing (Andersen, 1979). Measurements of all Gramineae pollen >37 μm (long axis) and/or an annulus diameter (anl-D) of >8 μm (measurements in silicone oil), were made, following Andersen (1979). The anl-D, pore diameter, M+ (largest diameter of a pollen grain), and M− (diameter at a right angles to M+) were measured at 40× magnification. Our material was mounted in glycerine and the measurements were adjusted to make them comparable to Andersen's measurements in silicone oil using *Corylus* as a datum. Size measurements and sculpturing made it possible to distinguish the following groups:

1. Gramineae (undifferentiated): anl-D <8 μm and/or pollen size <37 μm.
2. Cereal-type: anl-D >8 μm, pollen size >37 μm (long axis). This included cultivated crops of *Hordeum distichon*, *Hordeum vulgare*, and *Avena sativa.*
3. Large (wild) Gramineae: anl-D >8 μm, or pollen size >37 μm (long axis), which were not thought to be cereals, based on anl-D, sculpturing, and anl-D/pore diameter ratio. These noncultivated species could include *Glyceria fluitans*, *Elytrigia* spp., or *Leymus arenarius.*

The pollen data are presented as percentages of a terrestrial pollen sum (Fig. 2), which included Cyperaceae but excluded Pteridophytes and aquatic plants.

Macrofossil analysis was based on 5-cm contiguous samples that were sieved (mesh size 285 μm) and counted using standard techniques (Berglund, 1986). Identifications were made using a reference collection. The macrofossil data are presented separately as either concentration per unit volume (30 ml) or as presence/absence (Fig. 3).

Dating

Plant macrofossils submitted for (AMS) radiocarbon dating were extracted from the cores, rinsed through individual 180-μm sieves with distilled water, and after identification dried at 50°C overnight in aluminum foil. The dates were calibrated using the program OxCal 3.4.

Charcoal and Organic Content

Microscopic charcoal (<180 μm) was expressed as presence/absence (Fig. 2). The number of macroscopic charcoal fragments per 30 ml were recorded in two size classes (>285 μm, >400 μm) (Fig. 3). The percentage weight loss on ignition at 550°C was determined at 1-cm intervals (Fig. 2).

Microtephra

The exact dating of settlement was hampered by the coincidental occurrence of a radiocarbon plateau, so a pilot study around the settlement horizon was undertaken at Tjørnuvík and Ei∂i by concentrating rhyolitic microtephra (25–80 μm) (Turney, 1998). Microtephra were analyzed because they can travel far from their point of origin yet be geochemically characterized, using a microprobe, to help identify their source eruption. Geochemical details of these investigations are presented separately (Wastegård *et al.*, in press).

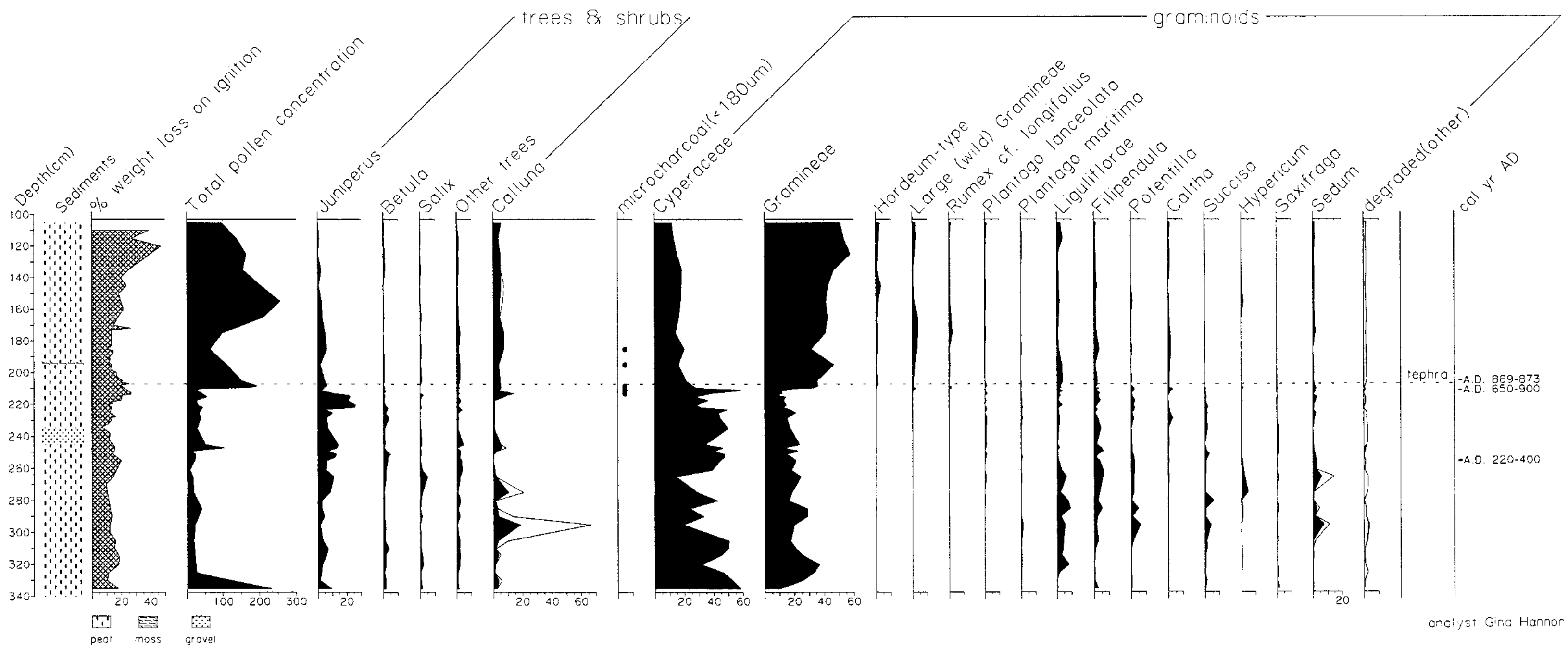

FIG. 2. Summary percentage pollen diagram from Tjørnuvík. Total pollen concentration is expressed as grains/cm^3. Hollowed graphs beside the *Calluna* and *Sedum* profiles show degraded pollen (excluded from the pollen sum). The date for the Landnám tephra (A.D. 871 ± 2) is from the GRIP ice core (Grönvold *et al.*, 1995).

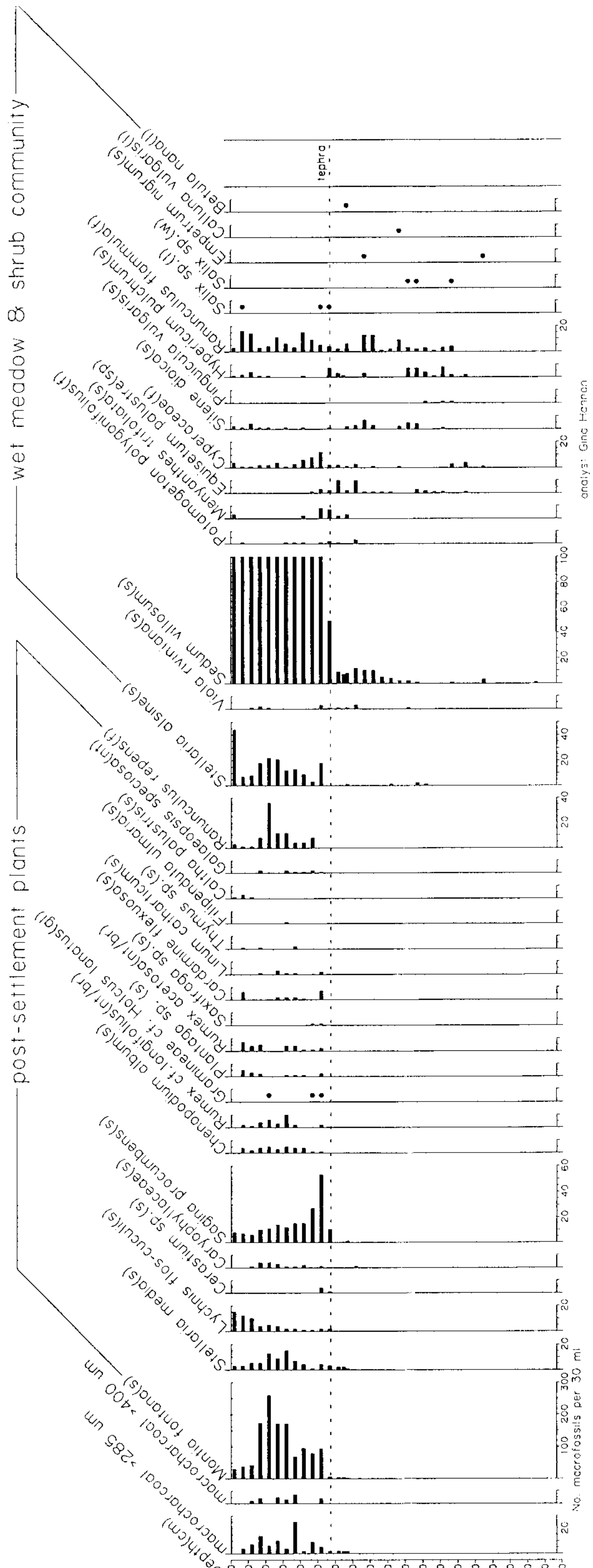

FIG. 3. Macrofossil concentration diagram from Tjørnuvík. br, bract; f, fruit or fruitstone; 1, leaf; nt, nut or nutlet; s, seed; sp, sporangial cone; w, wood; 0, presence. The Landnám tephra is indicated as a dashed line.

RESULTS

Sediments

The greatest sediment depth at Tjørnuvík was 357 cm, located close to where the present village and hayfields lie. Sedimentary analysis revealed many of the details observed by Jóhansen (1985). The sediments in the lower sections were primarily inorganic, with layers of sorted minerogenic material and highly disintegrated herbaceous detritus. The overlying sediments had a higher organic content. Limnic indicators such as *Potamogeton polygonifolius* fruits and *Menyanthes trifoliata* seeds (Fig. 3) confirm that pools of shallow water or "tjørns" were occasionally present. A moss layer was recorded between 193 and 195 cm and a gravel layer from 235 to 245 cm.

Radiocarbon Dates

The calibrated age ranges (2 σ variation) for settlement at all three sites are clearly greater than those proposed from archaeological and historical studies, but they support previous palaeoecological investigations (Jóhansen, 1985) (Table 1). The settlement horizon in all cases was defined as the first pollen instance of cultivated crops. We include in Table 1 other "old" dates for settlement: the bulk date of moss from the house foundations at the village of Ei∂i, and an AMS date on collagen from sheep/goat bones from another house foundation in the village of Gøtu (Fig. 1). Macrofossil seeds/fruits of *Montia fontana, Stellaria media, Silene dioica, Ranunculus flammula,* and *Sedum villosum,* together with *Equisetum palustre* sporangial cones, were chosen for dating the settlement horizon at Tjørnuvík (TUa-1412). *Montia fontana, Ranunculus flammula, Potamogeton* sp., *Myriophyllum alterniflorum, Carex* sp., and *Sedum villosum* macrofossils were the chosen dating material at Ei∂i (TUa-2202).

Palaeoenvironmental Reconstruction

The pollen and macrofossil diagrams presented from Tjørnuvík (Figs. 2 and 3) cover the time period prior to, during, and after the occurrence of the first cereal, *Hordeum*-type pollen grains. The most common presettlement plants were wet meadow taxa, mainly Cyperaceae, which varied between 30 and 60% of total pollen, but also Liguliflorae, *Filipendula, Potentilla, Hypericum, Saxifraga, Succisa, Plantago maritima,* and moderate representation by *Ranunculus, Geranium, Armeria,* Polypodiaceae, *Equisetum,* and *Selaginella* (not shown). Gramineae, which varied between 20 and 30% in the lower phases of the present study, became the largest pollen producer (50–60%) after settlement, along with *Rumex* cf. *longifolius,* large (wild) Gramineae, *Caltha,* and Caryophyllaceae, Cruciferae, Labiatae, *Oxyria/Rumex, Urtica dioica,* and *Angelica* (not shown). *Urtica dioica* was first recorded at the settlement horizon, and although native to the islands, is much favored by humans (Hansen and Jóhansen, 1982). Pollen of *Plantago lanceolata* was recorded below the settlement horizon and

TABLE 1
Radiocarbon Dates (cal yr B.P. 2 σ variation) from the Faroes Islands

Laboratory No., site	Type	Feature	Age (^{14}C yr B.P. ± 2σ)	Calibrated dates[a] (2σ)	Material
Tua[b]-1412 Tjörnuvík, Streymoy	AMS	Palaeobotanical settlement horizon	1270 ± 60	A.D. 650–900	Seeds
I-16535 Götu, Eysturoy (J. Jóhansen, pers. commun., 1995)	AMS	House foundation	1320 ± 80	A.D. 560–900	Sheep/goat bones
K-4690 Ei∂i village Eysturoy (Arge, 1991)	Bulk	House foundation	1540 ± 55	A.D. 410–640	Unknown moss
TUa-2202 Ei∂i lake Eysturoy	AMS	Palaeobotanical settlement horizon	1505 ± 50	A.D. 430–650	Seeds
TUa-2206 Korkadalur Mykines	AMS	Palaeobotanical settlement horizon	1355 ± 55	A.D. 560–780	*Sphagnum*
AAR-4054	AMS	Wood	1745 ± 30	A.D. 220–400	*Salix*

[a] OxCal 3.4.
[b] Tua, Trondheim; I, Teledyne Isotopes; K, Copenhagen.

comparable presettlement records have been described from northwestern and southwestern Iceland (Hansom and Briggs, 1990; Rose *et al.*, 1997).

The plant macrofossil diagram (Fig. 3) suggests a proportional shift in the community structure from wet meadow taxa to a drier environment. Many macrofossil taxa occurred either just before or at the horizon in which the cultivated crops were recorded and can be associated with human impact. *Montia fontana*, *Stellaria media*, *Sagina procumbens*, *Lychnis flos-cuculi*, *Cardamine flexuosa*, *Linum catharticum*, *Galaeopsis speciosa*, *Plantago* sp., *Viola riviniana*, *Caltha palustris*, *Ranunculus repens*, *Chenopodium album*, and *Rumex* cf. *longifolius* are continually recorded after settlement (Fig. 3).

Cereal Pollen Identification

The first instance of grains >37 μm and anl-D >8 μm (measurements available from the authors) that fulfilled the criteria for definite cultivated species occurred at 211.3 cm. Many of the grains were folded lengthwise, some were broken, but the annulus was clearly visible in all cases. They were within the diameter range for *Avena sativa* and *Hordeum* spp (>41 μm), but the anl-D (10.75 μm) was too large for the latter. The grains exceeded the largest size for *Eltrigia* spp. (37–39 μm) and *Glyceria fluitans* (41 μm) although they were within the size range for *Leymus arenarius*. However, the anl-D exceeded the size range for *L. arenarius* (8.36–9.40 μm; Andersen, 1979). In addition, the first three grains at 211.3 and 211 cm had verrucate sculpturing and were the characteristic pear-shape of *A. sativa*. We concluded that the grains >41 μm and anl-D of >10.75 μm represented cultivated crops (Fig. 4). Other large grass types >37 μm, not clearly definable as cereals by the above criteria, were grouped into a category of large wild Gramineae, which could include either *G. fluitans* or *Elytrigia* spp. However, *Glyceria* <41 μm can also be separated from cereal pollen, as long as the ratio of anl-D to pore diameter is measured. Cultivated crops have a small pore and wide anl-D, whereas *Glyceria* has a large pore and a thin anl-D (Andersen, 1993). The appearance of cultivated crops was synchronous with that of large wild grasses and was considered to represent the settlement horizon.

Microtephra

At Tjørnuvík, a distinct peak in microtephra concentration occurred at 207.4 cm, ca. 3.5 cm above the first settlement as inferred from paleobotanical data (Fig. 2), and included the basaltic phase (VIIa) of the "Landnám" tephra. This was also recorded at Ei∂i. The geochemistry of the tephra shards matched well that of the basaltic phase of the "Landnám" tephra in Iceland (Hafli∂ason *et al.*, 1992). Only five analyses could be carried out, but the correlation with VIIa is noteworthy, as basaltic tephra originates from less-explosive volcanism than rhyolitic tephra, and has not before been recorded in the British Isles or Scandinavia (Dugmore *et al.*, 1995). The technique used in this study was designed to concentrate rhyolitic rather than basaltic microtephra, so the recovery of this phase of the Landnám tephra was unexpected and is likely to underestimate the true shard concentration. The rhyolitic phase of the Landnám tephra (VIIb) was not recorded. We found no

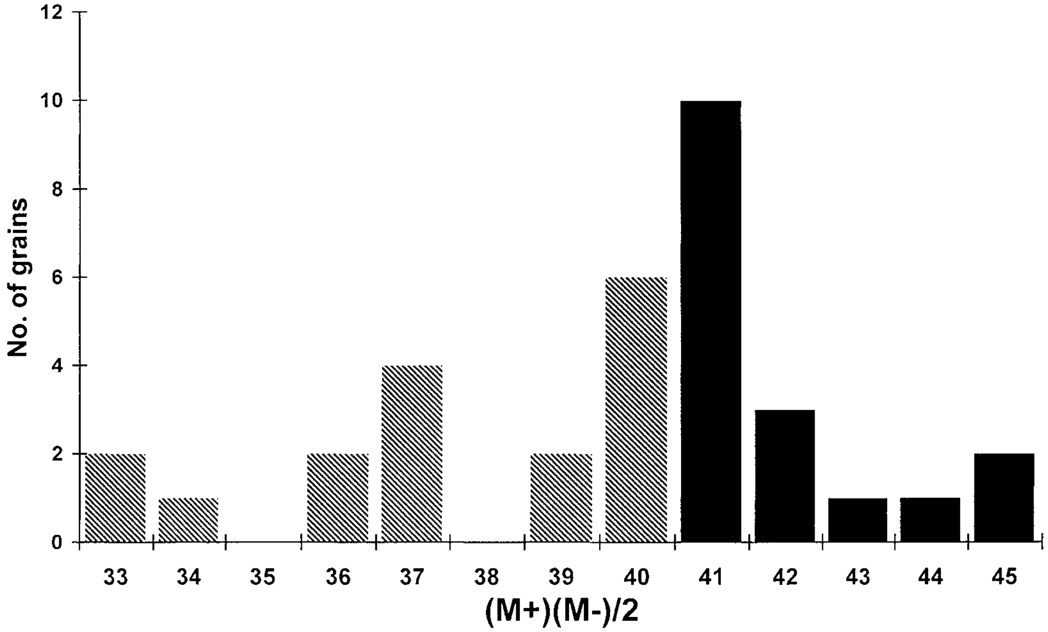

FIG. 4. Average diameters of Gramineae pollen from Tjørnuvík with annulus diameter >10.75 μm. The black columns are definite cereal grains (>40 μm average diameter).

evidence of an impact on vegetation of volcanic ashes (Hall *et al.*, 1994; Dwyer and Mitchell, 1997).

Organic Content and Fire

The percentage weight loss on ignition at 550°C was used to infer sediment organic content. This doubled above 217 cm, prior to the pollen evidence for crop cultivation and macrofossil seeds for disturbance (Figs. 2 and 3). Pollen concentration showed a minor increase at 215 cm, but quadrupled from ca. 50,000 to 200,000 grains/cm^3 between 210 and 209 cm, at the same time that Gramineae pollen percentages doubled (Fig. 2). The first microcharcoal was recorded at 213.1 cm (Fig. 2). Burnt pollen grains and a small peak in *Calluna* pollen frequencies were recorded in this sample. Macrocharcoal (>285 μm) was continuously recorded between 215 and 157 cm, with the highest concentration at 187 cm (Fig. 3). Larger charcoal fragments (>400 μm) were recorded from 202, 187–177, and 172–162 cm (Fig. 3).

DISCUSSION

There are striking changes in the pollen and macrofossil diagrams associated with the synchronous and continuous appearance of cultivated crops, charcoal fragments, and large (wild) Gramineae (Figs. 2 and 3). These changes are repeated from two other sites, with different stratigraphic settings (Hannon, 1998), and thus we present firm evidence for early settlement. The AMS dates from the settlement horizons at these sites give new credence to the earlier bulk dates of Jóhansen (1985) and support the early dates from both the house foundations at Ei∂i (Arge, 1991) and first domestic animals (J. Jóhansen, pers. commun. 1995) (Table 1). While the coincidence of a radiocarbon "plateau" at this time restricts dating precision using radiocarbon alone, these first settlement indicators are recorded below the basaltic phase of the Landnám tephra (VIIa; AD 871 ± 2 (Grönvold *et al.*, 1995), giving microtephrochronological support to the early radiocarbon dates. We have therefore found evidence for human impact on the vegetation that predates some current interpretation of existing archaeological and written sources, confirming the ideas of Jóhansen (1985).

An increase in pollen percentages of large (wild) Gramineae is characteristic of settlement on Iceland (Einarsson, 1963). Hallsdóttir (1987) reported single occurrences of cereal-type pollen (with the *Hordeum* sculpture type) below the Landnám tephra at Vatnsmýri and at Mosfell, although permanent settlement was interpreted as dating from the continuous occurrence of cereal grains. The present study gives new significance to such early, single finds of cereal-type pollen grains.

The clear representation of settlement in the palaeoecological record at Tjørnuvík, contrasts with the often weak signals recorded from the Scottish mainland (Edwards and Ralston, 1997). Either the Faroes vegetation was particularly sensitive to disturbance or, more likely, the introduction of livestock on an island system had a dramatic and rapid impact (Fig. 5). We present a conceptual model contrasting the dynamics of settlement impact on small northern Atlantic islands, such as the Faroes, and mainland sites such as Norway and Scotland (Fig. 5). The effects and extent of impact are more rapid and wide-

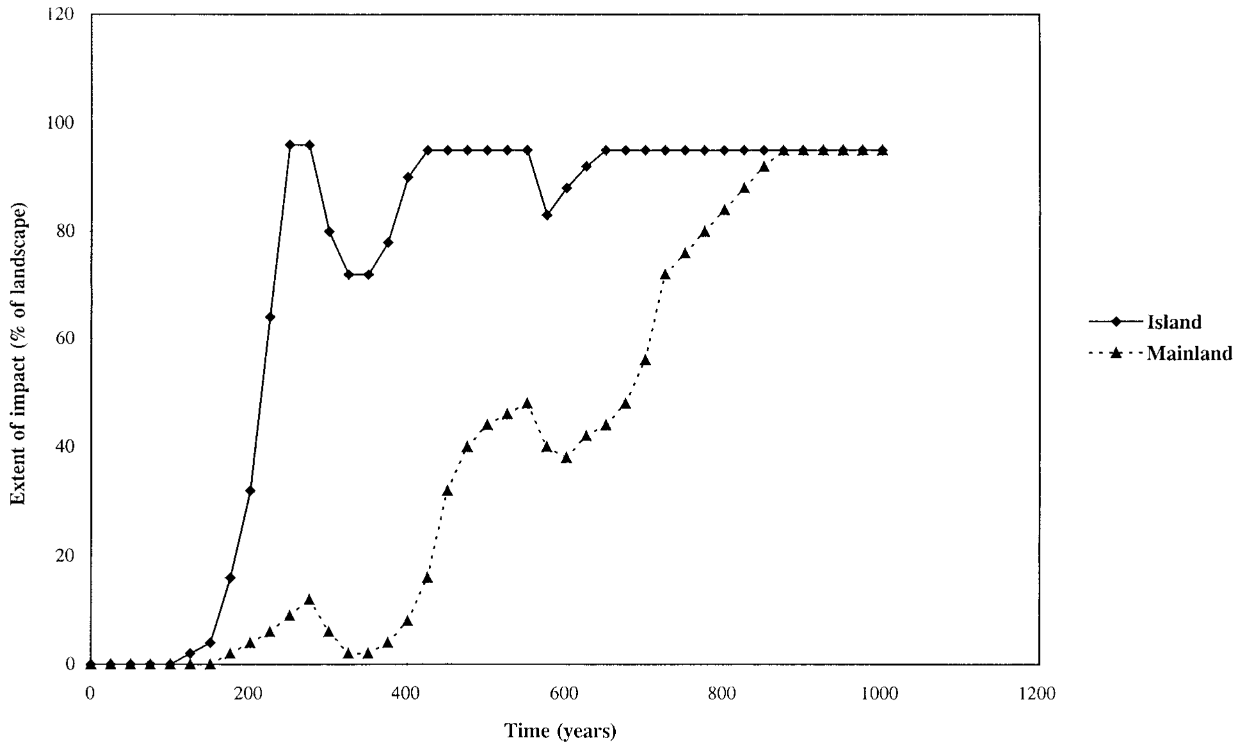

FIG. 5. Conceptual model comparing the time course of settlement impact on small northern Atlantic islands, such as the Faroes, and mainland sites, such as Norway and Scotland. For detailed explanation see text.

spread on the islands because of their small area. Sheep grazing, for example, will rapidly influence all available habitat. The two periods of decline in impact represent the effects of factors that temporarily reduce anthropogenic activities (e.g., unfavorable climatic change or disease).

Domestic and wild herbivores exert a major control on the composition and structure of much European seminatural vegetation (Humphrey *et al.*, 1998). The doubling of pollen concentration and the increase in Gramineae were originally suggested as being a consequence of the draining of the wet meadow and establishment of hay fields, in addition to the cultivation of cereals and erosion in the catchment (Jóhansen, 1985). However, the introduction of domestic animals to the islands (Reinert, 1982) could also be partially responsible for this increase, as sheep, in particular, tend to feed selectively, suppressing the herb flora and allowing the spread of grasses (Grant *et al.*, 1985; Lagerås, 1996).

Domestic animals were introduced to the islands between A.D. 560 and 900 (Table 1). The increase in pollen concentration, synchronous with the increase in Gramineae, could also be the result of depleted and destabilized vegetation on the steep slopes surrounding the valley, due to grazing animals. This would have increased the effective pollen catchment area for the site, although no degraded pollen is recorded as might have been expected (Fig. 2). Nevertheless, it is highly conceivable that the introduction of domestic animals to the islands by the first settlers contributed to the widespread and rapid changes observed in the palaeoecological record. A similar situation has been proposed for Iceland, where sheep continue to have a regional influence on vegetation (Einarsson, 1963). Bennett *et al.* (1992) suggested that a temporary introduction of red deer to the Shetland Islands during the Mesolithic Period (ca. 6400 B.C.) had a short-lived but significant influence on vegetation. There was a shift from herb and fern communities to heathland and mire plants (Bennett *et al.*, 1992). Natural soil acidification was not considered as a causative agent, as the changes were reversed ca. 4300 B.C.

A further research question was the nature and structure of the presettlement vegetation. Jóhansen (1985) believed that it had been forest-free throughout the Holocene. However, the continuous presence of tree pollen, albeit in low percentages, casts doubt on this hypothesis. Sheep devastate the current woody flora. At the Viking site of Argisbrekka, Eysturoy, a thick layer of *Betula pubescens* was recorded 0.6 m below the surface (Malmros, 1994). The site is situated 1.5 km from the coast at an altitude of 130 m. A series of dates revealed that *Betula* trees grew at Argisbrekka between 2460 B.C. and A.D. 770 (Malmros, 1994).

Trees grow at several locations in the Faroes today, but are mostly planted (Leivsson, 1989). The pollen data from the present study show that *Juniperus*, *Betula*, and *Salix* were more widespread prior to settlement (Fig. 2). Other tree pollen included *Fraxinus*, *Tilia*, *Corylus*, *Sorbus*, *Alnus*, *Ulmus*, *Quercus*, and *Pinus*. Possibly these pollen records reflect local presence of these tree species also, but macrofossil data are needed to confirm this suggestion. Very low tree pollen percentages in open landscapes have usually been interpreted as being of long-distance origin. The discovery of tree macro- and megafossils associated with very low pollen percentages in Sweden during the Holocene casts doubt on this presumption (Kullman, 1998). It seems likely that prior to settlement on the Faroe Islands, there were at least scattered woodland communities in favorable, protected sites.

Data from nearby marine cores (Kuijpers *et al.*, 1998) and some terrestrial sources (Jóhansen, 1989) suggest that between about 9000 and 5000 yr ago the climate was more suitable for tree growth on the Faroes and that conditions deteriorated during recent millennia (Humlum and Christiansen, 1998). Thus, settlement represented a disturbance to vegetation that was probably already stressed by deteriorating climate and was particularly prone to permanent alteration (Bradshaw and Hannon, 1992).

The climate of the Faroe Islands is chiefly controlled by the temperature of the surrounding surface waters. Evidence from the ENAM project (Kuijpers *et al.*, 1998) suggested significant Holocene variation in Norwegian Sea overflow possibly related to Gulf Stream activity. Core 94-13 showed a marked change from fine- to coarse-sediment deposition about 5000 yr ago. Coarse sediments are associated with strong bottom currents and large volumes of Norwegian Sea overflow water, while clay-rich sediments are deposited during times of weaker current activity. Before ca. 3000 B.C., the sediments show little sign of irregularity, indicating a stable circulation system. This stability was lost during subsequent millennia (Kuipers *et al.*, 1998). This observation relates to the dynamics of climatic development reconstructed from regional sea-surface temperature (SST) based on diatom assemblages (Koç *et al.*, 1996). The early Holocene is characterized by rather stable SSTs, followed by a significant temperature drop between ca. 4350 B.C. and 2300 B.C., interpreted as climatic deterioration. The ultimate separation of anthropogenic-driven from climate-driven vegetational change on the northwestern Atlantic islands can best be resolved by high-resolution analysis of terrestrial sediments and comparison with the marine record of climatic development.

CONCLUSIONS

Our study has used microtephra analyses to support AMS radiocarbon-dated plant remains from the Faroe Islands to establish the timing and effects of first human settlement. The first occurrence of cultivated crops from three locations was older than implied from previous archaeological and historical studies, but was consistent with earlier palaeoecological investigations (Jóhansen, 1985). The effects of settlement on the vegetation were rapid and widespread, probably because of the simultaneous introduction of domestic animals with cereal cultivation. The introduction of domestic animals, in combination with a deteriorating climate, destroyed any native tree cover that may well have survived from a period of more favorable climate prior to about 3000 B.C.

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