Holocene Tephra Layers in the Faroe Islands

Holosenar tefrafláir í Føroyum

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Úrtak

Tekin um minst fimm kisiltefrafláir og eina basalttefraflógv úr holosenari tíð eru funnin í Føroyum. Tað er sannlíkt, at allar hesar tefrafláirnar hava sín uppruna í Íslandi. Harafturat benda søgulig skjøl á møguligt avfall frá trimum nýligum eldgosum úr Køtlu í 1625, 1660 og 1755, men enn er eftir at staðfesta hetta við tefrafundum. Ein av basaltfláunum í Føroyum, sum vit í løtuni vita um, er nevnd Saksunarvatnstefran, og hon settist um 9100 BP. Hon myndar eina týðandi økisisokron, sum fevnir um allan landnyrðingspartin av atlantsøkinum. Her verður greitt frá nýggjum jarðevnafrøðiligum tilfari um Saksunarvatnstefruna og eini eldri kisiltefru, sum er merkt L3574. Meðan upprunin hjá tveimum teimum yngstu holosenu kisiltefrufundunum í Føroyum framvegis er óvissur, leggja vit jarðevnafrøðiligt tilfar fram um tvær miðholosenar kisiltefrur, ið eyðmerkir tær sum íslendsku tefrurnar H-4 (3800 BP) og H-S (3500 BP).

Abstract

Evidence of at least five silicic and one basaltic tephra layers of Holocene age have been found in the Faroe Islands. All these tephras are likely to have originated in Iceland. In addition, historical records suggest fallout may have occurred after three recent eruptions of Katla in 1625 AD, 1660 AD, 1755 AD, but this has yet to be confirmed with finds of tephra. The one basaltic layer currently known in Faroe is called the Saksunarvatn tephra, and was deposited about 9100 BP. It forms an important regional isochrone, that is present throughout the north-east Atlantic region. We report new geochemical data on the Saksunarvatn tephra from the type site, and an older silicic tephra designated L3574. While the identity of the two youngest Holocene silicic tephras found in Faroe remains uncertain, we present geochemical data on two mid-Holocene silicic tephras which identifies them as the Icelandic tephras H-4 (3800 BP) and H-S (3500 BP).

Introduction

A key step in understanding environmental changes in the North Atlantic Islands is determining the timing of events. No one technique satisfies all requirements for precision, accuracy and applicability, and there is a continuing search for new techniques to both refine and extend existing chronologies. Tephrochronology is one well-established dating method that is gaining wider applications in the North Atlantic region due to a series of recent methodological advances (Dugmore *et al.*, 1995a). Tephrochronology is based on the identification, correlation and dating of layers of volcanic ash, and provides a means of defining precise time-parallel marker horizons, or isochrones.

In the North Atlantic region, tephrochronology is based on the ash layers pro-

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duced by Icelandic volcanoes (Thórarinsson, 1981a; Sigurdsson and Loebner, 1981; Dugmore *et al.*, 1995a). Over the last 50 years detailed proximal chronologies have been developed in Iceland, (Thórarinsson, 1944; 1974; Larsen *et al.*, submitted) and, more recently, long-distance connections have been made to distal sequences on the ocean floor (Sigurdsson, 1982; Ruddiman and McIntyre, 1981), Scandinavia (Persson, 1971; Mangerud *et al.*, 1984; Birks *et al.*, 1996), the British Isles (Dugmore, 1989a; Pilcher and Hall, 1992; 1996), NW Europe (Merkt *et al.*, 1993; Bogaard *et al.*, 1994), and the Greenland icecores (Grönvold *et al.*, 1995). The key to recent developments has been the attention paid to microscopic tephra horizons which are important for two main reasons; firstly, they can enhance temporal resolution in areas with well-established tephrochronologies based on a sequence of visible layers. Secondly they can be used to greatly extend the spatial coverage of the technique.

Once established tephrochronology can be used to tackle a number of problems in palaeoenvironmental studies (e.g. Brown *et al.*, 1992; Blackford *et al.*, 1992; Froggatt and Rogers, 1990; Austin *et al.*, 1995). Most importantly tephras can be used to for the precise correlation of stratigraphic sequences, such as the connection of soil, peat and lake sediments, some of which may otherwise be undatable (Dugmore 1989b; Haflidason *et al.*, 1992). The identification of known tephras can permit the application of the best available absolute dating on each isochrone and associated sediments. For example, the identification of H-4 in the Faroes would enable precise absolute dates determined elsewhere to be applied within the islands. These would include the composite radiocarbon date 3,833 +/- 11 ^{14}C yrs BP based on sites in Iceland and the UK (Dugmore *et al.*, 1995b) or the equivalent calendrical 'wiggle match' date of 2310+/- 20 BC determined in Ireland (Pilcher *et al.*, 1995). This use of precise and accurate absolute dates is particularly important for key periods of rapid change, such as deglaciation and the first human colonisation. Finally, the stratigraphic distribution of a known tephra can be used to identify both sediment movement within a profile, and the wholesale regional reworking of sediments (Boygle, 1994).

Tephra layers and tephrochronology could make a key contribution to studies of environmental change in Faroe. The purpose of this paper is to assess the current status of tephrochronology in Faroe and consider future developments.

Holocene tephra layers in the Faroe Islands

Pioneering work on Holocene tephra layers in Faroe was undertaken by Persson (1968) as part of a wide ranging study that showed Icelandic tephra was present as discrete horizons in the peat bogs of both Faroe and mainland Scandinavia (Persson, 1966; 1967). In Faroe, Persson studied four bogs in detail, and showed that in the last 7,000 years silicic tephras have been deposited on at least four occasions. The tephra deposits are all younger than 4000 BP, with the refractive indices of the glass showing little variation between 1.497 – 1.521, and grain sizes generally < 100 µm (Persson, 1968). On the basis of radiocarbon dating, tentative identifications were made of three of the tephras; the 'Landnam Ash' from the Vatnaöldur eruptions of the ninth century AD or Hekla 1104 AD, H-3 and either H-4 or H-S. Persson had no geochemical data on the tephras, so precise identification of these Faroese horizons is uncertain and disputed (Waagstein and Jóhansen, 1968).

The key breakthrough of Persson's work was to prove that discrete horizons of tephras had been deposited across the Faroe Islands on a number of occasions during the Holocene. He showed that tephrochronology could be applied on Faroe, even though the necessary data for the precise identification of the tephras was lacking.

In the course of palynological studies in the Faroe Islands, Jóhannes Jóhansen identified a number of localities where a well-developed (cm-scale) layer of basaltic tephra was present within the early Holocene stratigraphy (Jóhansen, 1975; 1981). Subsequently, Saksunarvatn became the type site for the definition of the 'Saksunarvatn tephra' (Jóhansen, 1981; Mangerud *et al.*, 1986). Dated to c. 9,100 ^{14}C yrs BP this tephra has been traced southwards to the British Isles and Germany (Bennett *et al.*, 1992, Merkt *et al.*, 1993) and north to early Holocene, ice free areas of northern Iceland (Björk *et al.*, 1992). From its source within the Grimsvötn volcanic system of southern Iceland this tephra spread across much of the NE Atlantic region, where it forms a most significant isochrone, constraining studies of the rapid environmental changes of the termination of the last glacial cycle (Kvamme *et al.*, 1989).

The identification of the Saksunarvatn tephra in Faroe highlights three particularly important issues. Firstly, it established the presence of basaltic tephra from Iceland in stratigraphic sequences in Faroe. Persson had focused on the silicic tephras because of their contrast to the basaltic sediments that form the Faroe islands. With the definition of the Saksunarvatn tephra, it was shown that basaltic tephras from exotic sources could be identified, and traced through many different sites on Faroe. A second issue related to the identification of the Saksunarvatn tephra is the strengths and limitations of grain-specific major element analysis in the definition of individual tephras. A strength is that without this geochemistry, correlations between Faroe, seabed sites, NW Europe and Iceland would not have been convincing, and separation from other basaltic components of the North Atlantic Ash Zone One would not have been possible. Critical limitations of major element data on basaltic tephra are also highlighted, as, while the source volcano can be established with certainty, the specific eruption cannot (cf. Bennett *et al.*, 1992). This important caveat, reinforces the conclusions of Westgate and Gordon (1981) on the need for a rigorous, multi-strand approach to tephra identification and correlation. Finally, despite the importance of the Saksunarvatn tephra, it has seen little use as an isochrone in palaeoenvironmental study within Faroe (Edwards *et al.*, 1994). This does, however, also reflect the comparatively limited work undertaken on environmental changes in Faroe at the close of the 10th Millennium BP.

In addition to the physical records of tephra found in Faroe, historical records compiled by Thórarinsson (1981b) suggest that traces of three ash-falls within the last 400 years may also be present, and, by extension into prehistory, that tephras may be more numerous than the five identified by Persson (1971) and Mangerud *et al.* (1986).

Tephras in historical time in Faroe

At least one silicic tephra has formed an isochrone across Faroe in the early part of historical time. On the basis of its silicic character and radiocarbon age, Persson (1968; 1971) suggested that a tephra at Myrarnar may be either a part of the ninth century AD Icelandic 'Landnam Ash' or the 1104 AD Hekla tephra (Thórarinsson 1967). A silicic component of the 'Landnam Ash' was erupted from the Torfajökull volcanic system c. 871 AD (Grönvold *et al.*, 1995), but the volume of this component, at c. 0.1 km^3, is comparatively small (Larsen, 1984). As one alternative the Faroese deposit may be a part of the much larger-scale silicic tephra from the 1104 AD eruption of Hekla or, as a third possibility, the tephra from Hekla in 1158 AD. The 1158 AD tephra is smaller in volume than the 1104 AD, but of a similar size to the silicic component of the Landnam Tephra (Larsen *et al.*, submitted). Major element geochemistry can resolve this question and provide the identity of a key marker horizon for the colonisation or early settlement period in Faroe.

Other eruptions in Iceland during historical times in Faroe may have led to fall-out across the islands. The Öræfajökull eruption of 1362 AD was a very large, catastrophic event that produced a large volume of tephra blown eastwards from Iceland (Thórarinsson, 1958). Given the scale of this tephra and its direction of fall-out, it could be present in Faroe, although it was not found by Persson (1968) at his four sites. Traces are, however, present in the British Isles (Dugmore *et al.*, 1995a; Pilcher *et al.*, 1996), and it has been identified in the Greenland ice core (Palais *et al.*, 1991). Another tephra that may possibly be present in Faroe is from the 1510 AD eruption of Hekla. The tephra fall-out initially spread south from the volcano, but has been identified at sites across Scotland and in the north of Ireland, so it may have also reached Faroe (Dugmore *et al.*, 1995a; 1996; Pilcher *et al.*, 1996).

Further additional possibilities are highlighted by Thórarinsson's (1981b) compilation of historical records of dust falls on both land and ships which suggests that tephra from the Katla eruptions of 1625 AD, 1660 AD and 1755 AD could all be present in Faroe.

In general the historical references to dust falls in areas downwind of active volcanoes can be divided into two groups: those where there is physical evidence of fallout, and those where, at present, there is none. Dust falls from a variety of sources can coincide with either eruptions or the passing of tephra clouds, yet may be totally unrelated, so any such records have to be treated with considerable caution. This is a point stressed by Thórarinsson who drew attention to a cautionary event during the 1947 AD eruption of Hekla (Thórarinsson, 1954). Tephra from the 1947 AD eruption fell over a large area of southern Finland, where contemporary reports of dust fall were backed up with analysis of the fall-out that showed it to be volcanic glass (Salmi, 1948). As the eruption cloud was passing Denmark there were also reports of fallout from Jutland. Analysis of this material showed it to be mineral sand and not volcanic ash, showing the caution that has to be used when interpreting dust fall records even when they coincide precisely with either an eruption or the likely passage of an eruption cloud.

In the case of the seventeenth and eighteenth century eruptions of Katla no physical evidence in the palaeoenvironmental record has yet been found to support distal fallout. The historical records of black dust smelling of sulphur are most suggestive (Mitchell 1757 in Thórarinsson 1981b), but may be due to other factors. It is possible that the Holocene basaltic tephra eruptions in Iceland, while the most frequent form of volcanic activity and, on occasion, most voluminous, may not have lead to any significant distal tephra fall. Basaltic eruption columns generally lack the height and intensity of more silicic events, so may not have crossed the critical atmospheric thresholds permitting large scale dispersal. Extensive studies of mid to late Holocene peat profiles in Scotland by Dugmore *et al.* (1995a) only produced records of tephra layers with a silicic content >57% ('andesites' according to Le Maitre, 1989). Data that strongly suggests basaltic tephras have not been deposited on any significant scale over the British Isles during the last 7000 years. There are two notable Holocene examples of far-travelled basaltic tephras from Iceland, but they are likely to represent special cases, unrepresentative of explosive Holocene basaltic eruptions in general. The basaltic Saksunarvatn tephra does reach NW Europe, but it was erupted on an enormous scale during a major deglaciation of Iceland, and because of this timing it is unlikely to be similar to any later Holocene event. Traces of the Eldgjá eruption of mid 930s AD have been found in the Greenland icecap (Zielinski *et al.*, 1995). This eruption is also special as it is the largest known basaltic fissure event in the world in recorded history, producing c.16 km^3 lava and tephra (Miller, 1989). Despite its unusual size, in distal areas traces of fall-out may only be detectable in ice cores.

Even though there is little evidence for the repeated, wide-spread dispersal of basaltic tephra from Iceland during the Holocene, one possibility is that basaltic tephra may have spread as far as Faroe (up to 500 km from the source areas) but not as far as mainland Europe (>1,000 km from the source areas). However, until physical evidence of tephra fall from the Katla eruptions in 1625 AD, 1660 AD, and 1755 AD are found outside Iceland, the case for the distal fallout, whether in the Faroe Islands or elsewhere, must remain rather uncertain.

The key to resolving the status of historical-age tephra-falls in the Faroes lies in the development of Persson's pioneering (1968) approach as recently undertaken in the British Isles; the first step being the extraction of tephra from peat profiles, but followed by grain-discrete geochemical analysis (Larsen, 1981; Dugmore, 1989a), and comparison with reference material from Iceland (Imslands 1978; Jakobsson 1979; Dugmore *et al.*, 1992; 1995a; Larsen *et al.*, submitted).

Refining the palaeoenvironmental records of tephra

A basic framework of a prehistorical Holocene tephrochronology of Faroe is indicated by the work of Persson (1968;1971) and Mangerud *et al.* (1986). While the status of Persson's putative 'Landnam Ash'/Hekla 1104 AD and the c. 365 AD Saksunmyren tephra continues to be uncertain, recent work at Skaelingsvatn does seem to have resolved the status of the two older silicic tephras reported by Persson (1968), and linked to H-3 and either H-4 or H-S ('H-2' of Persson, 1968;1971). At Skaelingsvatn palaeoecological studies have been undertaken on the lake sediments (Edwards *et al.*, 1994), the full results of which will be reported elsewhere (Sadler *et al.*, ms). Two visible tephra layers were found, and their geochemistry characterised. Comparison to Icelandic reference material shows these tephras to be the c. 3500 BP H-S and c. 3800 BP H-4 layers (Kjartansson *et al.*, 1964; Larsen and Thórarinsson, 1977; Dugmore *et al.*, 1995b; and Table 1, Fig. 1). The implication is that upper of the two visible silicic tephra found elsewhere in Faroe by Persson (1968) and attributed to H-3 on the basis of radiocarbon dating is also part of somewhat older H-S tephra, and the lower silicic tephra is H-4. This also supports the conclusion of Waagstein and Jóhansen (1968) who identified the presence of 'H-2' (now known as H-S) elsewhere in Faroe on the basis of the radiocarbon dating. The H-S tephra may also be present in Shetland (the 'Kebister tephra' of Dugmore *et al.*, 1995a, and Dugmore and Newton, 1998), and in central Sweden (Boygle, *in press*).

In this paper we also present additional data on the Saksunarvatn tephra from the reference core in Saksunarvatn (Table 2). These analyses have been conducted under the same conditions as all other analyses of Holocene Icelandic tephra undertaken at Edinburgh (e.g. Dugmore and Newton, 1992; Dugmore *et al.*, 1992; 1995a;) and so are directly comparable with a growing North Atlantic tephra database (Newton *et al.*, 1997; and Tephrabase, 1998 at http://www.geo.ed.ac.uk/tephra/tbasehom.html). The spread of the data on the Saksunarvatn tephra (which probably reflects analytical precision as well as sample variability), is significantly less on this new data set than those reported by Mangerud *et al.* (1986) for Faroe, Kvamme *et al.* (1989) for the North Atlantic, and Bennett *et al.* (1992) for Shetland. Despite this improved resolution it is still not possible to use major element data alone to effectively discriminate between separate eruptions of Grimsvötn (Larsen, 1982). Resolving this question will still rely on the use of additional lies of evidence such as stratigraphic position, associated biostratigraphy and radiometric dating.

Jóhannes Jóhansen also provided a sample for us to analyse of a silicic tephra from below the Saksunarvatn tephra in the refer-

Figure 1a

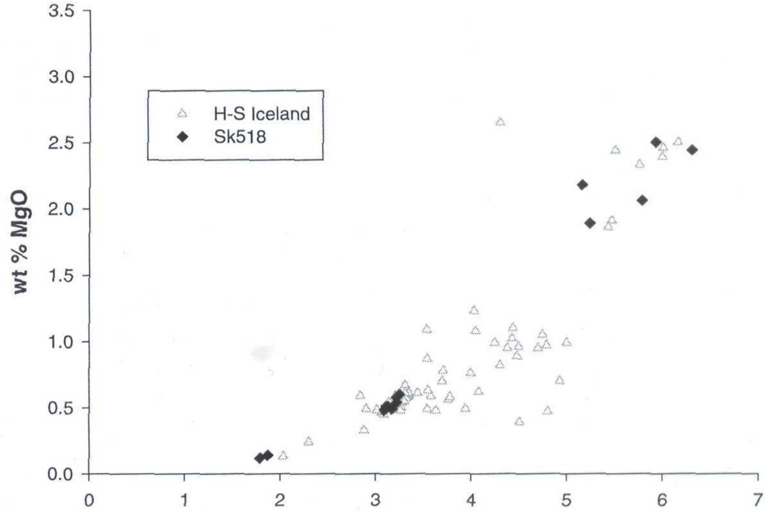

Figure 1b

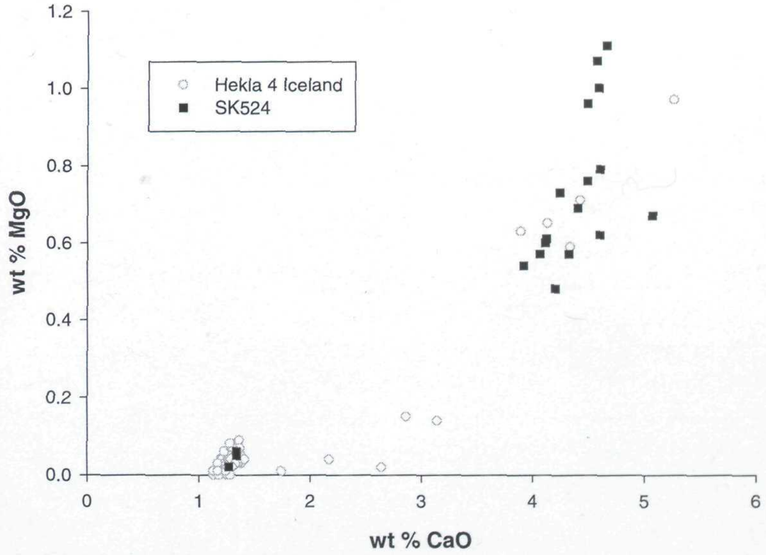

Figure 1. *Selected major element data from Skalingsvatn showing the correlations between SK 518 and H-S (a) and SK 524 and H-4 (b). Comparative data from Dugmore* et al. *(1992). All data is also available at http://www.geo.ed.ac.uk/tephra/tbasehom.html*

Mynd 1. Úrvaldar upplýsingar um høvuðsfrumevni úr Skælingsvatni, sum vísa samsvarið millum SK 518 og H-S (a) og SK 524 og H-4 (b). Tilfar til samanberingar úr Dugmore *et al.* (1992). Alt tilfarið er til taks á http://www.geo.ed.ac.uk/tephra/tbasehom.html

***Table 1.** Major element data on two visible silicic tephra layers in a core from Skaelingsvatn, Faroe. The upper layer is at 518 cm below lake level and the lower at 524 cm. Further details on this site are reported elsewhere (Edwards* et al., *1994). The samples were analysed with a Cambridge Instruments Microscan V using a standard WDS (wavelength dispersive) technique, an accelerating voltage of 20 kV and a beam current of 15 nA. The Microscan V was calibrated using standards of known composition, comprising a mixture of simple silica compounds and pure metals. Counter dead time, atomic number effects, and fluorescence were corrected using Sweatman and Long's (1969) ZAF correction programme. An andradite standard of known composition was analysed as an unknown compound at regular intervals through all analytical sessions in order to guard against unexpected variation in machine operating conditions. The nine major elements were analysed using two spectrometers and a counting time of 10 seconds for each element. Sodium is measured during the first and second counting period so that any mobility during the overall analysis can be assessed. Background counts were determined separately to the results presented. Further details on sample preparation are given in Dugmore* et al. *(1995a). Sk518 is H-S and Sk524 is H-4 (see also Fig. 1 and http://www.geo.ed.ac.uk/tephra/tbasehom.html).*

Talva 1. Upplýsingar um høvuðsfrumevni í tveimum sjónligum kisiltefrafláum í einum borikjarna úr Skælingsvatni í Føroyum. Tann ovara flógvin er 518 cm undir vatnskorpuni og tann niðara 524 cm. Greitt verður nágreiniligari frá hesum staðnum aðrastaðni (Edwards *et al.*, 1994). Royndirnar vórðu greinaðar við einum Cambridge Instruments Microscan V, arbeiðshátturin var standard WDS (wavelength dispersive = bylgjulongdarspjaðandi), økjandi spenningur upp á 20KV varð brúktur og geislastreymur upp á 15nA. Microscan V varð stillað við at brúka fyrisett mál av eini kendari samanseting, sum var ein blanding av einfaldum samansetingum av kisili og reinum metalum. Øvugt deyð tíð, atomnummarárin og flúrglógvan vórðu stillað við ZAF-stillingarforritinum hjá Sweatman and Long (1969). Alla tíðina, meðan greiningin fór fram, varð við jøvnum millumbilum ein andraditstandardur av kendum samansetingum greinaður, sum um talan var um eina ókenda samanseting, fyri at fyribyrgja óvæntaðum broytingum í umstøðunum hjá maskinum at virka undir. Tey níggju høvuðsgrundevnini vórðu greinað við einum spektrometri og eini teljingartíð upp á 10 sekund fyri hvørt grundevni. Natrium er mált í fyrsta og øðrum teljingarskeiði, so at tað ber til at staðfesta allar flytingar undir allari greiningini. Bakstøðisteljingar vórðu ásettar sundurskildar frá teimum framløgdu úrslitunum. Fleiri upplýsingar um tilbúgvingina av royndunum eru í Dugmore *et al.* (1995a). Sk 518 er H-S og Sk 524 er H-4 (sí eisini mynd 1 og http://www.geo.ed.ac.uk/tephra/tbasehom.html)

Table 1

Sk518

SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	Total
72.41	0.17	13.64	2.67	0.12	0.12	1.79	4.91	2.40	98.22
72.19	0.23	13.85	2.77	0.06	0.14	1.87	3.15	2.63	96.90
68.04	0.47	14.79	5.25	0.17	0.49	3.17	4.67	1.99	99.03
67.89	0.37	15.24	5.82	0.17	0.54	3.22	4.62	2.04	99.92
67.36	0.46	14.81	5.35	0.12	0.48	3.09	4.73	2.08	98.47
67.05	0.51	14.56	5.52	0.10	0.51	3.11	4.93	2.10	98.39
66.09	0.46	14.56	5.50	0.11	0.60	3.25	4.56	2.07	97.22
65.38	0.47	14.53	5.42	0.13	0.51	3.13	4.51	2.11	96.18
65.19	0.56	14.55	5.59	0.12	0.58	3.22	4.58	1.88	96.27
59.54	1.61	13.77	9.55	0.31	1.89	5.24	4.20	1.56	97.67
58.96	1.50	13.96	9.33	0.28	2.18	5.16	3.49	1.46	96.30
57.51	1.57	14.47	9.92	0.28	2.06	5.79	4.40	1.42	97.42
56.57	2.22	13.45	10.57	0.26	2.44	6.31	4.06	1.40	97.27
56.09	2.12	13.51	10.87	0.23	2.50	5.93	3.94	1.43	96.63

Sk524

SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	Total
75.46	0.10	13.01	1.76	0.08	0.02	1.27	4.62	3.01	99.33
73.40	0.07	13.15	1.94	0.03	0.06	1.34	4.58	2.97	97.53
73.31	0.10	13.69	1.51	0.06	0.05	1.34	5.54	2.58	98.18
64.68	0.59	14.40	8.74	0.26	0.48	4.20	4.65	1.69	99.69
64.30	0.63	14.46	8.52	0.32	0.61	4.12	4.82	1.69	99.47
64.26	0.65	14.26	8.47	0.26	0.54	3.92	4.59	1.71	98.66
63.75	0.72	14.33	8.44	0.26	0.57	4.32	4.77	1.87	99.02
63.61	0.78	15.05	8.30	0.22	0.62	4.60	4.82	1.48	99.49
63.46	0.74	14.26	8.55	0.27	0.69	4.40	4.79	1.62	98.79
63.39	0.65	13.92	8.28	0.34	0.60	4.11	4.41	1.67	97.37
63.28	0.77	14.88	9.17	0.28	0.76	4.49	4.61	1.58	99.83
62.81	0.71	14.67	8.57	0.28	0.73	4.24	4.28	1.49	98.33
62.76	0.76	14.34	8.86	0.30	0.57	4.06	4.56	2.04	98.25
62.45	0.73	14.50	9.32	0.27	0.79	4.60	4.32	1.60	98.67
62.01	0.91	14.85	9.54	0.27	1.07	4.57	4.31	1.49	99.00
61.67	0.66	16.50	7.36	0.19	0.67	5.07	5.29	1.31	98.72
61.54	0.85	14.70	8.91	0.29	0.96	4.49	4.40	1.94	98.07
61.47	0.93	14.47	9.00	0.26	1.00	4.59	4.48	1.58	97.79
61.35	0.97	14.85	9.64	0.30	1.11	4.66	4.52	1.62	99.02

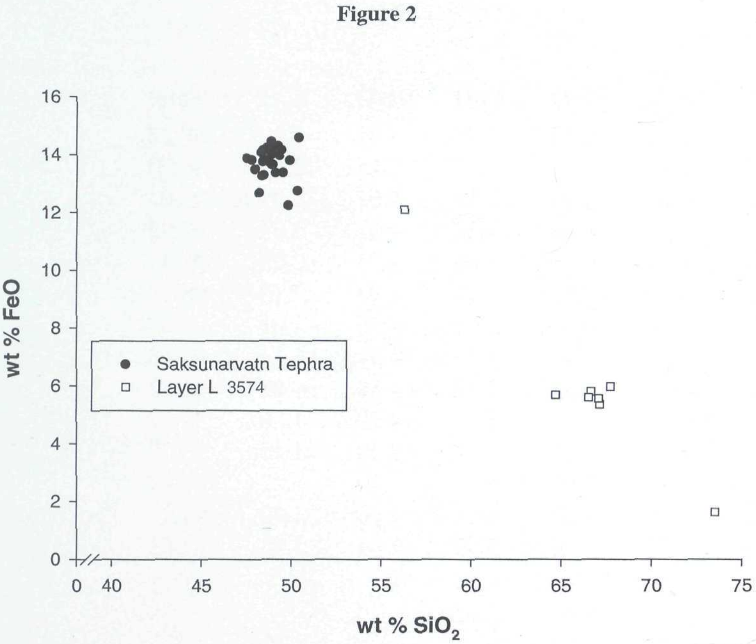

Fig. 2 . Selected major element data from Saksunarvatn showing the Saksunarvatn tephra and the L 3574 tephra (full data in Tables 2 and 3). The basaltic Saksunarvatn tephra is more homogeneous than the silicic layer L3574. All data is also available at http://www.geo.ed.ac.uk/tephra/tbasehom.html

Mynd 2. Úrvaldar upplýsingar um høvuðsfrumevni úr Saksunarvatni, sum vísa Saksunarvatnstefruna og 'L 3574-tefruna' (fullfíggjaðar upplýsingar á talvu 2 og 3). Saksunarvatnstefran úr basalti er meira einsháttað enn kisilflógvin L 3574. Alt tilfarið er eisini til taks á http://www.geo.ed.ac.uk/tephra/tbasehom.html.

ence core from Saksunarvatn (Jóhansen, 1981). Here it is provisionally named L 3574 (Table 3, Fig. 2). While it forms a cm-scale layer in Saksunarvatn, the well-developed sediment focusing in this lake basin (>30 m of accumulation in 9,000 years) means that its thickness in the core is likely to be exaggerated (Jóhansen, 1977). The actual thickness of the fallout is likely to be on the mm or sub-mm scale, but this should still form a recognisable isochrone across Faroe and neighbouring areas of the North Atlantic.

Conclusions

At least six Holocene tephras layers are present in the Faroe Islands. Five are silicic and one is basaltic in composition. Two silicic tephras have been positively identified on the basis of new geochemical analyses. They are H-S (3500 BP) and H-4 (3800 BP).

Historical records, and the identification of Icelandic tephras of historical age in the British Isles suggest that at least five other recent tephras may be present in the Faroe islands, but this has yet to be confirmed by physical evidence.

There is a considerable, and largely unrealised, potential for tephrochronology on Faroes. Tephras exist both as visible, cm-scale layers and as microscopic horizons. The development of an effective chronology will require the geochemical characterisation of all the tephras present that will permit the effective correlation to type sequences in Iceland.

Key reference profiles for tephrochrono-

Table 2

SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	Total
50.42	3.30	12.97	14.57	0.22	5.61	9.19	1.82	0.41	98.53
50.34	2.87	14.12	12.74	0.22	5.31	10.22	2.98	0.41	99.21
49.89	3.09	12.88	13.79	0.26	5.47	9.77	2.92	0.44	98.51
49.83	2.93	13.76	12.23	0.20	6.36	10.68	2.96	0.36	99.31
49.53	2.90	12.37	13.37	0.25	6.52	11.08	2.57	0.39	98.98
49.47	2.96	13.53	14.15	0.22	5.45	10.13	2.84	0.48	99.23
49.33	3.12	13.12	13.96	0.26	5.62	9.88	2.62	0.47	98.38
49.26	3.22	13.04	14.29	0.21	5.44	9.68	2.78	0.44	98.35
49.11	2.87	13.25	13.36	0.24	5.99	10.27	2.73	0.44	98.26
48.98	3.23	12.77	14.24	0.24	5.21	8.92	2.64	0.43	96.66
48.96	2.93	13.15	13.65	0.27	5.63	9.86	2.57	0.56	96.59
48.93	3.15	12.81	14.19	0.24	5.66	9.52	2.74	0.51	97.75
48.90	2.92	12.54	13.99	0.17	5.61	9.81	3.06	0.42	97.42
48.89	3.06	13.26	13.65	0.22	5.60	9.47	2.51	0.47	97.12
48.89	3.34	12.73	14.44	0.25	5.49	9.59	2.75	0.43	97.90
48.88	3.08	12.89	14.14	0.25	5.56	9.96	2.54	0.42	97.72
48.76	2.86	12.68	13.71	0.24	5.63	9.36	2.65	0.36	96.25
48.66	3.07	13.30	14.23	0.23	5.69	9.55	2.96	0.47	98.16
48.65	3.08	13.20	13.79	0.25	5.58	10.14	2.55	0.49	97.73
48.46	2.89	12.93	13.82	0.22	5.63	10.09	2.71	0.46	97.20
48.45	3.24	13.11	14.14	0.30	5.32	9.55	3.17	0.51	97.79
48.45	3.17	13.12	13.28	0.23	5.90	10.08	2.81	0.45	97.49
48.41	2.87	13.59	14.10	0.26	5.88	10.21	2.38	0.43	98.12
48.39	3.07	13.12	13.74	0.22	5.76	9.86	2.66	0.43	97.25
48.35	2.77	13.23	13.25	0.26	5.73	9.80	2.76	0.43	96.58
48.34	3.06	12.79	14.04	0.23	5.73	10.05	2.59	0.40	97.23
48.21	2.71	12.78	12.65	0.27	6.43	11.09	2.57	0.36	97.07
47.97	2.83	13.12	13.49	0.22	6.12	10.16	2.76	0.36	97.03
47.78	3.06	12.90	13.81	0.26	5.76	10.01	2.74	0.41	96.73
47.52	2.87	13.01	13.86	0.28	5.85	10.23	2.87	0.49	96.98

Table 2. *New major element data on the Saksunarvatn Tephra from the Saksunarvatn core. This data is also available at http://www.geo.ed.ac.uk/tephra/tbasehom.html. (Analytical details as in Table 1.).*
Talva 2. Nýggjar upplýsingar um høvuðsgrundevnini í Saksunarvatnstefruni úr borikjarna úr Saksunarvatni. Hetta tilfar er eisini til taks á http://www.geo.ed.ac.uk/tephra/tbasehom.html. (Upplýsingar um greiningina eru tær somu sum til talvu 1).

Table 3

SiO_2	TiO_2	Al_2O_3	FeO*	MnO	MgO	CaO	Na_2O	K_2O	Total
73.52	0.08	12.29	1.62	0.03	0.08	1.32	4.08	2.73	95.76
67.72	0.54	15.49	5.96	0.17	0.59	3.32	4.26	1.86	99.92
67.13	0.41	15.23	5.35	0.25	0.56	3.13	4.41	2.15	98.62
67.07	0.56	15.18	5.55	0.14	0.60	3.37	4.15	2.02	98.63
66.64	0.47	15.09	5.79	0.19	0.43	3.32	4.04	2.07	98.03
66.52	0.48	15.25	5.59	0.17	0.54	3.15	3.86	1.95	97.52
64.68	0.48	14.90	5.68	0.18	0.52	3.29	4.15	2.01	95.90
56.30	2.15	13.18	12.08	0.36	3.26	6.36	3.85	1.38	98.91

Table 3. *New major element data on the 'L 3574 Tephra' from the Saksunarvatn core. . This data is also available at http://www.geo.ed.ac.uk/tephra/tbasehom.html. (Analytical details as in Table 1.).*
Talva 2. Nýggjar upplýsingar um høvuðsgrundevnini í 'L 3574-tefruni' úr borikjarna úr Saksunarvatni. Hetta tilfar er eisini til taks á http://www.geo.ed.ac.uk/tephra/tbasehom.html. (Upplýsingar um greiningina eru tær somu sum til talvu 1).

logy are most likely to be found in peat profiles where the problems of sediment reworking within a catchment and sediment focusing can be avoided. The preservation of Holocene peats on Faroe is therefore an important issue for tephrochronology, as well as a being a critical factor in the survival of general palaeoecological archives.

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