# Early Holocene Investigations at Saksunardalur and the Origins of the Faroese Biota

## Eldri holosenar rannsóknir úr Saksunardali og upprunin til tað føroyska biota

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## Úrtak

Royndir av skordýrum og flogsáð vórðu tiknar av nøkrum støðum fram við Saksunardali í Streymoy. Skordýraroyndirnar vóru fjaldar av tefru frá einum miðholosenum eldgosi úr íslendska gosfjallinum Heklu, og nakrar royndir høvdu eitt undirlag av saksunarvatnsøsku. Flogsáðrøðin varð tikin tvørtur ígjøgnum saksunarvatnsøskuna, einar 4 km í ein landsynning úr vatninum. Tey biota, ið vórðu funnin, kunnu nýtast til framhaldandi kanningar av upprunaligum plantu- og djóralívi, og hvussu føroyska landslagið var í eldri tíð.

## Abstract

Insect and pollen samples were recovered from a series of locations along Saksunardalur on Streymoy, Faroe Islands. The insect samples were sealed by tephra from a mid-Holocene eruption of the Icelandic volcano Hekla, and one series was underlain by the Saksunarvatn Ash. The pollen sequence was taken across the Saksunarvatn Ash, some 4 km south east of the lake. The identified biota provide a basis for discussion of the origins of the flora and fauna, and the nature of the early Faroese landscape.

## Introduction

Lying some 320 km north west of the nearest point on the Scottish mainland, the Faroe Islands possess an essentially cool temperate palaearctic biota, showing close relationships with northern Britain and western Norway (Enckell, 1985). The origins of the flora and fauna of the Atlantic islands have been much discussed (e.g. Löve and Löve, 1963; Lindroth *et al.*, 1988). Botanists (e.g. Dahl, 1987), in particular, have tended towards the *refugia hypothesis*, in which during the maximum of glaciation, ice-free areas, either nunataks or on the coastal plain below present sea level provided refuges for elements of the biota to survive at least since the late Tertiary through repeated glacial interglacial cycles. This model was largely refuted by Buckland and Dugmore (1991), who pointed out that the prevailing climate at glacial maxima would have been similar to the ice-free dry areas of Antarctica, where there is no life beyond lichens, algae and microfungi in the surface of the rock. The hypothesis of long term survival *in situ*, however still has some adherents, despite the lack of endemic speces.

In the long term, however, any theoretical model can be supported or negated by recourse to the fossil record. The history of the flora has been considered by Jóhansen (1985), and Enckell (1985) has examined several elements in the invertebrate fauna. The fossil record of the Coleoptera was included by Buckland (1988) in his overview of the origins of North Atlantic island biota, although the detail of the various sites was not included in that essentially synthetic study. Coope (1986) had favoured a model in which the primary immigration of much of the plant and animal assemblage took place during a short ice rafting event from Scotland during the initial warming of the Lateglacial, *ca* 12 500 radiocarbon years ago, whilst Buckland and his co-workers (1988; Buckland *et al.,* 1986a) use a similar ice rafting model, although preferring a west Norwegian origin and placing it during the phase of rapid warming which opened the present interglacial some 10 000 radiocarbon years ago. Enckell (1985) agrees with Buckland, but indicates the Scottish affinities of much of the invertebrate fauna. Recent work on Lateglacial sediments in northern Iceland (Björk *et al.,* 1997; Rundgren, 1997) could be taken to indicate both Lateglacial and earliest Holocene phases of immigration, although the final cold stage of the Younger Dryas

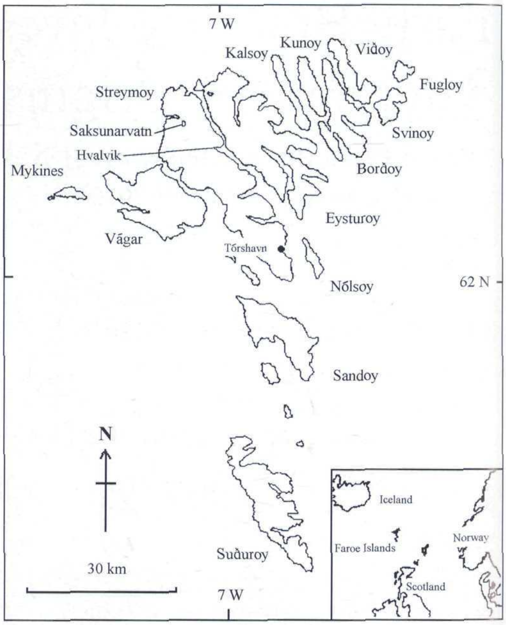


*Fig. 1. Location map of the Faroes, showing Saksunardalur.*
**Mynd 1.** Støðukort av Føroyum, sum vísir Saksunardal.

would have extinguished all but the most hardy cold stenotherms.

In the Faroes, the extent of the Late Weichselian and Younger Dryas ice sheet has only recently become the subject of detailed geomorphological research (e.g. Humlum *et al.,* 1996), and there are still no published palynological or other fossil records through the Lateglacial into the Holocene. The absence of human settlement until sometime late in the first millennium AD (Jóhansen, 1985; Arge, 1989), however, means that the fossil record for most of the Holocene lacks anthropogenic elements, and a baseline can be established from which to view the development of the biota.

*Saksunardalur*

The Saksunarvatn ash was first reported from the palaeolake site of Hoydalar, Streymoy by Waagstein and Jóhansen in 1968. In 1972, Jóhansen was able to obtain a long core from the lake Saksunarvatn, towards the north west end of the through valley from Hvalvik to Saksun in northern Stremoy (Fig. 1). At a depth centred around 30 m, the same tephra horizon, in this case some 0.45 m in thickness and not the (0.01 m as at Hoydalur, was noted (Jóhansen, 1978; Mangerud *et al.,* 1986). The ash is now known to be widespread in the North Atlantic region and has been dated to *ca* 8930-9060 BP (Birks *et al.,* 1996). Although the ash thickness of 0.45 m clearly indicates some redeposition into the basin, it appeared probable that the layer could be traced into adjacent peat deposits and used as an isochrone, in order to obtain a more extensive macrofossil record. In 1980, two thin white tephra horizons had been noted in abandoned peat cuttings south east of the lake, close to where Persson (1971) had identified similar ash layers, which he had been able to ascribe a source in mid-Holocene eruptions of the volcano Hekla in Iceland. Resampling by Dugmore (in prep.) has confirmed the presence of Hekla tephra layers $H_{sv}$ and $H_4$ in the Faroes, although it is unfortunate that the Saksunardalur sampling locality visited in 1980 had been levelled for cultivation by a second visit in 1982.

Exposures in the peat cuttings in 1980 were badly eroded, and the two samples taken (P1 & P2) came from a section in the stream bank to the northeast (Fig. 2), where the exposure could be easily cut back and cleaned. The excellent preservation of the insects in this material, led to a return visit to the valley in 1982, in company with Jóhansen, to obtain samples from beneath the lower Hekla ash down to the underlying bedrock, close to the location where Persson had obtained his tephra samples. Unlike the disturbed stratigraphy of the 1980 locality, this site, although cut over for peat, had 0.5 m of peat down to the underlying bedrock, and a tephra horizon at the base was tentatively identified in the field as the

*Fig. 2. Section for insect remains in Saksunardalur (1985).*

**Mynd 2.** Partar av Saksunardali, har skordýraleivdir eru (1985).

| Taxon | P2 | P1 | S1 | S2 | S3 | S4 | S5 |
|---|---|---|---|---|---|---|---|
| Carabidae | | | | | | | |
| *Nebria rufescens* (Strom.) | | | | | | 1 | |
| *Trechus obtusus* Er. | 1 | | 1 | | 6 | 3 | 2 |
| *Patrobus septentrionis* (Dej.) | 3 | | 1 | | | 1 | |
| *Patrobus* sp. | | | | | | | 2 |
| *Trichocellus placidus* (Gyll.) | | | | | 1 | | |
| Dytiscidae | | | | | | | |
| *Hydroporus pubescens* (Gyll.) | | 1 | 12 | 3 | 3 | | |
| *H. nigrita* (F.) | | 2 | | | 1 | | |
| *Hydroporus* spp. | 1 | 3 | 33 | 5 | 13 | 2 | 3 |
| *Agabus bipustulatus* (L.) | 1 | 1 | 1 | 1 | 1 | 1 | |
| Hydrophilidae | | | | | | | |
| *Helophorus flavipes* (F.) | | | | | 1 | | |
| *Coelostoma orbiculare* (F.) | | 3 | | | | | |
| *Anacaena globulus* (Payk.) | 1 | 2 | | | | | |
| *Olophrum fuscum* (Grav.) | 2 | 8 | | | | | |
| *Lesteva heeri* Fauv. | 3 | 10 | 1 | 2 | 8 | 5 | |
| *L. longoelytrata* Goez. | 3 | | | | 1 | 5 | 2 |
| *Stenus* spp. | 2 | 7 | 4 | 2 | 2 | | |
| *Lathrobium brunnipes* (F.) | 1 | 1 | 1 | | 2 | 1 | 1 |
| *Othius punctulatus* (Goez.) | 1 | 1 | | | | | |
| *O. angustus* Steph. | 2 | 1 | | | | | 1 |
| *Quedius curtipennis* Bernh. | | | 1 | | 1 | | |
| *Q. umbrinus* Er. | 1 | 2 | | | | | |
| *Q. boops* (Grav.) group | 1 | | | | | | |
| Aleocharinae_gen. indet. | 2 | | 1 | | 3 | | |
| Elateridae | | | | | | | |
| *Hypnoidus riparius* (F.) | 1 | | | | | | |
| Scirtidae | | | | | | | |
| *Elodes minuta* (L.) | 2 | 3 | | | | | |
| Curculionidae | | | | | | | |
| *Otiorhynchus nodosus* (Müll.) | | | | | | 1 | 1 |
| *Micrelus ericae* (Gyll.) | 1 | | | | | | |

***Table 1.** Insect remains from Saksunardalur*
**Talva 1.** Skordýraleivdir úr Saksunardali.

Saksunarvatn ash. A column of seven samples in 100 mm slices was taken down to the bedrock, although the two basal ones, an organic silt rather than a peat, lacked any preserved insect material. A recent visit (1998) showed this site to have also been destroyed, and a column for pollen analysis had to be taken further to the southeast (from an excavated section of blanket peat containing the ash layer, at an altitude of about 85 m above sea level and 4.0 km southeast of Saksunarvatn).

### *The insect faunas*

All samples, each of approximately 5 kg, were washed out over a 300 µm sieve and the resultant residues flosted with paraffin (kerosene). Table 1 lists the taxa recovered; taxonomy follows Lucht (1987). In addition to the Coleoptera, numerous fragments of caddis fly (Trichoptera) were also picked out of the floats.

Although there is variation between samples, the overall picture from both locations is of a bog with open water pools, which

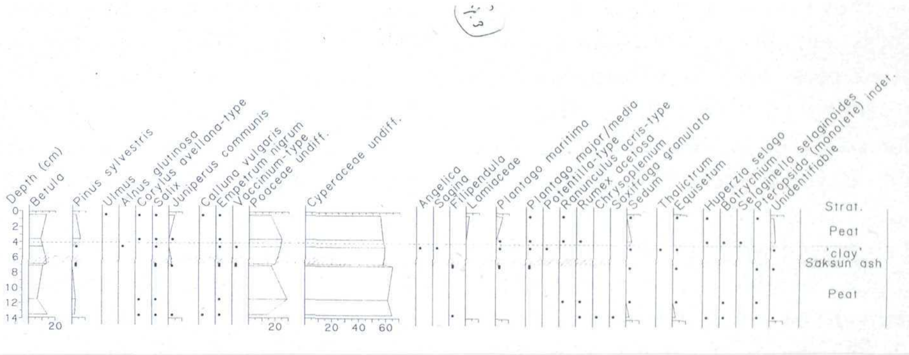


*Fig. 3. Pollen and spore diagram from Saksunardalur. All taxa expressed as percentages of total land pollen excluding alien arboreal taxa. • = < 2%.*

**Mynd 3.** Strikumynd av flogsáð og grókorni úr Saksunardali. Øll taxa eru lýst sum prosentpartur av øllum landflogsáð, undantikin fremmand taxa, sum liva á trøum. • = < 2 %.

provide habitat for the water beetles. The dytiscids *Agabus bipustulatus, Hydroporus nigrita* and *H. pubescens* are fairly eurytopic in their requirements, occurring in both oligotrophic and mesotrophic waters (Nilsson and Holmen, 1995), whilst the hydrophilid *Anacaena globulus* also extends to streams, wet meadow and grassland (Hansen, 1987). *Coelostoma orbiculare*, found in shallow water and moss at the water's edge (Koch, 1989), is not currently recorded from the Faroes, despite extensive recent pit fall trapping of the beetle fauna (Bengtson, 1981; Dinnin *et al.* unpubl.), although it is widespread in Central and Northern Europe. Whether it has succumbed to the large scale modification of virtually all of Faroes' wetlands by human activity, or has been overlooked, has yet to be ascertained.

Several of the other species recovered from the Saksunardalur samples are now rare in the islands. The staphylinid *Lathrobium brunnipes* is present in most samples, yet modern specimens are restricted to a single locality on Vagar. It shows a similar pattern of being a frequent fossil and rare at the present day in southern Iceland (Buckland *et al.*, 1991).

The fossil assemblage is typical of most remote islands in the paucity of monophagous or oligophagous phytophages. Of the two weevils, *Otiorhynchus nodosus* is polyphagous in most semi-natural habitats in Faroe, the larvae feeding on plant roots, whilst *Micrelus ericae* is usually found on *Calluna vulgaris*, although occasionally it may be found on the flowers of *Erica* spp. The elaterid *Hypnoidus riparius* and the scirtid *Elodes minuta* are also characteristic of wet grassland and meadow.

### *The pollen data*

The visible black ash layer at the pollen site was 1.0 cm thick and was underlain by black humified peat. Above the ash layer was a brownish clayey layer 1.7 cm in thickness and this was overlain by black humified peat. High resolution sampling with contiguous 2 mm thick layers was conducted across the Saksunarvatn ash deposits. Beyond the close-sampled sequences, sample thicknesses of 10 mm were employed with sampling intervals up to 40 mm. Samples were pre-treated with standard KOH, HCl, HF and acetolysis methods (Faegri and Iversen, 1989). More detailed discussion is given in Edwards and Craigie (ms). Computation and diagram construction were aided by the computer programs TILIA and TILIA.GRAPH (Grimm, 1991).

The pollen profile covers the monolith thickness of 14 cm. Statistically acceptable counts of pollen were not recovered from the top of the ash layer, although estimates of pollen concentration from five levels within and around the visible ash layer (not shown here) show a marked reduction. Pollen and spores in the diagram (Fig. 3) are expressed as percentages of a total land pollen (TLP) sum which excludes the pollen of taxa considered to represent off-island species (i.e. *Pinus sylvestris, Ulmus, Quercus, Fraxinus excelsior, Alnus* and possibly *Corylus avellana*-type).

The pollen diagram is dominated by Cyperaceae and Poaceae, which are, along with *Calluna vulgaris* (present at <2 % here), typical of blanket peat floras. *Betula* pollen is well represented and size measurements from similar contexts elsewhere (Edwards and Craigie, 1998) suggest that this derives from tree birch (cf. *B. pubescens*) rather than the dwarf birch, *B. nana.* It is not possible to say how much of the birch pollen could originate from off-island sources.

*Empetrum nigrum, Vaccinium*-type and *Potentilla*-type are frequent in mires and heaths, while the other pollen and spore taxa present are of types referrable to known plants and habitats in the Faroes (Hansen, 1966) or are already known from the fossil pollen record (Jóhansen, 1985) (e.g. *Filipendua, Sedum,* Lamiaceae, *Plantago maritima, P. major/media* (cf. *P. major*), *Saxifraga granulata*-type [cf. *S. rosacea* and *S. rivularis*], *Thalictrum, Equisetum, Huperzia selago, Selaginella selaginoides*). *Chrysosplenium* is unknown in the Faroes.

**Discussion**

The pre-landnám fauna of the Faroes shows many similarities with that of Iceland (Buckland, 1988), although it is somewhat more diverse. It is apparent that by the early Holocene, the fauna already contained many of those elements which became characteristic of infield as well as outfield areas after settlement. *Othius punctulatus*, now almost entirely restricted to infield sites and cliffs and shelves (Bengtson, 1981), and a likely candidate for anthropochorous dispersal, appears in the two preliminary samples (P1 & P2) and is also known from the poorly dated, although natural succession on Mykines (Buckland *et al.,* 1998). An association with the eutrophic areas of bird cliffs is probable, and it may have been dipersed casually with migrating birds. Whilst some species may have been dispersed in this way, the majority of the fauna is capable of flight, although the lists do include the large flightless weevil *Otiorhynchus nodosus*, which, although pathenogenic (Lindroth *et al.*, 1973), is unlikely to have been casually dispersed during the early Holocene. It is also present, with other flightless beetles, in Iceland (Buckland *et al.,* 1986b) before landnám. Rather than survival in refugia or casual individual dispersal, a single dispersal event in the early Holocene which introduced the bulk of the pre-landnám biota still appears the better solution to the origins of North Atlantic island biota.

The above sentiments are likely to apply to the flora also. The Saksunardalur palaeoflora is not dissimilar to that reported from elsewhere in the Faroes (Jóhansen, 1985), nor from either Iceland (Hallsdóttir, 1987; Rundgren, 1997) or Shetland (Bennett *et al.,* 1992). The fossil taxa include those types which became typical of grazed areas after landnám (e.g. Lamiaceae, *Angelica, Potentilla, Rumex acetosa* and *Ranunculus acris*). There are unlikely to be any elements here that could not have arrived via ice-rafting or avian transport of propagules.

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