# Insect Faunas at Landnám: a Palaeoentomological Study at Tjørnuvík, Streymoy, Faroe Islands

## Skordýrafauna í landnámstíð: ein fornskordýrafrøðilig rannsókn í Tjørnuvík í Streymoy

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### Úrtak

Útgrevstur fram við har, sum Jóhannes Jóhansen kannaði flogsáð í Tjørnuvík, gav ein parallella røð av royndum til greining av steinrunnum skordýrum. Hesar vístu, at sløgini vóru vorðin nógv fjølbroyttari stutt eftir, at flogsáðfrøðilig prógv eru um landnám. Í faununi eru fleiri sløg, sum mugu vera komin við teimum fyrstu niðursetufólkunum.

### Abstract

Excavation alongside the site of pollen research by Jóhannes Jóhansen at Tjørnuvík on Streymoy provided a parallel series of samples for fossil insect analysis. These showed a significant increase in species diversity shortly after the palynological evidence for landnám. The fauna includes several species which must have been introduced with the first settlers.

### Introduction

The village of Tjørnuvík lies at the north end of Streymoy, at the end of a short fjord facing north-eastwards towards the open Atlantic (Fig. 1). The settlement is surrounded by steep slopes, with the Tertiary basalt lavas being much in evidence beneath a sparse vegetation cover, and to the south these rise in a series of steps to the peak of Hægstafjall at 469m a.s.l. (Fig. 2). Only a limited amount of hayfield is available, on the flat land at the head of the fjord, and this is supplemented by small banked fields rising to 120m a.s.l. Beyond the limits of the hayfields, the area is heavily grazed by sheep. The modern farms cluster along the north-west side of the fjord, at the end of a cobble storm beach. At the south-east end of this beach, during road building in 1955, a group of Viking graves had been uncovered (Dahl and Rasmussen 1956), and in 1968 and subsequent years the late Jóhannes Jóhansen used the peat deposits beneath the adjacent hayfield as a source for pollen and macrofossil studies of the

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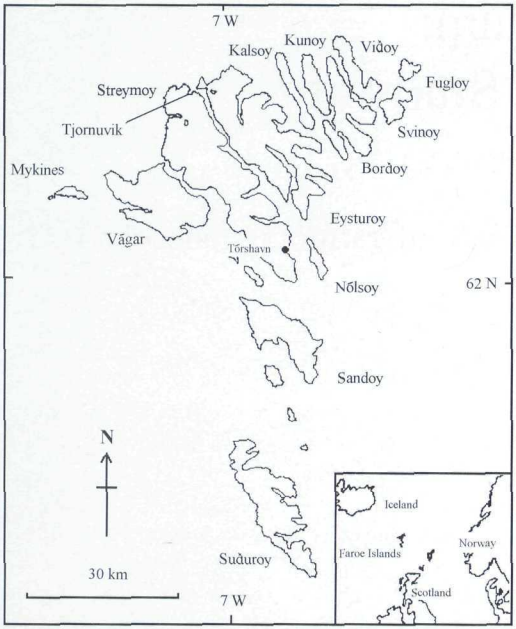


*Fig. 1. Location map.*
**Mynd 1.** Støðukort.

impact of landnám (Jóhansen 1971; 1985). His findings, with the earliest settlement dated to *ca.* AD 650, have proved controversial, particularly with archaeologists, who have pointed to the absence of any artefactual record for occupation of the Faroes before the ninth century (e.g. Arge 1989; Debes 1993; Krogh 1986). One historical reference, however, that of the Irish monk Dicuil, writing *ca.* 825 in France, may refer to Faroe, islands two days sailing out from the coast of Scotland where culdees, Irish monks, had settled, only to be driven away by the Norsemen (Tierney 1967). The archaeological problems remain unresolved, and Buckland (1992) has doubted whether either the Tjørnuvík site or that on Mykines (see also Buckland *et al.* 1998) were suitable for dating.

In 1985, Jóhansen and Buckland returned to the Tjørnuvík site to obtain a series of samples for fossil insect analysis. The original sampling site was relocated, and a section excavated one metre to the south in the same hayfield (Fig. 2). The profile exposed was essentially the same as the earlier ones, with at least 2.5m of slightly sandy peat, although the rock base encountered by Jóhansen (1971) in his cores was not reached, despite the similar depth. The dangerous nature of the 1.5m by 1.0m trench precluded deeper excavation. The coarse gravel and angular rock debris horizon, which Jóhansen had found at a depth of 1.55m in his 1968 core sample, was reached at depth of only 0.9m. In the seventeen years between the two excavations it is probable that drainage had led to the desiccation of the upper peat, and it is unfortunate that all measurements had been made from the modern hayfield surface, rather than a fixed outcrop. Jóhansen, however, was certain that this critical horizon was the same one, and a series of 3 kg samples was taken in 75 mm slices from immediately above the gravel to the base of the section (Tj1/1-19). The gravel lay immediately above the palynological evidence for landnám, although this was less evident in the open section used to obtain radiocarbon samples (Jóhansen, 1971). Preservation of both plant and insect remains in the lower part of the profile was poor and research was concentrated on the samples around Jóhansen's landnám horizon (Tj1/1-4). In

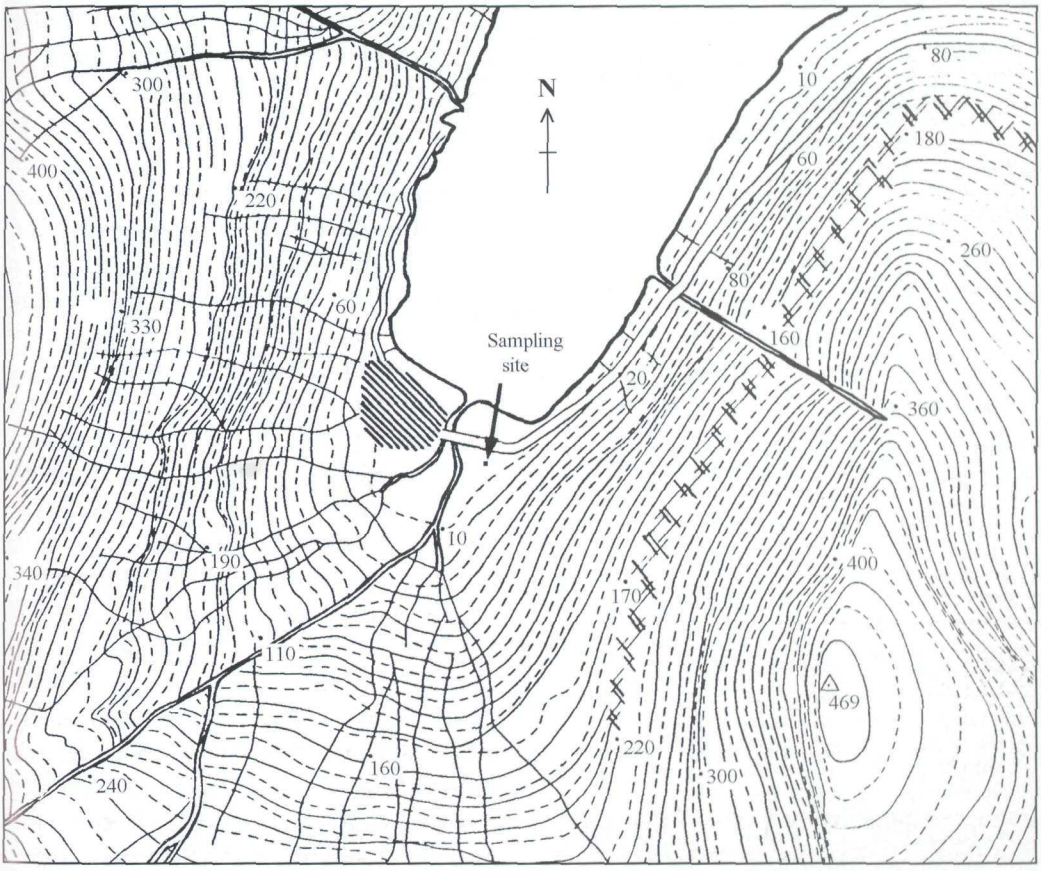


*Fig. 2. Tjørnuvík, showing the location of the sampling site (modifed from Jóhansen (1985)).*
**Mynd 2.** Tjørnuvík. Staðið, har royndirnar eru tiknar (nakað broytt eftir Jóhansen (1985)).

addition, Dinnin, in July-August 1986, carried out a detailed pit fall and search collection of the modern beetle fauna for comparison with the fossil record.

### *The Fossil Insect Faunas*

The sediment samples, sealed in polythene bags, were returned to the University of Birmingham in England for recovery of their fossil insect content. Samples were disaggregated over a 300 μm sieve and the insects concentrated by paraffin (kerosene) flotation (Coope and Osborne 1968). The floats were sorted under a low power microscope and the fragments identified by comparison with modern reference material. Table 1 lists the minimum number of individuals of each taxon in the samples; taxonomy follows Lucht (1987).

The impact of human settlement upon the insect faunas of remote islands previously unoccupied is well known from work

| Taxon | S19 | S3 | S2 | S1 |
|---|---|---|---|---|
| Carabidae | | | | |
| *Notiophilus biguttatus* (F.) | | | | 2 |
| *Loricera pilicornis* (F.) | | | | 1 |
| *Trechus obtusus* Er. | | | | 3 |
| *Bembidion bruxellense* Wesm. | | | | 2 |
| *Patrobus septentrionis* (Dej.) | | | | 1 |
| *Patrobus* sp. | | | | 1 |
| *Trichocellus placidus* (Gyll.) | | | | 1 |
| Dytiscidae | | | | |
| *Hydroporus gyllenhali* Schdte. | | | | 2 |
| *H. pubescens* (Gyll.) | 1 | | | 2 |
| *H. nigrita* (F.) | | 1 | | |
| Hydrophilidae | | | | |
| *Helophorus flavipes* (F.) | | 1 | | 4 |
| *Helophorus* sp. | | | 1 | |
| *Cercyon* sp. | 2 | | | |
| *Megasternum boletophagum* (Marsh.) | | | 1 | 7 |
| *Anacaena globulus* (Payk.) | | | | 5 |
| Staphylinidae | | | | |
| *Omalium rivulare* (Payk.) | | | | 5 |
| *Xylodromus concinnus* (Marsh.) | | | | 1 |
| *Olophrum fuscum* (Grav.) | | | 1 | 1 |
| *Lesteva heeri* Fauv. | | 2 | | 6 |
| *L. longoelytrata* Goez. | | 2 | | 1 |
| *Lesteva* sp. | 1 | 1 | 1 | 5 |
| *Ochthephilus omalinus* (Er.) | | | | 15 |
| *Stenus nitidiusculus* Steph. | | | | 5 |
| *Stenus* sp. | | | 1 | 5 |
| *Othius angustus* Steph. | | | 1 | 1 |
| *Othius* sp. | | | | 1 |
| *Philonthus* sp. | | | | 1 |
| *Quedius umbrinus* Er. | | | | 5 |
| *Quedius* sp. | | | | 2 |
| Aleocharinae gen. indet. | | 3 | 1 | 16 |
| Elateridae | | | | |
| *Hypnoidus riparius* (F.) | | | | 1 |
| Byrrhidae | | | | |
| *Simplocaria semistriata* (F.) | | | 1 | 1 |
| Scarabaeidae | | | | |
| *Aphodius lapponum* Gyll. | | | | 1 |
| Curculionidae | | | | |
| *Apion haematodes* Kirby | | | | 1 |
| *Notaris aethiops* (F.) | | | | 1 |
| *Ceutorhynchus contractus* (Marsh.) | | | | 1 |

***Table 1.*** *Insect remains from samples across landnám at Tjørnuvík, Stremoy, Faroe Islands*
**Talva 1.** Skordýraleivdir frá royndum í landnámstíð í Tjørnuvík.

in Iceland (Buckland *et al.* 1986; 1991a; Sadler and Skidmore 1995), where increased eutrophic habitat diversity around farms and hayfields allowed successful colonisation by many accidental invertebrate immigrants and the expansion of several apparently native species, once virtually restricted to bird cliffs, into man-made habitats. The Tjørnuvík site provides Faroe with a particularly striking example of a similar event, adding the fossil dimension to Enckell's (Enckell, 1985; Enckell *et al.* 1987) work with the modern earthworm fauna. Beneath the gravel horizon, insect preservation was poor, and sample Tj1/3 contained only ten individuals of six taxa. The long pre-landnám sample Tj1/19 was worse, with four individuals of three species. The small water beetle, *Hydroporus nigrita* occurs in peaty pools and cold streams (Nilsson and Holmén 1995), where *Helophorus flavipes* may also be found (Friday 1988). The staphylinids of the genus *Lesteva* are found in wet moss and on grassy heaths (Bengtson 1981). Sample Tj1/19 contains some suggestion of more eutrophic conditions, perhaps adjacent bird cliffs, in the two individuals of the hydrophilid genus *Cercyon*. The sites in Saksunardalur, 5 km to the south (Buckland *et al.* 1998a) provide a much more extensive pre-landnám faunal list, although Tjørnuvík does confirm the presence of a species of *Cercyon*, suspected on the Mykines evidence (Buckland *et al.* 1998.b).

The sample of the gravel horizon interpreted by Jóhansen (1971) as a result of flooding by the small stream in the valley contained a large fraction of coarse angular

*Fig. 3. Tjørnuvík from the south, looking down the fjord. The sample site lies at the base of the steep slope to the right of the picture. (1985).*
**Mynd 3.** Tjørnuvík sæð sunnanífrá, við útsýni niður yvir víkina. Staðið, har royndirnar eru tiknar, er niðast í teirri brøttu líðini høgrumegin á myndini. (1985).

basalt fragments to 70mm in length, and clearly largely derived from the steep slopes adjacent to the sampling locality. The faunal remains were poorly preserved, and, although individuals of nine taxa were identified, it is possible that this horizon reflects a significant break in peat growth on the site. Despite the changes in the pollen spectra immediately below this horizon (*op. cit.*), none of the beetles is directly associated with human activities. The small hydrophilid *Megasternum boletophagum* is frequent in synanthropic situations, in dung and decaying vegetable matter (Skidmore 1991), although this is insufficient to suggest an anthropochorous origin since it may appear before settlement in the Mykines samples (Buckland *et al.* 1998b).

There can be no doubt that sample Tj1/1, from above the gravel layer, reflects a significant amount of human activity on the site, although its date can only be obtained, by correlation with the 1970 open profile, as older than AD 1070 ± 100 and younger than AD 600 ± 100. The key species is the scarabaeid, *Aphodius lapponum*, which is restricted to the dung of larger herbivores (Landin 1961), and could not therefore

| Taxon | i | ii | iii | iv | v | vi |
|---|---|---|---|---|---|---|
| Carabidae | | | | | | |
| *Nebria rufescens* (Strom.) | 37 | 8 | 7 | 15 | | 3 |
| *N. salina* Fair. & Lab. | 54 | 15 | 18 | | | 2 |
| *Notiophilus biguttatus* (F.) | 1 | 1 | 2 | 30 | 1 | |
| *Loricera pilicornis* (F.) | 5 | 4 | 13 | | | |
| *Trechus obtusus* Er. | 14 | 15 | 10 | 47 | 3 | |
| *Patrobus septentrionis* (Dej.) | 7 | 17 | 6 | 24 | 29 | 1 |
| *Pterostichus strenuus* (Panz.) | | | | 1 | | |
| *P. diligens* (Strm.) | | | | 1 | | |
| *P nigrita* (Payk.)/*rhaeticus* Heer | | 3 | | | | |
| *Calathus fuscipes* (Goez.) | 4 | 3 | 6 | 1 | 1 | |
| *C. melanocephalus* (L.) | 1 | 4 | 3 | 1 | | |
| *Amara aulica* (Panz.) | 5 | 3 | 2 | | | |
| Dytiscidae | | | | | | |
| *Hydroporus pubescens* (Gyll.) | | | | | 28 | |
| *Agabus bipustulatus* (L.) | | | | | 12 | |
| Hydrophilidae | | | | | | |
| *Helophorus aquaticus* L. | | 2 | | | | |
| *H. brevipalpis* Bed. | 1 | 1 | | | | |
| *Cercyon littoralis* (Gyll.) | | | | | 5 | |
| *C. haemorrhoidalis* (F.) | 1 | | | | | |
| *Megasternum boletophagum* Marsh. | 11 | 49 | 5 | | 4 | |
| *Anacaena globulus* (Payk.) | | | | | 8 | |
| Staphylinidae | | | | | | |
| *Omalium riparium* Thom. | | | | | | 1 |
| *O. rivulare* (Payk.) | 2 | | | | | |
| *O. caesum* Grav. | 2 | | | | | |
| *Olophrum fuscum* (Grav.) | | | | | 3 | |
| *Eucnecosum brachypterum* (Grav.) | | | 1 | | 5 | |
| *Lesteva longoelytrata* Goez. | | | | 17 | | |
| *Stenus brunnipes* Steph. | | 1 | | 2 | | |
| *S. impressus* Germ. | | 1 | | 1 | | |
| *Othius angustus* Steph. | 1 | 3 | | 7 | 2 | |
| *O. myrmecophilus* Kies. | | | | | 1 | |
| *Philonthus succicola* Thom. | 4 | | 2 | | 1 | |
| *P. fimetarius* (Grav.) | 1 | | | | | |
| *Quedius mesomelinus* (Marsh.) | 1 | | | 4 | | |
| *Q. curtipennis* Bernh. | 1 | 1 | 2 | 11 | | |
| *Q. umbrinus* Er. | | | | | 2 | |
| *Q. boops* (Grav.) group | 1 | 1 | | 8 | | |
| *Tachinus pallipes* Grav. | 1 | 1 | | | | |
| *T. signatus* Grav. | 6 | 9 | 3 | 2 | | |
| *Ocalea picata* (Steph.) | | 1 | | | | |
| Aleocharinae gen. indet. | 9 | 2 | 2 | 14 | 1 | 3 |
| Elateridae | | | | | | |
| *Hypnoidus riparius* (F.) | 1 | | 9 | 3 | 1 | |
| Byrrhidae | | | | | | |
| *Byrrhus fasciatus* (Forst.) | | | | 1 | | |
| Chrysomelidae | | | | | | |
| *Chrysolina staphylaea* (L.) | | 4 | 3 | 6 | | |
| Curculionidae | | | | | | |
| *Otiorhynchus arcticus* (F.) | 1 | | 6 | 14 | | |
| *O. nodosus* (Müll.) | | | | 4 | | |
| *Barynotus squamosus* Germ. | | | | 2 | | |

***Table 2:*** *Beetles collected by pitfall trapping at Tjørnuvík, Streymoy, Faroe Islands, August, 1986*
**Talva 2.** Klukkur, sum eru fangaðar við fellum í Tjørnuvík í Streymoy, august 1986.

*Key*
*i) close to the settlement in* ***Rumex****-rich ungrazed meadow.*
*ii) lush mown grass meadow with* ***R. acetosa***, ***Rhinanthus minor*** *(agg.), and* ***Ranunculus acris.***
*iii) upper infield similar to ii, but less luxuriant.*
*iv) lower outfield of lightly grazed grass heath.*
*v) upland peat bog.*
*vi) along the strandline at the head of the fjord, with* ***Honkenya peploides*** *and* ***Rumex crispus.***

have been present in the Faroes before the arrival of settled farming communities. Although Buckland (1988) was inclined to accept this as evidence for a seventh century pre-Norse landnám, he later (1992) doubted the stratigraphic grounds and, on biogeographic grounds, suggested that a northern rather, than Irish origin, for the settlers seemed probable. Of the remaining 31 taxa in the list, only the small staphylinid *Xylodromus concinnus* is likely to have been synanthropous, as opposed to anthropochorous. Although from southern Sweden and Denmark southwards the species is recorded in the wild, on the Atlantic islands it is exclusively synanthropous, occurring, probably an a predator on the immature stages of Diptera, in old hay in barns and byres (Larsson and Gígja 1959), occasionally flying out into the infields, where Bengtson (1981) took one on Nólsoy. Both species are present with a range of other clearly synanthropous beetles in deposits associated with the landnám period farm at Toftanes on Eysturoy (Edwards *et al.* 1998). Several other taxa in the Tjørnuvík list are also probably anthropochorous, accidentally shipped out in the ballast and dunnage of the landnámsmen's ships (Sadler 1991). The Faroese species of *Philonthus* are all essentially synanthropous and liable to accidental transport. Two ground beetles may also belong to this group. *Loricera pilicornis* is holarctic in its distribution, although absent from Iceland. Essentially a species of damp deciduous woodland (Koch 1989), it is also frequent in man-made habitats (den Boer 1977), such as gardens, and could easily have been casually collected up with hay. Introduced to North America and to Iceland, where it appears restricted to hot-houses (Larsson and Gígja 1959), the eurytopic ground beetle, *Bembidion bruxellense* appears to have formed part of the landnám assemblage at Tjørnuvík. Of the remainder of the fauna, most are likely to have formed part of an initial early Holocene immigration, and there is a significant overlap with the list from Saksunardalur (Buckland *et al.* 1998a). Bengtson (1981) thought that Henriksen's identification of the byrrhid *Simplocaria metallica* Sturm from a pre-landnám site in Tórshavn (in Jessen and Rasmussen 1922) was more likely to have been *S semistriata*, present both at Tjørnuvík and Toftanes, and if this is the case, it may be added to the pre-settlement list.

Although only present in sample Tj1/1, the 15 individuals of the small staphylinid *Ochthephilus omalinus* (det. P. J. Osborne) are likely to represent a native species, which is either extinct on the islands, or overlooked. The beetle is recorded from moss lawns, flood debris and waterfalls (Koch 1989), all widespread habitats in the Faroes, although perhaps not adequately collected. It should be noted that two other species, *O. andalusiacus* (Fag.) and *O. venustulus* (Rosen.) have recently been added to the British list (Hodge and Jones 1995), and separation on the fossil specimens is unlikely without aedeagi.

The overall picture of the landscape of Tjørnuvík shortly after landnám is of damp pasture or meadow with occasional pools, represented by the water beetles, *Hydroporus* spp. Wet moss and damp decay-

ing vegetation is also present, whilst the flora provides hosts for three species of weevil. *Apion haematodes* prefers sheep sorrel, *Rumex acetosella* (agg.) (Morris 1990), which is not represented in the pollen diagram, but is likely to have grown on overgrazed bare areas of the surrounded rock ledges. *Notaris aethiops* appears polyphagous on a range of wetland grasses, as well as *Iris pseudacorus* (Koch 1992), and *Ceutorhynchus contractus* occurs on a wide range of cruciferous plants.

***The modern beetle fauna***

Comparison between fossil and modern insect faunas has serious taphonomic problems (cf. Buckland *et al.* 1991b). Not only is the fossil sample usually time-averaged to an unknown extent, but it is also likely to be dominated by those taxa immediate to the sampled habitat and by mobile eurytopic species. The problems have been discussed by Kenward (1976), who has advocated a more statistical approach to the fossil data, whilst recognising that the basis of interpretation has to be remain a sound knowledge of the modern habitat requirements of individual species. His methods are difficult to apply on the Atlantic islands, where faunal diversity is muted and fossil assemblages usually small. Perry *et al.* (1983) and Sadler (*in* Buckland *et al.* 1992) have used clustering techniques to discern pattern in fossil assemblages from Iceland, but direct comparison with modern faunas, either pitfall trapped, with their own inherent problems (*cf.* Adis 1971), or a combination of this with searching and sieved data, remains difficult. Both West (1930) and Bengtson (1980; 1981) provide detailed information on much of the fauna. In August 1986, this work was supplemented by a pit falling and search project around Tjørnuvík to enable comparison with fossil assemblages.

Pit fall traps were set in six different habitats: i) close to the settlement in *Rumex*-rich ungrazed meadow, ii) lush mown grass meadow with *R. acetosa*, *Rhinanthus minor* (agg.), and *Ranunculus acris*, iii) upper infield similar to ii, but less luxuriant, iv) lower outfield of lightly grazed grass heath, v) upland peat bog, and vi) along the strandline at the head of the fjord, with *Honkenya peploides* and *Rumex crispus*. The last habitat, with the strandline species *Cercyon littoralis* and *Omalium riparium* is not represented in the fossil record. The modern faunas (Table 2) are dominated by the carabids, *Nebria salina, N. rufescens*, *Patrobus septentrionis* and *Trechus obtusus*, all of which are fairly catholic in the Faroes. Neither species of *Nebria* is represented in the fossil assemblage. *N. salina* shows a preference for drier ground (e.g. Eyre and Luff 1990), and is likely to be a post-landnám introduction. The species of *Calathus* also prefer drier conditions, which may explain their absence from the fossil assemblage. The infield sample (iii) did, however, include a large number of the small hydrophilid *Megasternum boletophagum*, found in dung and damp hayfields (Bengtson 1981), which appears in the landnám sample. *Notiophilus biguttatus* occurs in large numbers in traps in the lower outfield areas, and the water beetles are restricted to pools in upland bog and adja-

cent areas of wet moss. Whilst *Aphodius lapponum* was collected from dung, it was not taken in the pitfall traps. The faunas from the modern cultivated localities differ from the fossil immediately post-landnám assemblage in the virtual absence of a wetland component. As Jóhansen (1971) noted on the pollen evidence, drainage and improvement of hayfields has removed the pools, which gave Tjørnuvík its name. The drier mown areas also support a different, more eutrophic carabid and staphylinid fauna.

## Conclusion

The fossil beetle assemblages from Tjørnuvík show the impact of Norse settlement in the sudden increase in diversity across the landnám boundary. It should be noted, however, that this change takes place above that defined by Jóhansen (1971) on palynological grounds. This is likely to reflect the taphonomic problem that, unlike at Toftanes (Edwards *et al.* 1998), the sampling locality is not immediately adjacent to the occupation site and poor preservation reduces the value of the samples below Tj1/1. The possibility of the incorporation of old carbon, site disturbance by movement downslope of soils disturbed at landnám, and the gap in deposition implied by the gravel horizon, limit the value of the site in determining the date of landnám. This problem will only be solved by the application of radiocarbon accelerator dates to single identified entities from well studied successions.

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## References

Adis, J. 1971. Problems of interpreting arthropod sampling with pitfall traps. *Zoologischer Anzeiger* 202: 177-184.

Arge, S. V. 1989. Om Landnamet på Færøerne. *hikuin* 15: 103-128.

Bengtson, S.-A. 1980. Species assemblages and coexistence of Faroe Island ground beetle (Coleoptera: Carabidae). *Entomologia Generalis* 6: 251-266.

Bengtson, S.-A. 1981. Terrestrial invertebrates of the Faroe Islands: III. Beetles (Coleoptera) : Checklist, distribution, and habitats. *Fauna Norvegica*, B28: 52-82.

Buckland, P. C. 1988. North Atlantic faunal connections – introduction or endemics? *Entomologica scandinavica Supplement* 32: 7-29.

Buckland, P. C. 1992. Insects and the pre-Norse settlement of Faeroe: a case not proven. *Fróðskaparrit* 38-39: 107-114.

Buckland, P.C., Dugmore, A. J., Perry, D. W., Savory, D. and Sveinbjarnardóttir, G. 1991a. Holt in Eyjafjallasveit, Iceland. A Paleoecological Study of the Impact of Landnám. *Acta Archaeologica* 61: 252-271.

Buckland, P.C., Dugmore, A.J. and Sadler, J. 1991b. Faunal change or taphonomic problem? A comparison of modern and fossil insect faunas from south east Iceland. In J.K.Maizels and C.Caseldine (eds.) *Environmental Change in Iceland: Past and Present*, Kluwer Academic Publishers, Dordrecht. pp. 127-146.

Buckland, P.C., Edwards, K. J., Sadler, J. P. and Dinnin, M.H. 1998a. Early Holocene investigations at Saksunardalur and the origins of the Faroese biota. *Fróðskaparrit* 46: 259-266.

Buckland, P.C., Edwards, K. J., Sadler, J. P. and Dinnin, M.H. 1998b. Late Holocene insect faunas from Mykines, Faroe Islands, with observations on asso-

ciated pollen and early settlement records. *Fróðskaparrit* 46: 287-296.

Buckland, P. C., Gerrard, A. J., Larsen, G., Perry, D. W., Savory, D. R. and Sveinbjarnardóttir, G. 1986. Late Holocene Palaeoecology at Ketilsstadir in Myrdalur, South Iceland. *Jökull* 36: 41-55.

Buckland, P.C., Sadler, J. P. and Sveinbjarnardóttir, G. (1992) Palaeoecological Investigations at Reykholt, Western Iceland. In, C. J. Morris and D. J. Rackman (eds.) *Norse and Later Settlement and Subsistence in the North Atlantic,* Dept. of Archaeology, University of Glasgow. pp.149-168.

Coope, G. R. and Osborne, P. J. 1968. Report on the Coleopterous Fauna of the Roman Well at Barnsley Park, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society* 86: 84-87.

Dahl, S. and Rasmussen, J. 1956. Víkingaaldargrøv í Tjørnuvík. *Fróðskaparrit* 5: 153-167.

Debes, H. J. 1993. Problems concerning the earliest settlement of the Faroes. In C. E. Batey, J. Jesch and C. D. Morris (eds.) *the Viking Age in Caithness, Orkney and the North Atlantic.* Edinburgh University Press, pp. 454-464.

den Boer, P. J. 1977. Dispersal Power and Survival. Carabids in a cultivated countryside. Landbouwhogeschool Wageningen The Netherlands Misc. Papers 14. H.Veenman and Sons, Wageningen 1977

Edwards. K.J., Craigie, R., Panagiotakopulu, E. and Stummann Hansen, S. 1998. Landscapes at Landnám: palynological and palaeoentomological evidence from Toftanes, Faroe Islands. *Fróðskaparrit* 46: 229-244.

Enckell, P. H. 1985. *Island Life: Agency of man upon dispersal, distribution, and genetic variation in Faroese populations of terrestrial invertebrates.* University of Lund.

Enckell, P. H., Bengtson, S.-A. and Wiman, B. 1987. Serf and waif colonization: distribution and dispersal of invertebrate species in the Faroe Island settlement areas. *Journal of Biogeography* 14: 89-104.

Eyre, M. D. and Luff, M. L. 1990. The Ground Beetle (Coleoptera: Carabidae) Assemblages of British Grasslands. *Entomologist's Gazette* 41: 197-208.

Friday, L. E. (1988) A Key to the Adults of British Water Beetles. Field Studies 7: 1-151.

Hodge, P.J. and Jones, R.A. 1995. *New British Beetles. Species not in Joy's practical handbook.* British Entomological and Natural History Society, Reading.

Jessen, K. and Rasmussen, R. 1922. Et profil gennem en Torvemose paa Faeroerne. *Danmarks geologiske undersøgelse, 4R.* 1: nr. 13.

Jóhansen, J. 1971. A palaeobotanical study indicating a previking settlement in Tjørnuvík, Faroe Islands. *Fróðskaparrit*, 19: 147-157.

Jóhansen, J. 1985. *Studies in the vegetational history of the Faroe and Shetland Islands.* Føroya Fróðskaparfelag, Tórshavn.

Kenward, H. K. 1976. Reconstructing ancient ecological conditions from insects remains : some problems and an experimental approach. *Ecological Entomology*, 1: 7-17.

Koch, K. 1989. Die Käfer Mitteleuropas. Ökologie, 1. Goecke and Evers, Krefeld.

Koch, K. 1992. Die Käfer Mitteleuropas. Ökologie, 3. Goecke and Evers, Krefeld.

Krogh, K. J. 1986. Um Føroya fyrstu Búsetung. *Mondul*, 12: 3-6.

Landin, B.-O. 1961. Ecological Studies on Dung-Beetles. *Opuscula Entomologica*, Suppl. 19.

Larsson, S. G. and Gígja, G. 1959. Coleoptera. Zoology of Iceland 43a. Munksgaard, Copenhagen.

Lucht, A. 1987. *Katalog. Die Käfer Mitteleuropas.* Goecke and Evers, Krefeld.

Morris, M. G. 1990. *Orthocerous Weevils. Coleoptera Curculionoidea (Nemonychidae, Anthribidae, Urodontidae, Attelabidae and Apionidae).* Handbooks for the Identification of British Insects, 5: 16. Royal Entomological Society of London.

Nilsson, A. N. and Holmén, M. 1995. The aquatic Adephaga (Coleoptera) of Fennoscandia and Denmark. II. Dytiscidae. *Fauna Entomologica Scandinavica*, 32. E.J.Brill, Leiden.

Perry, D.W., Buckland, P.C. and Snæsdóttir, M. 1983. The application of numerical techniques to insect assemblages from the site of Stóraborg, Iceland. *Journal of Archaeological Science* 12: 335-345.

Sadler, J. P. 1991. Beetles, Boats and Biogeography. *Acta Archaeologica* 61: 199-211.

Sadler, J. P. and Skidmore, P. 1995. Introductions, extinctions or continuity? Faunal change in the North Atlantic islands. In R.A. Butlin and N. Roberts (eds.) *Ecological Relations in Historical Times.* Blackwell, Oxford, pp.206-225.

Skidmore, P. 1991. *Insects of the British Cow-Dung Community.* Field Studies Council.

Tierney, J. J. 1967. Dicuilus, Liber de mensura orbis terrae. *Scriptores Latini Hiberniae* 6. Dublin.

West, A. 1930. Coleoptera. *Zoology of Faroes*, 2(1), 40. Andr. Fred. Høst and son, Copenhagen.