Analysis of Insect subfossils from Kirkjubæjarklaustur, Þykkvabæjarklaustur and Munkaþverá.

Lynda Howard

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Introduction

The analysis of insect remains from monastic settlement sites in Iceland essentially gives a window of opportunity to study the environmental impact of the early settlements on their environmental surroundings.

These can provide data on the activity within the buildings, and the materials used, such as wool processing or metal working. Each sample is unique and together with other detailed records from written texts or environmental proxies, can provide a wealth of information in understanding the living conditions and working environments within the monastic setting.

Samples from the sites were collected between 2002 and 2015 from three monastic settlement sites in Iceland. Samples were stored in bags and tubs until analysis for insect remains was possible. The samples were mostly less than 1kg in weight and many were dry at the time of analysis.

Where there were multiple samples from one site and it was clear that the samples were from the same context, the results have been combined.

34 samples were analysed in total from the three sites, combined to 27 in the results. My thanks go to Kristrún Kristinsdóttir for processing 16 of the samples in Iceland for further analysis in the UK.

Processing

Samples were weighed and volumes measured (Table 1). After soaking in water to aid disaggregation, the samples were wet sieved at 250μm to remove small silt and clay fractions and paraffin floated (Coope 1986). Where there was a large amount of woody material present, a larger 4mm sieve was inserted to remove most of the bulk material that would have floated with the insect sclerites. Each sample was floated at least three times to ensure all insect remains had been extracted. The resultant float was stored in water and insect sclerites picked out using a stereo microscope at 15-40 x magnification.

Coleoptera were stored in propanol for later identification using standard texts (Hansen, 1987; Holmen, 1987; Nilsson and Holmen, 1995; Harde, 1998; Friday, 1988) and the reference collection in Birmingham University under the supervision of Dr David Smith. The classification and nomenclature of Coleoptera follows Duff, 2008. Coleoptera were counted according to the maximum number of any given sclerite - the Minimum Number of Individuals (MNI).

Palaeoenvironmental interpretation was made using the BUGS database (Buckland and Buckland, 2006) along with currently available updates from various ecological websites for the Coleoptera.

Results

No identifiable insect remains were found in the following samples:

- Two from Munkaþverá
- One from Þykkvabæjarklaustur.
- Samples 8, 16(1) and 26, together with Barrel samples A and G from Kirkjubæjarklaustur.

Of the 27 combined samples, there were 14 which contained some charcoal. 2 samples consisted of mostly charcoal (9 and 24), and some contained a considerable amount of small woody twigs (Samples 10 and 28).

One sample (7) was noted to consist of mainly moss fragments.

Hammer scale was noted to be present in samples 26 and 29 with no insect material (Table 2).

As the sample sizes were mostly less than 1kg, the fauna extracted was limited in size and hence conclusions drawn from them are necessarily limited (Table 1).

The considerable age of the samples (some over 20 years) also may have affected the preservation of the insect material within them.

The number of sclerites identified in each sample varied from 1 to 49 with a total of 29 taxa identified (Table 2).

The insects identified were Coleoptera and Diptera pupae and were mainly synanthropic species with a smaller number of natural environmental faunal taxa discussed below (Table 3).

Natural fauna

There were two purely aquatic taxa. *Hydroporus melanarius* (sample 10) associated with peaty bog and *Hydrobius fuscipes* (sample 23) which is mainly found in standing water. These could have been carried in with material from the outside or possibly already present in peat material stored within the building structure of for fuel use (Konráðsdóttir H 2021).

Several species are associated with wetland areas. *Pterostichus diligens* is noted to be found in Icelandic fenland (Trautner 2006).

Larsson & Gígja in 1959 note that *Trechus rubens* in Iceland is photophobic, avoids draught and only occurs in biotopes well protected against sudden desiccation, prefers luxuriant vegetation, either tall and vigorous herbaceous or woody and shrubby growth and is therefore commonest on cultivated land but not actually synanthropic.

Actinicerus sjaelandicus is found on vegetation associated with damp heaths (Duff 1993).

Olophrum sp. *Lesteva* and *Lathrobium* are all associated with wetland environments (Buckland 2006).

Some species present are associated with drier areas as well. *Calathus melanocephalus* is stated to be found under stones or in litter in dry grassland or on cultivated soils (Duff 1993). It is not thought to be synanthropic.

Otiorhynchus nodosus and *Barynotus squamosus* are both polyphagus weevils, feeding on a wide variety of vegetation and are common. Larsson & Gígja 1959 state that *Barynotus squamosus* is commonest in the south of Iceland, preferring luxuriant, moderately moist meadows, especially clover. They could both be associated with the hay fauna brought into or with peat used within the building (Forbes et al., 2016).

Synanthropic taxa

Several taxa found here are only associated with human habitation and are thought to have derived from goods imported during Landnam and the subsequent colonisation (Konráðsdóttir et al., 2021).

Typhaea stercorea is a species associated with mouldy hay. Lindroth et al. 1973, states that in Iceland it is only found indoors, mostly among old hay or in other decaying vegetable matter.

Latridius minutus is especially associated with mildewed hay and straw, as well as compost, rotting vegetation and stable manure but is also found in mouldy wood (Koch 1989a). *Corticaria*, *Atomaria* and *Cryptophagus* species are all commonly associated with mouldy hay and although taxa are also found in outdoor vegetation they have most often been associated in Iceland with indoor environments as they are strongly synanthropic (Larsson and Gigja, 1959).

Ptinus tectis is a spider beetle, synanthropic and found in a great variety of dried organic materials, especially in granaries and food stores (Duff 1993).

Xylodromus concinnus and *Omalium caesum* are the only two taxa here associated with foul conditions (Buckland 2006). *Omalium caesum* can also be found in damp exterior environments associated with rotting vegetation (Koch 1989).

Xylodromus concinnus in Iceland is common throughout, rarest in NE but exclusively synanthropic in stables, outhouses and in summer also in adjoining fields, particularly in old hay (Larsson & Gígja 1959).

Catops fulginosus is found in the majority of samples and is known to feed on fungi and carrion (Lindroth et al 1973). It is also suggested to be feeding on maggots which are present here (Konráðsdóttir et al., 2021).

It has been recorded from bird nests so could be allochthonous, brought in with hay or peat.

The presence of numerous fly pupae in some of the samples suggests that animals were present close by, although there is no associated dung fauna in the samples.

One sample (16), from the base of a barrel, contained a single example of a *Melophagus ovinus* head. Although this was an isolated find, there were many fragments of puparia (one intact) in the same sample, thus suggesting that many were originally present.

This species, the sheep ked, is associated with the presence of sheep fleeces which have been removed from the sheep and cleaned (Buckland and Perry, 1989).

Its presence associated with a barrel suggests that the barrel may have been used for storage of urine necessary as part of the cleaning process for fleeces.

Sheep keds have been recovered from other Icelandic sites – Bessastadir (Amorosi et al., 1992), Goðataettur (Buckland et al., 1995), Nesstofa (Amorosi et al., 1994) and Skriðuklaustur (Konráðsdóttir 2009-2012).

Content by sample

It has not been possible to group the remaining samples into any quantifiable system, except in the cases where there were no insects present or there was the presence of hammer scale.

What follows will therefore be a discussion of the possible associations of each sample with reference to the fauna it contains.

It should be noted that most of the samples contained some synanthropic fauna associated with mouldy hay (Sadler and Dugmore 1995). This probably reflects the ubiquitous use of this material as a floor covering in many areas within the buildings.

The fauna has been grouped into 7 ecological categories for ease of discussion these are as follows (Table 3):

- AQ Purely aquatic taxa
- C Carnivorous or scavengers (*Catops fulginosus* only)
- D Dry environment associated
- F Foul environment associated
- W Wet environment associated
- S Purely Synanthropic taxa
- G General environments

These categories are based on the BUGS database assessments of environmental requirements or associations.

Sample 5

A total of 7 sclerites from 4 taxa. Three synanthropic, one general. No charcoal was found in this sample.

Sample 6

15 Sclerites from 7 taxa. 5 synanthropic, one foul, one carnivorous. Charcoal was found in this sample.

Sample 7

5 sclerites from 4 taxa. 3 Synanthropic, one carnivorous. No charcoal.

Sample 8

There was only charcoal in this sample. No fauna.

Sample 9

This sample consisted of mainly charcoal. 2 sclerites only, one carnivorous, one general.

Sample 10

28 sclerites from 9 taxa. One aquatic, one carnivorous, one foul (lots of fly pupae), one wet, three general and two synanthropic. A small amount of charcoal.

Sample 12

20 sclerites from 9 taxa. 5 synanthropic, two general, one wet and one foul. Some charcoal present.

Sample 13

19 sclerites from 11 taxa. 5 general, 4 synanthropic, one foul and one carnivorous. Small amount of charcoal.

Sample 14

2 sclerites from 2 taxa. One carnivorous and one dry. Small amount of charcoal.

Sample 15

15 sclerites from 8 taxa. 3 General, 2 synanthropic, one foul (fly pupa), one carnivorous, one dry. Charcoal was present.

Sample 16

21 Sclerites from 11 taxa. 3 synanthropic, 3 foul (including fly pupae and sheep keds), 2 wet, 2 general and one dry. There was no carnivorous *Catops fulginosus* here. No charcoal.

Sample 23

This sample produced the largest fauna. 49 Sclerites from 9 taxa. One aquatic, 4 synanthropic, one foul, one dry, one wet one carnivorous. *Catops fulginosus* was by far the most numerous taxon here but no fly pupae were seen. No charcoal.

There is quite a bit of a distinctive aquatic plant in this sample, possibly common mare's tail (*Hippuris vulgaris*) Patricia Shaw pers. comm.

Sample 24

14 sclerites from 8 taxa. 3 synanthropic, 2 general, one wet, one dry, one carnivorous. This sample was nearly all charcoal.

Sample 25

35 Sclerites from 14 taxa. This is the most taxon rich sample. 5 general, 3 synanthropic, 3 foul (the highest number of fly pupae (15)), one carnivorous, one dry and one wet. No charcoal.

Sample 26

No fauna. Charcoal and hammer scale only.

Sample 27(1)

11 Sclerites from 7 taxa. 3 synanthropic, 2 general, one carnivorous, one dry. No charcoal.

Sample 27(2)

7 sclerites from 5 taxa. 2 synanthropic, one carnivorous, one general, one dry. No charcoal.

Sample 28(1)

6 sclerites from 5 taxa. 2 dry, one foul, one carnivorous, one wet. No charcoal.

Sample 28(2)

5 sclerites from 3 taxa. One carnivorous, one foul, one wet. No charcoal.

Sample 29 (E)

Hammer scale only. No fauna. No charcoal.

Sample Barrel DL

1 sclerite of synanthropic taxon. No charcoal.

Sample Barrel F

One sclerite F (fly pupa). No charcoal.

Barrel samples G, H and A

No fauna or charcoal.

Discussion

Summary information environmental information is shown in Table 3.

Samples 26 and 29E, where there was a clear indication of metal working (hammer scale) had no associated fauna. Presumably the floor area would have been kept clear of combustible materials such as hay or peat.

The only samples not containing synanthropic fauna (9,14, and 28) presumably did not have a mouldy hay floor associated with them. They have different amounts of charcoal associated with them. 9 is mostly charcoal, 14 has a little charcoal and 28 has none.

Sample 28 also has a mixture of wet, dry and foul associated fauna.

Of the remaining synanthropic fauna samples, most have general fauna associated. These taxa probably were gathered with the hay when it was cut or possibly stored as would be the dry fauna.

The majority of these samples also have fauna indicating foul conditions which may indicate the environment included decaying matter and possibly animal faeces (Forbes et. al. 2016). There are no direct indicators of the presence of animals such as dung beetles.

The presence of some fauna associated with wet environments indicates a source outside the area that would have been hay meadow and hence the source of the mouldy hay fauna. It is

postulated that this fauna may have derived from peat brought into the building for use as fuel or even as part of the structure itself (Konráðsdóttir et. al. 2021).

Samples 10,16 and 25 contain significant numbers of fly pupae and are therefore from areas with more foul contamination than other areas. It is noted however, that the presence of *Catops fuliginosus* (the carnivore) and fly pupae do not coincide in samples 16 and 25 therefore this does not support the theory that *Catops fulginosus* is feeding on fly larvae here.

The presence of the sheep ked and its pupae in sample 16 however, does indicate that wool processing was nearby (Buckland 1989). This barrel sample may have contained the fleeces but more likely the urine used for the initial cleaning of the fleeces before processing.

Conclusions

The minimal amount of fauna present in the small samples represented here gives an indication of some of the uses of the areas within the monastery.

There is clear evidence that hay was used extensively within the building, metal working was present and that sheep fleeces were being processed.

There is also a possible storage of peat for use as fuel or for construction of the building.

References

Amorosi T, Buckland PC, Magnusson K, McGovern TH, Sadler JP. 1994. An Archaeozoological investigation of the Midden at Nesstofa, Reykjavik, Iceland, in: R Luff R, Rowley-Conwy P. (Eds) Whither Environmental Archaeology. Oxbow Monograph 38, Oxford, pp 69-80.

Amorosi TA, Buckland PC, Olafsson G, Sadler J, Skidmore P. 1992. Site status and the Palaeoecological record: A discussion of the results from Bessastaðir, Iceland, in: Morris CD, Rackham DJ (Eds) Norse and Later Settlement and Subsistence in the North Atlantic, Dept of Archaeology, University of Glasgow, pp. 169-192.

Buckland PC and Perry DW. 1989. Ectoparasites of Sheep from Storaborg, Iceland and their interpretation: Piss, parasites and people, a palaeoecological perspective. Hikuin 15, 37-46.

Buckland PC, Edwards KJ, Blackford J, Dugmore AJ, Sadler JP, Sveinbjarndottir G. 1995. A question of Landnam: pollen, charcoal and insect studies on Papey, Eastern Iceland, in: Butlin R, Roberts N (eds) Ecological Relations in Historical Times. Institute of British Geographers, Blackwell, Oxford, pp 245-264.

Buckland PI and Buckland PC. 2006. Bugs Coleopteran Ecology package Software [Component versions: Bugs CEP: Release 7.43; Bugsdata: Release 7.09; Bugs MCR: Release 2.0; Bustats: Release 1.2] [Downloaded/CDROM:Oct 2006].

Coope GR. 1986. Coleoptera analysis. In *Handbook of Holocene Palaeoecology and Palaeohydrology*, Berglund BE (ed). Chichester: John Wiley and Sons; 703-713.

Duff, AG. 1993. Beetles of Somerset: their status and distribution. Somerset Archaeological & Natural History Society, Taunton.

Duff AG. 2008. Checklist of Beetles of the British Isles. Somerset: A.G. Duff.

Forbes V, Dugmore AJ and Olafsson E. (2016). The life and death of barn beetles: faunas from manure and stored hay inside farm buildings in Northern Iceland. *Ecological Entomology* **41**, 480-499.

Friday LE. 1988. A key to the adults of British Water beetles. Dorset Press. Dorchester.

Hansen M. 1987. The Hydrophiloidea (Coleoptera) of Fennoscandia and Denmark. Brill. Leiden.

Harde KW. 1998. A field guide in colour to Beetles. 2nd (English) edn. Blitz Editions. Leicester.

Holmen M. 1987. The aquatic Adephaga (Coleoptera) of Fennoscandia and Denmark. Brill. Leiden.

Larsson SJ and Gigja G, 1959. Coleoptera (Vol 43). Munksgaard, Copenhagen.

Lindroth CH, Andersson H, Bodvarsson H, and Richter SH. 1973. Surtsey, Iceland. The Development of a new fauna, 1963-1970. Terrestrial invertebrates. Entomol. Scandinavica, Suppl. 5.

Koch K, 1989. Die Kafer Mitteleuropa, Vol 1. Goecke and Evers, Krefeld.

Konráðsdóttir H, Panagiotakopulu E, Lucas G, 2021. A very curious larder – Insects from post-mediaeval Skalholt, Iceland and their implications for interpreting activity areas. *Journal of Archaeological Science*, 126.

Konráðsdóttir H, 2009. Archaeoentomological analysis of samples from the 2008 season of Skriðuklaustur excavation. Skýrslur Skriðuklaustursrannsókna XXI, Reykjavík.

Konráðsdóttir H, 2010. Archaeoentomological analysis from Gásir in Eyjafjörður, in: O. Vésteinsson, O., Guðmundsdottir Beck, S., Mould, Q., Konráðsdóttir, H., Juel Hansen, S. C. (H. M. Roberts (Ed.)). Gásir Post Excavation Reports 2. Fornleifastofnun Íslands, Reykjavík, pp. 51-72.

Konráðsdóttir H, 2012. Archaeoentomological analysis of samples from the 2011 season of Skriðuklaustur excavation. Skýrslur Skriðuklaustursrannsókna XXXIII, Reykjavík.

Nilsson AN and Holmen M. 1995. The aquatic Adephaga (Coleoptera) of Fennoscandia and Denmark II. Dytiscidae. Fauna Entomologica Scandinavica, 32 edn. E J Brill. Leiden.

Sadler JP and Dugmore AJ. 1995. Habitat distribution of terrestrial Coleoptera in Iceland as indicated by numerical analysis. *Journal of Biogeography* **22**, 141-148.

Trautner J, 2006. Some ground beetles from western Iceland (Col., Carabidae). Entomologist's monthly Magazine, 142, 81-83.

Sample	Weight	Volume	Date
Munkaþverá above tephra	1000g	750ml	21/02/2015
Munkaþverá below tephra	1004g	750ml	21/02/2015
Þykkvabæjarklaustur	1000g	675ml	02/07/2015
Kirkjubæjarklaustur 5	407g	250ml	26/06/2002
Kirkjubæjarklaustur 6	313g	400ml	26/06/2002
Kirkjubæjarklaustur 6	225g	100ml	2002
Kirkjubæjarklaustur 7	318g	250ml	26/06/2002
Kirkjubæjarklaustur 8	350g	175ml	24/06/1905
Kirkjubæjarklaustur 8	483g	250ml	03/02/2002
Kirkjubæjarklaustur 9	284g	150ml	04/07/2002
Kirkjubæjarklaustur 9	300g	200ml	2002
Kirkjubæjarklaustur 10	502g	500ml	10/07/2002
Kirkjubæjarklaustur 12	469g	400ml	13/06/2003
Kirkjubæjarklaustur 12	358g	250ml	13/06/2003
Kirkjubæjarklaustur 13	618g	500ml	13/06/2003
Kirkjubæjarklaustur 14	856g	360ml	17/06/2004
Kirkjubæjarklaustur 15	223g	100ml	29/06/2004
Kirkjubæjarklaustur 15	300g	175ml	2004
Kirkjubæjarklaustur 16	261g	125ml	08/07/2004
Kirkjubæjarklaustur 16	250g	100ml	2004
Kirkjubæjarklaustur 23	960g	825ml	18/06/2005
Kirkjubæjarklaustur 24	1100g	500ml	15/06/2005
Kirkjubæjarklaustur 25	1008g	700ml	23/06/2005
Kirkjubæjarklaustur 26	360g	200ml	14/07/2005
Kirkjubæjarklaustur 26	200g	160ml	2005
Kirkjubæjarklaustur 27	1000g	1600ml	28/06/2006
Kirkjubæjarklaustur 27	600g	650ml	2006
Kirkjubæjarklaustur 28	383g	375ml	07/07/2006
Kirkjubæjarklaustur 28	350g	200ml	2006
Kirkjubæjarklaustur 29	310g	200ml	21/06/2006
Kirkjubæjarklaustur Barrel B	200g	100ml	No date
Kirkjubæjarklaustur Barrel A	150g	100ml	No date
Kirkjubæjarklaustur Barrel DL	70g	80ml	No date
Kirkjubæjarklaustur Barrel G	200g	50ml	2002

Table 1. Weights, volumes measured and dates for all samples.

Table 2 Fauna and miscellaneous results for all samples.

Taxon	5	6	7	8	9	10	12	13	14	15	16	23	24	25	26	27(1)	27(2)	28(1)	28(2)	29E	DL	B	
Coleoptera																							
Catops fuliginosus		2	1		1	2		2	1	4		16	5	5		1	1	1	1				C
Pterostichus diligens												1											W
Calathus melanocephalus											1	4											D
Trechus rubens											1		2					1	2				W
Hydrobius fuscipes												1											AQ
Hydroporus melanarius						1																	AQ
Actinicerous sjaelandicus							1																W
Typhaea stercorea			2			1	7	1				1	1	3		2	2						S
Latridius minutus	1	3	1				6	4		3	2	8	1			3	2						S
Ptinus tectus		1					1					8		1									S
Cryptophagus	4	3				1	1				3	6	2			1							S
Corticaria sp.		2						3		1											1		S
Atomaria sp.	1	2	1				1	1			2			1									S
Crataraea suturalis						1																	G
Xylodromus concinnus		2					1	2				4		1				1					F
Tachyporus sp.					1			1		1				1		1							G
Omalium sp.						1		1			2		1	3									G
Omalium Caesum											1												F
Olophrum sp.														1									W
Quedius sp.										1				1									G
Lesteva sp.						2																	W
Lathrobium sp.											1												W
Stenus sp.								1															G
Philonthus sp.							1	1		1			1	1									G
Alleocharinae sp & gen indet.	1					11	1	5			2			1		2	1						G
Otiorhynchus nodosus									1	1			1	1		1	1	2					D
Barynotus sqamosus																		1					D
Diptera																							
Helomyza serata						8				3	3			11					2			1	F
Melophagus ovinus											3												F
Caliphoridae														4									F
	7	15	5		2	28	20	22	2	15	21	49	14	35		11	7	6	5		1	1	
Miscellaneous																							
Moss			Y																				
Charcoal		Y		Y	Y	Y	Y	Y	Y	Y	Y		Y		Y				Y	Y			
metal hammer scale															Y					Y			

Table 3 Taxa sorted by environmental designation.

Taxon	5	6	7	8	9	10	12	13	14	15	16	23	24	25	26	27(P)	27(2)	28(1)	28(2)	29E	DL	B	
Hydrobius fuscipes												1											AQ
Hydroporus melanarius						1																	AQ
Catops fuliginosus		2	1		1	2		1	1	4		16	5	5		1	1	1	1				C
Calathus melanocephalus											1	4											D
Otiorhynchus nodosus									1	1			1	1		1	1	2					D
Barynotus sqamosus																		1					D
Xylodromus concinnus		2					1	2				4		1				1					F
Omalium Caesum											1												F
Helomyza serata						8				1	3			11					1			1	F
Melophagus ovinus											3												F
Caliphoridae														4									F
Tachyporus sp.					1			1		1				1		1							G
Crataraea suturalis						1																	G
Alleocharinae sp & gen indet	1					11	1	5			2			1		2	1						G
Omalium sp.						1		1			2		1	3									G
Quedius sp.										1				1									G
Stenus sp.								1															G
Philonthus sp.							1	1		1			1	1									G
Typhaea stercorea			2			1	7	1				1	1	3		2	2						S
Latridius minutus	1	3	1				6	3		3	2	8	1			3	2						S
Ptinus tectus		1					1					8		1									S
Cryptophagus	4	3				1	1				3	6	2			1							S
Corticaria sp.		2						2		1											1		S
Atomaria sp.	1	2	1				1	1			2			1									S
Pterostichus diligens												1											W
Trechus rubens											1		2					1	2				W
Actinicerous sjaelandicus							1																W
Olophrum sp.														1									W
Lesteva sp.						2																	W
Lathrobium sp.											1												W