Archaeoentomology at Tatsip Ataa: Evidence for the Use of Local Resources and Daily Life in the Norse Eastern Settlement, Greenland

Article *in* Journal of the North Atlantic · April 2014

DOI: 10.3721/037.002.sp604

Frédéric Dussault
Memorial University of Newfoundland

Veronique Forbes
Memorial University of Newfoundland

Allison Bain
Laval University

Archaeoentomology at Tatsip Ataa: Evidence for the Use of Local Resources and Daily Life in the Norse Eastern Settlement, Greenland

Frédéric Dussault[1,*], Véronique Forbes[2], and Allison Bain[3]

Abstract - Thirty-one sediment samples collected from midden layers at the Tatsip Ataa (E172) site located in the former Norse Eastern Settlement in Greenland were analyzed for insect remains. These efforts allowed for the identification of species believed to have been introduced involuntarily with Norse settlers upon colonization, while suggesting the origin of materials disposed of in the midden. Our analysis of outdoor insects and synanthropes also identified resources exploited from the local environment, suggesting that the midden represents the end result of a number of domestic activities including construction, maintenance, hygienic practices, and animal husbandry.

Introduction

Archaeoentomology is the scientific study of insect remains recovered from archaeological sites. Its use on an archaeological site in the United Kingdom was first described by Coope and Osborne (1967) and it is nowadays a branch of archaeology whose methods are widely utilized around the world (Elias 2010). Insects represent one of the most common animal forms on earth and are found in almost all terrestrial environments. When they die, their exoskeletons are preserved in sediments and may be recovered for analysis. Insect remains are used to understand past climates and environments, to perceive human activities that may have transformed past landscapes, and to identify the introduction of foreign species related to human settlements.

In Greenland, the identification of entomological remains from archaeological sites has been employed as part of the study of Norse sites located in the former Western and Eastern Settlements. The findings have contributed to a better understanding of the timing and impacts of *Landnám*, while also allowing archaeologists to better understand the agropastoral economy in the Norse colonies. Over the last 30 years, archaeoentomological analyses have explored manuring and field-irrigation practices, as well as animal husbandry and trade. These studies have enhanced our understanding of the Norse impact on the surrounding environment as well as site-formation and abandonment processes (Buckland et al. 2009, McGovern et al. 1983, Panagiotakopulu and Buckland 2013, Panagiotakopulu et al. 2012, Sadler 1987, Skidmore 1996, Vickers and Panagiotakopulu 2011).

This paper presents the results of the analysis of insects remains preserved in 10^{th}–12^{th}-century midden deposits from the site of Tatsip Ataa in the former Norse Eastern Settlement, located in southwest Greenland (Fig. 1). Species identified include insects and arthropods accidentally imported by Norse settlers, as well as taxa that suggest the use of local resources by the site's former occupants.

Methodology

Because it has been demonstrated that most insects have not evolved appreciably over the past 2 million years (Coope 1978:185, Elias 2010:1), insect remains are reliable proxies for past environmental conditions (Kenward 1978). Different orders of insects and other arthropods are used in archaeoentomology, including mites (Acarina) (Chepstow-Lusty et al. 2007, Erickson 1988, Haarløv 1967); flies (Diptera) (Panagiotakopulu 2004, Panagiotakopulu et al. 2007); and beetles (Coleoptera) (Elias 2010, Kenward 2009). Beetles are one of the most well-documented orders of insects, and many species have specific ecological requirements. Furthermore, their chitinous exoskeletons result in their preservation in archaeological deposits where waterlogged or dry conditions occur. Beetles, or Coleoptera, are therefore the most commonly studied order in archaeoentomology (Elias 1994, 2010:26; Kenward 2009:38).

Site context and field methodology

The site of Tatsip Ataa is located on the eastern shore of Igaliku Fjord (Fig. 1). It is considered to be a typical inner fjord farm without a church or other evidence of high status or economic specialization. It is located on a gentle and damp slope and has a substantial home-field area and productive vegetation (Smiarowski 2012:6).

In 2007, a 2-m by 3-m trench (block A) was excavated in a nearby midden located on a gentle natural slope (midden A; Fig. 2). In 2009, this

[1]Memorial University, Newfoundland and Labrador, Canada. [2]University of Aberdeen, Scotland, UK. [3]Environmental Archaeology Laboratory, Université Laval, Québec, Canada. [*]Corresponding author - dussault.fred@gmail.com.

excavation was extended by 2 m to the South and 3 m to the East (blocks B and C) for a total of 25 m^2 (5 m x 5 m) (Smiarowski 2012:8–9). Midden levels were excavated individually using a single-context recording method, where each context excavated is given a unique number and its relation in the stratigraphy is expressed in a matrix (Smiarowski 2012:5, 8). At 70 cm below the surface, a deposit composed mainly of turf debris was encountered throughout the different sections of the midden (context [022] excavated in 2009). This layer clearly marked a separation between the upper deposits where preservation of organic material was poor, and the lower deposits, where organic materials (wood and bones) were well-preserved. Other than samples s004 and s049 (contexts [020] and [021]), all samples analyzed in this study were taken from below this well-defined layer. Bedrock was encountered at 160 cm below the surface. Radiocarbon dates obtained from *Bos taurus* and caprine bones indicate an occupation from A.D. 890–1020 to A.D. 1205–1265 (Smiarowski 2012:35), thus providing a chronological framework for excavation block C, where most of the archaeoentomological samples were taken (Table 1).

Samples for archaeoentomological analyses were collected in 2009 and 2010. The matrix of the samples was primarily composed of partially decomposed plant material (60–90%), mixed with white, fine sand (10–30%). Wood, twigs, and wood shavings were also found in most samples, as well as small pieces of charcoal and small bone fragments. The only exception was context [020], or sample 4, which contained a higher percentage of sand (60%).

Laboratory methodology

Thirty-one sediment samples were analyzed at the Laboratoire d'archéologie environnementale at Université Laval in Quebec City, Canada, following the procedure devised by Coope and Osborne (1967), described by Kenward et al. (1980, 1986), and later modified by Bain (2001). The 3-l samples were washed with lukewarm water and sieved through a geological mesh screen with a 250-µ opening. All samples were subjected to kerosene flotation, and this step was repeated twice for samples rich in plant material. The floated material was stored in ethanol in glass jars and later sorted and examined for entomological remains using a low-power binocular microscope. The heavy residues,

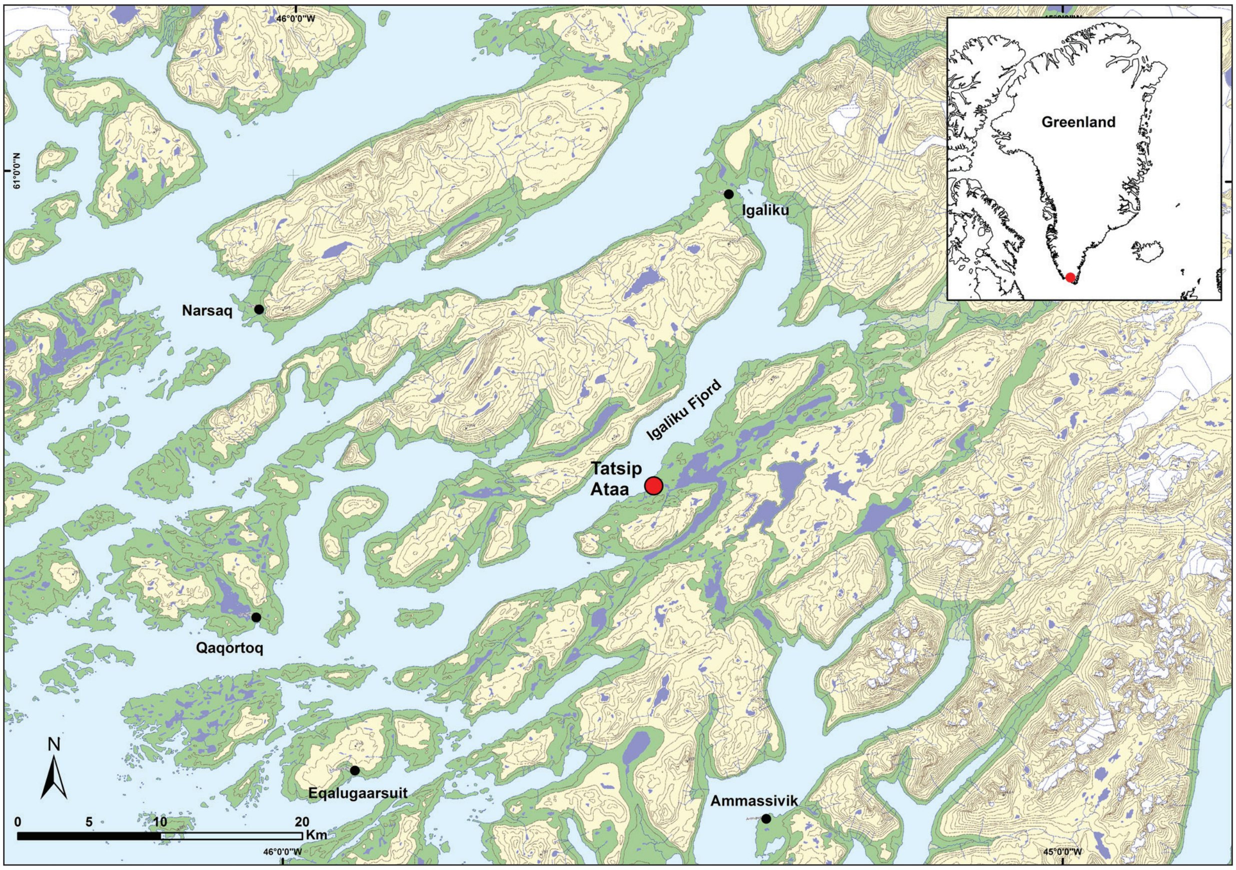

Figure 1. Igaliku fjord showing the location of Tatsip Ataa, with its location in Greenland in the inset. Based on maps provided by Nunagis.gl (NunaGIS and the Danish Geodata Agency 2013) and modified by the authors using ArcGIS 10.1.

left after the kerosene processing, were sorted under a magnifying lamp. Only a single Carabidae fragment and several Acarina were found in the heavy fractions.

The identification of beetles, true bugs, and ectoparasite remains was undertaken by the first author with the help of reference manuals (Böcher 1988; Lindroth 1961, 1963, 1966, 1968, 1969) and

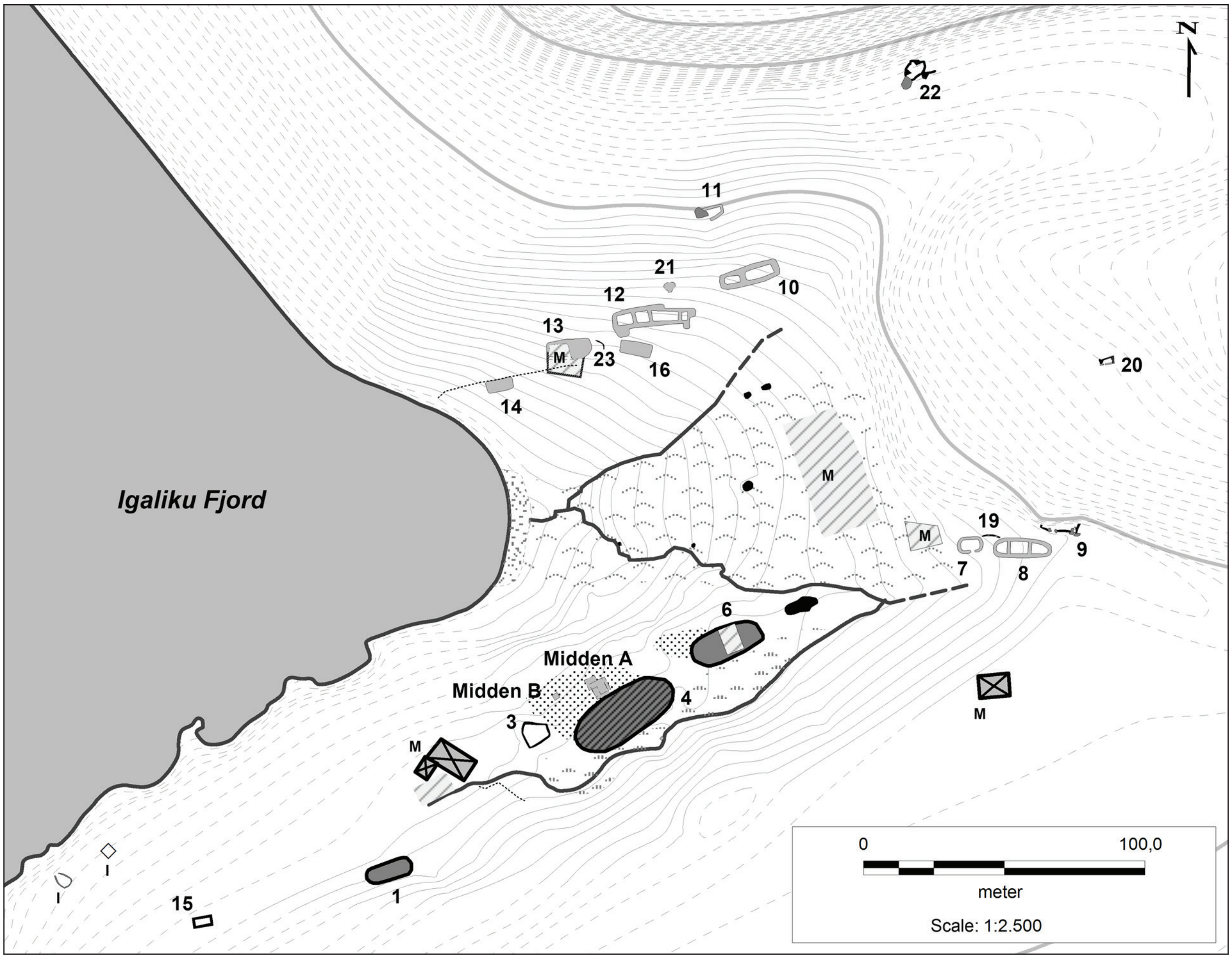

Figure 2. Plan of the Tatsip Ataa site showing the Ruin No.4 dwelling with midden. Excavation blocks A, B, and C are in midden A. The plan also show modern features (M), modern fields or gardens (obliquely shaded), Inuit features (I) and modern clearance cairns (black spots). Structures shown on the plan also include a byre with midden (6), outbuildings (1, 7, 8, 10-16, 21), storage buildings (15, 20), animal enclosures (3, 9, 22) and dikes (19, 23). Plan by Christian Koch Madsen.

Table 1. Radiocarbon dates from the site of Tatsip Ataa. Samples were dated at the Scottish Universities' Environmental Research Center SUERC (Smiarowski 2012:35).

E 172 AMS Radiocarbon (bone collagen)					Calibrated years			
Entomo. Sample #	Context	Species	Lab reference	^{14}C Before Present	Sd	Delta ^{13}C	1 Sigma	2 Sigma
	E172 [01]	*Bos taurus*	SUERC 17573	810	35	-21.1	1205–1265	1160–1280
	E172 [018]	*Bos taurus*	SUERC 33597	905	35	-21.5	1040–1180	1023–1210
	E 172 [055]	*Bos taurus*	SUERC 33593	930	35	-20.6	1030–1160	1020–1190
s063	E172 [055]	*Bos taurus*	SUERC 33594	935	35	-21.3	1030–1160	1020–1180
	E172 [12]	*Bos taurus*	SUERC 17575	960	35	-21.1	1020–1160	1010–1160
s049	E172 [021]	*Caprine*	SUERC 33596	960	35	-19.8	1020–1160	1010–1160
	E172 [16]	*Bos taurus*	SUERC 17579	965	35	-20.6	1020–1160	1010–1160
s049	E172 [021]	*Bos taurus*	SUERC 33595	990	35	-21.0	990–1150	980–1160
	E172 [12]	*Bos taurus*	SUERC 17574	1000	35	-20.3	990–1120	990–1280
s034	E 172[037]	*Bos taurus*	SUERC 33489	1035	35	-21.4	975–1025	890–1050
s084	E172 [069]	*Bos taurus*	SUERC 33587	1050	35	-21.5	900–1030	890–1030
S084	E172 [069]	*Bos taurus*	SUERC 33588	1080	35	-21.4	890–1020	890–1020

anatomical comparisons with modern specimens from reference collections housed at the Laboratoire d'archéologie environnementale at Université Laval and at the René Martineau Insectarium at the Canadian Forestry Services Centre in Quebec City. Many studies on the Norse occupation of Greenland have included dipterous or fly remains in their interpretations (Buckland et al. 1996, 2009; Panagiotakopulu 2004); however, Diptera are not included in the present analysis. Minimum numbers of individuals (MNI) for each taxon were calculated on the basis of the most abundant insect part. The taxonomic list of insects presented in Appendix 1 was produced using the BugsCEP database (Buckland and Buckland 2006) and follows Böhme (2005).

Results

Overview of the archaeoentomological assemblage

In general, the samples exhibited good preservation of entomological and arthropod remains, such as the human louse *Pediculus humanus* shown in Figure 3a. More than 1000 specimens were identified (see Appendix 1), while only two samples, s042 and s049, were found to be sterile. Synanthropic beetles (those often found in, or restricted to, environments created by humans) as well as outdoor taxa, ectoparasites (i.e., lice), and eurytopic taxa (able to thrive in various environmental situations) were identified.

While the following discussion of the recovered insect and arthropod fauna classifies the fauna into broad generalized categories, ecological groupings and their relative abundance were also considered. Each of the taxa identified was placed into an ecological group (Fig. 4). This classification is based on information about the preferred habitats of these species in Greenland (Böcher 1988). To allow for a better appreciation of the variation in the archaeoentomological data, a diagram (Fig. 5) showing the total number of insects identified from each sample, as well as the proportion represented by each ecological group, was constructed using Tilia 1.7.16 (Grimm 2011). This diagram demonstrates that the number of insects recovered varies greatly between samples, but that nearly all assemblages are dominated by taxa exploiting various types of organic matter and insects feeding on dry moulding matter such as hay. Most of these synanthropes were introduced by Norse settlers to Greenland and were transported in ships' provisions, including foodstuffs, ballast, and dunnage, before seeking out new

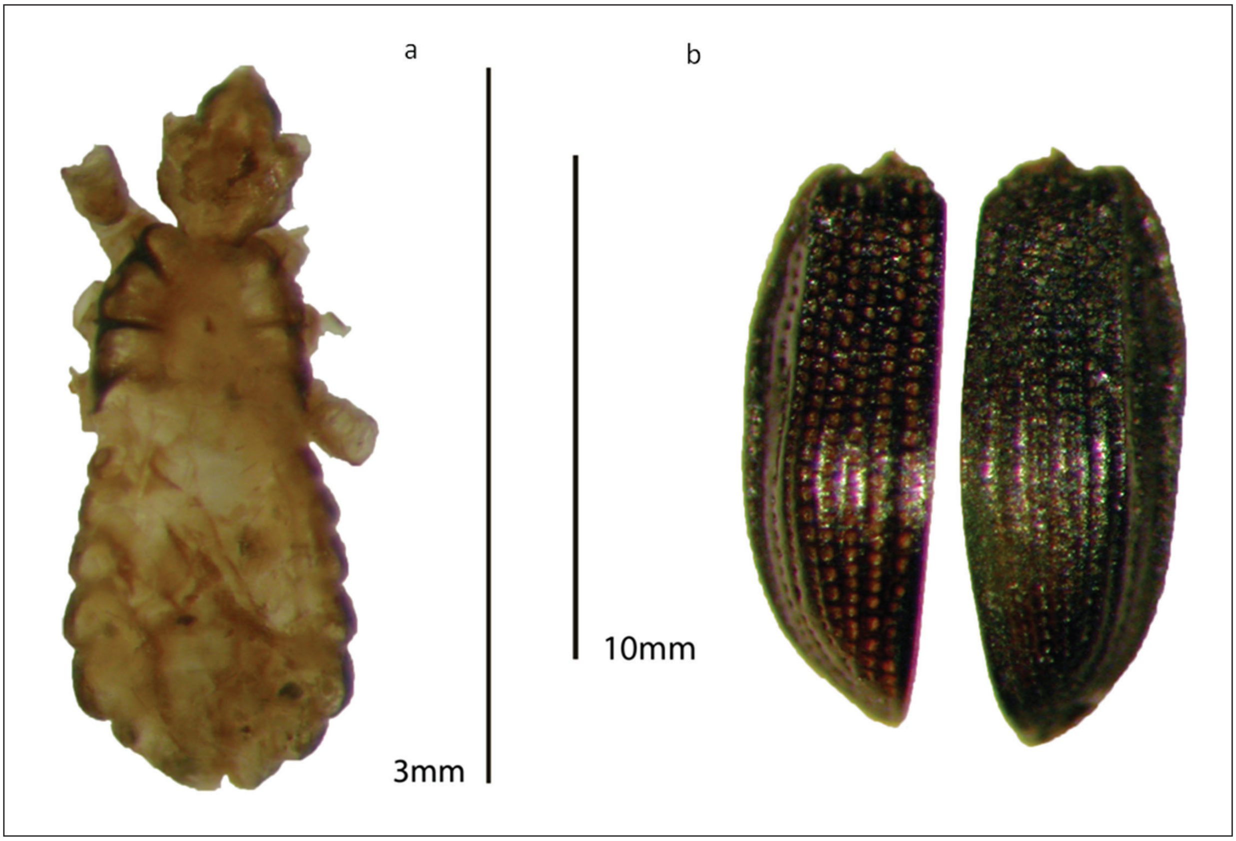

Figure 3. Some of the insect remains recovered from Tatsip Ataa: a) human louse, *Pediculus humanus,* from sample s051; b) elytron of *Latridius minutus* group from sample s034.

niches in the homes of Greenlandic Norse settlers (cf. Sadler 1991, Sadler and Skidmore 1995). As most of these insects can only survive in Greenland in the artificially heated environment provided by man-made buildings, the majority of them must have originated from homes and animal stalls or sheds before being deposited in the midden. They may have arrived in the midden as the result of successive dumping events to dispose of butchery waste, as demonstrated by the results of the zooarchaeological analysis (Smiarowski, in press), or as house sweepings and manure from animal stalls (cf. Buckland et

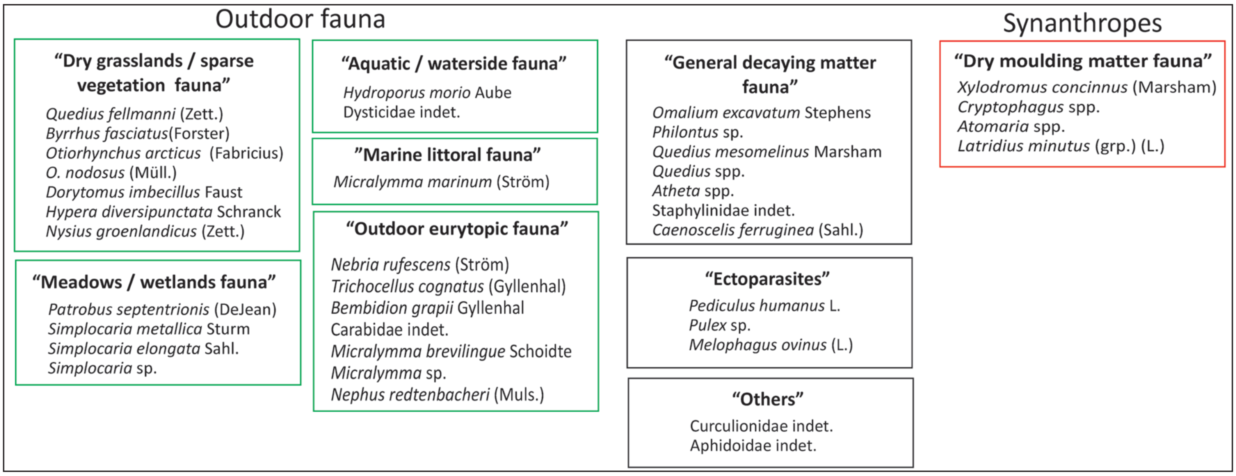

Figure 4. Ecological categorization of the identified insects and arthropods from Tatsip Ataa according to their preferred habitats in Greenland. The category "other" contains taxa that could not be placed into an ecological group because they were not identified to a sufficiently precise taxonomic level.

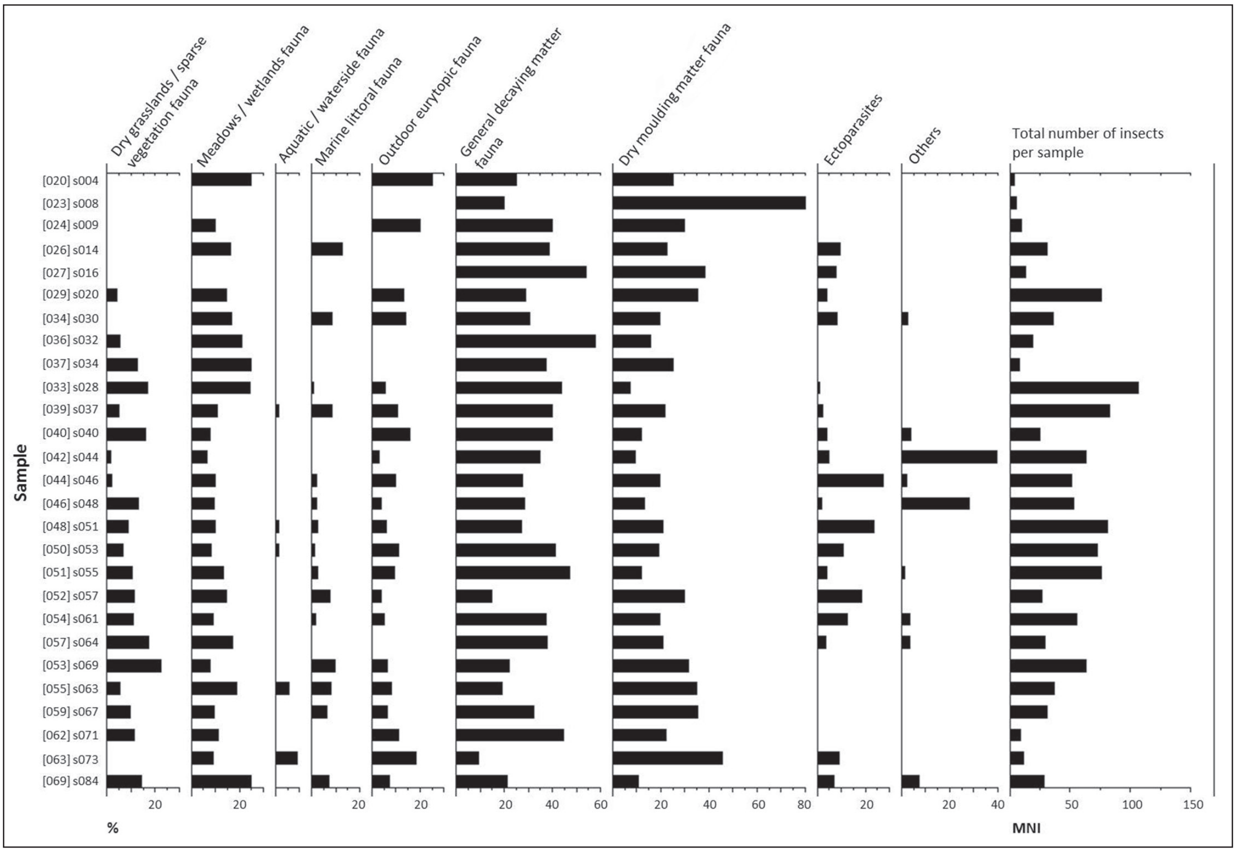

Figure 5. Comparison of the total number of insect remains recovered from each sample with the percentage represented by each ecological group as defined in Figure 4. Samples s088 and s101 were not included in the diagram because they bear no direct stratigraphic relationship to the remaining samples.

al. 1993:522). As such, they allow for a reconstruction of some the interior environments as well as some of the activities that took place there.

The midden environment, an open and exposed area, provided an ideal feeding and hunting ground for several outdoor beetle species. Figure 5 shows that nearly all samples yielded outdoor taxa which inhabit a variety of environments, including wet meadows, grasslands, the seashore, and aquatic environments. Some of these organisms probably arrived in the midden as they were searching for food or prey, and may have originated from the local environment. However, because Norse Greenlanders are known to have exploited many resources in the natural environment, such as peat, turf, and seaweed (Buckland 2000; Buckland et al. 1993:514, 1994:134–138), the use of such materials in building construction and for litter, fuel, and/or bedding probably accounts for the presence of at least some of the outdoor taxa recovered.

The following section presents synanthropic insects recovered from Tatsip Ataa that are believed to have been introduced to the islands as a result of the Norse colonization. Their ecological preferences, as well as those of the outdoor fauna and the ectoparasites, are also discussed in an attempt to identify some of the midden contents and to reconstruct characteristics of the site economy as well as the environment around the site.

Synanthropic insect travelers

The Tatsip Ataa study offered an opportunity to obtain new records of synanthropic or introduced species. Many of the insects in the synanthropic group were previously identified by Böcher (1988) as species introduced by Norse settlers to Greenland. The introduction of hay cultivation and animal husbandry no doubt enabled some of these species to survive in Greenland, as these activities produced accumulations of organic materials resulting in suitable habitats for them to colonize (Buckland 2000:149, Buckland et al. 1991, Sadler 1991:204–205). Among these, the rove beetles *Philonthus* sp. and *Quedius mesomelinus* are associated with cultivated ground, dung, and carrion—settings in which they prey on other insects (Böcher 1988:24). A number of mould-feeders and their predators—insects that live in human habitations, barns, and stables on dry, moulding vegetal matter such as old hay—have also been introduced by cultural agency. Two of the most common in this category are *Latridius minutus* group (Fig. 3b) and *Xylodromus concinnus*, both of which were recovered from most samples from Tatsip Ataa. *L. minutus* feeds exclusively on moulds and spores in rotting vegetation, while the predacious *X. concinnus* has a distribution limited to within turf huts in Greenland, in settings similar to *L. minutus* (Böcher 1988:31, 55; Bousquet 1990)

While most of the synanthropic fauna seem to have disappeared from Greenland after the demise of the Norse settlements (ca. mid-15th century), *Quedius mesomelinus* and *Xylodromus concinnus* were recorded in the early 20th century (Böcher 1988, 1997). This finding suggests that they may have successfully established themselves in the natural environment or that they survived by colonizing the interiors of Inuit structures. A third possibility is their reintroduction during the 19th and 20th centuries. At present, *Xylodromus concinnus* is extinct in Greenland (Böcher 1997).

Ectoparasites have also been recovered in previous studies on the Western Settlement and in Iceland (Amorosi et al. 1992, 1994; Buckland et al. 1992, 2009; McGovern et al. 1983; Skidmore 1996). At Tatsip Ataa, the human louse, *Pediculus humanus*, was identified. Taxonomically, the human louse has been subdivided into the subspecies *Pediculus humanus corporis* (the body louse) and *Pediculus humanus capitis* (the head louse), but this subspeciation is still open to debate (see Bailey et al. 2003, Leo et al. 2002, Maunder 1983, Veracx et al. 2012). Human lice remains have been found on Inuit and palaeoeskimo sites in Greenland dating to the middle of the previous millennium. These include the sites of Qaqaitsut and Cape Grinnell, as well as the Qilakitsoq mummies (Bresciani et al. 1983, 1989; Dussault 2011; Forbes et al. 2013; Hansen et al. 1991:161–163; McGhee 2009:79; Panagiotakopulu and Buckland 2013).

Insects parasitizing domestic animals were also recovered, in the form of the sheep ked, *Melophagus ovinus*. This parasite is specific to sheep and thus provides proxy evidence of sheep at the site. Because the sheep ked is strongly attached to the sheep's fleece, concentrations of this parasite are usually considered evidence of wool processing (Buckland and Perry 1989; Kenward 2009:56, 263; Panagiotakopulu 2004:1680). Other possible explanations for the presence of *M. ovinus* in the midden include secondary deposition of floor materials cleared from a farm or domestic building (Buckland et al. 2009:112, Panagiotakopulu, et al. 2012:543).

Resources collected from the local environment: The outdoor fauna

A number of outdoor species were also recovered. Some of these insects can be considered to be background fauna (sensu Kenward 1975), which may have arrived in the midden as a result of their search of food. However, an alternate explanation relates to the exploitation of local resources, such as peat, turf, seaweed, and hay, which has been widely documented in the Norse North Atlantic (Buckland 2000:147, 149; Hallsson 1964; Ólafsson and Ágústsson 2003:6; Ross and Zutter 2007).

Turf, or the upper layers of grass held together by roots, was used as a building material by Norse Greenlanders (Buckland 2000). It has been demonstrated that turf provides suitable environments for synanthropic species associated with mouldy decaying vegetation. Since turf was collected from meadows and wetlands, its collection would also introduce insects from these environments into the archaeological record (e.g., Amorosi et al. 1992:183, Buckland et al. 1992:161, Kenward et al. 1984). Among the outdoor species, the ground beetles *Nebria rufescens* and *Patrobus septentrionis* are often found in humid settings near lakes shores and river banks (Böcher 1988:7–10), and may have arrived in the midden among discarded turves. The ground beetles *Bembidion grapii* and *Trichocellus cognatus* are associated with similar, though at times drier, environments (Böcher 1988:12–15) and could also have been incorporated in this way. Weevil species such as *Otiorynchus arcticus, O. nodosus, Hypera diversipunctata,* and *Dorytomus imbecillus* are also associated with natural environments, including meadows and grasslands in Greenland (Böcher 1988:61–67). It is thus possible that their presence in the midden represents turf disposal as well. Other insects that may have entered the midden along with this material include the true bug *Nysius groenlandicus*, abundant in some grassy areas of Greenland (Böcher and Fredskild 1993:21), along with plant-feeding aphids.

Peat was also used for a variety of purposes in the North Atlantic, including fuel, litter, and fertilizer (Buckland et al. 1993:518), and pollen-analysis studies have recently provided evidence for peat cutting in the Qorlortoq valley (Schofield et al. 2008), also part of the Eastern Settlement. Because both peat and turf were collected from the natural environment, they may have introduced similar outdoor insect species into archaeological deposits. For this reason, it is difficult to differentiate between peat and turf in archaeoentomological assemblages (Amorosi et al. 1992:182–183, Buckland 2000:149–150, Buckland et al. 1992:161, Kenward et al. 2012). However, as peat would always have been collected from wet environments, such as peat bogs, mires, and wetlands, it is generally accepted that the use of peat is more likely to introduce aquatic species into archaeological deposits (Amorosi et al. 1994:77, Buckland 2000:150). The presence of moss-feeding beetles, associated with environments from which peat was collected, has also been interpreted as evidence for the presence of this material (Buckland et al. 1994:134–138).

The use of peat and turf at the site of Tasiusaq, located near Tatsip Ataa, has been discussed by Panagiotakopulu and Buckland (2013). Those authors argue that the pre-*Landnám* fauna of Tasiusaq was a willow-dominated wetland. During archaeoentomological analyses, they identified the willow feeding weevil *D. imbecillus* (Panagiotakopulu and Buckland 2013: 7). They also argue that in order to favor the growth of grass and hay, wetlands were cleared by burning. This clearance changed the entomological fauna by favoring predatory beetles such as *Quedius fellmani* and *Bembidion grapii*, as well as moss-feeders naturally found in wetlands such as *Simplocaria metallica* and *Byrrhus fasciatus* (Panagiotakopulu and Buckland 2013:8). This intentional clearing caused supplemental runoff, which likely would have accumulated and attracted water beetles, such as *Hydroporus morio*.

We identified specimens of *S. metallica* and *B. fasciatus,* both of which feed on moss in damp areas with short vegetation (Böcher 1988), as well as the water beetles *H. morio* and Dysticidae indet., from the Tatsip Ataa assemblages, although fewer water beetles were recovered than at Tasiusaq. This finding suggests the Norse settlement might also have opened up the landscape at Tatsip Ataa, creating a wetter environment encouraging peat growth. The presence of several byrrhid or moss-feeding beetles in the midden at Tatsip Ataa could also have been caused by the discard of peat used in building construction. As mentioned by Panagiotakopulu and Buckland (2013), there is an absence of good structural turf in Greenland due to the scarcity of animal grazing in the fields. In Iceland, the solution to this problem was to harvest superficial peats in wetlands (Panagiotakopulu and Buckland 2013:9). Buildings made out of turf need upkeep every 20–30 years in Iceland, and old turves were likely discarded in the midden (Ólafsson and Ágústsson 2003; van Hoof and van Dijken 2008). This activity was identified at Tatsip Ataa, as contexts [076] and [022] were identified as turf debris associated with such maintenance and repair of turf buildings.

The largest archaeoentomological presence in the Tatsip Ataa samples is that of the rove beetles, or members of the family Staphylinidae. This family includes both synanthropes and outdoor species that are generally associated with environments rich in decomposing organic material. Outdoor rove beetles include *Quedius fellmani*, which is widespread in Greenland and associated with fairly dry plant communities (Böcher 1988), as well as *Micralymma brevilingue* and *M. marinum.* Both of the latter species occur on the seashore, and *M. brevilingue* has also been recorded from inland tundra environments (Böcher 1988, Makarova et al. 2007). As Tatsip Ataa is located near the edge of the fjord, it is possible that these insects were part of the background fauna and thus originated from the local environment. However, it is also possible that they were deposited with resources collected from beaches (cf. Buckland et al. 1993:514). Seaweed is mentioned in North Atlantic ethnographic sources as a source of salt and animal fodder (Fenton 1978, Hallsson 1964, Zutter 2000). Both sheep and cattle have been observed grazing on seaweed on the seashore (Buckland and Panagiotakopulu 2005:141), and finds of insect species associated with seaweed on other Norse sites have been interpreted as evidence for the exploitation of this marine resource in Iceland and Greenland (e.g., Amorosi et al. 1992:182, 1994:75; Skidmore 1996).

Flooring material, household debris, and middens

Previous archaeoentomological analyses undertaken on middens in the former Western Settlement have demonstrated that some of the midden contents originated in Norse homes (Buckland et al. 1994). Layers mainly composed of wood chips and twigs, previously interpreted as residue from woodworking or animal fodder (Roussell 1941), have been reinterpreted on the basis of the entomological evidence as litter for Norse houses. The identification of many synanthropic mould-feeders and their predators from midden deposits from various Greenlandic Norse sites suggests that these layers formed indoors (Buckland et al. 1993, McGovern et al. 1983, Sadler 1987). Moss-feeders and aquatic insects also suggest the presence of peat in these deposits (Buckland et al. 1993:134–138). Thus, it appears that Norse Greenlanders used twigs, wood chips, and peat in the construction of their house floors, and that these materials provided stabilization and insulation against the cold ground surface below (cf. Buckland et al. 1994). Cleaning and sweeping activities would have allowed this material and the accompanying insect faunas (aquatic species as well as mould and moss feeders found on peat), to be re-deposited in middens (Ibid.).

The presence of the above-mentioned human lice may be used to infer hygiene and living conditions (Bain 2004, Coope 1981, Girling 1984), but also as evidence for the proximity of humans or their clothes (Amorosi et al. 1994:74, Konráðsdóttir 2007:63), or for residues from delousing (Buckland et al. 1992, Dussault 2011, Forbes et al. 2013). Buckland et al. (1993:519) suggest that the presence of human lice, along with beetles preferring dry conditions such as mould-feeders, can be used to identify faunas originating from house floors. In the United Kingdom, human ectoparasites and mould-feeder beetle taxa have been included in species groups representative of these contexts (Carrott and Kenward 2001:891, Hall and Kenward 1990:399, Kenward and Hall 1995:662). The presence of these insects at Tatsip Ataa thus serves to reinforce the possibility that flooring materials were dumped in the midden. Twigs and wood chips were recovered from the heavy fractions of many of the samples analyzed; it thus seems likely that the material used for flooring at Tatsip Ataa was similar to that used at other Norse Greenlandic sites (Buckland et al. 1983, 1994; McGovern et al. 1983). Our archaeoentomological analysis has thus confirmed some of the initial interpretations which suggested that many contexts were turf dumps or re-deposited floor layers (Smiarowski 2012).

Although the sheep ked, *Melophagus ovinus,* can serve as evidence that sheep were kept on the site or that their wool was processed, it is not the only insect recovered from these samples that can be connected with animal husbandry. It was essential for Norse farmers to cultivate enough hay to overwinter their animals (Amorosi et al. 1998, Buckland 2000:147), and there is little doubt that the presence of many synanthropic insects feeding on moulds and spores was at least partly enabled by the storage of fodder. Numerous *Philonthus* sp. and *Omalium excavatum* were present in the samples. As these taxa are often associated with animal dung and manure (Larsson and Gigja 1959), the specimens identified from Tatsip Ataa may have originated from the floors of animal stalls. It is also possible, however, that the former inhabitants of the site also spread animal manure onto fields to fertilize them. Samples collected from drainage ditches at Garðar (modern-day Igaliku) in the Eastern Settlement yielded many insects that originated from the interiors of houses and byres (Smith 1996), which were interpreted as evidence for manuring in Norse Greenland (Buckland et al. 2009, Panagiotakopulu et al. 2012).

Conclusion

Despite the fact that middens represent the re-deposition and discard of in situ deposits, the analysis of insects preserved in such contexts can offer a great deal of information on both the environments around a site and the activities that took place there (cf. Buckland et al. 1993). A large proportion of the insects recovered—including parasites infesting humans and their animals, as well as synanthropic beetles—were introduced to Greenland with the Norse colonization. These taxa were known from previous archaeoentomological research on Norse sites (e.g., Buckland et al. 1983, 1998, 2009; McGovern et al. 1983); and radiocarbon dates obtained from Tatsip Ataa indicate that these introductions arrived during or shortly after colonization. The presence of species from varied outdoor environments and those confined to human-made habitats suggests that some of the midden contents were the result of the disposal of domestic refuse. Based on the insect faunas, it appears that the inhabitants used the same flooring materials as the occupants of the farms of the Western Settlement (e.g., Buckland et al. 1983, 1994; McGovern et al. 1983; Sadler 1987), including peat, turf, hay, twigs, and wood. Sheep parasites and insects that exploited habitats produced by dung, manure, and hay can be connected to animal husbandry. Seaweed, collected from the beaches, may have been employed in conjunction with hay as fodder for the animals, while peat collected from meadows may not only have served as flooring but also as fuel. The different groups of insects identified from the Tatsip Ataa midden allow a privileged glimpse into the past daily lives of Norse Greenlanders.

Acknowledgments

The authors would like to thank Jette Arneborg of the Danish National Museum and Konrad Smiarowski, a doctoral candidate at the City University of New York, for the opportunity to participate in this project and for support for the laboratory analyses. We would also like to thank the Groupe de recherches en archéométrie at Université Laval for financing part of the sample preparation and processing. The authors would like to thank Bryn Tapper for his help with the ArcGIS program and Christian Koch Madsen for his plan of the *Tatsip Ataa* site, as well as Eva Panagiotakopulu and other anonymous reviewers for thoughtful suggestions on how to improve the original manuscript.

Literature Cited

Amorosi, T., P.C. Buckland, G. Ólafsson, J.P. Sadler, and P. Skidmore. 1992. Site status and the palaeoecological record: A discussion of the results from Bessasstaðir, Iceland. Pp. 169–191, *In* C.D. Morris and D.J. Rackham (Eds.). Norse and Latter Settlement and Subsistence in the North Atlantic. University of Glasgow, Glasgow, UK. 230 pp.

Amorosi, T., P.C. Buckland, K. Magnússon, T.H. McGovern, and J.P. Sadler. 1994. An archaeozoological examination of the midden at nesstofa, Reykjavík, Iceland. Pp. 69–80, *In* R. Luff and P. Rowley-Conwy (Eds.). Whither Environmental Archaeology. Oxbow Monograph, Oxford, UK. 212 pp.

Amorosi, T., P.C. Buckland, K.J. Edwards, I. Mainland, J.P. McGovern, and P. Skidmore. 1998. They did not live by grass alone: The politics and palaeoecology of animal fodder in the North Atlantic region. Environmental Archaeology 1:41–54.

Bailey, A.M., P. Prociv, and H.P. Petersen. 2003. Head lice and body lice: Shared traits invalidate assumptions about evolutionary and medical distinctions. Australian Journal of Medical Science 24:48–62.

Bain, A. 2001. Archaeoentomological and Archaeoparasitological Reconstructions at Îlot Hunt (CeEt-110): New Perspectives in Historical Archaeology (1850–1900). Vol. 973. British Archaeological Reports, Oxford, UK. 310 pp.

Bain, A. 2004. Irritating intimates: The archaeoentomology of lice, fleas, and bedbugs. Northeast Historical Archaeology 33:81–90.

Böcher, J. 1988. The coleoptera of Greenland. Meddelelser om Grønland, Biosciences 26:100.

Böcher, J. 1997. History of the Greenland insect fauna with emphasis on living and fossil beetles Pp. 35–48, *In* A.C. Ashworth, P.C. Buckland, and J.P. Sadler (Eds.). Studies in Quaternary Entomology: An Inordinate Fondness for Insects. Quaternary Proceedings. Vol. 5. Wiley, Chichester, UK. 305 pp.

Böcher, J., and B. Fredskild. 1993. Plant and arthropod remains from the palaeo-Eskimo site on Qeqertasussuk, West Greenland. Meddelelser om Grønland, Geoscience Vol. 30. 37 pp.

Böhme, J. 2005. Die Käfer Mitteleuropas. K. Katalog (Faunistiche Übersicht) (2nd Editon). Spektrum Academic, Munich, Germany.

Bousquet, Y. 1990. Beetles Associated with Stored Products in Canada : An Identification Guide. Canadian Government Publishing Centre, Ottawa, ON, Canada. 220 pp.

Bresciani, J., N. Haarløv, P. Nansen, and G. Moller. 1983. Head louse (*Pediculus humanus* subsp. capitis de Geer) from mummified corpses of Greenlanders, A.D. 1460 (± 50). Acta Entomologica Fennica 42:24–27.

Bresciani, J., N. Haarløv, P. Nansen, and G. Moller. 1989. Head lice in mummified Greenlanders from A.D. 1475. Pp. 89–92, *In* J.P.H. Hansen and H.C. Gulløv (Eds.). The Mummies from Qilakitsoq: Eskimos in the 15th Century. Meddelelser om Grønland, Man and Society, Copenhagen, Denmakr. 198 pp.

Buckland, P.C. 2000. The North Atlantic environment. Pp. 146–153, *In* W. Fitzhugh and E.I. Ward (Eds.). Viking: The North Atlantic Saga. Smithsonian Institution Press, Washington, DC, USA. 432 pp.

Buckland, P.C., and E. Panagiotakopulu. 2005. Archaeology and palaeoecology of the Norse Atlantic Islands: A review. Pp. 136–150, *In* A. Mortensen and S.V. Arge (Eds.). Viking and Norse North Atlantic. Select Papers from the Proceedings of the Fourteenth Viking Congress, Tórshavn, 19–30 July 2001. Annales Societatis Scientiarum Færoensis, Tórshavn, The Faroe Islands. 441 pp.

Buckland, P.C., and D.W. Perry. 1989. Ectoparasites of sheep from Storaborg, Iceland and their interpretation. Piss, parasites, and people, a palaeoecological perspective. Hikuin 15:37–46.

Buckland, P.C., G. Sveinbjarnadóttir, D. Savory, T.H. McGovern, P. Skidmore, and C. Andreasen. 1983 Norsemen at Nipáitsoq, Greenland: A palaeoecological investigation. Norwegian Archaeological Review 16:86–98.

Buckland, P.C., A.J. Dugmore, and J.P. Sadler. 1991. Faunal change or taphonomic problem? A comparison of modern and fossil insect faunas from southeast Iceland. Pp. 127–146, *In* J.K. Maizels and C. Caseldine (Eds.). Environmental Change in Iceland: Past and Present. Kluwer Academic Publishers, Dordrecht, The Netherlands. 332 pp.

Buckland, P.C., J.P. Sadler, and G. Sveinbjarnadóttir. 1992. Palaeoecological Investigations at Reykholt, Western Iceland. Pp. 149–167, *In* C.D. Morris and D.J. Rackham (Eds.). Norse and Latter Settlement and Subsistence in the North Atlantic. University of Glasgow, Glasgow, UK. 230 pp.

Buckland, P.C., J.P. Sadler, and D. Smith. 1993. An Insect's eye-view of the Norse farm. Pp. 518–528, *In* C.E. Batey, J. Jesch, and C. D. Morris (Eds.). The Viking Age in Caithness, Orkney, and the North Atlantic. Edinburgh University Press, Edinburgh, UK. 560 pp.

Buckland, P.C., T.H. McGovern, J.P. Sadler, and P. Skidmore. 1994. Twig layers, floors, and middens. Recent palaeoecological research in the Western Settlement, Greenland. Pp. 132–143, *In* B. Ambrosiani and H. Clarke (Eds.). Developments Around the Baltic and the North Sea in the Viking Age (Twelfth Viking Congress) Birka Studies 3. Produced by the Birka Project for Riksantikvarieämbetet and Statens Historiska Museer, Stockholm, Sweden. 320 pp.

Buckland, P.C., T. Amorosi, L.K. Barlow, A.J. Dugmore, P.A. Mayewski, T.H. McGovern, A.E.J. Ogilvie, J.P. Sadler, and P. Skidmore 1996. Bioarchaeological and climatological evidence for the fate of Norse farmers in medieval Greenland. Antiquity 70:88–96.

Buckland, P.C., P.I. Buckland, and P. Skidmore. 1998. Insect remains from GUS: An interim report. Pp. 74–79, *In* J. Arneborg and H.C. Gulløv (Eds.). Man, Culture, and Environment in Ancient Greenland. Danish National Museum, Copenhagen, Denmark. 212 pp.

Buckland, P.C., K.J. Edwards, E. Panagiotakopulu, and E.J. Schofield. 2009. Palaeoecological and historical evidence for manuring and irrigation at Garðar (Igaliku), Norse Eastern Settlement, Greenland. The Holocene 19:105–116.

Buckland, P.I., and P.C. Buckland. 2006. BugsCEP Coleopteran Ecology Package. IGBP PAGES/World Data Center for Paleoclimatology Data Contribution Series # 2006–116. NOAA/NCDC Paleoclimatology Program, Boulder CO, USA. Available online at http://www.bugscep.com. Accessed 5 April 2013.

Carrott, J., and H.K. Kenward. 2001. Species associations among insect remains from urban archaeological deposits and their significance in reconstructing the past human environment. Journal of Archaeological Science 28:887–904.

Chepstow-Lusty, A.J., M.R. Frogley, B.S. Bauer, M.J. Leng, A.B. Cundy, K.P. Boessenkool, and A. Gioda. 2007. Evaluating socio-economic change in the Andes using oribatid mite abundanced as indicators of domestic animal densities. Journal of Archaeological Science 34:1178–1186.

Coope, G.R. 1978. Constancy of insect species versus inconstancy of Quaternary environments. Pp. 176–187, *In* L.A. Mound and N. Waloff (Eds.). Diversity of Insect Faunas. Vol. 9. Blackwell, Oxford, UK. 204 pp.

Coope, G.R. 1981. Report on the coleoptera from an eleventh-century house at Christ Church Place, Dublin. Pp. 51–56, *In* H. Bekker-Nielsen, P. Foote, and O. Olsen (Eds.). Proceedings of the Eighth Viking Congress (1977). Odense University Press, Odense, Denmark. 294 pp.

Coope, G.R., and P.J. Osborne. 1967. Report on the coleopterous fauna of the Roman well at Barnsley Park, Gloucestershire. Transactions of the Bristol and Gloucestershire Archaeological Society 86:84–87.

Dussault, F. 2011. Hygiène et Considérations Hygiéniques des Inughuits du Nord-ouest du Groenland. Étude Archéoentomologique des Sites d'Iita, Cap Grinnell et Qaqaitsut au Groenland. Master's degree. Université Laval, Québec City, PQ, Canada. 117 pp.

Elias, S.A. 1994. Quaternary Insects and their Environments. Smithsonian Institution Press, Washington, DC, USA. 284 pp.

Elias, S.A. 2010. Advances in Quaternary Entomology. Vol. 12 Elsevier, Amsterdam, The Netherlands. 288 pp.

Erickson, J.M. 1988. Fossil oribatid mites as tools for Quaternary paleoecologists: Preservation quality, quantities, and taphonomy. Pp. 207–226, *In* R.S. Laub, N.G. Miller, and D.G. Steadman (Eds.). Late Pleistocene and Early Holocene Paleoecology and Archaeology of the Eastern Great Lakes Region. Vol. 33. Bulletin of the Buffalo Society of Natural Sciences, Buffalo, NY, USA. 316 pp.

Fenton, A. 1978. The Northern Isles: Orkney and Shetland. Tuckwell Press, Edinburgh, UK. 721 pp.

Forbes, V., F. Dussault, and A. Bain. 2013. Contribution of ectoparasites studies in archaeology with two examples from the North Atlantic region. International Journal of Paleopathology. Available online at http://dx.doi.org/10.1016/j.ijpp.2013.07.004. Accessed 6 December 2013.

Girling, M. 1984. Eighteenth-century records of human lice (Phthiraptera, Anoplura) and fleas (Siphonaptera, Pulicidae) in the city of London. Entomologist's Monthly Magazine 120:207–210.

Grimm, E.C. 2011. Tilia version 1.7.16. Available online at http://museum.state.il.us/pub/grimm/. Accessed 19 November 2013.

Haarløv, N. 1967. Arthropoda (Acarina, Diptera) from subfossil layers in West Greenland. Meddelelser om Grønland 184:1–17.

Hall, A.R,. and H.K. Kenward. 1990. Environmental evidence from the colonia: Tanner row and Rougier street. Vol. 14/6 Council for British Archaeology for York Archaeological Trust, York, UK. 56 pp.

Hallsson, S.V. 1964. The Uses of Seaweeds in Iceland. Pergamon, New York, NY, USA. Pp. 398–405.

Hansen, J.P.H., J. Meldgaard, and J. Nordqvist. 1991. The Greenland Mummies. British Museum Publications, London, UK. 192 pp.

Kenward, H.K. 1975. Pitfalls in the environmental interpretation of insect death assemblages. Journal of Archaeological Science 2:85–94.

Kenward, H.K. 1978. The value of insect remains as evidence of ecological conditions on archaeological sites. Pp. 25–38, *In* D.R. Brothwell, K.D. Thomas, and J. Clutton-Brock (Eds.). Research Problems in Zooarchaeology. Occasional Publication 3. Institute of Archaeology, University of London, London, UK. 155 pp.

Kenward, H.K. 2009. Northern Regional Review of Environmental Archaeology Invertebrates in Archaeology in the North of England Environmental Studies Report. English Heritage, Portsmouth, UK. 625 pp.

Kenward, H.K., and A.R. Hall. 1995. Biological evidence from Anglo-Scandinavian deposits at 16-22 Coppergate. The Archaeology of York 14:435–797.

Kenward, H.K., A.R. Hall, and A.K.G. Jones. 1980. A Tested set of techniques for the extraction of plant and animal macrofossils from waterlogged archaeological deposits. Science and Archaeology 22:3–15.

Kenward, H.K., A.R. Hall, A.K.G. Jones, and T.P. O'Connor. 1984. Environmental archaeology at York in retrospect and prospect. Pp. 152–179, *In* H.C.M. Keeley (Ed.). Environmental Archaeology. A regional review. Department of Ancient Monuments and Historic Buildings Occasional Papers 6, London, UK. 379 pp.

Kenward, H.K., C. Engleman, A. Robertson, and F. Large. 1986. Rapid scanning of urban archaeological deposits for insect remains. Circaea 3:163–172.

Kenward, H.K., A.R. Hall, and A.K.G. Jones. 2012. Turf roofs and urban archaeological build-up. Environmental Archaeology 17(1):66–79.

Konráðsdóttir, H. 2007. An Archaeoentomological Contribution to the Skálholt Project, Iceland. University of Edinburgh, Edinburgh, UK. 88 pp.

Larsson, S.G. and G. Gigja. 1959. Coleoptera 1. synopsis. Pp. 218, *In* A. Fridriksson and S. L. Tuxen (Eds.). The Zoology of Iceland 3, Part 46a. Ejnar Munksgaard, Copenhagen, Denmark, and Reykjavik, Iceland. 218 pp.

Leo, N.P., H.J.H. Campbell, X. Yang, K. Mumcuoglu, and S.C. Barker 2002. Evidence from mitochondrial DNA that head lice and body lice of humans (Phthiraptera: Pediculidae) are conspecific. Journal of Medical Entomology 39:662–666.

Lindroth, C.H. 1961. The Ground Beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Vol. 2 Lund Entomologiska Sällskapet, Lund, Sweden. 1192 pp.

Lindroth, C.H. 1963. The Ground Beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Vol. 3 Lund Entomologiska Sällskapet, Lund, Sweden. 1192 pp.

Lindroth, C.H. 1966. The Ground Beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Vol. 4 Lund Entomologiska Sällskapet, Lund, Sweden. 1192 pp.

Lindroth, C.H. 1968. The Ground Beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Vol. 5 Lund Entomologiska Sällskapet, Lund, Sweden. 1192 pp.

Lindroth, C.H. 1969. The Ground Beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Vol. 6 Lund Entomologiska Sällskapet, Lund, Sweden. 1192 pp.

Makarova, O.L., A.O. Bieńkowski, V.I. Bulavintsev, and A.V. Sokolov. 2007. Beetles (Coleoptera) in polar deserts of the Severnaya Zemlya Archipelago. Entomological Review 87(9):1142–1154.

Maunder, J.W. 1983. The appreciation of lice. Proceedings of the Royal Institution of Great Britain 55:1–31.

McGhee, R. 2009. The population size and temporal duration of the Thule in arctic Canada. Pp. 75–90, *In* B. Gronnow and H.C. Gullov (Eds.). On the Track of the Thule Culture from Bering Strait to East Greenland; Proceedings of the SILA Conference "The Thule Culture—New Perspectives in Inuit Prehistory", Copenhagen, 26th–28th October 2006. Greenland Research Center (Nationalmuseet : Denmark), Copenhagen, Denmark. 263 pp.

McGovern, T.H., P.C. Buckland, D. Savory, G. Sveinbjarnardóttir, C. Andreason, and P. Skidmore. 1983. A study of the faunal and floral remains from two Norse farms in the Western settlement, Greenland. Arctic Anthropology 20:93–120.

NunaGIS and the Danish Geodata Agency. 2013. Topographic map of Greenland. Available online at http://www.nunagis.gl/en/ and http://www.gst.dk/English/. Accesssed 11 May 2013.

Ólafsson, G., and H. Ágústsson. 2003. The reconstructed medieval farm in Jórsárdalur and the development of the Icelandic turf house. National Museum of Iceland, Reykjavík, Iceland. 35 pp.

Panagiotakopulu, E. 2004. Dipterous remains and archaeological interpretation. Journal of Archaeological Science 31:1675–1684.

Panagiotakopulu, E., and P. Buckland. 2013. Late Holocene environmental change in southwest Greenland: Fossil assemblages from Tasiusaq. Boreas. Available online at DOI:10.1111/j.1502-3885.2012.00277.x. Accessed 1 October 2013.

Panagiotakopulu, E., P. Skidmore, and P. Buckland. 2007. Fossil insect evidence for the end of the Western Settlement in Norse Greenland. Naturwissenschaften 94:300–306.

Panagiotakopulu, E., M. Greenwood, and P. Buckland. 2012. Insect fossils and irrigation in medieval Greenland. Geografiska Annaler: Series A. Physical Geography 94:531–548

Ross, J.M., and C. Zutter. 2007. Comparing norse animal husbandry practices: Paleoethnobotanical analyses from Iceland and Greenland. Arctic Anthropology 44:62–85.

Roussell, A. 1941. Farms and churches of the medieval Norse settlement in Greenland. Meddelelser om Grønland 89:1.

Sadler, J.P. 1987. The analysis of insect remains from Norse sites in the former Western Settlement of Greenland. M.Sc. Thesis. University of Birmingham, Birmingham, UK.

Sadler, J.P. 1991. Beetles, boats, and biogeography. Acta Archaeologia 61:199–211.

Sadler, J.P., and P. Skidmore. 1995. Introductions, extinctions or continuity? Faunal change in the North Atlantic Islands. Pp. 206–225, *In* R. Butlin and N. Roberts (Eds.). Ecological Relations in Historical Times. Institute of British Geographers, Blackwell, Oxford, UK. 344 pp.

Schofield, J.E., K.J. Edwards, and C. Christensen. 2008. Environmental impacts around the time of Norse landnám in the Qorlortoq valley, Eastern settlement, Greenland. Journal of Archaeological Science 35:1643–1657.

Skidmore, P. 1996. A Dipterological Perspective on the Holocene History of the North Atlantic. Ph.D. Dissertation. University of Sheffield, Sheffield, UK.

Smiarowski, K. 2012. E172 Tatsip Ataa midden excavation 2009 and 2010 preliminary excavation report. City University of New York, NY, USA. 128 pp.

Smith, D.N. 1996. Thatch, turves, and floor deposits: A survey of Coleoptera in material from abandoned Hebridean blackhouses and the implications for their visibility in the archaeological record. Journal of Archaeological Science 23:161–17

van Hoof, J., and F. van Dijken 2008. The historical turf farms of Iceland: Architecture, building technology, and the indoor environment. Building and Environment 43:1023–1030.

Veracx, A., R. Rivet, K.D. McCoy, P. Brouqui, and D. Raoult. 2012. Evidence that head and body lice on homeless persons have the same genotype. Plos One 7(9):1–8.

Vickers, K., and E. Panagiotakopulu. 2011. Insects in an abandoned landscape: Late Holocene palaeoentomological investigations at Sandhavn, Southern Greenland. Environmental Archaeology 16:49–57.

Zutter, C. 2000. Wood and plant-use in 17^{th}–19^{th}-century Iceland: Archaeobotanical analysis of Reykholt, Western Iceland. Environmental Archaeology 5:73–82.

Appendix 1. Insects and arthropods identified from excavation blocks B and C in a midden at the Tatsip Ataa. The two columns preceding the Total column in the second part of the Appendix represent the samples taken in the excavation block C. This Appendix was produced using the BugsCEP database (Buckland and Buckland 2006)

Species name	[020] s004	[021] s049	[023] s008	[024] s009	[026] s014	[027] s016	[029] s020	[034] s030	[036] s032	[033] s028	[037] s034	[039] s037	[040] s040	[041] s042	[042] s044	[044] s046
Coleoptera																
Carabidae																
Carabidae indet.							2	1				1				
Nebria rufescens (Ström.)															1	
Bembidion grapii Gyll.				1			3	3			2	2	1		1	1
Patrobus septentrionis Dej.									1						1	
Trichocellus cognatus (Gyll.)				1			2	1			1	4	2			3
Dytiscidae																
Dytiscidae indet.												1				
Hydroporus morio Aubé																
Staphylinidae																
Staphylinidae indet.			1	2	4	5	5	2	4	2	15	13	2		4	6
Omalium excavatum Steph.					3		7	3	1		4	7	2		7	2
Xylodromus concinnus (Marsham)			1	1	4	3	8	6	2	1	5	8	2		2	8
Micralymma marinum (Ström.)					4			3			1	7				1
Micralymma brevilingue Schöidte											1	2				1
Micralymma sp.	1						3				1		1			
Philonthus sp.					2		2			1						
Quedius mesomelinus (Marsham)								1				1	3			
Quedius fellmanni (Zett.)										1	9		4			1
Quedius spp.	1			2	2	2	3	4	1		21	3			7	1
Atheta spp.					1		5	1	5		7	9	3		4	5
Byrrhidae																
Simplocaria metallica (Sturm)	1			1	5		11	6	3	1	24	9	2		3	5
Simplocaria elongata Sahl.											1					
Simplocaria sp.										1	1					
Byrrhus fasciatus (Forst.)																
Cryptophagidae																
Cryptophagus spp.			2				3					1			1	
Caenoscelis ferruginea (Sahl.)																
Atomaria spp.							3									
Latridius minutus group (L.)	1		1	2	3	2	13	1	1	1	3	9	1		3	2
Coccinelidae																
Nephus redtenbacheri (Muls.)											1					
Curculionidae																
Curculionidae indet.								1								1
Otiorhynchus arcticus (O. Fabricius)							1				1					
Otiorhynchus nodosus (Müll.)							2		1		3					
Dorytomus imbecillus Faust											1					
Hypera diversipunctata Schrank																

Species name	[020] s004	[021] s049	[023] s008	[024] s009	[026] s014	[027] s016	[029] s020	[034] s030	[036] s032	[033] s028	[037] s034	[039] s037	[040] s040	[041] s042	[042] s044	[044] s046
Phthiraptera																
Pediculidae																
Pediculus humanus L.						1										8
Siphonaptera																
Pulicidae																
Pulex sp.					3											
Diptera																
Hippoboscidae																
Melophagus ovinus (L.)							3	3			1	2	1		3	6
Hemiptera																
Lygaeidae																
Nysius groenlandicus (Zett.)											4	4			1	
Aphidoidae																
Aphidoidae indet.													1		25	
MNI	4	0	5	10	31	13	76	36	19	8	107	83	25	0	63	51

Species name	[046] s048	[048] s051	[050] s053	[051] s055	[052] s057	[054] s061	[057] s064	[053] s069	[055] s063	[059] s067	[062] s071	[063] s073	[069] s084	[075] s088	[195] s101	Total
Coleoptera																
Carabidae																
Carabidae indet.									1			1				6
Nebria rufescens (Ström.)	1															2
Bembidion grapii Gyll.	1	1	2	2	1	1		1		1			2			26
Patrobus septentrionis Dej.					1											3
Trichocellus cognatus (Gyll.)		1	1	2				1	1	1				1		22
Dytiscidae																
Dytiscidae indet.															1	2
Hydroporus morio Aubé		1	1						2			1				5
Staphylinidae																
Staphylinidae indet.	5	4	12	13	1	9	4	6	3	1	1		2			126
Omalium excavatum Steph.	4	4	2	7	1	4		5	2	5	1		1	5	1	78
Xylodromus concinnus (Marsham)	3	10	7	8	6	6	4	9	9	6	2	3	3	4	1	132
Micralymma marinum (Ström.)	1	2	1	2	2	1		6	3	2			2	1		39
Micralymma brevilingue Schöidte		2		2		2		1			1					12
Micralymma sp.			4									1			1	12
Philonthus sp.											1					6
Quedius mesomelinus (Marsham)		3		1	1		1	1								12
Quedius fellmanni (Zett.)	2	3	3	4	1	4	3	6	1	1	1		4			48
Quedius spp.	3	7	9	3			4		1	1				2		77
Atheta spp.	3	4	7	12	1	8	2	2	1	2	1	1	3	2		89

Species name	[046] s048	[048] s051	[050] s053	[051] s055	[052] s057	[054] s061	[057] s064	[053] s069	[055] s063	[059] s067	[062] s071	[063] s073	[069] s084	[075] s088	[195] s101	Total
Byrrhidae																
Simplocaria metallica (Sturm)	5	8	5	10	3	5	5	5	6	3	1		7	4		138
Simplocaria elongata Sahl.																1
Simplocaria sp.			1						1			1			1	6
Byrrhus fasciatus (Forst.)			1													1
Cryptophagidae																
Cryptophagus spp.	1	1	1			1						1		1		13
Caenoscelis ferruginea (Sahl.)										1						1
Atomaria spp.																3
Latridius minutus group (L.)	3	6	6	1	2	4	2	11	4	5		1		5	1	94
Coccinelidae																
Nephus redtenbacheri (Muls.)		1	1	1				1	1							6
Curculionidae																
Curculionidae indet.				1		1	1						1	1		7
Otiorhynchus arcticus (O. Fabricius)				1				2		1						6
Otiorhynchus nodosus (Müll.)	1	1			1				1							10
Dorytomus imbecillus Faust	2														1	4
Hypera diversipunctata Schrank	1		1		1		1									4
Phthiraptera																
Pediculidae																
Pediculus humanus L.		13			1	5	1						2			31
Siphonaptera																
Pulicidae																
Pulex sp.												1				4
Diptera																
Hippoboscidae																
Melophagus ovinus (L.)	1	6	8	3	4	2										43
Hemiptera																
Lygaeidae																
Nysius groenlandicus (Zett.)	1	3		3		2	1	6		1						26
Aphidoidae	15					1							1			43
Aphidoidae indet.	53	81	73	76	27	56	29	63	37	31	9	11	28	26	7	1138