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Insect remains from the Romano-British ditch terminal at the Flodden Hill Rectilinear Enclosure

by Harry Kenward

Summary

Following assessment, a single sample from the lowest fill, dated to c. AD 200, of a ditch terminal at the Flodden Hill Rectilinear Enclosure site has been analysed for its content of insect and other macro-invertebrate remains. Numerous remains were present, and their preservation excellent. It is argued that the remains represent a use phase and not abandonment.

The ditch probably held water for most of the year, and its banks (and probably the adjacent ground surface) bore nettlebeds and other perennial weeds. There was no evidence of large accumulations of decaying matter, and no clear trace of insects from buildings.

Species indicating open ground and dung suggested that grazing land predominated in the surroundings. There was no evidence of woodland or scrub. Four specimens of the nettlebug Heterogaster urticae *are of particular significance as strong evidence of temperatures well above those of the present day.*

Keywords: INVERTEBRATE REMAINS; INSECTS; ROMANO-BRITISH; LANDSCAPE; GRAZING; CLIMATE; *HETEROGASTER URTICAE*

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Introduction

A single sample of sediment, 19 (2 of 2) from a fill (Context 005) of a cut feature identified as a ditch terminal at the Flodden Hill Rectilinear Enclosure site was submitted for assessment of insect remains by Clive Waddington, Newcastle University. (The site is also referred to in certain records as Milfield, site code MILF 99.4.) The remains clearly had considerable potential for local ecological reconstruction, as well as including at least one species with significant climatic implications (Kenward 2000). Detailed analysis was therefore undertaken.

The following is condensed from a draft of the archaeological report.

The Flodden Hill rectilinear enclosure survives as a crop mark site visible on aerial photographs. It is centred at NT92003610 on an east-facing slope. The area investigated was on the east side of the enclosure, located at the downslope end of the site. The trench included the entrance, associated ditch terminals, and part of the interior of the enclosure.

The ditch fills had been truncated by ploughing. The south terminal was sectioned by machine; it was considered unsafe to excavate by hand. The cut revealed a section which showed that the ditch had a single original cut [006] with no later recuts evident. The ditch had a singe continuous concave profile on the outer edge and a stepped convex profile on the inner. It measured 5.15m in width and 2.07m deep below the base of the modern top soil.

The basal ditch deposit (005), examined here, was a waterlogged black silty clay. It was the primary deposit and appeared as one block of homogeneous dark sloppy silt with high organic content including waterlogged wood. Occasional small stones up to 0.1m across were encountered. It was not horizontally bedded but sloped upwards at its sides, suggesting that it had formed naturally and was not a dump. It had a maximum depth of 0.37m. The excavated silt contained charred barley seeds, waterlogged branch wood and herbs plants typical of disturbed ground with nearby cultivation.

Above 005 was a lower clay fill (004) consisting of a horizontally bedded loose grit and clay with large stones. It had a maximum depth of 0.75m, and was overlain by a 0.65m deep horizontally bedded clay silt (003) consisting of a stiff fine clay, light grey in colour with a blue tint indicating that it had gleyed. The upper fill of the terminal (Context 002) consisted of a boulder fill set in a loose and gritty silty clay matrix brown in colour. This was probably deliberate backfilling.

Enclosures of this kind are common in northern England, and considered to be Romano-British in date. Radiocarbon dates for the context analysed for insect remains will be forthcoming but a date around c.200AD is anticipated, relating to the time at which the enclosure was occupied. The manner of subsequent infilling of the ditch suggests that the site was finally abandoned and the ditch deliberately levelled.

Methods

After brief description following a standard *pro forma*, a subsample of 2.0 kg was submitted to sieving and full paraffin flotation following the methods described by Kenward *et al.* (1980). No further raw sediment was available for the phase of detailed analysis so, in order to search for climatic indicators and synanthropes, the dried residue from a bulk-sieved sample processed at the University of Durham was wetted then boiled to expel air, then subjected to paraffin flotation.

Results

The sample of raw sediment was described in the laboratory as moist, dark brown slightly

sandy silty amorphous and detrital organic material, with some stones to 50 mm. About 5 ml of organic matter was recovered in the flot, and most of this was fragments of insects. Preservation was superb (modes E1.5, F 2.0, following the scheme of Kenward and Large 1992), and there were many entire or nearly entire sclerites of even large species such as dung beetles, chafers and silphids, as well as the delicate nymphs of bugs. A very large flot (about 50 ml) was recovered from the bulk-sieved material and this, too, was rich in insect remains. The species recorded from the two subsamples are listed in Table 1, and species lists by subsample given in Table 2 (numbers of individuals for the 2 kg subsample and non-quantitative record of additional taxa for the BS subsample). Statistics concerning ecological groups are given in Table 3, and the ecological groups defined briefly in Table 4.

Because this is a primary fill it is very likely that it accumulated while the site was in use, and not in abandonment. This is supported by the strong indications of an open environment (see below). It is therefore considered safe to use the fauna to reconstruct conditions at the site in its use phase. The following account is based on remains recovered from the 2 kg raw sediment sample (numbers of individuals are for this), but the results from the bulk sample have been drawn on where appropriate ('BS'). It should be noted that many species mentioned below as being represented by one or a few individuals were present in larger numbers in the bulk sample, suggesting that they lived close by and were not 'background fauna' which had travelled long distances.

Main statistics for the assemblage of adult beetles and bugs are given in Table 3. In general terms, this was a very species-rich fauna (alpha of Fisher *et al.* 1943 = 121, SE = 13), mostly reflecting open-air habitats (63% of individuals and 61% of taxa falling in the 'outdoor' category, 'OB' in Table 3, being unable to live in buildings or artificial accumulations of decaying matter). Species associated with decomposing matter (RT) were poorly represented by comparison with occupation deposits *sensu stricto*, making up a third of the fauna; of this component about a third again was contributed by species usually found in dung and other very foul matter (RF). Synanthropes (species favoured by intensive human occupation, excluding those associated with farmland etc., SA in Table 3) were rare (11%), and species typical of such habitats very rare (ST: 2%). There were no insects dependant upon human dwellings or other structures (SS).

Conditions in the ditch

That the deposit formed in water was clear from the presence of a range of aquatics. These included abundant ephippia (resting eggs) of cladocerans (waterfleas), principally a form identifiable as *Daphnia* sp., but including at least three other species. There were appreciable numbers of a range of aquatic beetles and bugs (21 species, 39 individuals). The latter were almost all species which would be at home in shallow, reasonably clean, water with a little vegetation, and not necessarily permanent. The more abundant were two small *Helophorus* species (8 and 2), *H. aquaticus* (3), *Limnebius truncatellus* (3), a corixid bug (2), *Hydrobius fuscipes* (2) and *Ochthebius minimus* (2). Duckweeds (*Lemna*) are suggested by the weevil *Tanysphyrus lemnae* (BS). There were remains of two species of elmid beetles, indicative of flowing water: *Esolus parallelipipedus* (two individuals) and *Oulimnius* sp. (one). These may have come from a clean, permanent stream inflow, but

seem more likely to have arrived on the wing as 'background fauna' (*sensu* Kenward 1978).

There were a few waterside taxa, none of them abundant. Among the ground beetles, *Pterostichus nigrita* (2) is particularly associated with litter by water, as is the hydrophilid *Cercyon ustulatus* (Hansen 1987; BS). *Trechus secalis* and *T. rubens* (both from the bulk sample) are found in shady and damp places. The rove beetles *Lesteva longoelytrata* (2), *Platystethus nitens* (3) and *P. nodifrons* (BS) are typically found on waterside mud. There were several other species likely to be found at the edge of the water in a ditch, among them some plant-feeders and ground beetles. The plant-feeders included *Chrysolina staphylaea*, a leaf beetle generally found in damp places and associated with plants such as *Mentha* spp. and *Veronica beccabunga* L. (Hansen 1927). Similarly, *Phaedon tumidulus* lives on various umbellifers (Greenwood 1996), very often by water or in damp places. Among the 'froghoppers', *Aphrodes flavostriatus* (2) is found on grasses in damp places and *Megophthalmus ?scanicus* (3) is also associated with grasses (Le Quesne 1965). The weevil *Notaris acridulus* (BS) is typical of waterside vegetation.

The immediate surroundings

It seems that the immediate surroundings of the ditch supported a flora of perennial weeds. A range of species typical of well-established beds of stinging nettles (*Urtica dioica* L.) was recorded. These included: *Brachypterus glaber* (13 individuals, the most numerous beetle, and a nettle feeder); *Scolopostethus ?affinis* (5 individuals, a ground bug typical of nettle beds but not confined to them); *Cidnorhinus quadrimaculatus* (3, a weevil almost entirely confined to nettles); *Trioza urticae* (2 adults and numerous nymphs, a nettle-feeding 'plant louse'); and *Heterogaster urticae* (a single individual, the 'nettlebug', well to the north of its normal range in Northumberland, see below). This fauna suggests well established and little-disturbed clumps of nettles of substantial size, perhaps at least a metre or more across, in a sunny spot. The plants may well have grown on the banks of the ditch.

Other insects associated with particular perennial weeds were recorded. There were three *Gastrophysa viridula* (a leaf beetle found on docks and their relatives, *Rumex* and *Polygonum*), and *Chaetocnema concinna* (1) and *Rhinoncus pericarpius* (BS), both also associated with *Rumex* and *Polygonum*. There were single individuals of *Phyllotreta nemorum* group (found on various crucifers) and *Crepidodera ferruginea* (on a range of herbaceous plants). *Gymnetron labile* (1) and *Mecinus pyraster* (BS) both live on plantains, *Plantago*, and *Alophus triguttatus* (BS) is a polyphage with a preference for plantains (Morris 1997). The various *Apion* were probably of species associated with clovers and vetches. Some other polyphagous plant feeders were recorded, for example the 'cuckoo spit' bug *Philaenus spumarius* (3), and the froghoppers *Aphrodes* spp. (3+2). The ladybird *Rhyzobius litura*, a typical denizen of rough herbaceous vegetation, was also present (1).

Many of the other species recorded probably lived on the ground or in litter below these weeds, for example the ground bugs *Stygnocoris pedestris* and *Drymus sylvaticus* (one of each); most of the ground beetles, *Tachyporus* and *Tachinus* species, and *Micropeplus staphylinoides*. The weevil *Otiorhynchus ovatus* (BS) is found amongst short vegetation, often where there is bare soil, and may have lived on the eroding ditch bank.

The wider surroundings: land use

Some species may have lived in the immediate vicinity of the ditch but seem as likely to reflect the wider landscape. Species indicating short herbaceous vegetation, including grassland, were conspicuous and included the chafers *Phyllopertha horticola* (3 individuals, and rather abundant in the bulk sample) and *Serica brunnea* (1), the elaterids (click beetles) *Athous haemorrhoidalis* (?2 adults and several larvae, the latter perhaps having lived in soil which eroded into the ditch) and *Agriotes* sp., and *Dascillus cervinus* (1).

Dung beetles were well represented, *Aphodius prodromus* (Brahm) and *A. contaminatus* (Herbst) being rather common (11 and 8 individuals respectively and abundant in the BS), while there were also single individuals of *A. fimetarius*, *A. granarius* and three unidentified species from this genus, and one *Geotrupes* sp. It appears likely that dung was abundant in the landscape, and perhaps very near by, probably indicating grazing land. (The interpretation of land use from suites of dung beetles is discussed by Robinson 1983; 1991). In addition to these scarabaeid dung beetles, which almost certainly bred in dung, various other species may have lived in the droppings of livestock, but may have used other foul matter: *Megasternum obscurum* (5); *Anotylus nitidulus* (5); *Platystethus arenarius* (4); *Onthophilus striatus* (3); and the *Anotylus* species (5 *nitidulus*, 3 each of ?*sculpturatus* and *tetracarinatus*, 2 *rugosus*), the *Tachinus* species (3 *marginellus*, 2 each of *corticinus* and *signatus*) and *Cryptopleurum minutum* (1). Overall, species typically associated with foul matter made up about 12% of the assemblage of adult beetles and bugs (Table 3, PNRF), and true dung beetles over 10%. There was no evidence of material such as house floor litter, midden accumulations, hay, or stable manure.

Much of the fauna consisted of species favoured by human modification of the natural landscape (i.e. 'semi-natural' environments, cf. Kenward and Allison 1994). This impact may have been quite strong, leading to a generally open landscape, as no species associated with trees or shrubs were found in either subsample despite the presence of 'branch wood' in the sediment (see above). This is regarded as good evidence that the deposit formed during a period when the site saw intensive use. Although tree-associated species may not occur in deposits formed even quite close to woodland (Kenward *et al.* unpublished), scrub would cover an abandoned site, including the ditch margins, in only a few years and so be detectable in the ditch fill.

Synanthropic species associated with human occupation

The lack of evidence for the kind of decaying matter typical of occupation sites has been remarked upon above. Some beetles often found in artificial accumulations of decomposing matter were present, although in modest numbers., and most may have exploited dung (or for most of these species, litter amongst vegetation or by water). A few, for example *Ptenidium* sp. (2) and *Gyrohypnus* spp. (one each of *angustatus* and *fracticornis*), are perhaps more likely to have come from litter-like material, and this is certainly the case for species such as *Stephostethus lardarius* (2) and *Enicmus* sp. (2). This material was not necessarily the litter of human occupation, however: naturally fallen plant debris or piles of vegetation left after cutting would have sufficed.

Clearly occupation waste was not dumped into this ditch in the way sometimes seen at other sites. It seems likely that there were no structures *immediately* adjacent (although unpublished calculations by the author and John Carrott, also of the EAU, indicate that structures more than a few metres away will not necessarily be visible in ditch fill such as these). The conspicuous absence of species strongly tied to artificial habitats (e.g. grain pests and decomposers associated with stable manure) suggests an isolated settlement (Kenward 1997).

Climatic implications

The most remarkable find in this superb assemblage is of significance beyond archaeology: a specimen of the nettlebug *Heterogaster urticae* (F.) from the small subsample, and remains of three others from the bulk sample. A colony of the bug thus appears to have been established at the site, even though in the mid 20th century it was common only in England only in the far south. A single specimen may be a stray migrant, but several cannot be. The possibility of importation from the south in (for example) hay can be ruled out since (a) there is no evidence of disposal of such material in the ditch and (b) the bugs were co-habiting with a range of other typical denizens of nettlebeds. Most of these species (apart from the *Trioza* nymphs) are far more likely to drop off vegetation as it was cut than to remain with it, making importation of the whole community extremely unlikely. It is also hard to imagine bulk plant material having been brought great distances to a site of this kind.

H. urticae is principally associated with stinging nettle, *Urtica dioica* L. During the middle of the 20th century the bug was confined primarily to the south-east of England, with sporadic occurrences in Norfolk and Cheshire, and what seems to have been a stray from Yorkshire (Massee 1955; Southwood and Leston 1959). However, there are numerous fossil records from Roman, Anglo-Scandinavian, and sometimes post-Conquest York, and elsewhere outside the recent range (Hall and Kenward 2000; Kenward and Hall 1995), and the species is regarded as indicating that higher temperatures obtained in these periods than in the middle of the 20th century. If it was established in Northumberland *substantially* higher temperatures are indicated. The Yorkshire records indicate mean July temperatures about 1 C above mid 20th century values (Institute of Terrestrial Ecology 1978; Kenward 2001), but a colony in Northumberland indicates temperatures at least 2 C above mid 20th century. Probably greater continentality is implied too, for the principal range of *H. urticae* has a south-easterly bias in both England and Scandinavia (Coulianos and Ossiannilsson, 1976; Massee, 1955).

H. urticae appears to have returned to Yorkshire only in the past few years, with records from Eastern Yorkshire (Dolling, in lit) and of colonies near York in 2001 (Kenward, unpublished). It is thus a very convincing indicator of the real effect of the rather small temperature rises associated with the current phase of global warming as well as a promising guide to past climatic change.

Kenward (2001) suggests that records of certain *Platystethus* species may reflect climate change. Three of the species have been recorded from the present site: *P. nitens* (3) and, from the bulk-sieved sample, *P. cornutus* group and *P. nodifrons*. Of these, *P. nodifrons* appears to be the most southerly in its present distribution, reaching about to the Severn-Wash line (Hammond 1971). Some

doubt remains as to their significance, however, since Hammond suggests that they may be under-recorded and have had a wider range in the 20th century.

Conclusion

The study of single samples from a site is often unsatisfactory, since there is no way of investigating changes in space and time. However, in the present case a remarkably clear picture of the local environment has been arrived at, and in addition very significant climatic information has been obtained. In summary, the ditch held water, though perhaps not permanently since the range of aquatic insects was limited. There was some vegetation with an aquatic-marginal character in the ditch. Its banks, and probably the immediate surroundings, supported a perennial plant community including nettlebeds and stands of weeds such as docks and plantains. There was pastureland close by and this was probably the predominant land use locally. Nettlebugs, and perhaps some rove beetles, indicate temperatures significantly above those of the middle of the 20th century - perhaps two degrees or more.

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*Table 1. Complete list of invertebrate remains recorded from samples from the Flodden Hill site, in taxonomic order. Order and nomenclature follow Kloet and Hincks (1964-77) for insects. Where both secure and tentative identifications for a given taxon were recorded, only the former are listed here. Key: * = not used in calculating assemblage statistics (Table 3); (BS) - recorded only from the bulk-sieved sample; ecode—ecological code used in generating main statistics; Sp(p).—species not previously listed; Sp(p). indet.—may be a species already listed.*

Taxon	**ecode**
Annelida	
*Oligochaeta sp. (egg capsule)	u
Crustacea	
**Daphnia* sp. (ephippium)	oa-w
*Cladocera spp. (ephippium)	oa-w
*Ostracoda sp.	u
Insecta	
Dermaptera	
*Dermaptera sp.	u
Hemiptera	
Heterogaster urticae (Fabricius)	oa-p
Stygnocoris pedestris (Fallen)	oa
Drymus sylvaticus (Fabricius)	oa-p
Scolopostethus ?affinis (Schilling)	oa-p
Anthocoris sp. (BS)	oa-p
Gerris sp.	oa-w
Corixidae spp.	oa-w
Philaenus spumarius (Linnaeus)	oa-p
Megophthalmus ?scanicus (Fallen)	oa-p
Aphrodes flavostriatus (Donovan)	oa-p-d
Aphrodes spp.	oa-p
Cicadellidae spp.	oa-p
Delphacidae sp.	oa-p
*Auchenorhyncha sp. (nymph)	oa-p
Trioza urticae (Linnaeus)	oa-p
**Trioza urticae* (nymph)	oa-p
*Aphidoidea sp.	u
Lepidoptera	
*Lepidoptera sp. (pupa)	u
Diptera	
*Chironomidae sp. (larva)	w
*Bibionidae sp.	u
*Dolichopodidae sp.	u
*Diptera sp. (adult)	u
*Diptera sp. (puparium)	u
Coleoptera	
Loricera pilicornis (Fabricius)	oa
Dyschirius globosus (Herbst) (BS)	oa
Clivina fossor (Linnaeus)	oa
Trechus quadristriatus (Schrank) (BS)	oa
Trechus obtusus or *quadristriatus*	oa
Trechus rubens (Fabricius) (BS)	u
Trechus secalis (Paykull) (BS)	oa-d
Bembidion lampros (Herbst) (BS)	oa
Pterostichus cupreus (Linnaeus) (BS)	oa
Pterostichus nigrita (Paykull)	oa-d
Pterostichus strenuus (Panzer)	oa
Calathus fuscipes (Goeze)	oa
Calathus melanocephalus (Linnaeus)	oa
Amara ?lucida (Duftschmid)	oa
Amara sp.	oa
Harpalus rufipes (Degeer) (BS)	oa
Harpalus rufibarbis (Fabricius)	oa
Badister sp. (BS)	oa
Haliplus sp.	oa-w
Hydroporus spp.	oa-w
Agabus bipustulatus (Linnaeus)	oa-w
Agabus sp.	oa-w
Colymbetes fuscus (Linnaeus) (BS)	oa-w
Dytiscus sp. (BS)	oa-w
Gyrinus sp.	oa-w
Helophorus aquaticus (Linnaeus)	oa-w
Helophorus grandis Illiger	oa-w
Helophorus spp.	oa-w
Sphaeridium sp. (BS)	rf
Cercyon analis (Paykull)	rt-sf
Cercyon ?haemorrhoidalis (Fabricius) (BS)	rf-sf
Cercyon tristis (Illiger)	oa-d
Cercyon ustulatus (Preyssler) (BS)	oa-d
Megasternum obscurum (Marsham)	rt
Cryptopleurum minutum (Fabricius)	rf-st
Hydrobius fuscipes (Linnaeus)	oa-w
Acritus nigricornis (Hoffmann) (BS)	rt-st
Onthophilus striatus (Forster)	rt-sf
Histerinae sp.	rt
Ochthebius ?minimus (Fabricius)	oa-w
Hydraena sp. (BS)	oa-w
Limnebius truncatellus (Thunberg)	oa-w
Ptenidium sp.	rt
Acrotrichis sp. (BS)	rt
Ptiliidae sp.	u
Choleva sp.	u
Catops sp. (BS)	u
Aclypea opaca (Linnaeus) (BS)	ob-rt
Silpha sp. (BS)	u
Micropeplus porcatus (Paykull) (BS)	rt
Micropeplus staphylinoides (Marsham)	rt
Megarthrus denticollis (Beck) (BS)	rt-sf
Megarthrus sp. indet.	rt
Olophrum piceum (Gyllenhal) (BS)	oa

Lesteva longoelytrata (Goeze)	oa-d
Omalium ?caesum Gravenhorst	rt-sf
Omalium ?italicum Bernhauer	rt-sf
Coryphium angusticolle Stephens (BS)	u
Carpelimus bilineatus Stephens	rt-sf
Platystethus arenarius (Fourcroy)	rf
Platystethus cornutus group (BS)	oa-d
Platystethus nitens (Sahlberg)	oa-d
Platystethus nodifrons (Mannerheim) (BS)	oa-d
Anotylus nitidulus (Gravenhorst)	rt
Anotylus rugosus (Fabricius)	rt
Anotylus ?sculpturatus group	rt
Anotylus tetracarinatus (Block)	rt
Stenus spp.	u
Lathrobium sp. (BS)	u
Rugilus orbiculatus (Paykull) (BS)	rt-sf
Othius sp.	rt
Leptacinus ?pusillus (Stephens)	rt-st
Gyrohypnus angustatus Stephens	rt-st
Gyrohypnus fracticornis (Muller)	rt-st
Xantholinus linearis (Olivier)	rt-sf
Philonthus spp.	u
Staphylinus sp.	u
Staphylininae sp. indet.	u
Tachyporus spp.	u
Tachinus corticinus Gravenhorst	u
Tachinus marginellus (Fabricius)	u
Tachinus signatus Gravenhorst	u
Cordalia obscura (Gravenhorst)	rt-sf
Falagria sp. (BS)	rt-sf
Drusilla canaliculata (Fabricius) (BS)	u
Aleochara sp.	u
Aleocharinae spp.	u
Pselaphidae sp.	u
Geotrupes sp?p.	oa-rf
Aphodius contaminatus (Herbst)	oa-rf
Aphodius fimetarius (Linnaeus)	oa-rf
Aphodius granarius (Linnaeus)	ob-rf
Aphodius prodromus (Brahm)	ob-rf
Aphodius spp.	ob-rf
Serica brunnea (Linnaeus)	oa-p
Phyllopertha horticola (Linnaeus)	oa-p
Dascillus cervinus (Linnaeus)	oa-p
Cytilus sericeus (Forster) (BS)	oa-p
Esolus parallelepipedus (Muller)	oa-w
Oulimnius sp.	oa-w
Athous ?haemorrhoidalis (Fabricius)	oa-p
**Athous haemorrhoidalis* (larva)	oa-p
Agriotes sp.	oa-p
Cantharis spp.	ob
Ptinus sp.	rd-sf
Brachypterus glaber (Stephens)	oa-p
Meligethes sp.	oa-p
Monotoma longicollis (Gyllenhall) (BS)	rt-st
Cryptophagus sp.	rd-sf
Atomaria spp.	rd
Rhyzobius litura (Fabricius)	oa-p
Stephostethus lardarius (Degeer)	rt-st
Enicmus sp.	rt-sf
Corticaria sp.	rt-sf
Corticarina ?fuscula (Gyllenhal)	rt
Cortinicara gibbosa (Herbst)	rt
Donaciinae sp.	oa-d-p
Chrysolina staphylaea (Linnaeus)	oa-p
Gastrophysa viridula (Degeer)	oa-p
Phaedon tumidulus (Germar)	oa-p
Phyllotreta nemorum group	oa-p
Crepidodera ferruginea (Scopoli)	oa-p
Chaetocnema concinna (Marsham)	oa-p
Chaetocnema sp.	oa-p
Psylliodes sp. (BS)	oa-p
Cassida sp. (BS)	oa-p
Apion spp.	oa-p
Otiorhynchus ovatus (Linnaeus) (BS)	oa-p
Phyllobius or *Polydrusus* sp. (BS)	oa-p
Sitona lepidus (BS) Gyllenhal	oa-p
Sitona sp. (BS)	oa-p
Hypera sp.	oa-p
Alophus triguttatus (Fabricius) (BS)	oa-p
Tanysphyrus lemnae (Paykull) (BS)	oa-w-p
Notaris acridulus (Linnaeus) (BS)	oa-d-p
Micrelus ericae (Gyllenhal) (BS)	oa-p-m
Cidnorhinus quadrimaculatus (Linnaeus)	oa-p
Ceutorhynchus contractus (Marsham) (BS)	oa-p
Ceutorhynchus spp.	oa-p
Rhinoncus pericarpius (Linnaeus) (BS)	oa-p
Mecinus pyraster (Herbst) (BS)	oa-p
Gymnetron labile (Herbst)	oa-p
Curculionidae spp.	oa
Coleoptera spp.	u
*Coleoptera sp. (larva)	u
Hymenoptera	
*Chalcidoidea sp.	u
*Hymenoptera Parasitica sp.	u
**Myrmica* sp. (BS)	u
*Formicidae sp.	u
*Insecta sp. (immature)	u
Arachnida	
*Aranae sp.	u
*Acarina sp.	u

Table 2. Insects and other macro-invertebrates from the Flodden Hill site: species list for the 2 kg subsample. Taxa are listed in descending order of abundance except those marked '', which were not used in calculation of statistics in Table 3, and are listed together at the end. Key: n - minimum number of individuals; q - quantification (s - semi-quantitative 'several', m - semi-quantitative 'many', both sensu Kenward* et al. *(1986), e - estimate); ec - ecological codes (see Table 4 for explanation); ReM - recording method (N - non-quantitative; D - detailed,* sensu *Kenward 1992).*

Context: 5 Sample: 0/BS ReM: N

Notes: Entered HK 29/8/01. Paraffined BS material, re-wetted and boiled. Scanned for additional taxa and to estimate abundance of rarer ones seen in /1. Usually, new taxa only have been listed here. **1 = present.**

Taxon	**n**	**q**	**ec**
Heterogaster urticae	3	-	oa-p
Anthocoris sp.	1	-	oa-p
Dyschirius globosus	1	-	oa
Clivina fossor	1	-	oa
Trechus quadristriatus	1	-	oa
Trechus rubens	1	-	u
Trechus secalis	1	-	oa-d
Bembidion lampros	1	-	oa
Pterostichus cupreus	1	-	oa
Calathus melanocephalus	1	-	oa
Harpalus rufipes	1	-	oa
Badister sp.	1	-	oa
Colymbetes fuscus	1	-	oa-w
Dytiscus sp.	1	-	oa-w
Sphaeridium sp.	1	-	rf
Cercyon ?haemorrhoidalis	1	-	rf-sf
Cercyon ustulatus	1	-	oa-d
Histerinae sp.	1	-	rt
Hydraena sp.	1	-	oa-w
Acrotrichis sp.	1	-	rt
Catops sp.	1	-	u
Aclypea opaca	1	-	ob-rt
Silpha sp.	1	-	u
Micropeplus porcatus	1	-	rt
Megarthrus denticollis	1	-	rt-sf
Olophrum piceum	1	-	oa
Coryphium angusticolle	1	-	u
Platystethus cornutus group	1	-	oa-d
Platystethus nodifrons	1	-	oa-d
Lathrobium sp.	1	-	u
Rugilus orbiculatus	1	-	rt-sf
Cordalia obscura	1	-	rt-sf
Falagria sp.	1	-	rt-sf
Drusilla canaliculata	1	-	u
Geotrupes sp.	1	-	oa-rf
Aphodius fimetarius	1	-	oa-rf
Cytilus sericeus	1	-	oa-p
Monotoma longicollis	1	-	rt-st
Psylliodes sp.	1	-	oa-p
Cassida sp.	1	-	oa-p
Otiorhynchus ovatus	1	-	oa-p
Phyllobius or Polydrusus sp.	1	-	oa-p
Sitona lepidus	1	-	oa-p
Sitona sp.	1	-	oa-p
Alophus triguttatus	1	-	oa-p
Tanysphyrus lemnae	1	-	oa-w-p
Notaris acridulus	1	-	oa-d-p
Micrelus ericae	1	-	oa-p-m
Ceutorhynchus contractus	1	-	oa-p
Rhinoncus pericarpius	1	-	oa-p
Mecinus pyraster	1	-	oa-p
Acritus nigricornis	1	-	rt-st
Coleoptera sp. A	1	-	u
*Formicidae sp.	1	-	u
*Myrmica sp.	1	-	u

Context: 5 Sample: 12/1 ReM: D
Weight: 2.00 E: 2.00 F: 2.00

Notes: Entered HK 19/7/01. Mostly recorded on filter paper. E 1.5-3.0, mode 2.0, very strong; F 1.5-3.0, mode 2.0, distinct. No colour change seen. Many fossils distorted, but not as seen in bird droppings: perhaps caused by pressure on sediment, even cattle trampling?

Taxon	**n**	**q**	**ec**
Brachypterus glaber	13	-	oa-p
Aphodius contaminatus	11	-	oa-rf
Helophorus sp. D	8	-	oa-w
Aphodius prodromus	8	-	ob-rf
Aleocharinae sp. E	6	-	u
Scoloposteth us ?affinis	5	-	oa-p
Megastemum obscurum	5	-	rt
Anotylus nitidulus	5	-	rt
Platystethus arenarius	4	-	rf
Cordalia obscura	4	-	rt-sf
Ceutorhynchus sp. C	4	-	oa-p
Philaenus spumarius	3	-	oa-p
Megophthalmus ?scanicus	3	-	oa-p
Aphrodes sp. A	3	-	oa-p
Haliplus sp.	3	-	oa-w
Helophorus aquaticus	3	-	oa-w
Onthophilus striatus	3	-	rt-sf

Limnebius truncatellus	3	-	oa-w
Micropeplus staphylinoides	3	-	rt
Platystethus nitens	3	-	oa-d
Anotylus ?sculpturatus group	3	-	rt
Anotylus tetracarinatus	3	-	rt
Xantholinus linearis	3	-	rt-sf
Tachinus marginellus	3	-	u
Phyllopertha horticola	3	-	oa-p
Gastrophysa viridula	3	-	oa-p
Cidnorhinus quadrimaculatus	3	-	oa-p
Corixidae sp. A	2	-	oa-w
Aphrodes flavostriatus	2	-	oa-p-d
Aphrodes sp. B	2	-	oa-p
Trioza urticae	2	-	oa-p
Pterostichus nigrita	2	-	oa-d
Helophorus sp. A	2	-	oa-w
Cercyon tristis	2	-	oa-d
Hydrobius fuscipes	2	-	oa-w
Ochthebius ?minimus	2	-	oa-w
Ptenidium sp.	2	-	rt
Lesteva longoelytrata	2	-	oa-d
Omalium ?caesum	2	-	rt-sf
Carpelimus bilineatus	2	-	rt-sf
Anotylus rugosus	2	-	rt
Philonthus sp. A	2	-	u
Tachinus corticinus	2	-	u
Tachinus signatus	2	-	u
Aleocharinae sp. D	2	-	u
Esolus parallelepipedus	2	-	oa-w
Athous ?haemorrhoidalis	2	-	oa-p
Meligethes sp.	2	-	oa-p
Stephostethus lardarius	2	-	rt-st
Enicmus sp.	2	-	rt-sf
Phaedon tumidulus	2	-	oa-p
Ceutorhynchus sp. B	2	-	oa-p
Heterogaster urticae	1	-	oa-p
Stygnocoris pedestris	1	-	oa
Drymus sylvaticus	1	-	oa-p
Gerris sp.	1	-	oa-w
Corixidae sp. B	1	-	oa-w
Cicadellidae sp. A	1	-	oa-p
Cicadellidae sp. B	1	-	oa-p
Delphacidae sp.	1	-	oa-p
Loricera pilicornis	1	-	oa
Clivina fossor	1	-	oa
Trechus obtusus or quadristriatus	1	-	oa
Pterostichus strenuus	1	-	oa
Calathus fuscipes	1	-	oa
Calathus ?melanocephalus	1	-	oa
Amara ?lucida	1	-	oa
Amara sp.	1	-	oa
Harpalus rufibarbis	1	-	oa
Hydroporus sp. A	1	-	oa-w
Hydroporus sp. B	1	-	oa-w
Agabus bipustulatus	1	-	oa-w
Agabus sp.	1	-	oa-w
Gyrinus sp.	1	-	oa-w
Helophorus grandis	1	-	oa-w
Helophorus sp. B	1	-	oa-w
Helophorus sp. C	1	-	oa-w
Helophorus sp. E	1	-	oa-w
Cercyon analis	1	-	rt-sf
Cryptopleurum minutum	1	-	rf-st
Histerinae sp.	1	-	rt
Ptiliidae sp.	1	-	u
Choleva sp.	1	-	u
Megarthrus sp.	1	-	rt
Omalium ?italicum	1	-	rt-sf
Stenus sp. A	1	-	u
Stenus sp. B	1	-	u
Othius sp.	1	-	rt
Leptacinus ?pusillus	1	-	rt-st
Gyrohypnus angustatus	1	-	rt-st
Gyrohypnus fracticornis	1	-	rt-st
Philonthus sp. B	1	-	u
Philonthus sp. C	1	-	u
Philonthus sp. D	1	-	u
Staphylinus sp.	1	-	u
Staphylininae sp.	1	-	u
Tachyporus sp. A	1	-	u
Tachyporus sp. B	1	-	u
Aleochara sp.	1	-	u
Aleocharinae sp. A	1	-	u
Aleocharinae sp. B	1	-	u
Aleocharinae sp. C	1	-	u
Pselaphidae sp.	1	-	u
Geotrupes sp.	1	-	oa-rf
Aphodius fimetarius	1	-	oa-rf
Aphodius granarius	1	-	ob-rf
Aphodius sp. A	1	-	ob-rf
Aphodius sp. B	1	-	ob-rf
Aphodius sp. C	1	-	ob-rf
Serica brunnea	1	-	oa-p
Dascillus cervinus	1	-	oa-p
Oulimnius sp.	1	-	oa-w
Agriotes sp.	1	-	oa-p
Cantharis sp. A	1	-	ob
Cantharis sp. B	1	-	ob
Ptinus sp.	1	-	rd-sf
Cryptophagus sp.	1	-	rd-sf
Atomaria sp. A	1	-	rd
Atomaria sp. B	1	-	rd
Rhyzobius litura	1	-	oa-p
Corticaria sp.	1	-	rt-sf
Corticarina ?fuscula	1	-	rt
Cortinicara gibbosa	1	-	rt
Donaciinae sp.	1	-	oa-d-p
Chrysolina staphylaea	1	-	oa-p
Phyllotreta nemorum group	1	-	oa-p
Crepidodera ferruginea	1	-	oa-p
Chaetocnema concinna	1	-	oa-p
Chaetocnema sp.	1	-	oa-p
Apion sp. A	1	-	oa-p
Apion sp. B	1	-	oa-p
Apion sp. C	1	-	oa-p
Hypera sp.	1	-	oa-p

Ceutorhynchus sp. A	1	-	oa-p
Gymnetron labile	1	-	oa-p
Curculionidae sp. A	1	-	oa
Curculionidae sp. B	1	-	oa
Coleoptera sp.	1	-	u
*Daphnia sp. (ephippium)	500	e	oa-w
*Cladocera sp. L (ephippium)	100	e	oa-w
*Acarina sp.	50	e	u
*Ostracoda sp.	15	m	u
*Trioza urticae (nymph)	15	m	oa-p
*Insecta sp. (immature)	15	m	u
*Diptera sp. (adult)	6	s	u
*Bibionidae sp.	6	s	u
*Chironomidae sp. (larva)	6	s	w
*Athous haemorrhoidalis (larva)	6	-	oa-p
*Coleoptera sp. (larva)	6	s	u
*Aphidoidea sp.	4	-	u
*Auchenorhyncha sp. (nymph)	3	-	oa-p
*Hymenoptera Parasitica sp.	3	-	u
*Cladocera sp. F (ephippium)	2	-	oa-w
*Dermaptera sp.	1	-	u
*Oligochaeta sp. (egg capsule)	1	-	u
*Cladocera sp. (ephippium)	1	-	oa-w
*Lepidoptera sp. (pupa)	1	-	u
*Diptera sp. (puparium)	1	-	u
*Dolichopodidae sp.	1	-	u
*Chalcidoidea sp.	1	-	u
*Formicidae sp.	1	-	u
*Aranae sp.	1	-	u

Table 3. Main statistics (given to nearest whole number) for the assemblage of adult Coleoptera and Hemiptera, excluding Aphidoidea and Coccidoidea, from the 2 kg subsample from the Flodden Hill site. For explanation of codes see Table 4.

Context	**5**
Sample	**12**
Ext	**/1**
S	138
N	257
ALPHA	121
SEALPHA	13
SOB	84
PSOB	61
NOB	162
PNOB	63
ALPHAOB	70
SEALPHAOB	9
SW	21
PSW	15
NW	39
PNW	15
ALPHAW	19
SEALPHAW	5
SD	6
PSD	4
ND	12
PND	5
ALPHAD	0
SEALPHAD	0
SP	37
PSP	27
NP	75
PNP	29
ALPHAP	29
SEALPHAP	6
SM	0
PSM	0
NM	0
PNM	0
ALPHAM	0
SEALPHAM	0
SL	0
PSL	0
NL	0
PNL	0
ALPHAL	0
SEALPHAL	0
SRT	39
PSRT	28
NRT	86
PNRT	33
ALPHART	28
SEALPHART	5
SRD	4
PSRD	3
NRD	4
PNRD	2
ALPHARD	0
SEALPHARD	0
SRF	10
PSRF	7
NRF	30
PNRF	12
ALPHARF	5
SEALPHARF	2
SSA	16
PSSA	12
NSA	27
PNSA	11
ALPHASA	17
SEALPHASA	6
SSF	11
PSSF	8
NSF	21
PNSF	8
ALPHASF	10
SEALPHASF	4
SST	5
PSST	4
NST	6
PNST	2
ALPHAST	0
SEALPHAST	0
SSS	0
PSSS	0
NSS	0
PNSS	0
ALPHASS	0
SEALPHASS	0
SG	0
PSG	0
NG	0
PNG	0
ALPHAG	0
SEALPHAG	0
ALPHAG	0
SEALPHAG	0

Table 4. Abbreviations for ecological codes and statistics used for interpretation of insect remains in text and tables. Lower case codes in parentheses are those assigned to taxa and used to calculate the group values (the codes in capitals). See Table 1 for codes assigned to taxa from the Flodden Hill site. Alpha - the index of diversity alpha (Fisher et al. *1943); Indivs - individuals (based on MNI); No - number.*

No taxa	S
Estimated number of indivs (MNI)	N
Index of diversity ( )	alpha
Standard error of alpha	SE alpha
No 'certain' outdoor taxa (oa)	SOA
Percentage of 'certain' outdoor taxa	PSOA
No 'certain' outdoor indivs	NOA
Percentage of 'certain' outdoor indivs	PNOA
No OA and probable outdoor taxa (oa+ob)	SOB
Percentage of OB taxa	PSOB
No OB indivs	NOB
Percentage OB indivs	PNOB
Index of diversity of the OB component	alphaOB
Standard error	SEalphaOB
No aquatic taxa (w)	SW
Percentage of aquatic taxa	PSW
No aquatic indivs	NW
Percentage of W indivs	PNW
Index of diversity of the W component	alphaW
Standard error	SEalphaW
No damp ground/waterside taxa (d)	SD
Percentage D taxa	PSD
No damp D indivs	ND
Percentage of D indivs	PND
Index of diversity of the D component	alphaD
Standard error	SEalphaD
No strongly plant-associated taxa (p)	SP
Percentage of P taxa	PSP
No strongly P indivs	NP
Percentage of P indivs	PNP
Index of diversity of the P component	alphaP
Standard error	SEalphaP
No heathland/moorland taxa (m)	SM
Percentage of M taxa	PSM
No M indivs	NM
Percentage of M indivs	PNM
Index of diversity of the M component	alphaM
Standard error	SEalphaM
No wood-associated taxa (l)	SL
Percentage of L taxa	PSL
No L indivs	NL
Percentage of L indivs	PNL
Index of diversity of the L component	alphaL
Standard error	SEalphaL
No indivs of grain pests (g)	NG
Percentage of indivs of grain pests	PNG
No decomposer taxa (rt + rd + rf)	SRT
Percentage of RT taxa	PSRT
No RT indivs	NRT
Percentage of RT indivs	PNRT
Index of diversity of RT component	alpha RT
Standard error	SEalphaRT
No 'dry' decomposer taxa (rd)	SRD Percentage
of RD taxa	PSRD
No RD indivs	NRD
Percentage of RD indivs	PNRD
Index of diversity of the RD component	alphaRD
Standard error	SEalphaRD
No 'foul' decomposer taxa (rf)	SRF
Percentage of RF taxa	PSRF
No RF indivs	NRF
Percentage of RF indivs	PNRF
Index of diversity of the RF component	alphaRF
Standard error	SEalphaRF
No synanthropic taxa (sf+st+ss)	SSA
Percentage of synanthropic taxa	PSSA
No synanthropic indivs	NSA
Percentage of SA indivs	PNSA
Index of diversity of SA component	ALPHASA
Standard error	SEALPHASA
No facultatively synanthropic taxa (sf)	SSF
Percentage of SF taxa	PSSF
No SF indivs	NSF
Percentage of SF indivs	PNSF
Index of diversity of SF component	ALPHASF
Standard error	SEALPHASF
No typical synanthropic taxa (st)	SST
Percentage of ST taxa	PSST
No ST indivs	NST
Percentage of ST indivs	PNST
Index of diversity of ST component	ALPHAST
Standard error	SEALPHAST
No strongly synanthropic taxa (ss)	SSS
Percentage of SS taxa	PSSS
No SS indivs	NSS
Percentage of SS indivs	PNSS
Index of diversity of SS component	ALPHASS
Standard error	SEALPHASS
No uncoded taxa (u)	SU
Percentage of uncoded indivs	PNU