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Plant and animal remains from Viking Age deposits at Kaupang, Norway

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Summary

Part I presents the results of investigations of plant and invertebrate remains (with some comments on vertebrates where relevant) from a series of samples from 9th century deposits from Kaupang, Norway, excavated in 2002. Preservation by anoxic waterlogging was essentially confined to a series of pitfills, with other deposits yielding few plant remains other than wood charcoal and a few other charred fossils, and no invertebrates. The pitfills appeared to include a fairly consistent suite of food and other useful plants. There was sometimes strong evidence for imported turf. Waste from house floors (or possibly roofs) was present, and probably also waste water. One pit gave strong indications of dryish animal matter, and perhaps incorporated waste from leather or skin processing or storage. There was no evidence for livestock on the site, nor for the disposal of human faeces.

Part II presents an analysis of the mammal, fish and bird bone from the 2002 Kaupang excavations. The material was collected using stringent recovery methods, but suffers from poor preservation. Seventy-five percent of the mammal bone and 63% of the bird bone was burned. The fish bone (much of which came from waterlogged pits) was slightly better preserved, but 27% of it was also burned.

Despite these unpromising conditions, the assemblage has provided a surprising quantity of evidence regarding the economy and character of the settlement. The abundance of pigs and herring is consistent with other Viking Age urban centres (particularly in the Baltic region), and the combination of cod, saithe and ling is characteristic of Norwegian and North Atlantic fish assemblages. The apparent abundance of pigs may, however, be a taphonomic bias given the preferential survival of small foot bones at this site. There is no evidence that wild fur-bearing taxa were processed locally, which contrasts with evidence from Birka and the implications of Ottar's 9th century account. Only cats and possibly hare were skinned. This implies either that furs were not traded at Kaupang or (more likely) that they arrived in a pre-processed state.

There is no evidence for imported stockfish. It is possible, however, that the settlement was provisioned with domestic livestock from its hinterland. Birds were very rare, with domestic fowl (chicken) most common. Nevertheless, the presence of barnacle and brent geese in the assemblage may imply winter occupation, an observation with implications for whether or not the settlement was seasonal. Stable isotope analysis of the bone was not successful due to poor preservation conditions.

Part III considers a selection of bulk sieved samples and their associated botanical and animal bone assemblages in order to evaluate the initial field interpretation of deposits identified as house floors, occupation layers and side benches. Contexts described as 'floors' in the field contained more gravel, a higher proportion of burnt bone, less bone in total, less charcoal and less hazelnut shell than deposits interpreted as 'benches'. These 'floors' also lacked any large or nearly complete bones. The 'benches' exhibited the opposite characteristics. Layers described as 'occupation' had densities of gravel, bone, charcoal and hazelnut shell most similar to 'bench' deposits. However, the proportion of burnt bone and

the level of bone fragmentation in these contexts resembled the 'floors'. Thus the three deposit types do appear to be distinct. The presence of higher proportions of fine gravel in the 'floor' layers may imply purposeful deposition as a living surface, a practice documented in later Viking Age Dublin. Moreover, the high level of bone fragmentation and the low density of large charcoal may indicate a combination of trampling and cleaning that is also consistent with a living surface. The characteristics of the 'benches' are less obviously consistent with their assumed function. If correctly identified, they must have been constructed largely of re-deposited midden material – presumably retained in a wood or wattle frame. The occupation layers, which had characteristics of both 'floor' and 'bench' deposits, may simply have been trampled areas of midden material without the purposeful addition of fine gravel.

Part IV assesses plant and invertebrate macrofossil remains from four samples from the 2003 season of excavations in the Kaupang harbour. All the samples yielded large components of woody debris, including fragments of wood, bark and twig, and with fragments bearing evidence of cut edges (wood chips) in all cases. The most notable taxon was juniper—fragments of shoot, leaves, and seeds—as well as seeds of rose, blackberry and hazel nutshell. There was no strong component of foods. The overall impression from the insect assemblages is of fairly typical occupation-site deposits, with a restricted range of remains from natural or semi-natural habitats, and most of those (plant-feeders, deadwood associated species, aquatics) quite possibly imported with resources of some kind or another. Overall there was a subjective impression of very diluted stable manure insect fauna, from the mixture of foul decomposers, plant feeders perhaps imported in hay, and aquatics. Overall the plant and insect evidence suggests that these are dumps of material from occupation, possibly from floors.

Part V is an analysis of mammal, fish and bird bone from the 2003 Kaupang excavations. The excavation took place within the area believed to have been the Viking Age harbour. This was a relatively small-scale excavation and the material recovered has yet to be dated and phased but is believed to be broadly contemporaneous with the material from the 2002 excavation.

The overwhelming factor in the analysis of this assemblage has been the taphonomic issues. Because of the acidic nature of the soil at Kaupang the preservation of bone is not good. In addition, the high degree of fragmentation and burning has led to a particularly biased recovered assemblage, which most likely bears little resemblance to the original deposited assemblage.

A total of 2289 fragments of bone were examined. The assemblage was dominated by mammal bone (2226 fragments), followed by fish (61) and bird (2). Mammalian species present (in order of prevalence) include horse (44 fragments), cattle (27), pig (18) and caprine (5). This is slightly different to the previous assemblages from Kaupang where pig bones predominate. However, this difference may be a result of slightly better preservation of some contexts in this assemblage. The main fish species present were saithe (9 fragments), cod (6) and hake (5). The presence of hake bones, may indicate summer occupation of the site, but does not preclude year-round occupation.

KEYWORDS: KAUPANG; NORWAY; VIKING AGE; OCCUPATION DEPOSITS; MACROFOSSIL PLANT REMAINS; INSECTS; ZOOARCHAEOLOGY

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Part I: Plant and invertebrate remains from Viking Age deposits at Kaupang, Norway, 2002

Harry Kenward and Allan Hall

Background to this report

A series of sediment samples collected from excavations of 9th century occupation deposits at Kaupang in 2002 was subjected to assessment of plant and insect remains (Hall and Kenward 2003a). The material examined comprised (a) a group of samples of whole sediment ('GBA samples' *sensu* Dobney *et al*. 1992), processed using disaggregation and paraffin flotation of subsamples of 2 kg, and (b) the 'washovers' from a series of 'BS' samples which had been bulk-sieved on site. On the basis of the results obtained a more detailed investigation was undertaken of plant and insect remains from selected samples from the corpus of GBAs examined during the assessment, and to process a further set of those not assessed (to provide additional insect remains). It was considered appropriate to make a full record of the plant remains from a range of GBAs to provide information about plant use (especially diet and raw materials) at Kaupang, as well as to explore deposit formation and in particular the nature of the material being discarded into pits. A group of BS washovers not examined initially would also be checked to explore the character of some contexts interpreted by the excavator as bench or floor deposits associated with structures.

With regard to the insect (and other invertebrate) remains, many of the samples deserved detailed quantitative recording, to amplify context interpretation (the nature of deposited material, and its implications for environment and living conditions, as well as conditions at the point where the sediments formed), and to gather data for analysis at the site level. It was also considered worthwhile to examine a selection of samples from contexts stratigraphically related to those found productive in the assessment.

For both plant and invertebrate remains, in addition to addressing the specific problems posed by the stratigraphic analysis, it was considered important to make comparisons with other sites of the period to place the results from Kaupang in a broader perspective and in particular to determine whether there were any implications concerning the special nature of the settlement.

Methods

Most of the samples examined in the main phase for invertebrate remains were chosen following priorities based on the results of the assessment, but some were selected following a second phase of assessment. A record was made of the lithology of the selected GBA samples, using a standard *pro forma*. Where possible, at least 3kg of sediment was processed; where less sediment was available, the whole of the sample was processed. The sediment was sieved to 300 μm, and invertebrate macrofossils recovered using procedures broadly following the paraffin (kerosene) flotation method described by Kenward *et al*. (1980; 1986).

A tally of plant remains and other components of the various fractions (flots, washovers and residues) examined was recorded directly into a personal computer (using *Paradox* software), together with notes on the general nature of the material. All plant taxa and other components

were recorded using a four-point semi-quantitative scale (from 1—one or a few specimens or fragments to 4—abundant, or a major component of the sample, and with a simpler three-point scale for the BS samples).

The flots were examined for invertebrate remains, although records of any invertebrates picked out during the analysis of washovers and residues for plants were added to the data.

Invertebrate remains were identified in the flot (for familiar species) or placed on damp filter paper for more careful inspection where necessary. The remains of adult beetles and bugs from a selection of samples were 'detail' recorded in the terminology of Kenward (1992); results for other samples examined during the two phases of assessment are also summarised here.

In addition to the priorities determined during assessment, choice of samples for detailed analysis at this stage was dictated by availability of more sediment where needed, and by the need to avoid sorting too many very large residues (each taking some days to sort).

Quality of preservation was recorded using the scales of Kenward and Large (1998). In summary, preservation was recorded as chemical erosion (E) and fragmentation (F), in each case on a scale from 0.5 (in superb condition) to 5.5 (extremely decayed or fragmented), giving a range and mode for the whole assemblage of fossils. Other characteristics such as colour change were recorded where appropriate. When there were few fossils only single values were applied to each of these characteristics.

Fossils were identified by comparison with modern reference material and using the standard works. Adult beetles and bugs, other than aphids and scale insects, were recorded fully quantitatively and a minimum number of individuals estimated on the basis of the fragments present. Other invertebrate macrofossils were usually recorded semi-quantitatively using the scale described by Kenward *et al.* (1986) and Kenward (1992), again using estimates for extremely abundant taxa. Data pertaining to invertebrate remains were recorded directly or transferred from a paper record to computer databases (using *Paradox* software) for analysis and long-term storage.

Interpretative methods

Interpretation of assemblages of plant remains followed ARH's usual practice. All identifiable remains were assigned to one or more groups according to their ecological preferences (mainly relating to the kinds of vegetation in which each may be found) or to their known or supposed usefulness to people in the past. An outline of this method is given by Hall and Kenward (1990). Account was also taken of the many other components recorded during examination of the plant remains—material such as charcoal, wood and bark fragments, and the mineral matrix surviving the sieving process, as well as inclusions such as bone and artefactual material, and so on. The full data for the semi-quantitiative abundance scores for these groupings are not presented here but form the basis for the discussion of the results of the individual samples.

The interpretative methods employed for insect remains were essentially the same as those used in work on a variety of sites by Hall, Kenward and co-workers (see Kenward 1978, with modifications outlined by, for example, Kenward 1982; 1988; Hall and Kenward 1990; and

Kenward and Hall 1995). Interpretation rests primarily on a number of 'main statistics' of whole assemblages of adult beetles and bugs, and on the recognition of ecologically-related groups of species. The main statistics used include: (a) a measure of species-richness (or diversity), α of Fisher *et al*. (1943), for the whole assemblage and for components of it; and (b) proportions of 'outdoor' species (OB, calculated from taxa coded oa and ob), aquatics (W, w), waterside species (D, d), phytophages (plant-feeders) (P, p), species associated with dead wood (L, l), moorland/heathland taxa (M, m), and decomposers (species associated with decomposing matter of some kind). Decomposers are subdivided into (a) species primarily associated with somewhat dry habitats (RD, rd), (b) those found mostly in rather, to very, foul habitats (RF, rf), and (c) a residuum not easily assignable to one of these (rt). The category 'RT' includes all three of these groups of decomposers (rt + rd + rf). (In each case, the lower-case codes (e.g. 'rd') are those applied to species and the upper-case codes ('RD') are for the ecological group.)

A further ecological component quantified for the present site was the synanthropes, i.e. those species favoured by human activity (Kenward 1997). Taxa have been assigned codes for degree of synanthropy as follows: 'sf'—facultative synanthrope, common in natural as well as artificial habitats; 'st'—typically synanthropic, but able to live in nature; 'ss'—strong synanthrope, absent from or very rare in natural habitats in the relevant geographical area. These codes give rise to ecological groups SF, ST, and SS, which are summed to give SA (all synanthropes). A group of synanthropes regarded as particularly typical of buildings of various kinds has been termed 'house fauna' (Kenward and Hall 1995; see also Carrott and Kenward 2001).

The quantification of an 'outdoor' component in what are sometimes clearly natural or semi-natural assemblages may not appear entirely logical, but in fact is useful when working with any deposits associated, even if rather indirectly, with human occupation.

The abundance of these 'ecological' groups is discussed against the background of values for many other assemblages from a large number of sites. Thus, % N OB = 30 is a high value, but % N RT = 30 is low; while % N W and % N RF are both high at 10.

The index of diversity offers a guide to the presence or absence of remains of insects which bred in or on the developing deposit (autochthones), low values indicating breeding communities, high ones faunas of mixed origins. Note that 'significantly' low values differ for the various components of assemblages; the more inherently rich a component is, the higher the value of the index of diversity for a living community will be. Thus, 'outdoor' communities associated with natural vegetation tend to give a high value of α, while very specialised communities, such as those of decaying matter deposited by humans, or stored grain, have low or very low ones.

Results and discussion

Detailed results, discussed sample by sample, appear below. Table 1.1 shows the material examined for this study. Results from examination of BS samples are presented in Table 1.2. A complete list of plant taxa recorded from the site is included (Table 1.3), with a list of 'useful' taxa in Table 1.4; records of plant remains and other components from individual subsamples appear in Table 1.5. A complete list of insect and other macro-invertebrate taxa is

given in Table 1.6, with lists for individual subsamples in Table 1.7. Statistics relating to the assemblages of adult beetles and bugs are given in Table 1.9.

General comments on the plant and invertebrate remains

In comparison with some other sites of early medieval date—such as parts of York, Dublin and Haithabu, preservation of plant material in the deposits from Kaupang examined for this study was rather limited, at least in terms of the *range* of taxa present, although those deposits with anoxic waterlogging generally yielded material of good quality. These were invariably the fills of pits. Surface-laid occupation layers, however, generally contained only small amounts of charred material, even wood charcoal, and the few uncharred remains from these are thought for the most part to be of recent origin, presumably reaching the deposits from above by the action of earthworms. Taken as a whole, the deposits at the Kaupang site rather rarely contained many delicate invertebrate remains, and in the few deposits where fossils had survived their preservation was sometimes poor. Clearly the site is marginal for organic preservation, although whether the degradation of organics occurred during and immediately after deposition, or subsequently as a result of ground-water changes, is not certain (see below).

Insect remains were usually dilute, so some of the groups recorded were small, but some of these small groups were useful for interpretation at the context level, and of course they contributed to the body of data for site-level analysis. A number of samples processed for insect analysis were rejected for further detailed analysis after assessment, generally because the combination of a very large flot and small numbers of remains would have made sorting unacceptably time consuming in relation to the information which would be obtained. The assemblages in these rejected samples appeared to be too small and ecologically 'bland' to be useful for analysis at the context level, and would not have contributed sufficiently to the value of the project to justify the effort of sorting.

The average concentration of remains in the recorded samples was low and none of the assemblages were very large, even after processing of quite large subsamples in some cases (the largest group was of 178 individuals from 7.0 kg of sediment from Context 88226, Sample 257).The concentration of adult beetle and bug remains, at 24 per kg (based on MNI) in the subsamples recorded quantitatively, was very low by comparison with many other sites. In town deposits at 16-22 Coppergate, York, England, for example, the mean concentration of adult beetles and bugs for the Anglo-Scandinavian and early medieval periods was 70 per kg; in medieval layers at Mindets Tomt – Søndre Felt in Oslo it was 183 per kg, and in a small Early Christian farmstead at Deer Park Farms, Co Antrim, Northern Ireland, it was 127 per kg (Kenward and Hall 1995; Kenward 1988; Allison *et al.* 1999a; b). However, for the Søndersø site at Viborg, Denmark, not entirely dissimilar in character to the present one, the value was 27 per kg (Kenward forthcoming), so perhaps the way the sites were used influenced the way insects became incorporated into deposits. In neither of these cases does post-depositional decay seem to have been responsible for the low concentrations: the deposits on which the estimates of concentration are based were those with fossils, and almost none gave even hints that an appreciable proportion of the beetles at least had been completely lost by decay (the more delicate remains such as lice may have been, however). Overall, the most plausible explanation for the low concentration of remains is that insect populations were quite small and that their remains were diluted by abundant plant debris.

Identification of the remains of one group of synanthropic beetles, spider beetles of the genus *Ptinus*, proved problematic. There were modest numbers of *P. raptor*, which was also found in 11th century deposits in Denmark at Viborg (Kenward forthcoming). There were also some positively identified remains of *P. fur* (the species usually encountered in deposits in Britain, where identification is confident). However, there was at least one other species present, and this could not be named; preservation was mostly poor and diagnostic parts often absent, but these specimens appeared not to match the commoner species which might be expected (and in particular, *P. pusillus* and *P. sexpunctatus*). Analysis of further material from contemporaneous sites in Norway may cast light on this problem, and the significance of these species.

Most of the botanical evidence from these deposits at Kaupang is for woody taxa, probably mostly originating from brushwood or other 'twiggy' litter—this might well be the source of, for example, juniper, and some heathland plants (especially various of the mosses). Wood chips from wood-working and/or construction may well have been used for litter in the first instance, too, rather than just being thrown away, though presumably their presence in pit fills indicates that their eventual fate was to be discarded. Grassland is represented in some deposits, with some freshwater marsh and saltmarsh taxa perhaps from cut vegetation or dung, but perhaps just arriving by natural dispersal from the nearby waterside of the fjord. There was perhaps also some imported turf, especially in the case of one sample (from Pit 99030, Phase I) with waterlogged rhizome/culm fragments bearing a very characteristic 'dried-unrewetted' appearance. (This may be of significance given the possibility that the pit pre-dates the timber structures; it may date to an initial phase of construction in turf.) Several other pit fills may have contained smaller components of rather similar material. It is tempting to see this as originating in turves used in roofing or otherwise in construction; many of the insects associated with human dwellings may have come from roofing, too (see below).

The insects were dominated by species associated with, or at least often found in, decaying matter ranging from dryish mouldering plant debris to dung and animal remains. Species found primarily in natural or semi-natural habitats were rare and often typically associated with herbaceous vegetation. Insects associated with trees, whether living or dead, were uncommon. This ecological group was mainly represented by *Rhinosimus planirostris* and *Dromius quadrimaculatus* and *D. quadrinotatus*, the first associated at least as often with small dead twigs as with substantial timber, the last two living on trees, sheltering in bark crevices, but ranging onto twigs in search of prey (Lindroth 1986). There were a few bark beetles, probably imported with timber, but not enough to provide evidence of relative importance of tree species. Even woodworm beetles (*Anobium*) were rare.

Activity, living conditions and the nature of the settlement

It has proved difficult to identify the specific uses of pits or the nature of conditions in the buildings from these deposits, in stark contrast to the evidence from sites such as 16-22 Coppergate, York (Kenward and Hall 1995), where many of the pit fills proved to be rich in faecal material, whilst another important component of the deposits in general was an abundance of remains of plants used in textile dyeing. The floors at Coppergate were generally rich in uncharred plant and insect remains, though the plants were of a much more mixed character than in many of the pit fills at that site.

It has been suggested (Kenward 1997) that analysis of the synanthropic insects (defined above) from archaeological deposits can provide a range of information about the character and use of sites. The synanthropic component at Kaupang was characteristic, with a large proportion of facultative species, few typical and almost no obligate synanthropes (Table 1.10). While this estimate is based on analysis of a limited number of deposits of a restricted range of types (no floors, for example), and the whole-site assemblage is fairly small (1024 adult beetles and bugs), it is hard to believe that it differed greatly from the fauna of the site as a whole. Many of the assemblages had high diversity and are almost certainly rich in background fauna, which should mean that they presented an 'averaged' fauna for the site, and others appeared to contain material dumped from within buildings, so 'house fauna' has been sampled.

The statistics for the site fauna as a whole thus show that synanthropes were not as strongly represented as in some other occupation sites. However, the comparative figures are sometimes substantially affected by the presence of other components, for example the strength of the outdoor fauna, and at two of the comparative sites by *Aglenus brunneus*, which may be extremely abundant. The first problem is easily overcome by examining the internal structure of the synanthropic fauna (Table 1.11). This shows that species designated as facultative synanthropes (likely to have colonised from natural habitats as well as artificial ones, though it should be remembered that the classification is inevitably somewhat arbitrary) were far more important at Kaupang than at the contemporaneous site of Coppergate, York, or the small isolated rural site of Deer Park Farms, County Antrim, Northern Ireland (Allison *et al.* 1999a; b; Kenward 1997; Kenward and Allison 1994; Kenward and Hall 1995). Indeed, this component gives a value closest to that for the isolated lake-dwelling at Buiston, Ayrshire, Scotland (Kenward 1997; Kenward *et al*. 2000a-c) and for the essentially rural workshops at Viborg, Denmark (Kenward forthcoming). However, facultative synanthropes were important in occupation deposits at the medieval 'Søndre Felt' site in Oslo (Table 1.11), suggesting the possibility of regional differences. But in fact, the large proportion of facultative synanthropes at Søndre Felt was the result of the abundance of a small number of species in a few samples, and the synanthrope fauna of the site as a whole was rich and well developed. This simply serves as a reminder that *species composition* must be examined, rather than relying simply on statistics.

The proportion of facultative synanthropes probably reflects the degree to which more specialised synanthropes, much less likely to have been abundant in the wild locally and therefore relying on trade and the passage of time, had been able to colonise and survive. Although a few species thought to be more specialised had arrived, presumably as a result of trade (e.g. *Aglenus brunneus* and *Tenebrio obscurus*), the data for the Kaupang site appear to suggest isolation, a very new settlement, or intermittent occupation. These comparative figures are skewed by the presence of abundant *Aglenus brunneus*, which probably bred in the deposits post-depositionally, at Coppergate and Deer Park Farms. Removing *A. brunneus* (Table 1.12) strongly emphasises the similarity between Deer Park Farms and Coppergate, and between Kaupang, Viborg and Buiston, with Søndre Felt somewhat intermediate. The values for the typical synanthropes emphasise the similarity between the intensively occupied sites at Coppergate and Oslo.

There was a slight, but statistically insignificant, increase in the proportion of synanthropes in the assemblages through time, but no pattern in the variation of the internal structure of the synanthrope component. It was thus unfortunately not possible to address the question as to whether the site was permanently or seasonally occupied in the various phases—there were

too few deposits containing appreciable numbers of insects in each of the periods to provide an objective assessment. However, the extremely limited synanthrope fauna, and predominance of facultative forms, may be a pointer to seasonal occupation, large populations of typical or strong synanthropes being unable to develop in a short period of occupation, and (if occupation was in summer) not having artificially warmed places for overwintering. Seasonal occupation might also account for the rather limited abundance of annual nitrophile weeds in comparison with other occupation sites.

Many of the deposits at Kaupang contain an appreciable component of fauna presumed to have originated from within buildings ('house fauna'). It seems very possible that most of the deposits analysed here included material cleared from floors, perhaps predominantly waste from indoor processes rather than the debris of long-term domestic life (a contrast with many of the deposits at the Coppergate site in York). There were some records of human fleas (*Pulex irritans*) from two deposits, five being recovered from one of these, and three records of 'Siphonaptera', which were probably human fleas but lacked easily identified parts (i.e. heads and genitalia). These were probably brought from within buildings in which they bred, but human fleas are common in stable manure deposits, and so were apparently not confined to human dwellings. No lice were found, though this may have been a result of the generally challenging preservational regime rather than their absence when the deposits formed. There was no coherent evidence for the presence of stable manure (cf. Kenward and Hall 1997).

Pale, soft, and apparently newly-emerged remains of *Apion* weevils were found in a number of the samples. Such remains are very typical of stable manure assemblages (Kenward and Hall 1997), in which they are frequently accompanied by a range of weevils and other insects found on herbaceous plants and presumed to have been imported in hay. There is no very clear botanical evidence for hay at Kaupang (though plant taxa which may have arrived in hay are regularly found in small numbers), and an alternative source for the insects (and many plant remains) may be turf.

It is possible that one activity carried on at Kaupang was the preparation, or at least storage, of skins and hides. There were three assemblages with appreciable numbers of the beetle *Omosita colon*, together with a range of other species likely to have been attracted to dryish animal matter (including skins and bones): *Saprinus* sp., *Creophilus maxillosus*, *Trox scaber*, *Dermestes lardarius* adults and larvae, *Necrobia violacea*, *Necrobia* sp. indet. and *Tenebrio obscurus*. No ectoparasitic insects such as might be shed from skins were recorded, but this may be because they were not preserved. Another possibility is that these insects were attracted to drying fish.

While imported plant resources demonstrate the presence of various kinds of vegetation within the catchment of Kaupang, the biota cast rather little light on semi-natural habitats on or immediately adjacent to the site, except for the consistent component of weed taxa, most of which might well have been growing around the settlement. Their numbers were much smaller than for occupation deposits at some other sites of the period, however, and weed-associated insects are quite rare (cf. Kenward and Hall 1995). Indeed, outdoor insect fauna was remarkably limited in most cases, considering that the analysed layers were all external deposits (site PNOB = 16). The number of outdoor individuals is not proportional to assemblage size across the samples, the regression line showing a reduction in the importance of the outdoor component with increasing assemblage size (Figure 1.1). The percentage of outdoor insects falls steeply with assemblage size in a logarithmic relationship (Figure 1.2).

This probably means that the larger assemblages included substantial autochthonous or imported communities, while smaller ones were dominated by background fauna. This offers support to the argument that the more richly organic deposits consisted mainly of waste which either came from buildings or was very rapidly deposited and buried, so that insects could not breed in large numbers.

Fully aquatic invertebrates were present but, with the exception of water flea resting eggs (mostly *Daphnia*), were rare: overall, aquatic beetles and bugs accounted for only 1% of the fauna, far less than at many other sites. Fully aquatic plants were absent. Waterside insects were also rare (2% of site fauna), though some plants typically found by water sometimes occurred in quantity—especially celery-leaved crowfoot (*Ranunculus sceleratus*), but also several marsh/swamp taxa. There are three likely sources for aquatic and waterside remains in deposits formed as a result of intensive occupation: imported water, imported waterside resources, and flooding (occasionally, aquatics may have lived in pits, wells and ditches at many sites, but this seems to have been the exception in intensively used, urban or semi-urban areas). Given the quantity of evidence and the proximity of the site to the fjord, and the relative fall in water level since the Viking Period, any or all of these mechanisms could have operated. There is a good chance that the 'compressed straw' in one of the samples from Context 86018 included cut wetland vegetation, given the nature of some of the taxa present as fruits and seeds and perhaps also from some of the epidermis material which may well have come from culms (stems) of large sedges or emergent plants such as bulrush or sea club-rush *(Scirpus* spp.), although it could not be identified with certainty.

The presence of quite large numbers of water flea eggs in the absence of other aquatics perhaps represents an argument for imported water rather than flooding (a much richer fauna being expected from the latter). Flooding does seem to be a possibility, however, from the rather abundant fragments of colonial coelenterate stem. These may, alternatively, have arrived with seaweed (for which there is some evidence from the charred plant remains) or shellfish (for which the only evidence from these samples were traces of bivalve periostracum, any calcareous shell components probably having dissolved). There were small quantities of salt-tolerant plants such as sea arrow-grass (*Triglochin maritima*) in the deposits, probably no more than casual arrivals from nearby fjord-edge communities.

Food and other resources (see also separate reports on vertebrate remains)

A very modest range of food taxa was represented amongst the plant remains. As far as 'staples' are concerned, there were low concentrations of cereals (as charred grains), mainly barley (the most frequently recorded plant taxon, though only twice present at more than very low concentrations), with a little rye and oats, but with no certainly identified wheat. This is entirely consistent with what might be expected in the Kaupang area at this period. Wild foods included rose, blackberry, raspberry, strawberry, apple and perhaps rowan. There were no clearly cultivated fruits and certainly no evidence for importation of exotic fruits—as is also the case at other N. European Viking Age sites like Coppergate and Haithabu.

Two taxa seem very characteristic of sites of this period in N. Europe: hemp and hop, the former recorded at Kaupang in small amounts from two pits and more frequently in two of the fills of a third (65132), whilst hop was also present in trace amounts in two pits, but rather frequent through the fills of Pit 65132, reaching an abundance of 3 (on the 4-point scale used) in two samples from Context 86018.

Behre (1983; 1984) has described the finds of hop from Haithabu, and put them in the context of early medieval use of plants as flavourings for beer. Both taxa were frequent at Coppergate (Kenward and Hall 1995), and have also been recorded from Birka, Sweden (Hansson and Dickson 1997), and Novgorod (M. Monk, pers. comm.), whilst Aalto and Heinäjoki-Majander (1997) have demonstrated their importance in 9th-10th C deposits at the Viking Age town of Staraja Ladoga in W Russia (a little to the N of Novgorod). Though frequent at Haithabu, hemp was, perhaps surprisingly, not recorded there.

The use to which the hops were put seems most likely to have been related to flavouring beer though the plant is credited with other uses such as in dyeing. In contrast to the rich evidence for dyeplants in York (cf. Kenward and Hall 1995, and a more recent synthesis by Hall *et al.* 2004b) only woad amongst the plants recorded at Kaupang stands out as being likely to have had this purpose (although certainly many of the wild plants might have furnished colour for textiles). It is difficult to see why woad remains were present in the Kaupang deposits (in single fills in each of two pits, but also recorded from a sample from the 'harbour area' recovered during the 2003 excavation; see Part IV) unless it had been brought for use in dyeing—though it is a successful coloniser of certain kinds of disturbed soils (having, for example, become a pernicious weed in parts of N. America following introduction by European settlers). Woad is well known from other Viking Age sites in S Norway, notably the Oseberg Ship (Holmboe 1927)

The sparse remains of flax (linseed, mostly from pit 65132, but with a record of capsule fragments from 64891) represent a plant perhaps most likely to have been used as food or a source of oil, though also perhaps for fibre. Hemp, of course, is likely to have been another fibre crop, though its use as food for human or animal consumption and as an oil-seed, like flax, cannot be discounted. Almost all of the material from Kaupang comprised achene fragments, which may indicate breakage during processing for food or oil extraction.

With the exception of woad, hemp, flax and the cereals, all of the plants recorded from Kaupang are native to Norway and all might have grown in the vicinity of the site. The crop plants might all have been in cultivation in S. Scandinavia before the 9th century—woad, for example, is recorded as pottery impressions from Roman Iron Age (1st C AD) Thy in Denmark (Jessen 1933)—and none is particularly significant in terms of possible trade connexions.

A single positive identification was made of a honey bee, *Apis mellifera*, and there were two tentative identifications. These do not stand as evidence of bee-keeping, or even exploitation of bee products (compare with the abundant bees from Oslo (Kenward 1978), York (Kenward and Hall 1975) and Aberdeen, Scotland (Hall *et al.* 2004a), but they at least show their availability.

Comments on plant material in bulk-sieved samples

Plant remains from a selection of the samples bulk-sieved on site were examined using the dried washovers and (to a lesser extent) material sorted from the residues. This material comprised mainly charcoal, with a little charred hazel nutshell and some charred cereals (mainly barley) and weeds likely to have been growing with the cereal crop, and perhaps a few remains originating in burnt peat or turves. Other evidence of burning consisted of

material variously recorded as ‘ash beads’, ‘glassy ash’ and ‘ash concretions’—plant ash in small subspherical clasts or larger, more amorphous, whitish fragments, all no doubt originating in plant material. Rather surprisingly, charred seaweed (or material thought to be this) was recorded in a few of the GBA subsamples, but not seen in the BS washovers and residues. One last category of material noted in a rather high proportion of the BS samples (and very rarely also in the GBA subsamples) was termed ‘charred organic material’ during recording. This was used for some fragments of resin-like material with a characteristic ‘sunken-pustular’ surface on one face of the clasts and usually some sand embedded in the material on the other—as if it had flowed onto a sandy surface and congealed but with bubbles on the upper surface which burst and left the sunken rounded pustules. The identity of this material remains a mystery, though one very likely contender is resin from the burning of coniferous timber.

Long-term survival of organics at Kaupang

As remarked above, it appears that the Kaupang site is marginal for the survival of delicate organic remains such as those of plants and insects (and also of course leather, textiles and the like). Even in those deposits with organic preservation, many of the insect remains showed considerable degradation. A few assemblages showed fairly general colour change towards reddish or brownish. It has been argued (Kenward and Hall in press) that such general degradation may flag recent wholesale decay of deposits brought about by changes in ground-water level and chemistry. However, many of the assemblages showed a range of preservational states, argued by the same authors perhaps to flag varying degrees of decay before and during deposit formation. At the present site it seems very likely that many of the deposits incorporate waste which had lain elsewhere, probably on fairly dry surfaces, or had come from roofs, before final burial. Such indirect routes would certainly have led to heterogeneous decay. Despite this, it seems possible that there is a threat to any organic matter remaining in the wider area of the Kaupang site, and this is a factor to be taken into account in developing policy regarding the future management of the site.

Sample by sample discussion

In this section the results of the various analyses of the samples are listed in phase, context type, and stratigraphic order. It can be assumed that where no plant remains are reported they were not investigated. Sample numbers given by the excavators (‘Intrasis’ numbers) and those used by the authors (‘CHP’ numbers) are both given.

Site Period I (all from Plot 2, Phase 1)

(i) Pit fills

Pit 99030

Context 99879: Lower pit fill in 99030
Intrasis 99948, CHP 294
Very dark grey to black, moist, crumbly humic sand with lumps of very dark blue-grey plastic clay.

The /T subsample yielded a large washover of about 900 cm^3 of organic debris, mainly granular woody fragments (to 40 mm) with much fine material; there were many floating achenes of celery-leaved crowfoot, and some quite large lumps of rhizome/root material and some monocot culm, the latter two types from something quite small, not reed or cereal. This pale, strawy, root/rhizome and culm material (which was up to about 1.5 mm in maximum width) gave the appearance of having dried and not fully rewetted. There were also quite a lot of grey dusty debris still adhering to some wood and bark clasts. One can speculate that such material might, for example, have originated in roofing or flooring that was buried whilst still very dry.

Amongst the modest-sized range of quite well preserved plant remains were woad pods (two specimens), well-preserved hop achenes and moderate numbers of fruits of the cornfield weed annual knawel, *Scleranthus annuus* (also having a 'dried-unrewetted' appearance). Potentially 'useful' taxa in this sample included hazel nut, strawberry, hop, woad, raspberry and rose, though only the last of these was present in more than trace amounts. The large residue of about 525 cm^3 comprised sand, grit and gravel (to 45 mm).

The large residue, about 1175 cm^3 from the /T2 subsample was mainly sand, with some grit and gravel. The very large washover of about 1500 cm^3 of woody and herbaceous detritus contained some floating material with the same 'dried-unrewetted' appearance of the debris seen in the /T subsample. Close inspection revealed some small (<10 mm) clasts of material that looked like debris from turf or very unconsolidated peat (masses of rootlets, but not with the dense matrix usually seen in peat itself). In addition to rose seeds some juniper seeds were noted; it is possible that some rose seeds in the /T subsample had been misidentified and were, in fact, juniper. Traces of hemp seed and charred rye grains were added to the list of 'useful' taxa via this subsample.

There was a large flot but invertebrate remains were very dilute and only 36 adult individuals of 32 beetle taxa were recovered, together with modest numbers of mites and significant numbers of water flea resting eggs. Preservation was variable (E 2.0-3.5, mode 2.5 weak; F 1.5-4.0, mode 2.5 weak) and identifications limited by fragmentation in many cases. (Remains in the extremely large flot from the /T2 subsample were too dilute to be practicable to record.) The beetles may all have been background fauna, and certainly outdoor species were strongly represented (a third of the assemblage). The presence of 'many' ephippia of *Daphnia* and of a second cladoceran strongly suggest the presence of fairly clean water (either *in situ* or waste). They may have arrived by the same route as the crowfoot seeds.

Intrasis 100492, CHP 295

The large flot contained rather few insects, with no distinctive ecological groups recognisable; it was not possible to justify the time required to record the material.

Intrasis 100566, CHP 296

Preservation was good in a very large flot; there were rather few insects, and no distinctive ecological components apart from some water fleas. The data obtained would not have justified the time required to sort and record this material.

Context 99897: 'wood from pit 99030'
Unnumbered spot sample: see Table 1.13.

Bone from Pit 99030

The pit as a whole produced cow, pig, caprine, saithe and pollack bone, plus many unidentified mammal and fish specimens (many of them burned). Sample 99948/294 in particular contained one gadid bone, two unidentified fish bones and 13 unidentified mammal specimens. Five of the mammal specimens were burned.

Comments on Pit 99303

Several samples from a single context were examined. Only one sample yielded more than a trace of insect remains, and these and the accompanying plant fossils suggested that human occupation was well established with a range of food and other useful plants as well as bones from edible fish and mammals. There was a component of plant remains indicative of turf, the material perhaps being used for construction at this phase. The pit may have held water, or been subjected to flooding, but perhaps more probably received waste water,

(ii) Other deposits

All of the following **occupation layers** were examined via BS samples; see Table 1.2 for a summary of results.

Context 75001 (Intrasis 75134, CHP 132, with 1 other sample from the same context not examined)
Context 75167 (Intrasis 75215, CHP 134 with 1 other sample from the same context not examined)
Context 75579 (Intrasis 75679, CHP 140, with 7 other samples from the same context not examined)
Context 77759 (Intrasis 78139, CHP 162)
Context 78587 (Intrasis 78680, CHP 174)
Context 87926 (Intrasis 88581, CHP 260)

Site Period II: Plot 1

(i) Pit fills

Pit 64891
Context 88073 (Phase 2)
(No samples from this context examined.)

Context 87793 (Phase 3)

Intrasis 87806, CHP 256
Very dark grey, moist, unconsolidated stony coarse sand with a little very decayed humic material (perhaps mainly wood).

The small washover of about 175 cm^3 from the /T subsample was of very decayed wood (to 35 mm) and other organic detritus; there were rather few seeds and these were mostly rather worn and decayed. Only stinging nettle was present in more than trace amounts, but the assemblage overall included a variety of taxa probably representing damp to better-drained disturbed ground (and with a small food/flavouring component of hazel, blackberry, raspberry, and also hop). The large residue of about 750 cm^3 was of sand, grit and gravel (to 30 mm). Material from the /T2 subsample was essentially similar, but two 'useful' taxa added from it were strawberry (achenes) and flax (capsule fragments).

The records from the /T and /T2 subsamples were combined, but the resultant assemblage was still small (25 adult individuals of 21 beetle and bugs taxa, but very few other remains). The invertebrate remains were clearly very decayed, almost all being orangeish in colour (perhaps an indication of recent decay) and many being fragmented (E3.5-4.5, mode 4.0 strong; F 2.0-4.5, mode 2.5 weak; trend to yellow 2-4, mode 4). This may all have been transported (background or redeposited) fauna.

Context 65189 (Phase 3)
Intrasis 87792, CHP 255

Moist light to mid grey plastic clay in a matrix of more or less black crumbly ?humic sand.

The small washover of about 150 cm^3 consisted primarily of fine-grained charred material (with modest amounts of charcoal to 20 mm), some undisaggregated sediment, and moderate numbers of rather poorly preserved toad rush and raspberry seeds, with some very decayed wood fragments (to 5 mm). The few other charred and uncharred plant remains present provided little further interpretative information. The large residue of about 700 cm^3 was of sand, with some gravel (to 50 mm) and grit.

There was a minute flot, containing only traces of well-decayed insects (E 4.5; F 4.0; trend to orange 3). Only very few of the remains were identifiable.

Context 84137 (layer beside the pit, from the digging of this feature, Phase 2): not sampled

Bone from Pit 64891

The pit as a whole produced pig, cow, herring and saithe bone, plus many unidentified mammal and fish specimens (many of them burned). In particular, Sample 87806/256 yielded one herring bone, five unidentified fish specimens and seven unidentified mammal specimens. Four of the fish and one of the mammal specimens were burned.

Comments on Pit 64891

Plant and invertebrate remains were thinly distributed in the analysed fills of this pit and their preservation poor. The plant material was not particularly different from that in other deposits (other, perhaps, than in its degree of degradation). The poor preservation may have been the result of local ground-water conditions, but an alternative cause would be the initial input of organic matter.

Pit 65132

Context 86018 (Phase 2)
Intrasis 87732 (4.37 m), CHP 253
Very dark grey, moist, crumbly humic sandy silt with some wood fragments.

The large washover of the /T subsample of about 850 cm^3 was of organic debris, including twig fragments and other woody debris, perhaps 'cleaner' and less fine-strawy than 230 or 231, though there were a few coarser fragments of ?monocot culm. The material was also rather better preserved, generally, than for the other samples in this sequence and some material was noted as being 'well preserved'. A wide range of taxa was observed. There were modest amounts of hemp 'seeds', all fragmentary and many and well-preserved hop achenes (some with bract remains present). Traces of woad pod and flax seed were also noted. There was perhaps some food debris and taxa from hay or other cut grassland vegetation, and hints of material from bog or fen habitats. The modest-sized residue of about 450 cm^3 consisted of sand, grit and gravel (to 45 mm).

The /T2 subsample gave a rather modest residue of about 350 cm^3 of sand, grit and gravel, and a large washover of about 700 cm^3 of organic debris. The woody fragments in the >4 mm fraction were 'shiny' and mostly well or very well preserved, and some moss shoots and hazel nutshell fragments were also well preserved, whilst some of the herbaceous detritus looked as though it had become somewhat decayed and desiccated before being deposited. Some clasts of undisaggregated 'peaty' sediment gave an impression of being reworked occupation material.

Amongst these debris were some very fresh-looking hemp and hop fruits—indeed, there were some hop fruit bracts and some achenes still bore the yellow glands which furnish the bitter flavour of hops in brewing. Otherwise, the taxa were rather similar to those from the /T subsample.

The flot from the /T2 subsample was large, consisting of herbaceous detritus and some twig and wood fragments, among which invertebrate remains were hard to observe. Preservation was recorded as good to fair (E 1.5-3.5, mode 2.5 weak; F 1.0-3.5, mode 2.0 weak; trend to pale 1-3, mode 2 weak, based on the /T subsample). There were rather few insects (including 67 adults of 46 beetle and bug taxa), some mites, and a range of other invertebrates in small amounts. This was an ecologically mixed assemblage, with elements from waterside habitats (e.g. three *Platystethus nodifrons* and single *Chaetarthria seminulum* and *Notaris acridulus*, and perhaps the three *Platystethus arenarius*), and others probably from buildings (e.g. *Ptinus raptor* (5), *P. fur* (3), and five human fleas, *Pulex irritans*). This deposit may therefore have included material such as floor sweepings, but probably also a significant component of background fauna. There may have been an element of brought in water, unless there was fairly clean standing water in the cut.

A single honey bee, *Apis mellifera*, was recorded.

Intrasis 87731, CHP 251

Very dark grey moist, crumbly, somewhat laminated humic silty sand with wood fragments and stones.

There was a large washover of about 800 cm^3 of woody debris, including wood (to 25 mm), bark (to 35 mm), a few twig fragments and much finer material. Preservation was generally poorer than in 230 and 231, for example, though there were some moss shoots retaining a greenish colour. Some quite large and well-preserved hazel nutshell fragments were noted, though none bore the characteristic apical knife marks seen from material of Anglo-Scandinavian age at 16-22 Coppergate, York (Kenward and Hall 1995) or in Bergen (Krzywinski *et al.* 1983).

Plants likely to have been useful to the inhabitants of the settlement were rather well represented in this subsample, with abundant and mostly well-preserved achenes of hop, as well as fragmentary 'seeds' of hemp, and seeds of flax. The remainder of the assemblage largely comprised weeds and taxa of damp ground, including disturbed damp habitats, together with some debris from trees, including birch, oak and poplar/aspen and some woodland/heathland mosses. The modest-sized residue of about 450 cm^3 was of sand, grit and gravel (to 40 mm).

The flot was rather large and not very rich in insect remains. There were 97 adult individuals of 59 beetle and bug taxa, some mites, fly remains, and small quantities of a few other invertebrates. Preservation was often good (E 1.5-3.5, mode 2.5 weak; F 1.0-3.5, mode 2.5 weak). The fauna was ecologically mixed but not of very high mathematical diversity, perhaps suggesting the presence of coherent communities. If so, one may have arrived in waste from a building: there were two *Ptinus* species (neither identifiable to a species as a result of preservational condition and lack of critical parts) represented by six and four individuals respectively, while some of the rarer species may have arrived with them. A second community (e.g. five *Cercyon analis* and three *Platystethus arenarius*) may have been exploiting rather foul conditions, perhaps *in situ*, though apparently neither large populations nor a rich community were able to develop. A notable presence in this sample was four individuals of the *Dromius quadrinotatus* (also noted in some other samples), in this case accompanied by a single *D. quadrimaculatus*. These 'ground beetles' are associated with trees (see above), as is *Rhinosimus planirostis* (one individual) and they presumably had the same source as the tree debris.

Intrasis 87730, CHP 250

The flot was large, consisting of assorted plant debris. Adult beetles were fairly numerous, and there were a few bugs (totalling 119 individuals of 76 taxa); there were also some mites and a range of other invertebrates in smaller numbers. There were quite a lot of associated insect sclerites, normally a characteristic of excellent preservation, but in fact the condition of the remains was variable from quite good to poor even within single taxa (e.g. *Ptinus*), and

fragmentation limited identification in some cases (E 1.0-3.5, mode 2.0 weak; F 1.0-4.0, mode 2.5 weak). No species was particularly abundant, and assemblage diversity was high (alpha = 90, SE = 16), suggesting mixed origins. This was supported by the five most abundant species, each represented by four individuals: *Platystethus arenarius* and *Anotylus nitidulus* (both generally in foul matter, including waterside mud and litter), *Ptinus ?fur* and *P. raptor* (almost certainly from a building in this case), and the eurytopic (generalised) decomposer *Corticaria* sp. Other decomposers may have lived in the habitats suggested by these and arrived with them or lived *in situ*, but all may have been background fauna. Several *Daphnia* ephippia suggest water, but other aquatics were very rare.

Intrasis 86627, CHP 234

A rather large flot contained small numbers of well-preserved insects. There were hints of rather foul conditions from 'several' *Cercyon analis* and two each of *Oxytelus sculptus* and *Gyrohypnus fracticornis*, but not enough remains for this to be confirmed by full recording, and the total numbers were too small to justify the time required for recording to contribute towards site statistics.

Intrasis 86626, CHP 233

The flot was quite large, with fairly good insect preservation, but there were too few remains to justify the time required for sorting. The beetles were typical occupation-site decomposers, ecologically assorted. Some fragments of coelenterate skeleton were noted.

Intrasis 86386, CHP 230

Very dark grey, moist, crumbly, humic sandy silt with some lumps rich in small wood fragments.

The large washover of about 1000 cm^3 was mostly wood fragments (to 50 mm) and fine organic detritus, but rather a high proportion of the material was incompletely disaggregated matrix—humic silt, sometimes with compressed fine-strawy material, but overall the plant material was rather decayed. There were seeds in modest numbers, but the assemblage was not very diverse. Small but characteristic elements perhaps representing hay and/or grassland turves were present. The modest-sized residue of about 300 cm^3 was of sand, grit and gravel (to 40 mm).

The flot was of average size and contained rather small numbers of fossils: 60 adult individuals of 47 beetle and bug taxa, some mites, and very little else. These remains were in variable condition, often well decayed, limiting identifications (E 2.0-4.5, mode 3.5 weak; F 2.5-5.0, mode 3.0 weak; trend to pale 0-3, mode 2 weak). The only beetles represented by more than two individuals were *Lathridius minutus* group (8) and a *Philonthus* species (3), hardly a basis for a detailed reconstruction of past conditions since all or most of the remains could represent background fauna (diversity was high, alpha = 99, though SE = 30). However, much of this assemblage could have co-existed in (or be initial colonisers of) an accumulation of organic matter which varied in moisture content.

One soft *Apion* weevil prothorax was probably imported with the hay or other grassland plant remains.

Intrasis 86625, CHP 232

The large flot was only examined in part. There were very few, dilute, but fairly well preserved, insect remains and the time needed for sorting for so few records could not be justified. There were fragments of coelenterate skeleton.

Intrasis 86387, CHP 231
Very dark grey, moist, crumbly (and rather soft), humic sandy silt.

The large washover of about 1000 cm^3 consisted of organic debris including some undisaggregated sediment, of which some clasts were very compressed, very decayed fine-strawy debris, often spotted with fungal sclerotia. There was also some bark (to 50 mm). Identifiable plant remains were moderately common, the more abundant being ?tormentil, celery-leaved crowfoot and stinging nettle, with a range of other taxa including possible food/flavouring plants— hazel nut, strawberry, barley, blackberry and (as a single fragment) hop. Traces of taxa which might have arrived in hay or grassland turves were also present. The modest-sized residue of about 325 cm^3 was of sand, grit and gravel (to 50 mm).

The smallish flot contained a small assemblage of what were often rather pale and scrappy, sometimes 'reddened' fossils, their condition often limiting identification (E 2.0-4.0, mode 3.0 weak; F 1.5-4.0, mode 2.5 weak; trend to red-brown 1-3, mode 2 weak). There were 77 adults of 55 beetle and bug taxa, none very abundant, some mites, and single specimens of a range of other invertebrates, including a single fragmentary and very decayed hind tarsal segment of *?Apis mellifera* (honey bee). The beetles were mainly a typical (but restricted) range of occupation-site decomposers, the more abundant ones suggesting slightly to rather foul material, such as might be found in a compost heap. All might have been background fauna from other parts of the site, and beyond, however, and certainly the high diversity (alpha = 86, though SE = 20) would support mixed origins. There was nothing to suggest disposal of any characteristic kind of waste.

Intrasis 86385, 4.65 m, CHP 229: 'compressed straw blocks'
Highly compressed dark brown, coarse herbaceous plant material (with the appearance of straw), sometimes paler within clasts.

The compressed 'strawy' material forming the bulk of this layer disaggregated with extreme difficulty—after gentle handling and sieving it was mostly left as lumps of strongly compressed, strawy debris. An initial 'spot' subsample was supplemented by a large /T subsample to provide further material for examination of the plant remains forming the matrix as well as to provide some insect remains, though the likelihood of being able to extract a useful assemblage was always in doubt, given the very low concentration of insect remains amongst the well preserved plant fragments. For the most part these consisted of quite coarse culm fragments, pale and rather well preserved and probably cereal straw, but there were also rather frequent well-preserved leafy shoots of the mosses *Polytrichum* (*P. commune* var. *commune* Hedw. readily identifiable from the grooved apical cells of the

lamella as seen in section) and other moss shoots (some retaining a greenish coloration). Some cuticle remained attached to certain of the monocot culm fragments but none of this could be identified. Some fragments with crenulate cells bearing large papillae suggest a large sedge, but other taxa, probably grasses were also present. Certainly grasses were represented by other parts—there were, for example, some whole heath grass (*Danthonia*) spikelets, flattened and with the caryopsis inside. In at least one or two cases, pairs of spikelets still in association point to the presence of inflorescences incorporated into what must surely be cut vegetation (an origin for these in ruminant dung seems very unlikely, given the effects of mastication and rumination, though it may be that such material could pass the equine gut without becoming dissociated). Given the overall nature of the assemblage, an origin in something like stable litter or perhaps roofing or flooring, with a mixture of taxa from grassland as well as heathland, bog or woodland habitats coming together as litter of various kinds, is possible. A test for eggs of parasitic nematodes from this deposit proved negative, providing support—albeit through absence of evidence—for the view that this material did not consist of or contain herbivore dung or human faeces , although it must be stressed that some large domestic animals are unlikely to leave a disitinctive signal for their dung via parasite eggs.

No insect remains were observed in the 'spot' sample. The flot from the main-phase subsample was very large. It was almost impossible to sort effectively for insect remains among the mass of detritus and woody fragments; there were some 'sticky' woody particles to which insect had adhered. Preservation was fairly good (E 2.0-3.0, mode 2.5 weak; F 2.0-3.5, mode 2.5 weak). There were several *Cryptophagus* abdomens and elytra with wings attached, but the remains showed clear signs of appreciable decay even so. Insect remains were rather abundant, and there were numerous mites. There were 121 adult individuals of the beetle and bug groups used for calculating statistics, though of only 45 taxa, so that diversity was low (alpha = 26, SE = 4). There were only three taxa with more than three individuals: *Lathridius minutus* group (40), a *Cryptophagus* species (13), *Cercyon analis* (5), and an *Atomaria* species (4). These, all decomposers, and many of the rarer taxa, probably lived in the layer before burial, and suggest conditions which were not too foul. Overall, decomposers made up 74% of the assemblage, with 51% representing relatively dry litter and only 3% normally restricted to foul matter (Table 1.9). An obvious question of this material is whether it originated in a building (e.g. in a stable or byre). The insects give no evidence for this: although three of the most abundant taxa fall in the 'house fauna' group (outlined above), all are also found in the open, and there was no coherent component of this kind: even the single human flea, *Pulex irritans*, may have arrived in various ways, or bred in the material *in situ*.

There were some aquatic invertebrates: three *Daphnia* ephippia and one of a second type of water flea, though only one water beetle. These, too, may have entered in several ways, and were too rare to attest to either deposition in water or to the disposal of waste water. Various outdoor forms, mostly plant-associated, were probably background fauna from nearby vegetation; the 'outdoor' component was small for a surface-laid external deposit (% N OB = 13).

A single fragment of a bee hind tarsal segment was recorded from this sample, but it was very degraded and could not be confidently assigned to species.

Intrasis 86040, 4.67 m, CHP 226

Preservation of invertebrates was good in a fairly small flot, but numbers of remains were limited and there were no distinctive ecological components. The assemblage was not considered worth recording even to produce data for site-level analysis.

Context 86813 (Phase 2)
Intrasis 87368, CHP 249: BS sample not examined.

Context 84283 (Phase 2): not sampled

Context 84282 (Phase 3)
Intrasis 84730, CHP 223: BS sample, see Table 1.2

Context 84267 (Phase 3)
Intrasis 84386, CHP 220: BS sample not examined

Context 65159 (Phase 3): not sampled

Bone from Pit 65132

The pit as a whole produced pig, cow, herring and saithe bone, plus many unidentified mammal and fish specimens (many of them burned). Sample 87732/253, in particular, yielded nine herring bones, five unidentified fish specimens and seven unidentified mammal specimens. Three of the fish and five of the mammal specimens were burned. Not surprisingly, in view of its nature, the 'compressed straw' sample (86385/229) produced no bone.

Comments on Pit 65132

Much the most heavily sampled and investigated pit, 65132 yielded abundant and often very well preserved plant remains and sometimes also substantial insect assemblages. The same range of useful plants was recorded here as in the other pits. One layer appeared to consist almost entirely of cut vegetation in the form of compressed 'straw' (though it probably did not contain much cereal straw *per se*). This may have originally been roofing or litter from a floor (though if the latter, it accumulated very few 'domestic' debris in its life). The insects in several of the layers certainly pointed to an origin in a building. Some contexts contained water fleas, perhaps from waste water (although flooding is an alternative source—there was nothing to suggest that aquatics lived in the pit).

Pit 82649

Context 83319
Intrasis 83825, CHP 218: BS sample, see Table 1.2

The other fill contexts sampled were not examined:
Context 83660: Intrasis83827, CHP 214
Context 83826: Intrasis 83461, CHP 215

Context 83825: Intrasis 83319, CHP 218

Pit 84614

Context 84615
Intrasis 84937, CHP 224: BS samples examined, see Table 1.2

(ii) Other deposits

PLOT 1, PHASE 2

Context 61643: Clay from hearth of house A200
Intrasis 62381, CHP 20
Mid grey to grey-brown, dry, crumbly, locally somewhat indurated, ?ashy silt with ?fire-cracked stones.

There was a small washover of about 60 cm^3 of charred material, mostly <1mm, but with charcoal (including oak) to 10 mm and traces of hazel nutshell; there were also two uncharred blackberry seeds and some (presumably modern) rootlets. The large residue of about 825 cm^3 was of gravel (to 55 mm), grit and sand. No insect remains were observed.

Context 61670: Occupation layer, house 201
Of the Intrasis samples 62372/CHP 12; 72373/13; 62378/15; 62379/16; 62375/17; 62380/18 and 62377/21, only the last was examined, via a BS sample; see Table 1.2.

Context 64612: dumping layer
Of the intrasis samples 64664/CHP 45; 64665/46; 64666/47; 64667/48; 64668/49 and 75110/131, only the 64667/48 was examined, via a BS sample; see Table 1.2.

Context 68495: Layer in large dumping area at South of excavation area
Intrasis 68512, CHP 83
Very dark grey to black, moist, crumbly to soft, gritty, ?humic sandy silt or sandy humic deposit, probably charcoal rich.

The very large washover of about 500 cm^3 comprised charred material, much of it fine (<1 mm) clasts of (presumably) ash, with much charcoal (to 10 mm), sometimes with iron-concreted material adhering. There was also a little very decayed uncharred wood (to 5 mm). A light washover from this yielded some uncharred rush (*Juncus*) seeds. The large residue of about 475 cm^3 was of sand, grit and gravel (to 75 mm) with a single fragment (to 80 mm) which may have been from a quern. There was a small flot, with only traces of decayed invertebrate cuticle.

PLOT 2, PHASE 2

Context 68378: bench layer, house 406
Intrasis 68451, CHP 77 and Intrasis 68455, CHP 78 were examined via BS samples, see Table 1.2.

Context 69242: occupation layer, house 406
Intrasis 69304, CHP 89, 69305/90; 69306/91; 69307/92 and 69308/93 examined via BS samples 90, 91, 92, 93; see Table 1.2.

Context 74037: dumping layer
Intrasis 74111, CHP 118: see BS sample in Table 1.2.

PLOT 2, PHASE 3

Context 61359: layer [?hearth]
Intrasis 61410, CHP 4: BS sample, see Table 1.2
(Intrasis 61409, CHP 3 not examined)

Context 64458: dumping layer
Intrasis sample 64552/CHP 38; 64553/39; 64554 /40; 64555/41; 64556/42; 64550/43 and 64551/44: BS sample examined: CHP 43, see Table 1.2.

PLOT 3, PHASE 2

Context 64713: floor, house 303
Intrasis 78923, CHP 178 and 81537/199 both examined via BS: see Table 1.2.

Context 70602: dumping layer
Intrasis 73307, CHP 114: BS examined, see Table 1.2.

Context 78393: dumping layer
Intrasis 78456, CHP170: BS examined, see Table 1.2.

Context 81762: occupation layer, house 303
Intrasis 82227, CHP 200; 82228/201; 82229/203: all examined via BS samples, see Table 1.2

Context 82178: occupation layer
Intrasis 82310, CHP 207; 82311/209: Sample 207 examined, see Table 1.2.

Context 82362: levelling layer
Intrasis 82619, CHP 205: see BS sample, Table 1.2.

Context 83246: dumping layer

Intrasis 87461, CHP 245; 87783/252: BS Sample 252 examined, see Table 1.2

Context 84296: dumping layer
Intrasis 84672, CHP 221: BS sample examined, see Table 1.2.

Context 84844: hearth, house 303
Intrasis 84895, CHP 225: BS sample examined, see Table 1.2.

Context 85299: occupation layer
Intrasis 86599, CHP 239: BS sample examined, see Table 1.2.

Context 86485: layer
Intrasis 87318, CHP 242: BS sample examined, see Table 1.2.

PLOT 3, PHASE 3

Context 47045: layer in hearth in house 301
(Intrasis 62139, CHP 310)
Mid grey-brown, dry, crumbly, silty ash with some more or less orange brown patches of clay or ?burnt soil.

The very small washover was of charred material: about 40 cm^3 of ash-coated charcoal (to 10 mm). The large residue of about 725 cm^3 was of sand, grit and gravel (to 30 mm). No insect remains were observed.

Context 62023: occupation layer, house 301
Intrasis 63610, CHP 30 and 63865/35 both examined via BS samples, see Table 1.2.

Context 62068: occupation layer, house 301
Intrasis 63864, CHP 34: BS sample examined, see Table 1.2.

Context 65556: bench layer, house 301
Intrasis 66061, CHP 59: BS sample examined, see Table 1.2.

Context 65597: dumping layer
Intrasis 66007, CHP 60: BS sample examined, see Table 1.2.

Context 66085: floor, house 301
Intrasis 66400, CHP 64: BS sample examined, see Table 1.2.

Context 67217: occupation layer, house 302
Intrasis 67530, CHP 71; 67531/72; 68752/81; 71214/103: Sample 103 BS examined, see Table 1.2.

Context 68717: dumping layer [ash deposit]
Intrasis 68753, CHP 86: BS sample examined, see Table 1.2.

Context 68986: dumping layer [clay layer]
Intrasis 69558, CHP 94: BS sample examined, see Table 1.2.

Context 70696: occupation layer, house 301
Intrasis 71949, CHP 108: BS sample examined, see Table 1.2.

Context 70806: bench layer, house 301
Intrasis 71121, CHP 101: BS sample examined, see Table 1.2.

Context 71826: dumping layer
Intrasis 79086, CHP 182: BS sample examined, see Table 1.2.

Context 74121: dumping layer
Intrasis 74138, CHP 125: BS sample examined, see Table 1.2.

Context 74188: dumping layer
Intrasis 74292, CHP 126: BS sample examined, see Table 1.2.

Context 75751: dumping layer
Intrasis 75820, CHP 146: BS sample examined, see Table 1.2.

Context 76555: occupation layer, house 302
Intrasis 76883, CHP 151 and 76884/153: Sample 153 examined, see Table 1.2.

Context 76661: layer
Intrasis 78003, CHP 159: BS sample examined, see Table 1.2.

Context 76697: ditch fill
Intrasis 77600, CHP 158: BS sample examined, see Table 1.2.

Context 76910: hearth, house 302
Intrasis 78141, CHP 157: BS sample examined, see Table 1.2.

Context 77718: hearth, house 302
Intrasis 78274, CHP 166: BS sample examined, see Table 1.2.

Context 78143: dumping layer
Intrasis 78190, CHP 165: BS sample examined, see Table 1.2.

Context 78497: bench layer, house 302
Intrasis 78572, CHP 173: BS sample examined, see Table 1.2.

Site Period III

(i) Pit fills

Pit 43852 (Plot 3, Phase 4)

Context 88350: not sampled

Context 88226
Intrasis 88241, CHP 257
Very dark grey to black, moist, crumbly to more or less plastic, gritty sandy silt to silty sand, ?somewhat humic; stones to 40 mm.

The large washover of about 425 cm^3 from the /T subsample comprised woody organic material, including much bark (to 25 mm) and wood (to 15 mm); preservation was mostly good. There was a wide range of identifiable taxa including weeds, and plants of wetland and woodland habitats. Possible food remains were hazel and blackberry, and there was a single charred barley grain. The large residue of about 450 cm^3 was mainly sand, grit and gravel (to 10 mm) with some fish bone (to 15 mm). The /T2 subsample yielded a large washover of about 1000 cm^3. The >4 mm fraction was mainly charcoal and bark, with a little wood and twig material; some clasts of undisaggregated sediment were firmer than others and more 'peaty', so were perhaps reworked occupation material (but not peat as such). Some fragments of grass/cereal culm were quite robust but flattened, whilst some of the smaller wood fragments were quite thin and were apparently chips.

The combined flots from the /T and /T2 subsamples produced the largest assemblage from the Kaupang site: 178 adults of 75 beetle and bug taxa, accompanied by large numbers of mites and *Daphnia* ephippia and smaller numbers of various other invertebrates. Preservation ranged from quite good to rather poor (E 1.5-4.0, mode 2.5 weak; F 1.5-4.0, mode 1.5 weak). Like the assemblages from Samples 247 and 254 (below), this group was dominated by abundant *Omosita colon* (31); the remaining fauna had many echoes too: numerous *Orthoperus* sp. (11) and *Cordalia obscura* (8), significant numbers of spider beetles (four *P. ?raptor* and the *P. ?fur*), single *Necrobia violacea* and *Creophilus maxillosus*, and two

Dermestes lardarius. *Trox scaber*, *Saprinus* sp. and *Tenebrio obscurus* (all 1) may also have been attracted to drying animal matter.

Context 87992
Intrasis 88072, CHP 258
BS sample: not examined.

Context 87669
Intrasis 87679, CHP 254

Very dark grey, moist, silty sandy grit.

There was a large washover from the /T subsample of about 400 cm^3 of mainly fine organic debris with some granular woody fragments (to 15 mm), mostly rather decayed wood (though including some small flaky fragments of conifer wood that were quite well preserved, and which might have been thin 'chips'). There was also some charcoal (to 20 mm), undisaggregated sediment (with a surprising degree of coherence, containing mainly fine woody fragments and a little silt). A modest range of identifiable plant remains was present, preservation often being quite to very good (e.g. *Rubus* seeds and most of the spike-rush nutlets), sometimes poor (?bulrush); there were several tens of seeds per kg, the assemblage having a notable component of taxa from woody vegetation (four kinds of buds/bud-scales) but otherwise quite a broad mixture ecologically and with no one group dominating. There was a large residue of about 350 cm^3 of sand, grit and gravel (to 50 mm) with some slight concretion on mineral clasts or groups of clasts (which might be ?iron-rich material from the matrix or sediment, rather than being faecal in origin). The /T2 subsample gave a large washover of about 350 cm^3 and a residue of 325 cm^3 of sand, grit and gravel with a little bone. Some wood chips were checked and found to be from a conifer, the closest identification being larch, *Larix* (though this remains tentative). Plant material was generally rather decayed, but this subsample added a further record of hemp seed and there was one quite well preserved charred hulled barley grain.

Preservation of invertebrates was variable but generally poor, limiting identifications. Preservation in the /T2 subsample (E 4.0-5.0, mode 4.0 weak; F 2.5-5.0, mode 3.0 weak) was noticeably different from that in the /T (E 2.5-4.5, mode 3.5 weak; F 2.0-4.0, mode 2.5 weak; trend to pale/orange 1-4, mode 2 weak). It is not certain whether this reflects variation in the sediment in the ground or decay of the material used for the /T2 in a year's storage. The records from flots from the /T and /T2 subsamples were combined, giving an assemblage of 146 adult beetles (no bugs) of 73 taxa. There were also some mites, coelenterate hydroid skeletons, and various other invertebrates including some *Daphnia* (water flea) ephippia. The fauna was strikingly like that from Sample 247, although lacking the numerous *Ptinus*. There were 23 individuals of *Omosita colon*, here again accompanied by two adults (?) and two larvae of *Dermestes lardarius*. Single *Creophilus maxillosus* and *Necrobia* sp. represent further elements likely to have been attracted to dryish animal matter such as skins.

There was a single incomplete hind tarsal segment of *?Apis mellifera* (?honey bee), too decayed for a confident identification.

Context 61411
Intrasis 87216, CHP 237

Jumbled dark olive brown to mid yellowish brown to dark grey to black, moist, crumbly slightly silty sand, perhaps somewhat layered.

There was a small washover of about 100 cm^3 of mainly charred material (including charcoal to 10 mm), plus a very little uncharred organic debris. There were modest numbers of charred goosegrass (*Galium aparine*) fruits but no other identifiable plant taxa. The large residue of about 475 cm^3 was of sand, grit and gravel (to 50 mm), plus modest amounts of burnt bone (to 50 mm) and baked clay/daub (to 40 mm). No insect remains were observed.

Intrasis 87214, CHP 236

The flot contained only traces of very decayed and unidentifiable cuticle.

Context 62471:
Intrasis 63050, CHP 24; 83984/216 and 87298/241: not examined

Context 87626
Intrasis 87649, CHP 247
Very dark grey, moist, crumbly to more or less plastic silty clay sand to sandy clay silt with stones and much grit.

The modest-sized washover of about 275 cm^3 from the /T subsample was mostly rather fine granular woody organics, mainly wood (to 15 mm) and charcoal (to 20 mm). The rather large residue of about 500 cm^3 was of sand, grit and gravel (to 50 mm). A small assemblage of plant remains was recovered, with only sedge, spike-rush, toad rush, celery-leaved crowfoot, blackberry and stinging nettle present in more than trace amounts. No ecological or use group of plants was especially prominent, though overall woody taxa from woodland and scrub were the best represented plants. The /T2 subsample gave a washover of approximately 1750 cm^3 of woody debris, all rather decayed, and a large res of 1100 cm^3 of sand, grit and gravel, with some bone. The plant remains were essentially similar to those in the /T subsample.

The insects from the /T and /T2 subsamples were combined to boost numbers. The moderately large flots consisted of fine fibrous plant detritus, making sorting difficult. Preservation was very variable but generally poor, limiting identifications (E 1.5-5.0, mode 4.0 distinct; F 2.5-5.5, mode 3.0 weak). A total of 91 adult beetles and bugs from 49 taxa was recorded, an assemblage dominated by two taxa: *Omosita colon* (13) and a *Ptinus* sp. (10). *O. colon* is found in decaying matter, typically bones, dry carrion or old skins. It was even more abundant in Sample 254 (*q.v.*). Although it may have been exploiting a variety of materials at the Kaupang site, one hypothesis for testing is that this pit was involved in some way the treatment of skins and that the *Omosita* were attracted to them *in situ* or had invaded (perhaps with the ten *Ptinus* sp.) stored skins elsewhere before they or waste from them entered the cut. This line of argument is supported by the record of an adult (?identification) and two larvae of the hide beetle *Dermestes lardarius*, found in decaying animal matter, sometimes in

houses and birds' nests. Elements of the remaining fauna may have come from indoors (notably *?Tenebrio obscurus*), and many may have been attracted to hides or bones, but are not necessarily characteristic of skins or decaying animal matter. The numerous *Daphnia* ephippia were presumably brought with water, perhaps used in processing skins, unless they were introduced by flooding. These subsamples yielded quite large numbers of fragments of marine hydroids.

Context 87427
Intrasis 87447, CHP 243
Very dark grey to grey-brown, moist, crumbly to more or less plastic humic silty sand, locally humic silt.

The small to moderate-sized washover of about 150 cm^3 was of extremely well decayed, mostly fine woody and herbaceous detritus, not initially too well cleaned. The modest-sized residue of about 300 cm^3 consisted of sand, grit and gravel (to 35 mm) with one large (to 60 mm) fragment of slag. There were small numbers of mostly rather poorly preserved uncharred plant remains representing a range of taxa of limited interpretative value.

There were only a few well-decayed insect fragments (E 4; F 2.5-50, mode 3 weak) in the flot, mostly beyond identification. The remains had no interpretative significance.

Context 60829: not sampled

Context 61237:
Intrasis 83550, CHP 210: BS sample, see Table 1.2.

Context 61140: not sampled.

Bone from Pit 43852

The pit as a whole produced a rich assemblage of 3403 bone specimens from a number of contexts. Most were small fragments and only 328 specimens (236 fish, 87 mammal and four bird) were identified beyond the level of class. Nevertheless, this is a significant proportion of the total identified bone from the site, particularly in the case of fish. The main fish taxa represented were herring, cod, saithe, ling, dogfish, hake, and shark or ray. The mammal taxa were cattle, pig, caprine, cat, deer (one red deer antler tine and a comb tooth of unidentified antler) and shrew. The only identified bird specimens were of domestic fowl. Samples 88241/257, 87679/254 and 1029443 (previously 87649, CHP 247) in particular yielded 93 herring bones, three cod bones, eight cod family bones, 114 unidentified fish bones, two caprine bones, one shrew bone, one antler comb tooth, 155 unidentified mammal bones and one domestic fowl bone. Twenty-one of the fish specimens and 70 of the mammal specimens were burned. The bones are unlikely to be waste from skinning alone as common domesticates, fish and 'chicken' rather than furbearers. Burnt bone was common in both floor

layers and other deposit types (e.g. dumps), so its presence in pits is not indicative of a specific origin.

Comments on Pit 43852

Samples from several contexts from this pit were investigated and some proved to contain quite large numbers of insects and rich plant assemblages, the latter particularly maked by the presence (albeit in small concentrations) of wood chips. The most remarkable feature of the insects was the presence of remains of species likely to have been attracted to animal matter such as dryish bones or stored skins. There was also evidence for water, probably waste. It is just possible that the pitfall included, among a range of other materials, debris from leather or skin preparation or storage (cf. the discussion of an 'indicator group' for tanning by Hall and Kenward 2003b).

Deposits dated broadly to Site Periods I-II or I-III (only BS samples examined, see Table 1.2)

PHASE I-II, PLOT 3

Context 73520: dumping layer
Intrasis 78273, CHP 164

Context 78457: dumping layer
Intrasis 78495, CHP 171

Context 78522: dumping layer
Intrasis 78570, CHP 172

PHASE I-III, PLOT 3

Context 75901: layer
Intrasis 78142, CHP 150

Context 90609: layer
Intrasis 91136, CHP 282

Deposit from Heritage Management intervention

Context 94901: pit fill
(Intrasis 94864, CHP 289)
Moist, dark grey, very gritty but somewhat plastic stony clay sand with some waterlogged wood to 50mm, gravel to 100 mm, locally more clayey or sandy (some pellets of more or less pure clay).

The small washover of about 180 cm^3 consisted of mainly woody organics—very decayed wood (to 35 mm) and some herbaceous detritus, including fine roots which appear to be

ancient. There were rather few and rather worn seeds, mostly probably from weed taxa. The large residue of about 625 cm^3 comprised sand, grit and gravel (to 35 mm). The very small flot contained only traces of rather orange cuticle (E 5.5; F 5.0; trend to orange 4.0).

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Table 1.1. Material from Kaupang for which analyses of plant and/or invertebrate remains have been made. Samples are listed in order of site period, plot, plot phase and context number.

Key: GBA-A—subsample examined during initial assessment (weight 2 kg); GBA-M—GBA subsample examined during 'main analysis' phase (weight 3kg unless otherwise marked); B—BS sample examined (via washover and material sorted from residue), with weight, in kg, where known; S—spot find (usually of wood).

							Material examined			
Site Period	**Plot**	**Plot Phase**	**Context**	**Intrasis sample**	**CHP sample**	**Context**	**GBA-A**	**GBA-M**	**B**	**S**
I	2	1	75001	75134	132	occupation layer			+ (10.3)	
			75167	75215	134	occupation layer			+ (10.2)	
			75579	75679	140	occupation layer			+ (12.8)	
				78139	162				+ (13.1)	
			78587	78680	174	occupation layer			+ (8.7)	
			87926	88581	260	mixed layer			+	
			99879	99948	294	pit fill in 99030	+	+ (5)		
				-	99897	wood from 99030				+
II	1	2	61643	62381	20	clay from hearth, house 200	+			
				63190	25				+ (22)	
			61670	62377	21	occupation layer, house 201			+ (10)	
			64612	64667	48	dumping layer			+ (12.5)	
			68495	68512	83	large dump	+			
			86018	86040	226	pit fill in 65132		+		
				86385	229			+ (1.3)		+ (0.3)
				86386	230		+			
				86387	231		+			
				86625	232			+		
				86626	233			+		
				86627	234			+		
				87730	250			+		
				87731	251		+			
				87732	253		+	+ (2)		
	1	3	87793	87806	256	pit fill in 64891	+	+ (2.45)		
	2	2	68378	68451	77	bench layer, house 406			+ (14.5)	
				68455	78				+ (12)	

							Material examined			
Site Period	**Plot**	**Plot Phase**	**Context**	**Intrasis sample**	**CHP sample**	**Context**	**GBA-A**	**GBA-M**	**B**	**S**
			69242	69305	90	occupation layer, house 406			+ (12)	
				69306	91				+ (13)	
				69307	92				+ (6)	
				69308	93				+ (11.5)	
			74037	74111	118	dumping layer			+ (11.7)	
	2	3	61359	61410	4	layer [?hearth]			+ (6.5)	
			64458	64550	43	dumping layer			+ (10)	
	3	2	64713	78923	178	floor, house 303			+ (14.9)	
				81537	199				+ (11.7)	
			70602	73307	114	dumping layer			+ (12)	
			78393	78456	170	dumping layer			+ (12.2)	
			81762	82227	200	occupation layer, house 303			+ (12.4)	
				82228	201				+ (13.2)	
				82229	203				+ (11.9)	
			82178	82311	209	occupation layer			+ (14.9)	
			82362	82619	205	levelling layer			+ (13.6)	
			83246	87783	252	dumping layer			+ (13.4)	
			83319	83825	218	pit fill in 82649			+ (12.1)	
			84296	84672	221	dumping layer			+ (12.6)	
			84615	84937	224	pit fill (in small pit)			+ (14.3)	
			84844	84895	225	hearth, house 303			+ (13.1)	
			85299	86599	239	occupation layer			+ (14.3)	
			86485	87318	242	layer			+ (10.7)	
	3	3	47045	62139	10	clay from hearth, house 301	+			
			62023	63610	30	occupation layer, house 301			+ (11.5)	
				63865	35				+ (11)	
			62068	63864	34	occupation layer, house 301			+ (9)	
			65556	66061	59	bench layer, house 301			+ (11)	
			65597	66007	60	dumping layer			+ (9)	
			66085	66400	64	floor, house 301				
			67217	71214	103	occupation layer, house 302			+ (11)	
			68717	68753	86	dumping layer [ash deposit]			+ (11)	
			68986	69558	94	dumping layer [clay layer]			+ (13)	
			70696	71949	108	occupation layer, house 301			+	

							Material examined			
Site Period	**Plot**	**Plot Phase**	**Context**	**Intrasis sample**	**CHP sample**	**Context**	**GBA-A**	**GBA-M**	**B**	**S**
			70806	71121	101	bench layer, house 301			+ (10)	
			71826	79086	182	dumping layer			+ (9.7)	
			74121	74138	125	dumping layer			+ (13.2)	
			74188	74292	126	dumping layer			+ (12.6)	
			75751	75820	146	dumping layer			+ (13.5)	
			76555	76884	153	occupation layer, house 302			+ (12.6)	
			76661	78003	159	layer			+ (10.5)	
			76697	77600	158	ditch fill			+ (14)	
			76910	78141	157	hearth, house 302			+ (12.1)	
			77718	78274	166	hearth, house 302			+ (11.8)	
			78143	78190	165	dumping layer			+ (13)	
			78497	78572	173	bench layer, house 302			+ (11.8)	
III	1	3	65189	87792	255	pit fill in 64891	+			
			84282	84730	223	pit fill in 65132			+ (9.4)	
	3	4	61237	83550	210	pit fill in 43852			+ (12.8)	
			61411	87214	236			+		
				87216	237		+			
			87427	87447	243		+			
			87626	87649	247		+	+ (5)		
			87669	87679	254		+	+ (1.6)		
			88220	88152	261	pit fill in 43852 [stakehole fill]				+
			88221	88153	262					+
			88222	88154	263					+
			88223	88155	264					+
			88224	88157	266					+
			88225	88158	267					+
			88226	88241	257	pit fill in 43852	+	+ (5)		
			88589	88156	265	pit fill in 43852 [stakehole fill]				+
			88660	?	268	[stake]				+
I-II	3	?	78457	78495	171	dumping layer			+ (11.3)	
		2/3	73520	78273	164	dumping layer			+ (13.9)	
			78522	78570	172	dumping layer			+ (14.7)	
I-III	3	?	73950	74003	117	pit fill in 74095			+ (12)	
			75901	78142	150	layer			+ (12)	

							Material examined			
Site Period	**Plot**	**Plot Phase**	**Context**	**Intrasis sample**	**CHP sample**	**Context**	**GBA-A**	**GBA-M**	**B**	**S**
			90609	91136	282	layer			+	
Heritage Management intervention			94901	94864	289	pit fill	+			

Table 1.2. Plant remains and other components of the washovers from 52 selected BS samples. Data are presented by site period, plot and plot phase. For samples marked *, material from the residue as well as the washover was examined. Charcoal abundance: material included A—alder (*Alnus*); C—hazel (*Corylus*); Con—Coniferae; F—ash (*Fraxinus*); Q—oak (*Quercus*); ?P—?rose family, pro parte (Pomoideae); S/P—willow/aspen/poplar (*Salix/Populus*).

The term 'charred organic material' is used for the fragments of resin-like material with a characteristic 'sunken-pustular' surface, and 'fuel plant ash' for whitish beads and amorphous material thought to originate in the burning of plant materials. '+' and '++' represent the first two points on the semi-quantitative four-point scale of abundance used to record this material.

Site Phase	**Plot**	**Phase**	**Context**	**Intrasis sample**	**Sample**	**Charcoal: abundance**	**Charcoal: maximum dimension (mm)**	***Hordeum* grains**	**Other plant and non-plant components (charred and recorded at an abundance of '1' ('trace') unless otherwise indicated)**
I	2	1	75001	75134	132	++	25		*Carex*, plant fuel ash
			75167	75215	134	++	10	+	plant fuel ash
			75579	75679	140	+	15		plant fuel ash
			77759	78139	162	++	10	+	*Carex*, *Eleocharis palustris* sl, *Viola*, plant fuel ash, twig fragments
			78587	78680	174	++	15		plant fuel ash
			87926	88581	260	++	15		*Cenococcum* (sclerotia), *Chenopodium album*, unburnt bark, charred organic material, plant fuel ash
II	1	2	61643	63190	25	+	10		bark, herbaceous detritus
			61670	62377	21	+	15	+	Gramineae, *Stellaria media*, unburnt bark, unburnt bone, plant fuel ash
			64612	64667	48	++	10		*Triticum/Hordeum*, plant fuel ash
	2	2	68378	68451	77*	+ F Q	25	+	plant fuel ash
				68455	78	+ C Co F Q	35		plant fuel ash, *Carex*
			69242	69305	90*	++ C F Q	15	+	plant fuel ash, *Carex*, *Potentilla* cf. *erecta*, uncharred wood
				69306	91*	++	10	+	plant fuel ash, *Corylus avellana* nutshell, cf. *Juniperus communis* (seed)
				69307	92*	+	10		plant fuel ash (++), Carex, *Corylus avellana* nutshell, *Potentilla* cf. *erecta*

Site Phase	Plot	Phase	Context	Intrasis sample	Sample	Charcoal: abundance	Charcoal: maximum dimension (mm)	*Hordeum* grains	Other plant and non-plant components (charred and recorded at an abundance of '1' ('trace') unless otherwise indicated)
				69308	93*	+ F Q	15		plant fuel ash (++), *Rubus fruticosus* agg.
			74037	74111	118	++	25		*Carex*, *Potentilla* cf. *erecta*, *Scirpus lacustris sl*, *Stellaria media*, *S. palustris/graminea*, uncharred bark, plant fuel ash (++)
	2	3	61359	61410	4	++	15		*Carex*, bone (burnt and unburnt), plant fuel ash
			64458	64550	43	++	15	+	*Carex* (++), *Chenopodium album*, Gramineae, *Rumex*, bark, bone, plant fuel ash
	3	2	64713	78923	178*	+ F Q	10		
				81537	199*	+	5	+	
			70602	73307	114	++	15	+	charred organic material, plant fuel ash
			78393	78456	170	+	10	+	*Carex*, cf. *Secale cereale*, cf. *Triticum*, charred organic material, plant fuel ash
			81762	82227	200*	+ Q S/P	20	+	cf. *Juniperus communis* (seed)
				82228	201*	+ ?P Q			*Corylus avellana* nutshell
				82229	203*	++	15		*Corylus avellana* nutshell, *Rubus fruticosus* agg.
			82178	82311	209	++	15		plant fuel ash
			82362	82619	205	+	15	+	charred organic material, plant fuel ash
			83246	87783	252	+	10	+	*Carex*, *Polygonum persicaria*, unburnt bone, burnt fish bone, plant fuel ash
			83319	83825	218	+	10	++	*Atriplex*, *Avena*, *Carex*, *Chenopodium album*, *Galium*, *Polygonum persicaria*, cf. *Secale cereale*, unburnt bark and cancellous bone, charred organic material (++), herbaceous detritus, plant fuel ash
			84296	84672	221	++	15	+	*Carex*, plant fuel ash
			84615	84937	224	+	15	+	*Carex*, plant fuel ash
			84844	84895	225	+	10		
			85299	86599	239	++	10	+	*Chenopodium album*, *Galium aparine*, unburnt bark
			86485	87318	242	+	15		*Cenococcum* (sclerotia), plant fuel ash

Site Phase	Plot	Phase	Context	Intrasis sample	Sample	Charcoal: abundance	Charcoal: maximum dimension (mm)	*Hordeum* grains	Other plant and non-plant components (charred and recorded at an abundance of '1' ('trace') unless otherwise indicated)
	3	3	62023	63610	30	++	15	+	*Avena*, *Rosa*, bark, charred organic material
				63865	35*	+ A C F Q S/P	10	+	plant fuel ash, *Carex*, *Corylus avellana* nutshell, charred organic material
			62068	63864	34*	++ A/C Q	10		plant fuel ash, *Corylus avellana* nutshell
			65556	66061	59*	+	15	+	plant fuel ash, *Carex*, *Corylus avellana* nutshell, *Polygonum persicaria*, *Stellaria media,* charred organic material
			65597	66007	60	++	30		
			66085	66400	64*	+ Q	10		plant fuel ash, Corylus avellana nutshell
			67217	71214	103	++	30	+	*Carex*, charred organic material
			68717	68753	86	++	30	+	*Carex*, *Chenopodium album*, *Galium aparine*, charred organic material, plant fuel ash
			68986	69558	94	+	25	+	
			70696	71949	108*	+	15		*Carex*, Chenopodiaceae, *Corylus avellana* nutshell, *Eleocharis palustris sl*, charred organic material, plant fuel ash
			70806	71121	101*	+ F Q S/P	20	+	plant fuel ash, *Corylus avellana* nutshell
			71826	79086	182	++	15	+	cf. *Linum usitatissimum*, unburnt bark, unburnt cancellous bone and fish bone, plant fuel ash
			74121	74138	125	+	5		Cerealia indet., plant fuel ash
			74188	74292	126	++	30	+	bark, plant fuel ash
			75751	75820	146	+	20	+	*Bilderdykia convolvulus*, *Carex*, cf. *Eleocharis* sp., *Secale cereale*, charred organic material, plant fuel ash
			76555	76884	153	++	15		*Carex*, *Galium aparine*, unburnt fish bone, plant fuel ash
			76661	78003	159	++	20	+	*Carex*, Gramineae, *Plantago media*, *Ranunculus* Section *Ranunculus*, *R. flammula*, cf. *Triticum*, plant fuel ash

Site Phase	**Plot**	**Phase**	**Context**	**Intrasis sample**	**Sample**	**Charcoal: abundance**	**Charcoal: maximum dimension (mm)**	***Hordeum* grains**	**Other plant and non-plant components (charred and recorded at an abundance of '1' ('trace') unless otherwise indicated)**
			76697	77600	158	++	25	+	uncharred bark, plant fuel ash
			76910	78141	157	++	20	+	bark
			77718	78274	166	++	15	+	*Carex*, *Chenopodium album*, *Potentilla* cf. *erecta*, unburnt bone
			78143	78190	165	+	10	+	*Carex*, charred organic material, plant fuel ash
			78497	78572	173	++	20	+	*Carex*, *Potentilla* cf. *erecta*, plant fuel ash
III	1	3	84282	84730	223	+	25		cf. *Secale cereale*, charred organic material, unburnt fish bone
	3	4	61237	83550	210	+	10		*Carex*, *Galium aparine*, charred organic material, fuel plant ash
I-II	3		78457	78495	171	+	10	+	*Galium aparine*, *Polygonum persicaria*, cf. *Secale cereale*, unburnt bone, charred organic material (++), plant fuel ash
	3	2/3	73520	78273	164	++	15	+	*Carex*, *Chenopodium album*, *Galium*, *Polygonum hydropiper*, cf. *Triticum*, bark, charred organic material, plant fuel ash
			78522	78570	172	+	25	+	*Carex*, *Chenopodium album*, *Galeopsis* Subgenus *Ladanum*, *Polygonum lapathifolium*, *Spergula arvensis*, charred organic material
I-III	3		75901	78142	150	+	15	+	*Carex*, plant fuel ash
			73950	74003	117	++	20		*Chenopodium album*, uncharred *Rubus idaeus*
			90609	91136	282	+	10	++	*Secale cereale*, charred organic material, unburnt fish bone, plant fuel ash

Table 1.3. Complete list of plants taxa recorded from deposits at Kaupang. For vascular plants, nomenclature and taxonomic order follow Tutin *et al*. (1964-80), for mosses Smith (1978). Preservation of plant material was by anoxic waterlogging except where noted. Plant taxa marked * were certainly or probably of recent origin in all cases where they were recorded. C—number of contexts, S—number of samples, in which remains were recorded (where both recent and ancient material was recorded, only those contexts with ancient material are included in this count).

Taxon	**Common name**	**Parts recorded**	**C**	**S**
*cf. *Selaginella selaginoides* (L.) Link	?lesser clubmoss	megaspores	-	-
Pteridium aquilinum (L.) Kuhn	bracken	stalk fragments	1	
Juniperus communis L.	juniper	seeds	1	1
		leaves 2	2	
		shoot fragments	1	3
cf. *J. communis*	?juniper	charred seeds	2	2
Coniferae	conifer	charcoal fragments	2	2
		leaf/leaves	1	1
		part-charred wood fragments	1	1
		twig fragments	1	1
		wood chips	4	5
		wood fragments	1	1
Salix sp(p).	willow	buds	2	2
		fruits	2	2
		leaf fragments	1	1
		twig epidermis fragments	1	1
		twig fragments	1	1
cf. *Salix* sp(p).	?willow	wood fragments	4	4
Salix/Populus sp(p).	willow/aspen	charcoal fragments	4	4
		wood fragments	1	1
Populus sp(p).	aspen	buds and/or bud-scales	5	7
Betula pendula Roth	silver birch	bark fragments	1+?1	1+?1
Betula sp(p).	birch	fruits	4	4
		buds and/or bud-scales	2	2
Alnus sp(p).	alder	charcoal fragments	1	1
		buds and/or bud-scales	1	3
		female cones/cone-axes	1	1
Alnus/Corylus	alder/hazel	charcoal fragments	2	2
Corylus avellana L.	hazel	buds and/or bud-scales	1+?1	1+?1
		charcoal fragments	3	3
		nuts and/or nutshell fragments	9	14
		charred nuts and/or nutshell fragments	18	22
		roundwood fragments	1	1
Quercus sp(p).	oak	buds and/or bud-scales	3	6
		charcoal fragments	11	15
		wood chips	1	1
		wood fragments	2	2
Humulus lupulus L.	hop	achenes	3	5
		bracts	1	1
Cannabis sativa L.	hemp	achenes	3	4
Urtica dioica L.	stinging nettle	achenes	8	11
U. urens L.	annual nettle	achenes	6	10
Polygonum aviculare agg.	knotgrass	fruits	5	8
P. hydropiper L.	water-pepper	fruits	3	4
		charred fruits	2	2
P. persicaria L.	persicaria/red shank	fruits	5	6
		charred fruits	4	4
P. lapathifolium L.	pale persicaria	fruits	4	5

		charred fruits	2	2
Polygonum sp(p).	knotweeds, etc.	fruits	1	1
Bilderdykia convolvulus (L.) Dumort.	black bindweed	fruits	1	1
		charred fruits	1	1
Rumex acetosella agg.	sheep's sorrel	fruits	3	3
Rumex sp(p).	docks	fruits	3	5
		charred fruits	1	1
		perianths/perianth segments	1	1
Chenopodium album L.	fat hen	seeds	9	14
		charred seeds	12	12
Atriplex sp(p).	oraches	seeds	7	12
		charred seeds	1	1
Chenopodiaceae	goosefoot family	charred seeds	3	3
Montia fontana ssp. *fontana* (Fenzl) Walters	blinks	seeds	1	1
*Caryophyllaceae	pink/campion family	seeds	-	-
Stellaria media (L.) Vill.	chickweed	seeds	5	7
		charred seeds	5	5
S. palustris Retz./*S. graminea* L.	marsh/lesser stitchwort	seeds	2	6
		charred seeds	1	1
Sagina sp(p).	pearlworts	seeds	1	1
Scleranthus annuus L.	annual knawel	fruits	2	2
Spergula arvensis L.	corn spurrey	seeds	1	1
		charred seeds	2	2
Agrostemma githago L.	corncockle	seeds	1	1
Silene vulgaris (Moench) Garcke	bladder campion	seeds	1	1
Silene sp(p).	campions, etc.	seeds	2	2
Ranunculus Section *Ranunculus*	meadow/creeping/ bulbous buttercup	achenes	7	11
		charred achenes	1	1
R. cf. *sardous* Crantz	?hairy buttercup	charred achenes	1	1
R. sceleratus L.	celery-leaved crowfoot	achenes	8	12
R. flammula L.	lesser spearwort	achenes	3	5
		charred achenes	1	1
Fumaria sp(p).	fumitories	seeds	5	5
Descurainia sophia (L.) Webb ex Prantl	flixweed	seeds	1	1
Isatis tinctoria L.	woad	pod fragments	2	2
Rorippa palustris (L.) Besser	marsh yellow-cress	seeds	2	2
Rorippa sp(p).	yellow-cress	seeds	1	1
Capsella bursa-pastoris (L.) Medicus	shepherd's purse	seeds	1	1
Thlaspi arvense L.	field penny-cress	seed fragments	2	2
Raphanus raphanistrum L.	wild radish	pod segments and/or fragments	2	2
Filipendula ulmaria (L.) Maxim.	meadowsweet	achenes	3	4
Rubus idaeus L.	raspberry	seeds	9	9
R. fruticosus agg.	blackberry/bramble	seeds	8	13
		charred seeds	4	4
Rosa sp(p).	roses	achenes	2	2
		charred achenes	1	1
Potentilla palustris (L.) Scop.	marsh cinquefoil	achenes	2	2
P. anserina L.	silverweed	achenes	4	5
P. cf. *crantzii* (Crantz) Beck ex Fritsch	?alpine cinquefoil	achenes	1	1
P. cf. *erecta* (L.) Räuschel	?tormentil	achenes	6	11
		charred achenes	4	5
Potentilla sp(p).	cinquefoils, etc.	achenes	2	4
Fragaria cf. *vesca* L.	?wild strawberry	achenes	3	3
*cf. *Alchemilla* sp(p).	?lady's mantles	achenes	-	-
**Alchemilla/Aphanes* sp(p).	lady's-mantle/			

	parsley-piert	achenes	-	-
cf. Pomoideae	?Crataegus/Malus/ Pyrus/Sorbus	charcoal fragments	1	1
Malus sylvestris Miller	crab apple	endocarp	2	1
Sorbus aucuparia L.	rowan, mountain ash	seeds	1	1
Sorbus sp(p).	rowan/whitebeams	seeds	1	1
Trifolium pratense L.	red clover	calyx/calyces and/or pods	1	1
		pods and/or pod lids	1	1
Leguminosae	pea family	calyx/calyces and/or flowers	1	4
		flowers and/or petals	2	4
		immature seeds (waterlogged)	1	1
		pods and/or pod fragments	1	3
*Leguminosae	pea family	waterlogged seeds	-	-
Linum usitatissimum L.	cultivated flax	seeds	3	2
		capsule fragments	1	1
cf. *L. usitatissimum* L.	?cultivated flax	charred seeds	1	1
L. catharticum L.	purging flax	seeds	1	1
**Euphorbia helioscopia* L.	sun spurge	seeds	-	-
cf. *Acer* sp(p).	?maple, etc.	charcoal fragments	1	1
Malva sylvestris L.	common mallow	nutlets	2	2
Hypericum sp(p).	St John's worts	seeds	2	2
Viola sp(p).	violets/pansies, etc.	seeds	7	11
		charred seeds	1	1
		capsule segments	1	3
Heracleum sphondylium L.	hogweed	mericarps	1	1
Umbelliferae	carrot family	mericarps	1	1
Calluna vulgaris (L.) Hull	heather, ling	capsules	1	1
		flowers	1	1
Empetrum sp(p).	crowberry	seeds	1	1
Fraxinus excelsior L.	ash	charcoal fragments	12	12
Galium aparine L.	goosegrass, cleavers	charred fruits	6	6
Galium sp(p).	bedstraws, etc.	charred fruits	2	2
Galeopsis Subgenus *Ladanum*	hemp-nettles	charred nutlets	1	1
G. Subgenus *Galeopsis*	hemp-nettles	nutlets	2	5
Galeopsis sp(p).	hemp-nettles	nutlets	1	1
**Lamium* Section *Lamiopsis*	annual dead-nettles	nutlets	-	-
Lamium sp(p).	dead-nettles, etc.	nutlets	1	1
Stachys sp(p).	woundworts	nutlets	2+?1	2+?1
cf. *Glechoma hederacea* L.	ground-ivy	nutlets	1	1
Prunella vulgaris L.	selfheal	nutlets	2	4
Lycopus europaeus L.	gipsywort	nutlets	3	5
Labiatae	mint family	calyces	1	1
Hyoscyamus niger L.	henbane	seeds	1	2
Solanum nigrum L.	black nightshade	seeds	3+?1	4+?1
S. dulcamara L.	woody nightshade	seeds	1	1
Veronica sp(p).	speedwells, etc.	seeds	1	1
Rhinanthus sp(p).	yellow rattles	seeds	1	5
Plantago major L.	greater plantain	seeds	1	1
P. media L.	hoary plantain	charred seeds	1	1
P. lanceolata L.	ribwort plantain	seeds	1	1
Campanula rotundifolia L.	harebell, bluebell	seeds	2+?1	2+?2
Eupatorium cannabinum L.	hemp agrimony	achenes	1	1
Bidens sp(p).	bur-marigolds	achenes	2	3
Achillea millefolium L.	yarrow	capitulum fragments	1	1
**Matricaria maritima* L./ *M. perforata* Mérat	sea/scentless mayweed	achenes	-	-
Senecio sp(p).	groundsels/ragworts	achenes	1	1
Carduus/Cirsium sp(p).	thistles	achenes	6	8

Centaurea cf. *nigra* L.	?lesser knapweed	involucral bracts	1	1
Centaurea sp(p).	knapweeds, etc.	achenes	3	3
		immature achenes	1	1
		involucral bracts	1	1
Leontodon sp(p).	hawkbits	achenes	3	3
**Sonchus asper* (L.) Hill	prickly sow-thistle	achenes	-	-
**S. oleraceus* L.	sow-thistle	achenes	-	-
**Taraxacum* sp(p).	dandelions	achenes	-	-
Lapsana communis L.	nipplewort	achenes	3	3
Hieracium sp(p).	hawkweeds	achenes	1	2
Compositae	daisy family	achenes	1	1
		involucres/fragments	1	1
Triglochin maritima L.	sea arrowgrass	carpels	1	2
Juncus cf. *maritimus* Lam.	?sea rush	seeds	2	3
J. inflexus L./*J. effusus* L./ *J. conglomeratus* L.	hard/soft/compact rush	seeds	5	6
J. cf. *gerardi* Loisel.	?mud rush	seeds	3	3
J. bufonius L.	toad rush	seeds	10	15
Juncus sp(p).	rushes	seeds	3	5
Luzula sp(p).	woodrushes	seeds	2	5
Gramineae	grasses	waterlogged caryopses	3	7
		charred caryopses	4	4
		waterlogged culm bases/ rhizome fragments	1	1
		waterlogged spikelets/ spikelet fragments	1	1
Gramineae/Cerealia	grasses/cereals	waterlogged culm nodes	3	4
		waterlogged culm fragments	1	4
Cerealia indet.	cereals	charred caryopses	1	1
		waterlogged culm fragments	1	1
cf. *Triticum* sp(p).	?wheats	charred caryopses	3	3
Triticum/Hordeum sp(p).	wheat and/or barley	charred caryopses	1	1
Secale cereale L.	rye	charred caryopses	3+?4	3+?4
Hordeum sp(p).	barley	charred caryopses (inc some hulled specimens)	41	45
Avena sp(p).	oats	charred caryopses	2	2
Agrostis sp(p).	bent grasses, etc.	waterlogged caryopses	1	1
Danthonia decumbens (L.) DC. in Lam. & DC.	heath grass	caryopses	2	5
		waterlogged spikelets/ spikelet fragments	2	4
		waterlogged chaff	1	2
Scirpus cf. *maritimus* L.	?sea club-rush	nutlets	4	7
S. lacustris sensu lato	bulrush	nutlets	1+?2	1+?2
		charred nutlets	1	1
Eleocharis palustris sensu lato	common spike-rush	nutlets	7	12
		charred nutlets	2	2
cf. *Eleocharis* sp(p).	?spike-rushes	nutlets	1	1
Carex sp(p).	sedges	nutlets	9	14
		charred nutlets	30	33

Musci (remains were leaves and/or shoot fragments unless otherwise indicated)

Sphagnum squarrosum Crome		1	2
Sphagnum sp(p).	leaves	3	3
	leaves and shoot tips	3	3
	leaves and shoot fragments	1	1
Polytrichum commune Hedw.		1	2
Polytrichum commune var. *commune* Hedw.		1	1
Polytrichum/Pogonatum sp(p).	leaf-bases	2	2
	shoot fragments	1	1

Polytrichum sp(p).	leaves/leaf-bases and/ or shoot fgts	2	4
	shoot fragments	1	4
Dicranum scoparium Hedw.		1	1
Dicranum sp(p).		1	3
Leucobryum glaucum (Hedw.) Ångstr.		1	1
Racomitrium sp(p).		2	4
Plagiomnium undulatum (Hedw.) Kop.		1+?1	1+?1
cf. *Plagiomnium* sp(p).		1	1
Pseudobruym cinclidioides (Hüb.) Kop.		1	1
Aulacomnium palustre (Hedw.) Schwaegr.		1	2
Climacium dendroides (Hedw.) Web. & Mohr	1	2	
Leucodon sciuroides (Hedw.) Schwaegr.		2	2
Antitrichia curtipendula (Hedw.) Brid.		1	1
Thamnobryum alopecurum (Hedw.) Nieuwl.		1	1
Thuidium tamariscinum (Hedw.) Br. Eur.		1+?1	2+?3
cf. *Cratoneuron commutatum* (Hedw.) Roth		1	1
Calliergon cuspidatum (Hedw.) Kindb.		1	3
Isothecium myosuroides Brid.		1	1
Homalothecium sericeum (Hedw.) Br. Eur. / *H. lutescens* (Hedw.) Robins.		1	1
Hypnum cf. *cupressiforme* Hedw.		1	1
Rhytidiadelphus cf. *squarrosus* (Hedw.) Warnst.	1	3	
Rhytidiadelphus sp(p).		1	1
Pleurozium schreberi (Brid.) Mitt.		1	2
Hylocomium splendens (Hedw.) Br. Eur.		5	7

Table 1.4. 'Useful' plant taxa recorded from deposits at Kaupang, with their Norwegian vernacular names (courtesy of Den virtuella Floran, http://linnaeus.nrm.se/flora).

Taxon	**Parts used**	**Norwegian name**
Pteridium aquilinum	fronds	Einstape
Juniperus communis	shoots, berries	Einer
Salix	wood, twigs	Vier
Populus	wood	Osp
Betula	wood, bark	Bjørk
Alnus glutinosa	wood	Svartor
Corylus avellana	wood, nuts	Hassel
Quercus	wood, acorns	Eik
Humulus lupulus	fruits	Humle
Cannabis sativa	fruits	Hamp
Isatis tinctoria	leaves	Waid
Rubus idaeus	fruits	Bringbær
Rubus fruticosus agg.	fruits	Bjønnbær
Rosa	fruits	Nype
Fragaria cf. *vesca*	fruits	Markjordbær
Malus sylvestris	fruits	Villapal
Sorbus aucuparia	fruits	Rogn
Linum usitatissimum	seeds, stem fibres	Lin
Empetrum	fruit	Krekling
Calluna vulgaris	whole plant	Røsslyng
Fraxinus excelsior	wood	Ask
Secale cereale	grains, straw	Rug
Hordeum	grains, straw	Bygg
Avena	grains, straw	Havre

Table 1.5. Plant remains and other components of the GBA and BS samples from Kaupang. Records are presented in alphabetical order by context and sample,with material other than identified plant remains at the end of each list. The numbers are scores for abundance on a four-point scale. Notes about the material, where relevant, follow at the ends of the lines. A complete list of taxa, with parts recorded and type of preservation, can be found in Table 1.3.

Key to abbreviations: ab—abscission; cal—calyces; ch—charred; dec—decayed; fgts—fragments; fls—flowers; imm—immature; lf—leaf; max—maximum dimension; mgsps—megaspores; pet—petals; s—seeds; spec—spec; v—very.

Context 47045. Sample 10/T		
Chenopodium album	1	
Corylus avellana (ch)	1	
Polygonum aviculare agg.	1	?modern
bone fgts	1	max 2 mm
burnt bone fgts	1	max 5 mm
charcoal	1	max 10 mm
gravel	2	max 30 mm
grit	3	
sand	3	

Context 61237, Sample 210/BS		
Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Galium aparine (ch)	1	
Sonchus cf. oleraceus	1	modern
‘ash beads’	1	max 2 mm
charcoal	1	max 10 mm
charred organic material	1	max 20 mm
glassy ash	1	max 5 mm
insects (contaminant)	1	

Context 61359, Sample 4/BS		
Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Polygonum aviculare agg.	1	?modern
Stellaria media	1	?modern
‘ash beads’	1	max 5 mm
beetles (?contaminant)	1	
bone fgts	1	max 5 mm
burnt bone fgts	1	max 5 mm
charcoal	2	max 15 mm
glassy ash	1	max 20 mm

Context 61411, Sample 237/T		
Galium aparine (ch)	2	
‘ash beads’	2	max 5 mm
?flint	1	single spec, max 10 mm
ash concretions	1	max 2 mm
baked clay/daub	2	max 40 mm
bark fgts (ch)	1	max 10 mm
bone fgts	1	max 20 mm
burnt bone fgts	2	max 50 mm
burnt fish bone	1	max 10 mm
charcoal	1	max 10 mm
concretions	1	max 25 mm
fire-cracked pebbles	1	max 30 mm
fish bone	1	max 5 mm
glassy slag	1	max 15 mm
gravel	2	max 50 mm
grit	2	
sand	2	

Context 61643, Sample 20/T		
Corylus avellana (ch)	1	
Quercus sp(p). (charcoal)	1	max 10 mm
Rubus fruticosus agg.	1	?modern
bone fgts	1	max 5 mm
burnt bone fgts	1	max 15 mm
charcoal	1	max 10 mm
fire-cracked pebbles	1	max 55 mm
glassy ash	1	max 5 mm
gravel	3	max 55 mm
grit	2	
root/rootlet fgts (modern)	1	
sand	3	

Context 61643, Sample 25/BS		
bark fgts (ch)	1	max 20 mm
charcoal	1	max 10 mm
herbaceous detritus (ch)	1	

Context 61670, Sample 21/BS		
Alchemilla/Aphanes sp(p).	1	modern
Gramineae	1	modern
Gramineae (ch)	1	
Hordeum sp(p).	1	
Juncus sp(p).	1	
Stellaria media (ch)	1	
‘ash beads’	1	max 2 mm
bark fgts	1	max 10 mm
bone fgts	1	max 5 mm
charcoal	1	max 15 mm

root/rootlet fgts (modern)	1	

Context 62023, Sample 30/BS

Avena sp(p).	1	
Corylus avellana (ch)	1	
Hordeum sp(p). (inc hulled)	1	
Rosa sp(p). (ch)	1	
‘ash beads’	1	max 2 mm
bark fgts (ch)	1	max 10 mm
charcoal	2	max 15 mm
charred organic material	1	max 10 mm

Context 62023, Sample 35/BS

Alnus (charcoal)	1	max 10 mm
Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Corylus avellana (charcoal)	1	max 10 mm
Fraxinus excelsior (charcoal)	1	max 10 mm
Hordeum sp(p).	1	
Quercus sp(p). (charcoal)	1	max 10 mm
Rubus idaeus	1	?modern
Salix/Populus sp(p). (charcoal)	1	max 10 mm
ash concretions	1	max 5 mm
charcoal	1	max 10 mm
charred organic material	1	max 5 mm

Context 62068, Sample 34/BS

Alnus/Corylus (charcoal)	1	max 10 mm
Chenopodium album	1	
Corylus avellana (ch)	1	
Quercus sp(p). (charcoal)	1	max 5 mm
‘ash beads’	1	
charcoal	2	

Context 64458, Sample 43/BS

Carex sp(p). (ch)	2	
Chenopodium album (ch)	1	
Gramineae (ch)	1	
Hordeum sp(p).	1	
Juncus sp(p).	1	?modern
Rumex sp(p). (ch)	1	
bark fgts (ch)	1	max 10 mm
burnt bone fgts	1	max 10 mm
charcoal	2	max 15 mm
glassy ash	1	max 5 mm
insects (contaminant)	1	

Context 64612, Sample 48/BS

Alchemilla/Aphanes sp(p).	1	?modern
Chenopodium album	1	?modern
cf. Rosellinia sp(p).	1	
Rubus fruticosus agg.	1	?modern
Rubus idaeus	1	?modern
Spergula arvensis	1	?modern
Triticum/Hordeum sp(p).	1	a single spec
‘ash beads’	1	max 2 mm
charcoal	2	max 10 mm
root/rhizome fgts (ch)	1	max 5 mm
root/rootlet fgts (modern)	1	

Context 64713, Sample 178/BS

Atriplex sp(p).	1	modern
Betula sp(p).	1	modern
Chenopodium album	1	modern
Fraxinus excelsior (charcoal)	1	max 10 mm
Matricaria maritima/perforata	1	modern
Quercus sp(p). (charcoal)	1	max 10 mm
Stellaria media	1	modern
charcoal	1	

Context 64713, Sample 199/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	
charcoal	1	max 5 mm

Context 65189, Sample 255/T

Carex sp(p).	1	
Corylus avellana	1	v dec
Corylus avellana (ch)	1	
Fumaria sp(p).	1	
Juncus bufonius	2	
Rubus fruticosus agg.	1	
Rubus idaeus	2	
beetles	1	
bone fgts	1	max 10 mm
burnt bone fgts	1	max 15 mm
charcoal	2	max 20 mm
?charred seaweed	1	max 5 mm
concreted sediment	1	max 5 mm
earthworm egg caps	1	
glassy slag	1	max 5 mm
gravel	2	max 50 mm
grit	2	
root/rhizome fgts (ch)	1	max 2 mm
sand	3	
unwashed sediment	1	max 10 mm
wood fgts	1	v dec, max 5 mm

Context 65556, Sample 59/BS

cf. Alchemilla sp(p).	1	modern
Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Corylus avellana (ch)	1	

Gramineae (w/l spklts/fgts)	1	modern
Hordeum sp(p).	1	
Polygonum persicaria (ch)	1	
Stellaria media (ch)	1	
'ash beads'	1	max 4 mm
charcoal	1	max 15 mm
charred organic material	1	max 5 mm

Context 65597, Sample 60/BS

Chenopodium album	1	?modern
charcoal	2	max 30 mm
root/rootlet fgts (modern)	1	

Context 66085, Sample 64/BS

Chenopodium album	1	?modern
Corylus avellana (ch)	1	
Quercus sp(p). (charcoal)	1	max 10 mm
Taraxacum sp(p).	1	modern
'ash beads'	1	
beetles (contaminant)	1	
charcoal	1	max 10 mm

Context 67217, Sample 103/BS

Carex sp(p). (ch)	1	
Hordeum sp(p).	1	
Lamium Section Lamiopsis	1	modern
charcoal	2	max 30 mm
charred organic material	1	max 5 mm
root/rootlet fgts (modern)	1	

Context 68378, Sample 77/BS

Fraxinus (charcoal)	1	max 25 mm
Hordeum sp(p).	1	
Quercus sp(p). (charcoal)	1	max 10 mm
'ash beads'	1	
charcoal	1	max 25 mm

Context 68378, Sample 78/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Coniferae (charcoal)	1	max 20 mm
Corylus (charcoal)	1	max 10 mm
Fraxinus excelsior (charcoal)	1	max 35 mm
Hordeum sp(p).	1	
Quercus sp(p). (charcoal)	1	max 15 mm
'ash beads'	1	
charcoal	1	

Context 68495, Sample 83/T

Juncus bufonius	2	
Juncus inflexus/effusus/ conglomeratus	1	
ash	3	max 1 mm
burnt bone fgts	1	max 20 mm
charcoal	3	max 10 mm
gravel	2	max 75 mm
grit	2	
mammal tooth	1	max 15 mm
?quern fgts	1	max 80 mm
sand	3	
wood fgts	1	max 5 mm

Context 68717, Sample 86/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Chenopodium album (ch)	1	
Galium aparine (ch)	1	
Hordeum sp(p).	1	
'ash beads'	1	max 5 mm
charcoal	2	max 30 mm
charred organic material	1	max 5 mm
glassy ash	1	max 5 mm
root/rootlet fgts (modern)	1	
unwashed sediment	2	max 1 mm

Context 68986, Sample 94/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	a single spec
charcoal	1	max 25 mm
root/rootlet fgts (modern)	1	

Context 69242, Sample 90/BS

Alchemilla/Aphanes sp(p).	1	?modern
Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Corylus (charcoal)	1	max 10 mm
Fraxinus (charcoal)	1	max 10 mm
Hordeum sp(p).	1	
Juncus bufonius	1	?modern
Potentilla cf. erecta (ch)	1	
Quercus sp(p). (charcoal)	1	max 15 mm
Rubus idaeus	1	?modern
cf. Selaginella selaginoides (mgsps)	1	?modern
Spergula arvensis	1	?modern
'ash beads'	1	
beetles (contaminant)	1	
charcoal	2	max 15 mm
root/rootlet fgts (modern)	1	
wood fgts	1	max 10 mm

Context 69242, Sample 91/BS

Chenopodium album	1	?modern
Corylus avellana (ch)	1	
Hordeum sp(p).	1	
cf. Juniperus communis (ch)	1	
Quercus sp(p). (charcoal)	1	max 10 mm
'ash beads'	1	
charcoal	2	max 10 mm
root/rootlet fgts (modern)	1	

Context 69242, Sample 92/BS

Carex sp(p). (ch)	1	
Chenopodium album (ch)	1	
Corylus avellana (ch)	1	
Potentilla cf. erecta (ch)	1	
'ash beads'	2	max 5 mm
charcoal	1	max 10 mm

Context 69242, Sample 93/BS

Chenopodium album	1	?modern
Fraxinus excelsior (charcoal)	1	max 10 mm
Quercus sp(p). (charcoal)	1	max 15 mm
Rubus fruticosus agg. (ch)	1	a single spec
'ash beads'	2	
ash concretions	1	max 10 mm
charcoal	1	

Context 70602, Sample 114/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	
Sonchus oleraceus	1	modern
'ash beads'	1	max 2 mm
charcoal	2	max 15 mm
charred organic material	1	max 5 mm
root/rootlet fgts (modern)	1	

Context 70696, Sample 108/BS

Carex sp(p). (ch)	1	
Chenopodiaceae (ch)	1	
Chenopodium album	1	?modern
Corylus avellana (ch)	1	
Eleocharis palustris sl (ch)	1	
'ash beads'	1	max 2 mm
charcoal	1	max 15 mm
charred organic material	1	max 5 mm
insects (contaminant)	1	

Context 70806, Sample 101/BS

Chenopodium album	1	?modern
Corylus avellana (ch)	1	
Fraxinus (charcoal)	1	max 5 mm
Hordeum sp(p).	1	
Matricaria maritima/perforata	1	?modern
Quercus sp(p). (charcoal)	1	max 10 mm
Salix/Populus sp(p). (charcoal)	1	max 20 mm
Stellaria media	1	?modern
'ash beads'	1	
charcoal	1	

Context 71826, Sample 182/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	
cf. Linum usitatissimum (ch)	1	a single spec
'ash beads'	1	max 5 mm
bark fgts	1	max 15 mm
cancellous bone fgts	1	max 20 mm
charcoal	2	max 15 mm
fish bone	1	max 5 mm

Context 73520, Sample 164/BS

Carex sp(p). (ch)	1	
Chenopodium album (ch)	1	
Galeopsis Subgenus Galeopsis	1	?modern
Galium sp(p). (ch)	1	
Hordeum sp(p).	1	
Polygonum hydropiper (ch)	1	
cf. Triticum sp(p).	1	
'ash beads'	1	max 2 mm
bark fgts (ch)	1	max 10 mm
charcoal	2	max 15 mm
charred organic material	1	max 10 mm

Context 73950, Sample 117/BS

Chenopodium album (ch)	1	
Rubus idaeus	1	
charcoal	2	max 20 mm
root/rootlet fgts (modern)	1	

Context 74037, Sample 118/BS

Carex sp(p). (ch)	1	
Potentilla cf. erecta (ch)	1	
Scirpus lacustris sl (ch)	1	
Sonchus asper	1	modern
Stellaria media (ch)	1	
Stellaria palustris/graminea (ch)	1	
'ash beads'	2	max 10 mm
bark fgts	1	max 20 mm
charcoal	2	max 25 mm
root/rootlet fgts (modern)	1	

Context 74121, Sample125/BS

Cerealia indet.	1	
Chenopodium album	1	?modern
Hordeum sp(p).	1	
‘ash beads’	1	max 2 mm
charcoal	1	max 5 mm
root/rootlet fgts (modern)	1	

Context 74188, Sample 126/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	
‘ash beads’	1	max 2 mm
bark fgts (ch)	1	max 15 mm
charcoal	2	max 30 mm
root/rootlet fgts (modern)	1	

Context 75001, Sample 132/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
charcoal	2	max 25 mm
glassy ash	1	max 15 mm

Context 75167, Sample 134/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	
‘ash beads’	1	max 2 mm
charcoal	2	max 10 mm
insects (contaminant)	1	

Context 75579, Sample 140/BS

‘ash beads’	1	max 2 mm
charcoal	1	max 15 mm

Context 75751, Sample 146/BS

Bilderdykia convolvulus (ch)	1	
Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
cf. Eleocharis sp(p). (ch)	1	
Hordeum sp(p).	1	
Secale cereale	1	
‘ash beads’	1	max 3 mm
charcoal	1	max 20 mm
charred organic material	1	max 5 mm
root/rootlet fgts	1	

Context 75901, Sample 150/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Hordeum sp(p).	1	
Rubus idaeus	1	?modern
‘ash beads’	1	max 5 mm
charcoal	1	max 15 mm
insects (contaminant)	1	
root/rootlet fgts (modern)	1	

Context 76555, Sample 153/BS

Carex sp(p). (ch)	1	
Galium aparine (ch)	1	
charcoal	2	max 15 mm
fish bone	1	max 2 mm
glassy ash	1	max 2 mm
root/rootlet fgts (modern)	1	

Context 76661, Sample 159/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Gramineae (ch)	1	
Hordeum sp(p).	1	
Plantago media (ch)	1	
Ranunculus Sect. Ranunculus (ch)	1	
Ranunculus flammula (ch)	1	
cf. Triticum sp(p).	1	
‘ash beads’	1	max 5 mm
charcoal	2	max 20 mm

Context 7669, Sample 158/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	
Lamium Section Lamiopsis	1	?modern
Rumex sp(p). (per/segs)	1	?modern
bark fgts	1	max 5 mm
beetles (?contaminant)	1	
charcoal	2	max 25 mm
glassy ash	1	max 10 mm
root/rootlet fgts (modern)	1	

Context 76910, Sample 157/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	a single spec
bark fgts (ch)	1	max 5 mm
charcoal	2	max 20 mm
root/rootlet fgts (modern)	1	

Context 77718, Sample 166/BS

Carex sp(p). (ch)	1	
Chenopodium album (ch)	1	
Hordeum sp(p).	1	
Potentilla cf. erecta (ch)	1	

bone fgts	1	max 5 mm
charcoal	2	max 15 mm
root/rootlet fgts (modern)	1	

Context 77759, Sample 162/BS

Carex sp(p). (ch)	1	
Eleocharis palustris sl (ch)	1	
Hordeum sp(p).	1	
Lamium Section Lamiopsis	1	modern
Polygonum aviculare agg.	1	modern
Viola sp(p). (ch)	1	
'ash beads'	1	max 2 mm
charcoal	2	max 10 mm
glassy ash	1	max 5 mm
root/rootlet fgts (modern)	1	
twig fgts (ch)	1	max 5 mm

Context 78143, Sample 165/BS

Betula sp(p).	1	modern
Carex sp(p). (ch)	1	
Chenopodium album	1	modern
Hordeum sp(p).	1	
Matricaria maritima/perforata	1	modern
Rumex acetosella agg.	1	modern
Taraxacum sp(p).	1	modern
'ash beads'	1	max 2 mm
charcoal	1	max 10 mm
charred organic material	1	max 5 mm
insects (contaminant)	1	
root/rootlet fgts (modern)	1	

Context 78393, Sample 170/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Hordeum sp(p).	1	
cf. Secale cereale	1	
cf. Triticum sp(p).	1	
'ash beads'	1	max 1 mm
charcoal	1	max 10 mm
charred organic material	1	max 10 mm

Context 78457, Sample 171/BS

Caryophyllaceae	1	?modern
Chenopodium album	1	?modern
Galium aparine (ch)	1	
Hordeum sp(p).	1	
Polygonum persicaria (ch)	1	
cf. Secale cereale	1	
bone fgts	1	max 10 mm
charcoal	1	max 10 mm
charred organic material	2	max 40 mm
glassy ash	1	max 10 mm

Context 78497, Sample 173/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Hordeum sp(p).	1	
Potentilla cf. erecta (ch)	1	
'ash beads'	1	max 2 mm
charcoal	2	max 20 mm
root/rootlet fgts (modern)	1	

Context 78522, Sample 172/BS

Atriplex sp(p).	1	?modern
Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Chenopodium album (ch)	1	
Euphorbia helioscopia	1	modern
Galeopsis Subgenus Ladanum (ch)	1	
Hordeum sp(p).	1	
Polygonum lapathifolium (ch)	1	
Spergula arvensis (ch)	1	
charcoal	1	max 25 mm
charred organic material	1	max 5 mm

Context 78587, Sample 174/BS

'ash beads'	1	max 3 mm
charcoal	2	max 15 mm

Context 81762, Sample 200/BS

Betula sp(p).	1	modern
Chenopodium album	1	?modern
Hordeum sp(p).	1	
cf. Juniperus communis (ch)	1	
Quercus sp(p). (charcoal)	1	max 10 mm
Salix/Populus sp(p). (charcoal)	1	max 20 mm
Urtica dioica	1	?modern
charcoal	1	max 20 mm

Context 81762, Sample 201/BS

Chenopodium album	1	?modern
Corylus avellana (ch)	1	
cf. Pomoideae (charcoal)	1	max 10 mm
Quercus sp(p). (charcoal)	1	max 10 mm
beetles (?contaminant)	1	
charcoal	1	

Context 81762, Sample 203/BS

Corylus avellana (ch)	1	
Fumaria sp(p). (sf)	1	
Matricaria maritima/perforata	1	
Rubus fruticosus agg. (ch)	1	
Viola sp(p).	1	a single fgt

charcoal	2	max 15 mm

Context 82178, Sample 209/BS

'ash beads'	1	max 1 mm
charcoal	2	max 15 mm
insects (contaminant)	1	

Context 82362, Sample 205/BS

Chenopodium album	1	?modern
Hordeum sp(p).	1	
Polygonum aviculare agg.	1	modern
'ash beads'	1	max 2 mm
charcoal	1	max 15 mm
charred organic material	1	max 10 mm

Context 83246, Sample 252/BS

Carex sp(p). (ch)	1	
Hordeum sp(p).	1	
Polygonum persicaria (ch)	1	
Taraxacum sp(p).	1	modern
'ash beads'	1	max 2 mm
bone fgts	1	max 5 mm
burnt fish bone	1	max 5 mm
charcoal	1	max 10 mm

Context 83319, Sample 218/BS

Atriplex sp(p). (ch)	1	
Avena sp(p).	1	
Carex sp(p). (ch)	1	
Chenopodium album (ch)	1	
Galium sp(p). (ch)	1	
Hordeum sp(p).	2	
Polygonum persicaria (ch)	1	
cf. Secale cereale	1	
'ash beads'	1	max 2 mm
bark fgts	1	max 10 mm
cancellous bone fgts	1	
charcoal	1	max 10 mm
charred organic material	2	max 25 mm
herbaceous detritus (ch)	1	

Context 84282, Sample 223/BS

Juncus sp(p).	1	?modern
cf. Secale cereale	1	a single spec
charcoal	1	max 25 mm
charred organic material	1	max 20 mm
fish bone	1	max 5 mm

Context 84296, Sample 221/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Coniferae (part-ch wood)	1	max 10 mm
Hordeum sp(p).	1	a single spec
'ash beads'	1	max 2 mm
charcoal	2	max 15 mm
root/rootlet fgts (modern)	1	

Context 84615, Sample 224/BS

Carex sp(p). (ch)	1	
Chenopodium album	1	?modern
Hordeum sp(p).	1	
'ash beads'	1	max 2 mm
charcoal	1	max 15 mm
root/rootlet fgts (modern)	1	

Context 84844, Sample 225/BS

charcoal	1	max 10 mm
insects (contaminant)	1	

Context 85299, Sample 239/BS

Chenopodium album (ch)	1	
Galium aparine (ch)	1	
Hordeum sp(p).	1	
bark fgts	1	max 5 mm
charcoal	2	max 10 mm
root/rootlet fgts (modern)	1	

Context 86018, Sample 226/T

Atriplex sp(p).	1	
Carex sp(p).	2	
Centaurea sp(p). (inv br)	1	
Chenopodium album	1	
Coniferae (wood chips)	1	max 15 mm
Corylus avellana	1	
Corylus avellana (ch)	1	
Danthonia decumbens	1	
Eleocharis palustris sl	1	
Fumaria sp(p).	1	
Galeopsis Subgenus Galeopsis	1	
Gramineae/Cerealia (culm fgts)	2	
Hyoscyamus niger	1	
Juncus bufonius	2	
Juncus cf. maritimus	1	
Juniperus communis (sht fgts)	1	v dec
Leguminosae (cal/fls)	1	
Leguminosae (pods/fgts)	1	max 5 mm
Luzula sp(p).	1	
Lycopus europaeus	1	
Polytrichum sp(p). (sht fgts)	1	
Potentilla cf. erecta	1	
Potentilla sp(p).	1	

Ranunculus Section Ranunculus	1	
Ranunculus sceleratus	2	
Rhinanthus sp(p).	1	
Rubus fruticosus agg.	1	
Rubus idaeus	1	
Scirpus cf. maritimus	1	
Stachys sp(p).	1	
Stellaria palustris/graminea	1	
Thuidium tamariscinum	1	
Urtica urens	1	
Viola sp(p).	1	
bark fgts	1	v dec, max 15 mm
beetles	1	
bone fgts	1	max 10 mm
burnt bone fgts	1	max 20 mm
burnt fish bone	1	max 2 mm
charcoal	2	max 10 mm
earthworm egg caps	1	
fly puparia	1	fgts only
gravel	2	max 50 mm
grit	2	
herbaceous detritus	2	
nematodes (modern)	2	
sand	2	
twig fgts	1	max 10 mm
undisaggregated compressed plant debris	3	
unwashed sediment	3	max 10 mm
wood chips	1	max 10 mm
wood fgts	2	v dec, max 25 mm

Context 86018, Sample 229/T2+SPT

Achillea millefolium (cap fgts)	1	
Agrostis sp(p).	1	
Atriplex sp(p).	1	
Betula pendula (bark fgts)	1	max 10 mm
Calliergon cuspidatum	1	
Calluna vulgaris (fls)	1	
Campanula rotundifolia	2	
Carex sp(p).	2	
Carex sp(p). (ch)	1	a single spec
Centaurea cf. nigra (inv br)	1	
Centaurea sp(p).	1	
Cerealia indet. (culm fgts)	1	
Climacium dendroides	1	
Chenopodium album	1	
Coniferae (wood chips)	1	max 5 mm
Corylus avellana	1	
cf. Corylus avellana (b/bs)	1	
cf. Cratoneuron commutatum	1	
Danthonia decumbens	3	
Danthonia decumbens (spklts/fgts)	1	
Danthonia decumbens (wl chaff)	1	
Dicranum sp(p).	1	
Eleocharis palustris sl	1	
Filipendula ulmaria	1	
Fraxinus (charcoal)	1	max 10 mm
Galeopsis Subgenus Galeopsis	1	
Gramineae	2	
Gramineae/Cerealia (c/n)	2	
Gramineae/Cerealia (culm fgts)	2	
Hieracium sp(p).	1	
Hylocomium splendens	1	
Juncus bufonius	2	
Juncus cf. gerardi	1	
Juncus cf. maritimus	1	
Juniperus communis (lvs)	1	
Juniperus communis (sht fgts)	1	
Labiatae (cal)	1	
Leguminosae (cal/fls)	2	
Leguminosae (fls/pet)	1	
Leguminosae (imm s)	1	
Leguminosae (pods/fgts)	1	max 5 mm
Linum catharticum	1	
Luzula sp(p).	1	
Lycopus europaeus	2	
Plagiomnium undulatum	1	
Plantago lanceolata	1	inc flower parts
Pleurozium schreberi	1	
Polygonum persicaria	1	
Polytrichum commune var. commune	2	
Polytrichum sp(p).	1	
Polytrichum sp(p). (sht fgts)	1	
Populus sp(p). (b/bs)	1	
Potentilla cf. crantzii	1	
Potentilla cf. erecta	2	
Prunella vulgaris	2	
Pseudobryum cinclidoides	1	
Quercus sp(p). (b/bs)	1	
Ranunculus flammula	1	
Ranunculus sceleratus	2	
Rhinanthus sp(p).	1	
Rhytidiadelphus cf. squarrosus	1	
Rubus fruticosus agg.	1	
Salix sp(p). (tef)	1	
Scirpus cf. maritimus	1	
Sphagnum squarrosum	1	
cf. Stachys sp(p).	1	
Stellaria palustris/graminea	1	
Thuidium tamariscinum	1	
Trifolium pratense (cal/pods)	1	
Triglochin maritima	1	
Umbelliferae	1	v small type(s)
Viola sp(p).	2	subglobose type (Subg. Viola)
Viola sp(p). (caps segs)	1	
bark fgts	1	max 10 mm
beetles	1	
‘coils’	1	
charcoal	1	max 5 mm
earthworm egg caps	1	
gravel	1	max 15 mm
grit	1	

monocot lf/stem fgts	4	
pedicels indet.	1	
sand	1	
twig fgts	1	max 15 mm
undisaggregated compressed plant debris	4	

Context 86018, Sample 230/T

Atriplex sp(p).	1	
Carduus/Cirsium sp(p).	1	
Carex sp(p).	2	
Chenopodium album	1	
Corylus avellana	1	
Danthonia decumbens	1	
Eleocharis palustris sl	1	
Gramineae	1	
Juncus bufonius	1	
Juncus inflexus/effusus/ conglomeratus	1	
Leguminosae (cal/fls)	1	
Luzula sp(p).	1	
Lycopus europaeus	1	
Polygonum aviculare agg.	1	
Polytrichum/Pogonatum sp(p). (lf bases)	1	
Potentilla anserina	1	
Potentilla cf. erecta	2	
Quercus sp(p). (b/bs)	1	
Ranunculus Section Ranunculus	1	
Ranunculus sceleratus	2	
Rhinanthus sp(p).	1	
Rubus fruticosus agg.	1	fgts only
Sphagnum sp(p). (lvs/shts)	1	sp., not papillosum or imbricatum
Thlaspi arvense (sf)	1	
Urtica dioica	2	
Urtica urens	1	
Viola sp(p).	1	subglobose type (Subg. Viola)
bark fgts	1	max 25 mm
beetles	1	
charcoal	1	max 10 mm
?colonial hydroid	1	
earthworm egg caps	1	
fly puparia	1	
gravel	1	max 40 mm
grit	2	
herbaceous detritus	2	v dec
moss	1	
sand	2	
twig fgts	1	max 30 mm
unwashed peaty sediment	4	max 10 mm
wood chips	1	max 10 mm
wood fgts	3	max 50 mm

Context 86018, Sample 231/T

Atriplex sp(p).	1	
Campanula cf. rotundifolia	1	
Carex sp(p).	1	
Carex sp(p). (ch)	1	
Cenococcum (sclerotia)	1	
Chenopodium album	1	
Compositae (inv fgts)	1	
Corylus avellana	1	
Dicranum sp(p).	1	
Eleocharis palustris sl	1	
Fragaria cf. vesca	1	
Gramineae	1	
Gramineae/Cerealia (culm fgts)	1	
Homalothecium sericeum/lutescens	1	
Hordeum sp(p).	1	
Humulus lupulus	1	a single fgt
Juncus bufonius	1	
Juncus sp(p).	1	v dec
Polygonum aviculare agg.	1	
Polytrichum sp(p).	1	
Potentilla cf. erecta	2	
Racomitrium sp(p).	1	
Ranunculus Section Ranunculus	1	
Ranunculus sceleratus	2	
Rhinanthus sp(p).	1	
Rubus fruticosus agg.	1	
Rumex sp(p).	1	
Salix sp(p). (b)	1	
Scirpus cf. maritimus	1	
Stellaria media	1	
Stellaria palustris/graminea	1	
Urtica dioica	1	
Urtica urens	2	
Viola sp(p). (Viola)	1	slender type
ash concretions	1	max 2 mm
bark fgts	2	max 50 mm
beetles	1	
charcoal	1	max 15 mm
?colonial hydroid	1	

Context 86018, Sample 231/T

earthworm egg caps	1	
gravel	2	max 50 mm
grit	2	
herbaceous detritus	2	v dec
sand	3	
twig fgts	1	max 10 mm
unwashed peaty sediment	3	max 35 mm
wood chips	1	max 10 mm
wood fgts	1	

Context 86018, Sample 251/T

Agrostemma githago	1	v dec
Alnus sp(p). (b/bs)	1	
Atriplex sp(p).	1	

Aulacomnium palustre	1	
Betula cf. pendula (bark fgts)	1	max 20 mm
Betula sp(p). (b/bs)	1	
Bidens sp(p).	1	
Calliergon cuspidatum	1	
Cannabis sativa	2	fgts only
Carduus/Cirsium sp(p).	1	
Carex sp(p).	2	
Carex sp(p). (det utr)	1	
Chenopodium album	2	
Corylus avellana	2	
Corylus avellana (ch)	1	
Danthonia decumbens (spklts/fgts)	1	
Eleocharis palustris sl	1	
Galeopsis Subgenus Galeopsis	1	
cf. Glechoma hederacea	1	
Gramineae	1	
Gramineae/Cerealia (culm fgts)	1	
Humulus lupulus	3	
Hylocomium splendens	1	
Hyoscyamus niger	1	
Juncus bufonius	1	
Juncus sp(p).	1	
Leguminosae (fls/pet)	1	
Leucodon sciuroides	1	
Linum usitatissimum	1	
Plantago major	1	
Polygonum aviculare agg.	2	
Polygonum hydropiper	2	
Polygonum lapathifolium	1	
Polytrichum sp(p). (sht fgts)	1	
Populus sp(p). (b/bs)	1	
Potentilla cf. erecta	2	
Potentilla palustris	1	
Potentilla sp(p).	1	
Prunella vulgaris	1	
Quercus sp(p). (b/bs)	1	
Racomitrium sp(p).	1	
Ranunculus Section Ranunculus	1	
Ranunculus flammula	1	
Rhytidiadelphus cf. squarrosus	1	
Rubus fruticosus agg.	1	
Rumex acetosella agg.	1	
Rumex sp(p).	1	
Salix sp(p). (tw fgts)	1	max 10 mm
Scirpus cf. lacustris sl	1	
Silene vulgaris	1	
Solanum nigrum	1	
Spergula arvensis	1	
Sphagnum sp(p). (lvs/sht tips)	1	
Stellaria media	2	
Stellaria palustris/graminea	1	
Thamnobryum alopecurum	1	
Thuidium cf. tamariscinum	1	
Urtica dioica	2	
Urtica urens	2	
Viola sp(p). (caps segs)	1	
bark fgts	2	max 35 mm
beetles	1	
bone fgts	1	max 50 mm
burnt bone fgts	1	max 15 mm
charcoal	1	max 10 mm
dicot lf fgts	1	
earthworm egg caps	1	
fish bone	1	max 30 mm
fly puparia	1	
glassy ash	1	max 5 mm
gravel	2	max 40 mm
grit	2	
leather fgts	1	v dec, max 10 mm
mites	1	
sand	3	
twig fgts	1	max 40 mm
unwashed peaty sediment	1	max 5 mm
wood chips	1	max 25 mm
wood fgts	3	max 25 mm

Context 86018, Sample 253/T+T2

Alnus sp(p). (b/bs)	1	
Alnus sp(p). (fca)	1	
Atriplex sp(p).	1	
Aulacomnium palustre	1	
Betula sp(p).	1	
Bidens sp(p).	1	
Calliergon cuspidatum	1	
Cannabis sativa	2	inc fgts
Carduus/Cirsium sp(p).	1	
Carex sp(p).	2	
Carex sp(p). (ch)	1	
Centaurea sp(p). (imm)	1	
Chenopodium album	2	
Chenopodium album (ch)	1	
Climacium dendroides	1	
Coniferae (needles)	1	
Corylus avellana	1	
Corylus avellana (b/bs)	1	
Corylus avellana (ch)	1	
Corylus avellana (roundwood)	1	max 70x10 mm
Danthonia decumbens	1	
Danthonia decumbens (spklts/fgts)	2	
Danthonia decumbens (wl chaff)	1	
Dicranum scoparium	1	
Eleocharis palustris sl	1	
Empetrum sp(p).	1	
Filipendula ulmaria	2	
Galeopsis Subgenus Galeopsis	1	
Gramineae	1	
Gramineae/Cerealia (c/n)	1	
Heracleum sphondylium	1	
Hieracium sp(p).	1	
Hordeum sp(p).	1	a single spec
Humulus lupulus	3	
Humulus lupulus (bracts)	1	
Hylocomium splendens	1	
Hypnum cf. cupressiforme	1	
Isatis tinctoria (pod fgts)	1	a single spec
Isothecium myosuroides	1	

Juncus bufonius	2	
Juncus inflexus/effusus/ conglomeratus	1	
Juncus sp(p).	1	
Juniperus communis (sht fgts)	1	
Leguminosae (cal/fls)	1	
Leguminosae (fls/pet)	2	
Leguminosae (pods/fgts)	1	max 10 mm
Leontodon sp(p).	1	
Leucobryum glaucum	1	
Linum usitatissimum	2	
Luzula sp(p).	1	
Malus sylvestris (endo)	1	
Plagiomnium cf. undulatum	1	
Pleurozium schreberi	1	
Polygonum aviculare agg.	2	
Polygonum hydropiper	2	
Polygonum hydropiper (ch)	1	
Polygonum lapathifolium	1	
Polygonum persicaria	1	
Polygonum sp(p).	1	
Polytrichum commune	2	
Polytrichum sp(p).	2	
Polytrichum/Pogonatum sp(p). (sht fgts)	1	
Populus sp(p). (b/bs)	1	
Potentilla anserina	1	
Potentilla cf. erecta	2	
Potentilla sp(p).	2	
Prunella vulgaris	1	
Pteridium aquilinum (stalk fgts)	1	max 50 mm
Quercus sp(p). (b/bs)	1	
Quercus sp(p). (part-ch wood)	1	max 50 mm
Racomitrium sp(p).	1	
Ranunculus Section Ranunculus	2	
Ranunculus flammula	1	
Ranunculus sceleratus	2	
Rhinanthus sp(p).	1	
Rhytidiadelphus cf. squarrosus	1	
Rorippa palustris	1	
Rosa sp(p).	1	
Rubus fruticosus agg.	1	
Rumex sp(p).	1	
Rumex sp(p). (per/segs)	1	
Salix sp(p). (b)	1	
Salix sp(p). (fr)	1	large type(s)
Salix sp(p). (lf fgts)	1	
Scirpus cf. maritimus	1	
Scleranthus annuus	1	
Solanum nigrum	1	
Sorbus aucuparia	1	
Sorbus sp(p).	1	
Sphagnum squarrosum	1	
Sphagnum sp(p). (lvs)	1	
Stellaria media	2	
Stellaria palustris/graminea	1	
Thuidium cf. tamariscinum	1	
Trifolium pratense (pods/lids)	1	
Triglochin maritima	1	
Urtica dioica	1	
Urtica urens	1	
Viola sp(p).	1	slender type (Subg. Melanium)
Viola sp(p). (caps segs)	1	large type(s)
bark fgts	2	max 45 mm
beetles	1	
bivalve periostracum	1	max 10 mm
bone fgts	1	max 60 mm
burnt bone fgts	1	max 20 mm
burnt fish bone	1	max 2 mm
caddis larva cases	1	
charcoal	1	max 20 mm
charred seaweed	1	max 5 mm
‘coils’	1	
dicot lf fgts	2	max 10 mm
earthworm egg caps	1	
fish bone	1	max 10 mm
fish scale	1	max 5 mm
fly puparia	1	
gravel	2	max 45 mm
grit	2	
herbaceous detritus	1	
indet. seed(s)	1	
mites	1	
moss	1	
pedicels indet.	1	
sand	2	
twig fgts	2	max 50 mm
twig fgts (ch)	1	max 10 mm
unwashed peaty sediment	2	max 40 mm
wood chips	2	max 10 mm
wood fgts	3	max 30 mm

Context 86485, Sample 242/BS

Cenococcum (ch sclerotia)	1	
Chenopodium album	1	?modern
Rubus idaeus	1	?modern
‘ash beads’	1	max 2 mm
charcoal	1	max 15 mm

Context 87427, Sample 243/T

Carex sp(p).	1	
Cenococcum (ch sclerotia)	1	
Corylus avellana (ch)	1	
Eleocharis palustris sl	1	
Gramineae	1	
Hordeum sp(p).	1	
Juncus bufonius	2	
Juncus inflexus/effusus/ conglomeratus	1	
Rubus fruticosus agg.	1	
Rubus idaeus	1	
Urtica dioica	1	
‘ash beads’	1	max 2 mm

bark fgts	1	v dec, max 10 mm
bark fgts (ch)	1	max 5 mm
beetles	1	
bone fgts	1	max 30 mm
burnt bone fgts	1	max 5 mm
cancellous bone fgts	1	max 5 mm
charcoal	2	max 20 mm
?charred seaweed	1	max 3 mm
concreted sediment	1	max 5 mm
fish bone	1	max 5 mm
fly puparia	1	
glassy ash	1	max 2 mm
gravel	1	max 35 mm
grit	2	
herbaceous detritus	1	
mammal tooth	1	max 45 mm
pottery	1	max 10 mm
sand	2	
?slag	1	max 60 mm
wood fgts	1	v dec, max 5 mm

Viola sp(p).	1	subglobose type (Subg. Viola)
bark fgts	2	max 30 mm
beetles	1	
bone fgts	1	max 75 mm
burnt bone fgts	1	max 10 mm
charcoal	2	max 20 mm
concretions	1	max 10 mm
earthworm egg caps	1	
fish bone	1	max 25 mm
fly puparia	1	fgts only
glassy slag	1	max 10 mm
gravel	2	max 50 mm
grit	3	
?peat fgts	1	max 5 mm
sand	3	
sclereids (from bark)	1	
twig fgts (ch)	1	max 5 mm
unwashed sediment	1	max 5 mm
wood fgts	2	v dec, max 15 mm

Context 87626, Sample 247/T+T2

Alnus/Corylus (charcoal)	1	max 10 mm
Atriplex sp(p).	1	
Carduus/Cirsium sp(p).	1	
Carex sp(p).	2	
Chenopodium album	1	
Coniferae (wood chips)	1	max 10 mm
Corylus avellana	1	
Corylus avellana (ch)	1	
Eleocharis palustris sl	2	v dec
Eupatorium cannabinum	1	
Fraxinus (charcoal)	1	max 10 mm
Hypericum sp(p).	1	
Juncus bufonius	2	
Juncus cf. gerardi	1	
Leguminosae (w/l)	1	modern
Polygonum persicaria	1	fgts only
Populus sp(p). (b/bs)	1	
Potentilla anserina	1	
Potentilla sp(p).	1	
Quercus sp(p). (b/bs)	1	
Quercus sp(p). (charcoal)	1	max 10 mm
Ranunculus Section Ranunculus	1	
Ranunculus flammula	1	
Ranunculus sceleratus	2	
Raphanus raphanistrum (pod segs/fgts)	1	v dec
Rubus fruticosus agg.	2	v dec
Rubus idaeus	1	
Salix/Populus sp(p). (charcoal)	1	max 15 mm
Spergula arvensis (ch)	1	
Sphagnum sp(p). (lvs/sht tips)	1	
Urtica dioica	2	v dec
Veronica sp(p).	1	

Context 87669, Sample 254/T+T2

Alnus glutinosa (b/bs)	1	
Atriplex sp(p).	2	
Betula sp(p).	1	
Betula sp(p). (b/bs)	1	
Bilderdykia convolvulus	1	
Calluna vulgaris (caps)	1	
Campanula rotundifolia	1	
Cannabis sativa	1	fgts only
Carduus/Cirsium sp(p).	1	
Carex sp(p).	2	nutlets with utricles and/or free utricles
Cenococcum (sclerotia)	1	
Centaurea sp(p).	1	
Chenopodium album	1	
Chenopodium album (ch)	1	
Compositae	1	
Coniferae (wood chips)	1	max 40 mm
Corylus avellana	2	
Corylus avellana (part-ch)	1	
Corylus avellana (ch)	1	
Danthonia decumbens (spklts/fgts)	1	
Eleocharis palustris sl	1	
Filipendula ulmaria	1	
Fraxinus (charcoal)	1	max 20 mm
Fumaria sp(p).	1	
Heterodera (cysts)	1	
Hordeum sp(p).	1	
Hylocomium splendens	1	
Hypericum sp(p).	1	
Juncus bufonius	2	
Juncus sp(p).	1	
Lamium sp(p).	1	
Lapsana communis	1	

Leguminosae (w/l)	1	modern
Leontodon sp(p).	1	v dec
Lycopus europaeus	1	
Polygonum persicaria	1	
Polytrichum sp(p).	1	
Populus sp(p). (b/bs)	1	
Potentilla anserina	1	
Potentilla cf. erecta	2	
Quercus sp(p). (b/bs)	1	
Ranunculus Section Ranunculus	2	
Ranunculus flammula	1	
Ranunculus sceleratus	1	
Rubus fruticosus agg.	2	
Rubus fruticosus agg. (ch)	1	
Rubus idaeus	1	
Rumex sp(p).	1	
Scirpus cf. lacustris sl	1	
Scirpus cf. maritimus	2	
Silene sp(p).	1	
Solanum cf. nigrum	1	
Sphagnum sp(p). (lvs)	1	a single lf; sp., not papillosum or imbricatum
Stellaria media	1	
Stellaria media (ch)	1	
Stellaria palustris/graminea	1	
Urtica dioica	2	
Urtica urens	1	
Viola sp(p).	1	subglobose type (Subg. Viola)
‘ash beads’	1	max 2 mm
bark fgts	1	max 30 mm
beetles	2	
bone fgts	1	max 40 mm
burnt bone fgts	1	max 5 mm
burnt fish bone	1	max 5 mm
charcoal	2	max 20 mm
charred organic material	1	max 2 mm
?colonial hydroid	1	
concretions	1	max 5 mm
Daphnia (ephippia)	2	
earthworm egg caps	2	
fish bone	2	max 15 mm
fly puparia	1	mostly fgts
gravel	2	max 50 mm
grit	3	
leaf ab pads	1	
mites	1	
sand	3	
small vertebrate bones	1	
unwashed sediment	2	max 20 mm
twig fgts	1	max 30 x 5 mm
wood fgts	2	v dec, max 15 mm

Context 87793, Sample 256/T+T2

Atriplex sp(p).	1	
Bilderdykia convolvulus (ff)	1	
Carduus/Cirsium sp(p).	1	
Carex sp(p).	1	
Carex sp(p). (ch)	1	
Carex sp(p). (part-ch)	1	
Cenococcum (sclerotia)	1	
Chenopodiaceae (ch)	1	
Chenopodium album	1	
Coniferae (wood chips)	1	max 10 mm
Corylus avellana	1	
Corylus avellana (ch)	1	
Danthonia decumbens	1	
Eleocharis palustris sl	1	
Fragaria cf. vesca	1	
Fumaria sp(p).	1	
Gramineae	1	
Humulus lupulus	1	a single fgt
Hylocomium splendens	1	
Juncus bufonius	2	
Juncus cf. maritimus	1	
Juncus inflexus/effusus/ conglomeratus	1	
Lapsana communis	1	
Linum usitatissimum (caps fgts)	1	
Luzula sp(p).	1	
Montia fontana ssp. fontana	1	
Polygonum aviculare agg.	1	
Polygonum hydropiper	2	mostly v dec
Polygonum lapathifolium (ch)	1	
Polygonum persicaria	1	
Potentilla cf. erecta	1	
Ranunculus Section Ranunculus	1	
Ranunculus sceleratus	1	
Raphanus raphanistrum (pod segs/fgts)	1	
Rubus fruticosus agg.	2	
Rubus fruticosus agg. (ch)	1	
Rubus idaeus	1	
Rumex acetosella agg.	1	
Scirpus lacustris sl	1	
Scirpus cf. maritimus	1	
Solanum dulcamara	1	
Solanum nigrum	1	
Sphagnum sp(p). (lvs/sht tips)	1	
Urtica dioica	2	
Urtica urens	1	
Viola sp(p).	1	subglobose type (Subg. Viola)
bark fgts	1	max 20 mm
beetles	1	
bone fgts	1	max 25 mm
burnt fish bone	1	max 2 mm
cancellous bone fgts	1	max 15 mm
charcoal	2	max 10 mm
charred seaweed	1	max 2 mm
dicot lf skeletons	1	
earthworm egg caps	1	
fly puparia	1	

gravel	3	max 55 mm
grit	3	
pottery	1	max 45 mm
sand	3	
unwashed peaty sediment	1	max 25 mm
wood fgts	2	mostly v dec, max 35 mm

Context 87926, Sample 260/BS

Cenococcum (ch sclerotia)	1	
Chenopodium album	1	modern
Chenopodium album (ch)	1	
‘ash beads’	1	max 5 mm
bark fgts	1	max 5 mm
charcoal	2	max 15 mm
charred organic material	1	max 5 mm
root/rootlet fgts (modern)	1	

Context 88220, Sample 261/SPT

Salix/Populus sp(p). (wood)	1	max 20 mm

Context 88221, Sample 262/SPT

cf. Salix sp(p). (wood)	1	max 90 mm

Context 88222, Sample 263/SPT

cf. Salix sp(p). (wood)	1	max 85 mm

Contest 88223, Sample 264/SPT

cf. Salix sp(p). (wood)	1	max 130 mm

Context 88224, Sample 266/SPT

concretions	1	max 30 mm
wood fgts	1	max 15 mm

Context 88225, Sample 267/SPT

wood fgts	1	max 50 mm

Context 88226, Sample 257/T+T2

cf. Acer sp(p). (charcoal)	1	max 20 mm
Atriplex sp(p).	2	
Betula sp(p).	1	
Carduus/Cirsium sp(p).	1	
Carex sp(p).	2	
Chenopodiaceae (ch)	1	a single spec
Chenopodium album	2	
Coniferae (charcoal)	1	max 10 mm
Coniferae (wood)	1	max 15 mm
Corylus avellana	2	
Corylus avellana (ch)	1	
Eleocharis palustris sl	1	
Filipendula ulmaria	1	
Fraxinus (charcoal)	1	max 10 mm
Galeopsis sp(p).	1	
Gramineae/Cerealia (c/n)	1	
Hordeum sp(p).	1	a single spec
Hylocomium splendens	1	
Juncus bufonius	2	
Juncus inflexus/effusus/ conglomeratus	1	
Lapsana communis	1	
Leguminosae (fls/pet)	1	
Leontodon sp(p).	1	
Lycopus europaeus	1	
Malva sylvestris	1	v dec
Polygonum aviculare agg.	1	
Polygonum lapathifolium	1	
Populus sp(p). (b/bs)	1	
Potentilla anserina	1	
Potentilla cf. erecta	2	
Quercus (charcoal)	1	max 15 mm
Ranunculus Section Ranunculus	1	
Ranunculus cf. sardous (ch)	1	a single spec
Ranunculus sceleratus	1	
Rubus fruticosus agg.	2	
Sagina sp(p).	1	
Scirpus cf. maritimus	1	one v dec fgt
Senecio sp(p).	1	
Sphagnum sp(p). (lvs)	1	v dec
Stachys sp(p).	1	
Stellaria media	1	
Stellaria media (ch)	1	
Urtica dioica	2	
Urtica urens	1	
Viola sp(p).	1	
‘ash beads’	1	max 5 mm
bark fgts	3	max 25 mm
beetles	2	
bivalve periostracum	1	max 10 mm
bone fgts	1	max 30 mm
burnt bone fgts	1	max 5 mm
charcoal	3	max 20 mm
concretions	1	max 10 mm
Daphnia (ephippia)	1	
earthworm egg caps	1	
fish bone	2	max 15 mm
fly puparia	1	
gravel	3	max 55 mm
grit	3	
moss	1	
sand	3	
stones	2	max 60 mm
twig fgts	1	max 15 mm
unwashed sediment	2	max 15 mm
wood chips	1	max 10 mm
wood fgts	3	max 20 mm

Context 88589, Sample 265/SPT

wood fgts	1	max 45 mm

Context 88660, Sample 268/SPT

cf. Salix sp(p). (wood)	1	max 110 mm

Context 90609, Sample 282/BS

Chenopodium album	1	modern
Hordeum sp(p). (inc hulled)	2	
Secale cereale	1	
Viola sp(p).	1	modern
'ash beads'	1	max 2 mm
charcoal	1	max 10 mm
charred organic material	1	max 5 mm
fish bone	1	max 3 mm
?rodent droppings	1	

Context 94901, Sample 289/T

Atriplex sp(p).	1	
Carex sp(p).	2	
Chenopodium album	1	
Corylus avellana	1	
Juncus bufonius	2	
Polygonum aviculare agg.	1	
Polygonum lapathifolium	1	
Potentilla cf. erecta	1	
Ranunculus Section Ranunculus	1	
Ranunculus sceleratus	2	
Rorippa palustris	1	
Rubus idaeus	1	
Rumex sp(p).	1	
Salix sp(p). (fr)	1	
Stellaria media	1	
Thlaspi arvense (sf)	1	
Urtica dioica	1	
Urtica urens	1	
Viola sp(p).	1	subglobose type (Subg. Viola)
bark fgts	1	v dec, max 20 mm
beetles	1	
bone fgts	1	max 15 mm
charcoal	1	max 15 mm
earthworm egg caps	1	
fly puparia	1	
gravel	2	max 35 mm
grit	3	
herbaceous detritus	1	
root/rootlet fgts	2	
sand	3	
twig fgts	1	max 15 mm
wood fgts	2	v dec, max 35 mm

Context 99879, Sample 294/T+T2

Antitrichia curtipendula	1	
Atriplex sp(p).	1	
Betula sp(p).	1	
Bidens sp(p).	1	
Cannabis sativa	1	
Capsella bursa-pastoris	1	
Carduus/Cirsium sp(p).	1	
Carex sp(p).	2	
Cenococcum (sclerotia)	2	
Centaurea sp(p).	1	
Chenopodium album	1	
Coniferae (tw fgts)	1	max 10 mm
Corylus avellana	1	
Corylus avellana (ch)	1	
Descurainia sophia	1	
Eleocharis palustris sl	1	
Fragaria cf. vesca	1	
Fraxinus excelsior (charcoal)	1	max 10 mm
Galeopsis Subgenus Galeopsis	1	
Gramineae (ch)	1	
Gramineae (culm bases/rh fgts)	2	
Gramineae (w/l spklts/fgts) type(s)	1	very small
Gramineae/Cerealia (c/n)	1	
Heterodera (cysts)	1	
Humulus lupulus	1	
Hylocomium splendens	1	
Isatis tinctoria (pod fgts)	1	
Juncus bufonius	2	
Juncus cf. gerardi	1	v dec
Juniperus communis	1	
Juniperus communis (lvs)	1	
Leucodon sciuroides	1	
Malva sylvestris	1	
Polygonum aviculare agg.	2	
Polygonum hydropiper	1	
Polygonum lapathifolium	1	
Polygonum persicaria	1	
Polytrichum/Pogonatum sp(p). (lf bases)	1	
Populus sp(p). (b/bs)	1	
Potentilla cf. erecta	1	
Prunella vulgaris	1	
Quercus sp(p). (wood)	1	max 25 mm
Quercus (wood chips)	1	max 35 mm
Racomitrium sp(p).	1	
Ranunculus Section Ranunculus	1	
Ranunculus sceleratus	3	
Rosa sp(p).	1	
Rubus fruticosus agg.	1	
Rubus idaeus	1	
Rumex acetosella agg.	1	
Scleranthus annuus	2	
Secale cereale	1	
Silene sp(p).	1	
Solanum nigrum	1	
Stellaria media	1	
Urtica urens	1	
Urtica dioica	2	
'ash beads'	1	max 5 mm

bark fgts	2	max 25 mm
beetles	1	
bivalve periostracum	1	max 5 mm
bone fgts	1	max 30 mm
burnt bone fgts	1	max 30 mm
cancellous bone fgts	1	max 10 mm
charcoal	3	max 20 mm
colonial hydroid	1	
Daphnia (ephippia)	1	
dicot stem fgts	1	max 5 mm
earthworm egg caps	1	
fine plant detritus	3	
fish bone	1	max 5 mm
fly puparia	1	
glassy ash	1	max 10 mm
gravel	2	max 50 mm
grit	2	
mites	1	
monocot lf/stem fgts	1	
moss	1	
moss (lfless stems)	1	
part-burnt wood	1	max 40 mm
part-burnt wood chips	1	max 35 mm
root/rhizome fgts	3	max 10 mm
sand	3	
twig fgts	1	max 25 mm
undisaggregated compressed plant debris	2	max 10 mm
wood chips	2	max 20 mm
wood fgts	3	max 40 mm

Context 99897, Sample 99897/SPT

Quercus sp(p). (wood)	1	max 160 mm
Ranunculus sceleratus	1	
bark fgts	1	max 40 mm
monocot rhizome fgts	1	

Table 1.6. Complete list of invertebrate remains recorded from samples from the Kaupang site. 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. Ecological codes used in calculating statistics (Table 1.7) are given (they are explained in Table 1.8). * = not used in calculating assemblage statistics. The remains were of adults unless stated. 'Sp.' indicates that record was probably an additional taxon, 'sp. indet.' that the material may have been of a taxon listed above it. The two *Dromius* species should be coded oa-l but have not been included in the statistics in Table 1.9 for the tree-associated group.

Coelenterata	
*Coelenterata sp. (hydroid stem or theca)	u
Nematoda	
**?Heterodera* sp. (cyst)	u
Annelida: Oligochaeta	
*Oligochaeta sp. (egg capsule)	u
Crustacea	
**Daphnia* sp. (ephippium)	oa-w
*Cladocera sp. (ephippium)	oa-w
Insecta	
Hemiptera	
Lygaeidae sp.	oa-p
Cimicidae sp.	oa-p
Corixidae sp.	oa-w
Philaenus spumarius (Linnaeus)	oa-p
Cicadellidae sp.	oa-p
?Euconomelus lepidus (Boheman)	oa-p
Delphacidae sp.	oa-p
*Auchenorhyncha sp. (nymph)	oa-p
*Psylloidea sp. (nymph)	oa-p
*Aphidoidea sp.	u
Diptera	
*Chironomidae sp. (larva)	w
*Diptera sp. (adult)	u
*Diptera sp. (pupa)	u
*Diptera sp. (puparium)	u
Siphonaptera	
**Pulex irritans* Linnaeus	ss
*Siphonaptera sp.	u
Trichoptera	
*Trichoptera sp.	oa-w
Coleoptera	
Dyschirius globosus (Herbst)	oa
Clivina fossor (Linnaeus)	oa
Patrobus ?atrorufus (Strom)	oa
Patrobus sp. indet.	oa
Trechus ?micros (Herbst)	u
?Trechus sp.	ob
Pterostichus melanarius (Illiger)	ob
Pterostichus ?nigrita (Paykull)	oa-d
Pterostichus (*Poecilus*) sp.	oa
Pterostichus spp.	ob
Calathus sp.	oa
Amara sp.	oa
Dromius quadrimaculatus (Linnaeus)	oa (l)
Dromius quadrinotatus (Zenker)	oa (l)
Metabletus sp.	oa
Carabidae spp. and spp. indet.	ob
Helophorus spp.	oa-w
Cercyon analis (Paykull)	rt-sf
Cercyon atricapillus (Marsham)	rf-st
Cercyon haemorrhoidalis (Fabricius)	rf-sf
Cercyon quisquilius (Linnaeus)	rf-st
Cercyon ?tristis (Illiger)	oa-d
Cercyon spp. indet.	u
Cryptopleurum minutum (Fabricius)	rf-st
?Hydrobius fuscipes (Linnaeus)	oa-w
Chaetarthria seminulum (Herbst)	oa-w
Hydrophilinae sp.	oa-w
Acritus nigricornis (Hoffmann)	rt-st
Saprinus sp.	rt-sf
Histerinae sp.	rt
Ochthebius sp.	oa-w
Ptenidium spp.	rt
Acrotrichis sp.	rt
Ptiliidae sp.	u
Catops sp.	u
Micropeplus porcatus (Paykull)	rt
Micropeplus tesserula Curtis	rt
Megarthrus sp.	rt
Acidota cruentata Mannerheim	oa
Phyllodrepoidea crenata (Gravenhorst)	ob
Eusphalerum ?minutum (Fabricius)	oa-d
Phyllodrepa ?floralis (Paykull)	rt-sf
Omalium ? italicum Bernhauer	rt-sf
Omalium caesum or *italicum*	rt-sf
Omalium ?rivulare (Paykull)	rt-sf
Omalium sp. indet.	rt
Xylodromus concinnus (Marsham)	rt-st
Omaliinae spp.	rt
Carpelimus bilineatus Stephens	rt-sf
Carpelimus elongatulus (Erichson)	oa-d
Carpelimus sp.	u
Platystethus arenarius (Fourcroy)	rf
Platystethus nodifrons (Mannerheim)	oa-d
Anotylus nitidulus (Gravenhorst)	rt
Anotylus rugosus (Fabricius)	rt
Oxytelus sculptus Gravenhorst	rt-st

Stenus spp.	u
Lathrobium sp.	u
?Rugilus sp.	rt
Leptacinus ?intermedius Donisthorpe	rt-st
Leptacinus sp.	rt-st
Gyrohypnus angustatus Stephens	rt-st
Gyrohypnus fracticornis (Muller)	rt-st
Gyrohypnus sp. indet.	rt
Xantholinus sp.	u
Neobisnius sp.	u
Philonthus spp.	u
Creophilus maxillosus (Linnaeus)	rt
?Ontholestes sp.	rt
Quedius spp.	u
Staphylininae spp. indet.	u
Tachyporus sp.	u
Tachinus sp.	u
Cypha sp.	rt
Cordalia obscura (Gravenhorst)	rt-sf
Falagria caesa or *sulcatula*	rt-sf
Crataraea suturalis (Mannerheim)	rt-st
Aleochara sp.	u
Aleocharinae spp.	u
Euplectini sp.	u
Pselaphidae sp.	u
Trox scaber (Linnaeus)	rt-sf
Geotrupes sp.	oa-rf
Aphodius ?fimetarius (Linnaeus)	oa-rf
Aphodius granarius (Linnaeus)	ob-rf
Aphodius ?rufipes (Linnaeus)	oa-rf
Aphodius ?sphacelatus (Panzer)	oa-rf
Aphodius spp. and spp. indet.	ob-rf
Clambus sp.	rt-sf
**Melanotus erythropus* (Gmelin) (larva)	l
Dermestes ?lardarius Linnaeus	rd-sf
**Dermestes lardarius* (larva)	rd-sf
?Dermestes sp. indet.	rt-sf
Anobium sp.	l
Ptinus fur (Linnaeus)	rd-sf
Ptinus raptor Sturm	rd-sf
Ptinus sp. and spp. indet.	rd-sf
Lyctus linearis (Goeze)	l-sf
Necrobia violacea (Linnaeus)	rt-sf
Necrobia sp. indet.	rd-sf
Malachius sp.	u
Brachypterus sp.	oa-p
?Meligethes sp.	oa-p
Omosita colon (Linnaeus)	rt-sf
Glischrochilus quadripunctatus (Linnaeus)	rt-sf
Monotoma longicollis (Gyllenhall)	rt-st
Cryptophagus ?scutellatus Newman	rd-st
Cryptophagus spp.	rd-sf
Atomaria spp.	rd
Ephistemus globulus (Paykull)	rd-sf
Orthoperus spp.	rt
Coccidula ?scutellata (Herbst)	oa-p-d
?Scymnus sp. s. lat.	oa-p
Coccinellidae sp.	oa-p
Lathridius minutus group	rd-st
Enicmus sp.	rt-sf
Corticaria spp.	rt-sf
Corticarina sp.	rt
Corticarina or *Cortinicara* sp. indet.	rt
Cisidae sp.	l
Aglenus brunneus (Gyllenhal)	rt-ss
Tenebrio obscurus Fabricius	rt-ss
Rhinosimus planirostris (Fabricius)	l
Anthicus sp.	rt
Chrysomelinae sp.	oa-p
Galerucella sp.	oa-p
Longitarsus sp.	oa-p
Crepidodera sp.	oa-p
Chaetocnema arida group	oa-p
Chaetocnema concinna (Marsham)	oa-p
Chaetocnema sp. indet.	oa-p
Cassida sp.	oa-p
Apion spp.	oa-p
Sitona sp.	oa-p
Notaris acridulus (Linnaeus)	oa-d-p
Cidnorhinus quadrimaculatus (Linnaeus)	oa-p
Ceuthorhynchinae sp.	oa-p
Curculionidae spp. and spp. indet.	oa
Scolytus ?intricatus (Ratzeburg)	l
Leperisinus varius (Fabricius)	l
Scolytidae sp.	l
Coleoptera spp. and spp. indet.	u
*Coleoptera spp. (larva)	u

Hymenoptera

*Chalcidoidea spp.	u
*Proctotrupoidea spp.	u
*Hymenoptera Parasitica spp.	u
**Apis mellifera* Linnaeus	u
*Apoidea sp. indet.	u
*Formicidae spp.	u
*Hymenoptera spp.	u
*Insecta sp. (larva)	u

Arachnida

*Pseudoscorpiones sp.	u
*Aranae spp.	u
*Acarina spp.	u

Table 1.7. Species lists in rank order for invertebrate macrofossils from samples from the Kaupang site. For each sample assemblage the adult Hemiptera (bugs) and Coleoptera (beetles) are listed first, followed by the remaining invertebrates. Headers: weight is in kilogrammes; E - erosion; F - fragmentation (modes, following Kenward and Large 1998); ec - ecological codes; n = minimum number of individuals; sq = semi-quantitative (e = estimate; - = fully quantitative, m = 'many', translated as 15 individuals; s = several, translated as 6). For translation of ecological codes, see Table 1.8.

Context: 61411 Sample: 236/T ReM: D
Weight: 3.00 E: 5.50 F: 0.00

Notes: Entered HK 30/6/04. Recorded in flot. Only traces of very decayed and unidentifiable cuticle.

Taxon	n	sq	ec
*null	0	n	u

Context: 86018 Sample: 226/T ReM: A
Weight: 3.00 E: 0.00 F: 0.00

Notes: Entered HK 30/6/04. Preservation good in a fairly small flot but no distinctive ecological components. Not worth recording even for site statistics.

Taxon	n	sq	ec
Cercyon analis	1	n	rt-sf
Cercyon haemorrhoidalis	1	n	rf-sf
Ptenidium sp.	1	n	rt
Omalium sp.	1	n	rt
Omaliinae sp.	1	n	rt
Oxytelus sculptus	1	n	rt-st
Philonthus sp.	1	n	u
Quedius sp.	1	n	u
Tachinus sp.	1	n	u
Aleocharinae sp.	1	n	u
Aphodius sp. A	1	n	ob-rf
Aphodius sp. B	1	n	ob-rf
Ptinus sp.	1	n	rd-sf
Cryptophagus sp.	1	n	rd-sf
Atomaria sp.	1	n	rd
?Scymnus sp. s. lat.	1	n	oa-p
Lathridius minutus group	1	n	rd-st
Corticaria sp. A	1	n	rt-sf
Corticaria sp. B	1	n	rt-sf
?Sitona sp.	1	n	oa-p

Context: 86018 Sample: 229/T2 ReM: D
Weight: 1.30 E: 2.50 F: 2.50

Notes: Entered HK 30/6/04. Recorded in float and on filter paper. Flot large (> half jar), almost impossible to sort effectively among woody fragments; some 'sticky' particles to which insect had adhered. E 2.0-3.0, mode 2.5 weak; F 2.0-3.5, mode 2.5 weak. Several Cryptophagus abdomens and elytra with wings attached, but remains show clear decay even so. Bee hind tarsal segment apex very degraded.

Taxon	n	sq	ec
Lathridius minutus group	40	n	rd-st
Cryptophagus sp. A	13	n	rd-sf
Cercyon analis	5	n	rt-sf
Atomaria sp. B	4	n	rd
Aleocharinae sp. B	3	n	u
Clambus sp.	3	n	rt-sf
Corticaria sp. C	3	n	rt-sf
Galerucella sp.	3	n	oa-p
Carpelimus sp.	2	n	u
Platystethus arenarius	2	n	rf
Aleocharinae sp. D	2	n	u
Ptinus sp.	2	n	rd-sf
Cryptophagus sp. B	2	n	rd-sf
Corticaria sp. A	2	n	rt-sf
Corticaria sp. B	2	n	rt-sf
Corticarina sp.	2	n	rt
Chaetocnema arida group	2	n	oa-p
Apion sp. B	2	n	oa-p
Philaenus spumarius	1	n	oa-p
Cicadellidae sp.	1	n	oa-p
Delphacidae sp.	1	n	oa-p
Cercyon sp.	1	n	u
Hydrophilinae sp.	1	n	oa-w
Acritus nigricornis	1	n	rt-st
Phyllodrepoidea crenata	1	n	ob
Anotylus rugosus	1	n	rt
Oxytelus sculptus	1	n	rt-st
Stenus sp.	1	n	u
Gyrohypnus fracticornis	1	n	rt-st
Xantholinus sp.	1	n	u
Philonthus sp.	1	n	u
Quedius sp.	1	n	u
Staphylininae sp. A	1	n	u
Staphylininae sp. B	1	n	u
Cordalia obscura	1	n	rt-sf
Aleocharinae sp. A	1	n	u
Aleocharinae sp. C	1	n	u
Aleocharinae sp. E	1	n	u
Aphodius sp. A	1	n	ob-rf
Aphodius sp. B	1	n	ob-rf
Atomaria sp. A	1	n	rd
Corticarina or Cortinicara sp.	1	n	rt
Cassida sp.	1	n	oa-p
Apion sp. A	1	n	oa-p
Coleoptera sp.	1	n	u
*Acarina sp.	50	e	u

*Daphnia sp. (ephippium)	3	n	oa-w
*Trichoptera sp.	1	n	oa-w
*Cladocera sp. S (ephippium)	1	n	oa-w
*Diptera sp. (adult)	1	n	u
*Pulex irritans	1	n	ss
*Apoidea sp.	1	n	u
*Formicidae sp.	1	n	u
*Hymenoptera sp.	1	n	u

Context: 86018 Sample: 230/T ReM: D
Weight: 2.00 E: 3.50 F: 3.00

Notes: Entered HK 29/6/04. Flot 2-3 dishes. Recorded in flot and on filter paper. Often well decayed, limiting identifications. E 2.0-4.5, mode 3.5 weak; F 2.5-5.0, mode 3.0 weak; trend to pale 0-3, mode 2 weak. One soft Apion prothorax.

Taxon	**n**	**sq**	**ec**
Lathridius minutus group	8	n	rd-st
Philonthus sp.	3	n	u
Cercyon analis	2	n	rt-sf
Platystethus arenarius	2	n	rf
Leptacinus sp.	2	n	rt-st
Cryptophagus sp.	2	n	rd-sf
Cicadellidae sp.	1	n	oa-p
?Patrobus sp.	1	n	oa
Pterostichus sp.	1	n	ob
Metabletus sp.	1	n	oa
Acrotrichis sp.	1	n	rt
Eusphalerum ?minutum	1	n	oa-d
Omaliinae sp.	1	n	rt
Carpelimus ?bilineatus	1	n	rt-sf
Carpelimus sp.	1	n	u
Anotylus nitidulus	1	n	rt
Anotylus rugosus	1	n	rt
Oxytelus sculptus	1	n	rt-st
Stenus sp.	1	n	u
Gyrohypnus sp.	1	n	rt
Xantholinus sp.	1	n	u
Neobisnius sp.	1	n	u
Quedius sp.	1	n	u
Staphylininae sp.	1	n	u
Cordalia obscura	1	n	rt-sf
Falagria sp.	1	n	rt-sf
Aleocharinae sp. A	1	n	u
Aleocharinae sp. B	1	n	u
Aleocharinae sp. C	1	n	u
Aleocharinae sp. D	1	n	u
Aleocharinae sp. E	1	n	u
Trox scaber	1	n	rt-sf
Aphodius granarius	1	n	ob-rf
Aphodius sp.	1	n	ob-rf
Anobium sp.	1	n	l
Ptinus sp.	1	n	rd-sf
Omosita colon	1	n	rt-sf
Atomaria sp. A	1	n	rd
Atomaria sp. B	1	n	rd
Ephistemus globulus	1	n	rd-sf
Orthoperus sp.	1	n	rt
Corticaria sp. A	1	n	rt-sf
Corticaria sp. B	1	n	rt-sf
?Galerucella sp.	1	n	oa-p
Apion sp.	1	n	oa-p
Scolytus ?intricatus	1	n	l
?Leperisinus varius	1	n	l
*Acarina sp.	15	m	u
*Daphnia sp. (ephippium)	2	n	oa-w
*Aphidoidea sp.	1	n	u

Context: 86018 Sample: 231/T ReM: D
Weight: 2.00 E: 3.00 F: 2.50

Notes: Entered HK 29/6/04. Smallish flot. Recorded in flot and on filter paper. Often rather pale and scrappy fossils, limiting identifications. E 2.0-4.0, mode 3.0 weak; F 1.5-4.0, mode 2.5 weak. ?Apis very decayed.

Taxon	**n**	**sq**	**ec**
Lathridius minutus group	5	n	rd-st
Cercyon analis	3	n	rt-sf
Ptenidium sp.	3	n	rt
Omalium sp.	3	n	rt
Cordalia obscura	3	n	rt-sf
Carpelimus sp.	2	n	u
Platystethus arenarius	2	n	rf
Oxytelus sculptus	2	n	rt-st
Leptacinus sp.	2	n	rt-st
Aphodius sp.	2	n	ob-rf
Ptinus raptor	2	n	rd-sf
Omosita sp.	2	n	rt-sf
Cryptophagus sp.	2	n	rd-sf
Atomaria sp. A	2	n	rd
Corticarina or Cortinicara sp.	2	n	rt
Lygaeidae sp.	1	n	oa-p
Cimicidae sp.	1	n	oa-p
Corixidae sp.	1	n	oa-w
Dromius quadrinotatus	1	n	oa
Carabidae sp.	1	n	ob
Helophorus sp.	1	n	oa-w
Cercyon sp.	1	n	u
Acritus nigricornis	1	n	rt-st
Ochthebius sp.	1	n	oa-w
Micropeplus porcatus	1	n	rt
Carpelimus ?bilineatus	1	n	rt-sf
Platystethus ?nodifrons	1	n	oa-d
Anotylus nitidulus	1	n	rt
Anotylus rugosus	1	n	rt
Stenus sp. A	1	n	u
Stenus sp. B	1	n	u
?Rugilus sp.	1	n	rt
Gyrohypnus ?angustatus	1	n	rt-st
Philonthus sp. A	1	n	u
Philonthus sp. B	1	n	u
Staphylininae sp.	1	n	u
Aleocharinae sp. A	1	n	u
Aleocharinae sp. B	1	n	u

Aleocharinae sp. C	1	n	u
Aleocharinae sp. D	1	n	u
Aphodius ?sphacelatus	1	n	oa-rf
Clambus sp.	1	n	rt-sf
Lyctus linearis	1	n	l-sf
Brachypterus sp.	1	n	oa-p
Atomaria sp. B	1	n	rd
Ephistemus globulus	1	n	rd-sf
Corticaria sp. A	1	n	rt-sf
Corticaria sp. B	1	n	rt-sf
Corticaria sp. C	1	n	rt-sf
Cisidae sp.	1	n	l
?Rhinosimus planirostris	1	n	l
Longitarsus sp.	1	n	oa-p
Cidnorhinus quadrimaculatus	1	n	oa-p
Curculionidae sp.	1	n	oa
Coleoptera sp.	1	n	u
*Acarina sp.	15	m	u
*Daphnia sp. (ephippium)	1	n	oa-w
*Psylloidea sp. (nymph)	1	n	oa-p
*Aphidoidea sp.	1	n	u
*Diptera sp. (pupa)	1	n	u
*Diptera sp. (puparium)	1	n	u
*Siphonaptera sp.	1	n	u
*Coleoptera sp. (larva)	1	n	u
*?Apis mellifera	1	n	u
*Hymenoptera Parasitica sp.	1	n	u
*Proctotrupoidea sp.	1	n	u
*Insecta sp. (larva)	1	n	u
*Aranae sp.	1	n	u

Context: 86018 Sample: 232/T ReM: A
Weight: 3.00 E: 0.00 F: 0.00

Notes: Entered HK 30/6/04. Large flot, only part examined. Very few, dilute, but fairly well preserved, remains; cannot justify time needed for sorting for so few records, even at site level.

Taxon	**n**	**sq**	**ec**
Pterostichus ?nigrita	1	n	oa-d
?Xylodromus concinnus	1	n	rt-st
Aleocharinae sp.	1	n	u
Cryptophagus sp.	1	n	rd-sf
*Proctotrupoidea sp.	2	n	u
*Coelenterata sp. (hydroid stem or theca)	1	n	u
*Oligochaeta sp. (egg capsule)	1	n	u

Context: 86018 Sample: 233/T ReM: A
Weight: 3.00 E: 0.00 F: 0.00

Notes: Entered HK 30/6/04. Quite large flot, with fairly good insect preservation though to few remains to justify time for sorting.

Taxon	**n**	**sq**	**ec**
Corticaria sp.	2	n	rt-sf
?Pterostichus sp.	1	n	ob
Cercyon analis	1	n	rt-sf
Oxytelus sculptus	1	n	rt-st
Gyrohypnus sp.	1	n	rt
Xantholinus sp.	1	n	u
Staphylininae sp.	1	n	u
Aleocharinae sp. A	1	n	u
Aleocharinae sp. B	1	n	u
Aphodius sp. A	1	n	ob-rf
Aphodius sp. B	1	n	ob-rf
Ptinus sp.	1	n	rd-sf
Omosita sp.	1	n	rt-sf
Cryptophagus sp.	1	n	rd-sf
Atomaria sp.	1	n	rd
Lathridius minutus group	1	n	rd-st
*Coelenterata sp. (hydroid stem or theca)	2	n	u

Context: 86018 Sample: 234/T ReM: A
Weight: 3.00 E: 0.00 F: 0.00
Notes: Entered HK 30/6/04. Rather large flot (5 mm in jar) with quite small numbers of well preserved insects; would be slow to sort. Hints of rather foul conditions, but not enough remains for this to be confirmed by full recording; cannot justify recording even for site statistics.

Taxon	**n**	**sq**	**ec**
Cercyon analis	6	s	rt-sf
Oxytelus sculptus	2	n	rt-st
Gyrohypnus fracticornis	2	n	rt-st
Ptinus ?raptor	2	n	rd-sf
Helophorus sp.	1	n	oa-w
Ptenidium sp.	1	n	rt
Omalium sp.	1	n	rt
Xylodromus concinnus	1	n	rt-st
Anotylus rugosus	1	n	rt
?Philonthus sp.	1	n	u
Aleocharinae sp.	1	n	u
Aphodius sp.	1	n	ob-rf
Ptinus sp.	1	n	rd-sf
Omosita sp.	1	n	rt-sf
Lathridius minutus group	1	n	rd-st
Corticaria sp.	1	n	rt-sf
*Coelenterata sp. (hydroid stem or theca)	1	n	u
*Oligochaeta sp. (egg capsule)	1	n	u
*Aranae sp.	1	n	u

Context: 86018 Sample: 250/T ReM: D
Weight: 3.00 E: 2.00 F: 2.50

Notes: Entered HK 30/6/04. Recorded in flot and on filter paper. Flot large (> 10 mm in pot), assorted plant debris. Quite a lot of associated insect sclerites, but preservation variable even within taxa (e.g. Ptinus), and fragmentation limiting identifications in

some cases. E 1.0-3.5, mode 2.0 weak; F 1.0-4.0, mode 2.5 weak.

Taxon	n	sq	ec
Platystethus arenarius	4	n	rf
Anotylus nitidulus	4	n	rt
Ptinus ?fur	4	n	rd-sf
Ptinus raptor	4	n	rd-sf
Corticaria sp. C	4	n	rt-sf
Cercyon analis	3	n	rt-sf
Omalium caesum or italicum	3	n	rt-sf
Carpelimus bilineatus	3	n	rt-sf
Anotylus rugosus	3	n	rt
Gyrohypnus fracticornis	3	n	rt-st
Cordalia obscura	3	n	rt-sf
Lathridius minutus group	3	n	rd-st
Corticaria sp. B	3	n	rt-sf
Dromius quadrinotatus	2	n	oa
Xylodromus concinnus	2	n	rt-st
Leptacinus ?intermedius	2	n	rt-st
Falagria caesa or sulcatula	2	n	rt-sf
Aleocharinae sp. C	2	n	u
Aleocharinae sp. D	2	n	u
Aleocharinae sp. H	2	n	u
Cryptophagus sp. A	2	n	rd-sf
Atomaria sp. A	2	n	rd
Atomaria sp. B	2	n	rd
Ephistemus globulus	2	n	rd-sf
Orthoperus sp.	2	n	rt
Cicadellidae sp.	1	n	oa-p
?Euconomelus lepidus	1	n	oa-p
Dyschirius globosus	1	n	oa
?Trechus sp.	1	n	ob
Pterostichus sp. A	1	n	ob
Pterostichus sp. B	1	n	ob
Helophorus sp. A	1	n	oa-w
Helophorus sp. B	1	n	oa-w
Cercyon haemorrhoidalis	1	n	rf-sf
Cercyon quisquilius	1	n	rf-st
Cercyon ?tristis	1	n	oa-d
Cryptopleurum minutum	1	n	rf-st
Ptenidium sp. A	1	n	rt
Ptenidium sp. B	1	n	rt
Catops sp.	1	n	u
Micropeplus tesserula	1	n	rt
Omaliinae sp. A	1	n	u
Omaliinae sp. B	1	n	u
Carpelimus elongatulus	1	n	oa-d
Stenus sp.	1	n	u
Gyrohypnus ?angustatus	1	n	rt-st
Philonthus sp. A	1	n	u
Philonthus sp. B	1	n	u
Philonthus sp. C	1	n	u
Philonthus sp. D	1	n	u
Quedius sp.	1	n	u
Staphylininae sp.	1	n	u
?Crataraea suturalis	1	n	rt-st
Aleocharinae sp. A	1	n	u
Aleocharinae sp. B	1	n	u
Aleocharinae sp. F	1	n	u
Aleocharinae sp. G	1	n	u
Aleocharinae sp. I	1	n	u
Geotrupes sp.	1	n	oa-rf
Aphodius sp. A	1	n	ob-rf
Aphodius sp. B	1	n	ob-rf
Aphodius sp. C	1	n	ob-rf
Aphodius sp. D	1	n	ob-rf
?Dermestes sp.	1	n	rt-sf
Omosita colon	1	n	rt-sf
Glischrochilus quadripunctatus	1	n	rt-sf
Cryptophagus sp. B	1	n	rd-sf
Coccinellidae sp.	1	n	oa-p
Corticaria sp. A	1	n	rt-sf
Corticaria sp. D	1	n	rt-sf
Cisidae sp.	1	n	l
Chrysomelinae sp.	1	n	oa-p
Longitarsus sp.	1	n	oa-p
Apion sp.	1	n	oa-p
Curculionidae sp.	1	n	oa
Scolytidae sp.	1	n	l
*Acarina sp.	15	m	u
*Coelenterata sp. (hydroid stem or theca)	6	s	u
*Oligochaeta sp. (egg capsule)	6	s	u
*Daphnia sp. (ephippium)	6	s	oa-w
*Aphidoidea sp.	6	s	u
*Diptera sp. (adult)	6	s	u
*Coleoptera sp. (larva)	6	s	u
*Aranae sp.	6	s	u
*Diptera sp. (puparium)	3	n	u
*Chalcidoidea sp.	3	n	u
*Auchenorhyncha sp. (nymph)	1	n	oa-p
*Psylloidea sp. (nymph)	1	n	oa-p
*Siphonaptera sp.	1	n	u
*Melanotus erythropus (larva)	1	n	l
*Apoidea sp.	1	n	u
*Formicidae sp.	1	n	u
*Proctotrupoidea sp.	1	n	u

Context: 86018 Sample: 251/T ReM: D
Weight: 2.00 E: 2.50 F: 2.50

Notes: Entered HK 30/6/04. Flot 5mm in jar. Recorded in flot and on filter paper. Fossils from residue (AH) included. Preservation often good: E 1.5-3.5, mode 2.5 weak; F 1.0-3.5, mode 2.5 weak. Apion soft. See listing sheet for comments on Ptinus, which do not appear to be the species usually recorded.

Taxon	n	sq	ec
Ptinus sp. A	6	n	rd-sf
Cercyon analis	5	n	rt-sf
Corticaria sp. C	5	n	rt-sf
Dromius quadrinotatus	4	n	oa
Ptinus sp. B	4	n	rd-sf
Lathridius minutus group	4	n	rd-st
Platystethus arenarius	3	n	rf
Aleocharinae sp. A	3	n	u

Corticaria sp. B	3	n	rt-sf
Omalium sp.	2	n	rt
Xylodromus ?concinnus	2	n	rt-st
Platystethus nodifrons	2	n	oa-d
Anotylus rugosus	2	n	rt
Cordalia obscura	2	n	rt-sf
Crataraea suturalis	2	n	rt-st
Aleocharinae sp. B	2	n	u
Aphodius granarius	2	n	ob-rf
Aphodius sp. B	2	n	ob-rf
Corticaria sp. A	2	n	rt-sf
Philaenus spumarius	1	n	oa-p
Cicadellidae sp.	1	n	oa-p
Dyschirius globosus	1	n	oa
Dromius quadrimaculatus	1	n	oa
Cercyon ?haemorrhoidalis	1	n	rf-sf
Cryptopleurum minutum	1	n	rf-st
Micropeplus tesserula	1	n	rt
Omaliinae sp.	1	n	rt
Anotylus nitidulus	1	n	rt
Oxytelus sculptus	1	n	rt-st
Stenus sp. A	1	n	u
Stenus sp. B	1	n	u
Gyrohypnus ?angustatus	1	n	rt-st
Gyrohypnus ?fracticornis	1	n	rt-st
Philonthus sp. A	1	n	u
Philonthus sp. B	1	n	u
Creophilus maxillosus	1	n	rt
?Ontholestes sp.	1	n	rt
Quedius sp. A	1	n	u
Quedius sp. B	1	n	u
Staphylininae sp.	1	n	u
Falagria caesa or sulcatula	1	n	rt-sf
Aleochara sp.	1	n	u
Aleocharinae sp. C	1	n	u
Aleocharinae sp. D	1	n	u
Aleocharinae sp. E	1	n	u
Aleocharinae sp. F	1	n	u
Aleocharinae sp. G	1	n	u
Aphodius sp. A	1	n	ob-rf
Aphodius sp. C	1	n	ob-rf
Cryptophagus sp.	1	n	rd-sf
Atomaria sp. A	1	n	rd
Atomaria sp. B	1	n	rd
Ephistemus globulus	1	n	rd-sf
Orthoperus sp.	1	n	rt
Corticarina sp.	1	n	rt
Rhinosimus planirostris	1	n	l
Apion sp.	1	n	oa-p
Ceuthorhynchinae sp.	1	n	oa-p
Leperisinus varius	1	n	l
*Acarina sp.	15	m	u
*Diptera sp. (adult)	6	s	u
*Diptera sp. (puparium)	6	s	u
*Aphidoidea sp.	3	n	u
*Coleoptera sp. (larva)	3	n	u
*Oligochaeta sp. (egg capsule)	2	n	u
*Aranae sp.	2	n	u
*Psylloidea sp. (nymph)	1	n	oa-p
*Chalcidoidea sp.	1	n	u
*Hymenoptera Parasitica sp.	1	n	u

Context: 87427 Sample: 244/T ReM: A
Weight: 3.00 E: 5.00 F: 0.00

Notes: Entered HK 30/6/04. Recorded in flot. Only a few well-decayed insect fragments, mostly beyond identification. No interpretative significance; leave.

Taxon	**n**	**sq**	**ec**
*Insecta sp.	6	s	u

Context: 87626 Sample: 247/T+T2 ReM: D
Weight: 7.00 E: 4.00 F: 3.00

Notes: Entered HK 30/6/04. Moderately large flot, fine fibrous plant detritus. /T and ?T2 combined to boost numbers. Preservation very variable but generally poor, limiting identifications: E 1.5-5.0, mode 4.0 distinct; F 2.5-5.5, mode 3.0 weak. Soft Apion. Fossils from residue (AH) listed.

Taxon	**n**	**sq**	**ec**
Omosita colon	13	n	rt-sf
Ptinus sp.	10	n	rd-sf
Orthoperus sp.	5	n	rt
Lathridius minutus group	5	n	rd-st
Cordalia obscura	3	n	rt-sf
Cryptophagus sp. B	3	n	rd-sf
Corticaria sp.	3	n	rt-sf
Ptenidium sp.	2	n	rt
Xylodromus concinnus	2	n	rt-st
Platystethus arenarius	2	n	rf
Anotylus nitidulus	2	n	rt
Aleocharinae sp. B	2	n	u
Corticarina or Cortinicara sp.	2	n	rt
Apion sp.	2	n	oa-p
Cicadellidae sp.	1	n	oa-p
Clivina fossor	1	n	oa
Metabletus sp.	1	n	oa
Cercyon ?analis	1	n	rt-sf
Cercyon atricapillus	1	n	rf-st
Histerinae sp.	1	n	rt
Omaliinae sp.	1	n	rt
Carpelimus sp.	1	n	u
Platystethus ?nodifrons	1	n	oa-d
Anotylus rugosus	1	n	rt
Oxytelus sculptus	1	n	rt-st
Gyrohypnus ?angustatus	1	n	rt-st
Gyrohypnus fracticornis	1	n	rt-st
Xantholinus sp.	1	n	u
Aleocharinae sp. A	1	n	u
Aleocharinae sp. C	1	n	u
Aleocharinae sp. D	1	n	u
Pselaphidae sp.	1	n	u
Trox scaber	1	n	rt-sf
Aphodius ?granarius	1	n	ob-rf
Aphodius sp. A	1	n	ob-rf

Aphodius sp. B	1	n	ob-rf
Clambus sp.	1	n	rt-sf
Dermestes ?lardarius	1	n	rd-sf
Lyctus linearis	1	n	l-sf
?Meligethes sp.	1	n	oa-p
Monotoma longicollis	1	n	rt-st
Cryptophagus sp. A	1	n	rd-sf
Atomaria sp. A	1	n	rd
Atomaria sp. B	1	n	rd
Atomaria sp. C	1	n	rd
Ephistemus globulus	1	n	rd-sf
?Tenebrio obscurus	1	n	rt-ss
Chaetocnema concinna	1	n	oa-p
Coleoptera sp.	1	n	u
*Daphnia sp. (ephippium)	15	m	oa-w
*Coelenterata sp. (hydroid stem or theca)	6	s	u
*Acarina sp.	6	s	u
*Diptera sp. (puparium)	3	n	u
*Oligochaeta sp. (egg capsule)	2	n	u
*Dermestes lardarius (larva)	2	n	rd-sf
*Diptera sp. (adult)	1	n	u
*Chalcidoidea sp.	1	n	u
*Insecta sp. (larva)	1	n	u
*Pseudoscorpiones sp.	1	n	u
*Aranae sp.	1	n	u

Context: 87669 Sample: 254/T+T2 ReM: D
Weight: 3.60 E: 4.00 F: 3.00

Notes: Entered HK 30/6/04. Normal-sized flot, recording in flot and on filter paper. Preservation variable but generally poor, limiting identifications (E 4.0-5.0, mode 4.0 weak; F 2.5-5.0, mode 3.0 weak). Record of fossils from residue (AH) added. /T2 contained rather few remains by comparison with /T.

Taxon	**n**	**sq**	**ec**
Omosita colon	23	n	rt-sf
Orthoperus sp.	11	n	rt
Lathridius minutus group	9	n	rd-st
Cordalia obscura	5	n	rt-sf
Atomaria sp. C	4	n	rd
Corticaria sp. A	4	n	rt-sf
Cercyon analis	3	n	rt-sf
Xylodromus concinnus	3	n	rt-st
Aleocharinae sp. D	3	n	u
Cryptophagus sp. B	3	n	rd-sf
Patrobus sp.	2	n	oa
Ptenidium sp.	2	n	rt
Platystethus arenarius	2	n	rf
Platystethus nodifrons	2	n	oa-d
Anotylus nitidulus	2	n	rt
?Crataraea suturalis	2	n	rt-st
Aleocharinae sp. A	2	n	u
Aleocharinae sp. C	2	n	u
Aphodius sp. B	2	n	ob-rf
Dermestes ?lardarius	2	n	rd-sf
Ptinus ?fur	2	n	rd-sf
Ptinus raptor	2	n	rd-sf
Atomaria sp. A	2	n	rd
Enicmus sp.	2	n	rt-sf
Corticaria sp. C	2	n	rt-sf
Dyschirius globosus	1	n	oa
Carabidae sp. A	1	n	ob
Carabidae sp. B	1	n	ob
Helophorus sp.	1	n	oa-w
Cercyon sp.	1	n	u
Cryptopleurum minutum	1	n	rf-st
Chaetarthria seminulum	1	n	oa-w
Histerinae sp.	1	n	rt
Ptiliidae sp.	1	n	u
Megarthrus sp.	1	n	rt
Phyllodrepa ?floralis	1	n	rt-sf
Omalium ?rivulare	1	n	rt-sf
Omalium sp.	1	n	rt
Carpelimus ?bilineatus	1	n	rt-sf
Carpelimus sp.	1	n	u
Anotylus rugosus	1	n	rt
Oxytelus sculptus	1	n	rt-st
Leptacinus sp.	1	n	rt-st
Gyrohypnus ?fracticornis	1	n	rt-st
Philonthus sp. A	1	n	u
Philonthus sp. B	1	n	u
Creophilus maxillosus	1	n	rt
Staphylininae sp. A	1	n	u
Staphylininae sp. B	1	n	u
Tachinus sp.	1	n	u
Aleocharinae sp. B	1	n	u
Aleocharinae sp. E	1	n	u
Aleocharinae sp. F	1	n	u
Aleocharinae sp. G	1	n	u
Trox scaber	1	n	rt-sf
Geotrupes sp.	1	n	oa-rf
Aphodius ?granarius	1	n	ob-rf
Aphodius ?rufipes	1	n	oa-rf
Aphodius sp. A	1	n	ob-rf
Clambus sp.	1	n	rt-sf
Lyctus linearis	1	n	l-sf
Necrobia sp.	1	n	rd-sf
Malachius sp.	1	n	u
Cryptophagus ?scutellatus	1	n	rd-st
Cryptophagus sp. A	1	n	rd-sf
Cryptophagus sp. C	1	n	rd-sf
Atomaria sp. B	1	n	rd
Corticaria sp. B	1	n	rt-sf
Corticarina or Cortinicara sp.	1	n	rt
Rhinosimus planirostris	1	n	l
?Anthicus sp.	1	n	rt
Chaetocnema sp.	1	n	oa-p
Sitona sp.	1	n	oa-p
*Acarina sp.	15	m	u
*Coelenterata sp. (hydroid stem or theca)	6	s	u
*Daphnia sp. (ephippium)	6	s	oa-w
*Diptera sp. (puparium)	6	s	u
*Dermestes lardarius (larva)	2	n	rd-sf
*Auchenorhyncha sp. (nymph)	1	n	oa-p
*Psylloidea sp. (nymph)	1	n	oa-p

*Coleoptera sp. (larva)	1	n	u
*?Apis mellifera	1	n	u
*Chalcidoidea sp.	1	n	u
*Hymenoptera sp.	1	n	u
*Pseudoscorpiones sp.	1	n	u

Context: 87732 Sample: 253/T2 ReM: D
Weight: 2.00 E: 0.00 F: 0.00

Notes: Entered HK 30/6/04. No record of preservation (oversight). Flot large (> 10 mm in pot), herbaceous detritus and some twig and wood fragments. Recorded in flot and on filter paper. Rather few insects.

Taxon	**n**	**sq**	**ec**
Ptinus raptor	5	n	rd-sf
Platystethus arenarius	3	n	rf
Platystethus nodifrons	3	n	oa-d
Anotylus nitidulus	3	n	rt
Ptinus fur	3	n	rd-sf
Cryptophagus sp. A	3	n	rd-sf
Cercyon analis	2	n	rt-sf
Acrotrichis sp.	2	n	rt
Xylodromus concinnus	2	n	rt-st
Carpelimus ?bilineatus	2	n	rt-sf
Aleocharinae sp. A	2	n	u
Corticaria sp.	2	n	rt-sf
Corticarina sp.	2	n	rt
Cicadellidae sp.	1	n	oa-p
Dyschirius ?globosus	1	n	oa
Carabidae sp.	1	n	ob
Chaetarthria seminulum	1	n	oa-w
Ochthebius sp.	1	n	oa-w
Ptenidium sp.	1	n	rt
Ptiliidae sp.	1	n	u
Omalium ? italicum	1	n	rt-sf
Omaliinae sp.	1	n	rt
Carpelimus sp.	1	n	u
Stenus sp.	1	n	u
Lathrobium sp.	1	n	u
Gyrohypnus angustatus	1	n	rt-st
Gyrohypnus ?fracticornis	1	n	rt-st
Philonthus sp.	1	n	u
Staphylininae sp.	1	n	u
Cypha sp.	1	n	rt
Aleocharinae sp. B	1	n	u
Aleocharinae sp. C	1	n	u
Aleocharinae sp. D	1	n	u
Aleocharinae sp. E	1	n	u
Aleocharinae sp. F	1	n	u
Aleocharinae sp. G	1	n	u
Aleocharinae sp. H	1	n	u
Aphodius ?fimetarius	1	n	oa-rf
Omosita colon	1	n	rt-sf
Cryptophagus sp. B	1	n	rd-sf
Atomaria sp.	1	n	rd
Orthoperus sp.	1	n	rt
Enicmus sp.	1	n	rt-sf
Apion sp.	1	n	oa-p
Notaris acridulus	1	n	oa-d-p
Coleoptera sp.	1	n	u
*Acarina sp.	15	m	u
*Pulex irritans	5	n	ss
*Oligochaeta sp. (egg capsule)	3	n	u
*Coleoptera sp. (larva)	3	n	u
*Aphidoidea sp.	2	n	u
*Diptera sp. (adult)	2	n	u
*Formicidae sp.	2	n	u
*Hymenoptera sp.	2	n	u
*?Heterodera sp. (cyst)	1	n	u
*Auchenorhyncha sp. (nymph)	1	n	oa-p
*Diptera sp. (pupa)	1	n	u
*Diptera sp. (puparium)	1	n	u
*Apis mellifera	1	n	u

Context: 87793 Sample: 256/T+T2 ReM: D
Weight: 4.45 E: 4.00 F: 2.50

Notes: Entered HK 28/6/04. Recorded in flot and on filter paper. Combined list for ?T and /T2; remains in single tube in /T jar. Flots smalls, remains very pale to yellowish (E3.5-4.5, mode 4.0 strong; F 2.0-4.5, mode 2.5 weak; trend to yellow 2-4, mode 4). Fossils from /T residue (AH tube) included.

Taxon	**n**	**sq**	**ec**
Quedius sp.	2	n	u
Aphodius sp. B	2	n	ob-rf
Ptinus sp.	2	n	rd-sf
Lathridius minutus group	2	n	rd-st
Pterostichus melanarius	1	n	ob
Pterostichus (Poecilus) sp.	1	n	oa
Cercyon ?analis	1	n	rt-sf
Omaliinae sp.	1	n	rt
Platystethus arenarius	1	n	rf
Anotylus nitidulus	1	n	rt
Philonthus sp.	1	n	u
Aleocharinae sp. A	1	n	u
Aleocharinae sp. B	1	n	u
Trox scaber	1	n	rt-sf
Aphodius sp. A	1	n	ob-rf
Cryptophagus sp. A	1	n	rd-sf
Cryptophagus sp. B	1	n	rd-sf
Atomaria sp.	1	n	rd
Notaris acridulus	1	n	oa-d-p
Ceuthorhynchinae sp.	1	n	oa-p
Coleoptera sp.	1	n	u
*Diptera sp. (puparium)	3	n	u
*Coelenterata sp. (hydroid stem or theca)	1	n	u
*Daphnia sp. (ephippium)	1	n	oa-w
*Aranae sp.	1	n	u

Context: 88226 Sample: 257/T+T2 ReM: D
Weight: 7.00 E: 2.50 F: 2.50

Notes: Entered HK 30/6/04. Combined list for /T and /T2. Recorded in flot and on filter paper. Preservation ranges from quite good to rather poor. E 1.5-4.0, mode 2.5 weak; F 1.5-4.0, mode 1.5 weak. Concentration of remains seems higher in /T. Some soft, pale parts of Apion.

Taxon	n	sq	ec
Omosita colon	31	n	rt-sf
Orthoperus sp. A	11	n	rt
Cordalia obscura	8	n	rt-sf
Cercyon analis	6	n	rt-sf
Xylodromus concinnus	6	n	rt-st
Lathridius minutus group	6	n	rd-st
Ptenidium sp.	5	n	rt
Corticaria sp. C	5	n	rt-sf
Corticarina or Cortinicara sp.	5	n	rt
Ptinus ?raptor	4	n	rd-sf
Cryptophagus sp.	4	n	rd-sf
Platystethus arenarius	3	n	rf
Platystethus nodifrons	3	n	oa-d
Anotylus nitidulus	3	n	rt
Ptinus ?fur	3	n	rd-sf
Corticaria sp. B	3	n	rt-sf
Clivina fossor	2	n	oa
Carpelimus ?bilineatus	2	n	rt-sf
Anotylus rugosus	2	n	rt
Aleocharinae sp. A	2	n	u
Aleocharinae sp. D	2	n	u
Aphodius sp. C	2	n	ob-rf
Atomaria sp. A	2	n	rd
Atomaria sp. B	2	n	rd
Atomaria sp. C	2	n	rd
Enicmus sp.	2	n	rt-sf
Corticaria sp. A	2	n	rt-sf
Chaetocnema arida group	2	n	oa-p
Apion sp. A	2	n	oa-p
Lygaeidae sp.	1	n	oa-p
Cicadellidae sp.	1	n	oa-p
Delphacidae sp.	1	n	oa-p
Dyschirius globosus	1	n	oa
Patrobus ?atrorufus	1	n	oa
Trechus ?micros	1	n	u
Pterostichus sp.	1	n	ob
Amara sp.	1	n	oa
Dromius ?quadrinotatus	1	n	oa
Cercyon ?atricapillus	1	n	rf-st
Cercyon haemorrhoidalis	1	n	rf-sf
Saprinus sp.	1	n	rt-sf
Acrotrichis sp.	1	n	rt
Ptiliidae sp.	1	n	u
Acidota cruentata	1	n	oa
Omalium sp.	1	n	rt
Carpelimus elongatulus	1	n	oa-d
Carpelimus sp.	1	n	u
Gyrohypnus angustatus	1	n	rt-st
Gyrohypnus fracticornis	1	n	rt-st
Xantholinus sp.	1	n	u
Philonthus sp.	1	n	u
Creophilus maxillosus	1	n	rt
Quedius sp.	1	n	u
Staphylininae sp. A	1	n	u
Staphylininae sp. B	1	n	u
Cypha sp.	1	n	rt
Crataraea suturalis	1	n	rt-st
Aleocharinae sp. B	1	n	u
Aleocharinae sp. C	1	n	u
Aleocharinae sp. E	1	n	u
Aleocharinae sp. F	1	n	u
Euplectini sp.	1	n	u
Trox scaber	1	n	rt-sf
Aphodius sp. A	1	n	ob-rf
Aphodius sp. B	1	n	ob-rf
Necrobia violacea	1	n	rt-sf
Monotoma ?longicollis	1	n	rt-st
Ephistemus globulus	1	n	rd-sf
Orthoperus sp. B	1	n	rt
Coccidula ?scutellata	1	n	oa-p-d
Coccinellidae sp.	1	n	oa-p
Aglenus brunneus	1	n	rt-ss
Tenebrio obscurus	1	n	rt-ss
Anthicus sp.	1	n	rt
Apion sp. B	1	n	oa-p
*Acarina sp.	100	e	u
*Daphnia sp. (ephippium)	50	e	oa-w
*Oligochaeta sp. (egg capsule)	6	s	u
*Aranae sp.	6	s	u
*Aphidoidea sp.	3	n	u
*Diptera sp. (puparium)	3	n	u
*Dermestes lardarius (larva)	2	n	rd-sf
*Coelenterata sp. (hydroid stem or theca)	1	n	u
*Psylloidea sp. (nymph)	1	n	oa-p
*Diptera sp. (pupa)	1	n	u
*Siphonaptera sp.	1	n	u
*Coleoptera sp. (larva)	1	n	u
*Hymenoptera Parasitica sp.	1	n	u
*Hymenoptera sp.	1	n	u

Context: 99879 Sample: 294/T ReM: D
Weight: 2.00 E: 2.50 F: 2.50

Notes: Entered HK 28/6/04. Recorded in flot and on filter paper. Large flot - 1 cm in jar. Fossils from residue (AH tube) added. Preservation: E 2.0-3.5, mode 2.5 weak; F 1.5-4.0, mode 2.5 weak. Identifications limited by fragmentation in many cases. (NB Remains too dilute in whole-jar flot of /T2 to be practicable to record.)

Taxon	n	sq	ec
Platystethus arenarius	2	n	rf
Platystethus nodifrons	2	n	oa-d
Tachyporus sp.	2	n	u
Corticaria sp.	2	n	rt-sf
Lygaeidae sp.	1	n	oa-p
Patrobus sp.	1	n	oa
Pterostichus sp.	1	n	ob

Carabidae sp.	1	n	ob
Helophorus sp. A	1	n	oa-w
Helophorus sp. B	1	n	oa-w
Cercyon ?analis	1	n	rt-sf
Micropeplus tesserula	1	n	rt
Omalium sp.	1	n	rt
Carpelimus ?bilineatus	1	n	rt-sf
Anotylus nitidulus	1	n	rt
Anotylus rugosus	1	n	rt
Stenus sp.	1	n	u
Gyrohypnus sp.	1	n	rt
Philonthus sp.	1	n	u
Staphylininae sp.	1	n	u
Aleocharinae sp. A	1	n	u
Aleocharinae sp. B	1	n	u
Aphodius sp. A	1	n	ob-rf
Aphodius sp. B	1	n	ob-rf
Ptinus sp.	1	n	rd-sf
Omosita colon	1	n	rt-sf
Cryptophagus sp.	1	n	rd-sf
Orthoperus sp.	1	n	rt
Lathridius minutus group	1	n	rd-st
Crepidodera sp.	1	n	oa-p
Apion sp.	1	n	oa-p
?Leperisinus varius	1	n	l
*Daphnia sp. (ephippium)	15	m	oa-w
*Cladocera sp. S (ephippium)	15	m	oa-w
*Acarina sp.	15	m	u
*Diptera sp. (puparium)	2	n	u
*Auchenorhyncha sp. (nymph)	1	n	oa-p
*Aphidoidea sp.	1	n	u
*Chironomidae sp. (larva)	1	n	w
*Aranae sp.	1	n	u

Context: 99879 Sample: 296/T ReM: A
Weight: 3.00 E: 0.00 F: 0.00

Notes: Entered HK 30/6/04. Preservation good in a very large flot. Rather few insects, no distinctive ecological components apart from water fleas. Cannot justify time needed to record.

Taxon	**n**	**sq**	**ec**
Calathus sp.	1	n	oa
Helophorus sp.	1	n	oa-w
Cercyon sp.	1	n	u
?Hydrobius fuscipes	1	n	oa-w
Omalium sp.	1	n	rt
Stenus sp.	1	n	u
Gyrohypnus sp.	1	n	rt
*Cladocera sp. S (ephippium)	15	m	oa-w
*Diptera sp. (puparium)	6	s	u
*Oligochaeta sp. (egg capsule)	1	n	u
*Daphnia sp. (ephippium)	1	n	oa-w

Table 1.8. 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 1.6 for codes assigned to taxa. Indivs - individuals (based on MNI); No - number.

No taxa	S
Estimated number of indivs (MNI)	N
Index of diversity (α)	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 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	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	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	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
No indivs of grain pests (g)	NG
Percentage of indivs of grain pests	PNG

Table 1.9. Main statistics for assemblages of adult beetles and bugs (excluding aphids and scale insects) from samples from the Kaupang site. For explanation of abbreviations, see Table 1.8. Assessment-recorded assemblages and 'null' samples (those lacking adult beetles and bugs of the groups used for preparing statistics) are excluded.

Context	**86018**	**86018**	**86018**	**86018**	**86018**	**87626**
Sample	**229**	**230**	**231**	**250**	**251**	**247**
Ext	**/T2**	**/T**	**/T**	**/T**	**/T**	**/T+T2**
S	45	47	55	76	59	49
N	121	60	77	119	97	91
ALPHA	26	99	86	90	64	44
SEALPHA	4	30	20	16	12	8
SOB	12	9	14	21	12	10
PSOB	27	19	25	28	20	20
NOB	16	9	15	22	18	11
PNOB	13	15	19	18	19	12
ALPHAOB	0	0	0	206	0	0
SEALPHAOB	0	0	0	184	0	0
SW	1	0	3	2	0	0
PSW	2	0	5	3	0	0
NW	1	0	3	2	0	0
PNW	1	0	4	2	0	0
ALPHAW	0	0	0	0	0	0
SEALPHAW	0	0	0	0	0	0
SD	0	1	1	2	1	1
PSD	0	2	2	3	2	2
ND	0	1	1	2	2	1
PND	0	2	1	2	2	1
ALPHAD	0	0	0	0	0	0
SEALPHAD	0	0	0	0	0	0
SP	8	3	5	6	4	4
PSP	18	6	9	8	7	8
NP	12	3	5	6	4	5
PNP	10	5	6	5	4	5
ALPHAP	0	0	0	0	0	0
SEALPHAP	0	0	0	0	0	0
SM	0	0	0	0	0	0
PSM	0	0	0	0	0	0
NM	0	0	0	0	0	0
PNM	0	0	0	0	0	0
ALPHAM	0	0	0	0	0	0
SEALPHAM	0	0	0	0	0	0
SL	0	3	3	2	2	1
PSL	0	6	5	3	3	2
NL	0	3	3	2	2	1
PNL	0	5	4	2	2	1
ALPHAL	0	0	0	0	0	0
SEALPHAL	0	0	0	0	0	0
SRT	21	25	28	40	34	33
PSRT	47	53	51	53	58	67
NRT	89	36	49	79	65	73
PNRT	74	60	64	66	67	80
ALPHART	9	37	27	33	29	23
SEALPHART	2	13	7	6	6	5
SRD	6	6	6	8	7	9
PSRD	13	13	11	11	12	18

Context	**86018**	**86018**	**86018**	**86018**	**86018**	**87626**
Sample	**229**	**230**	**231**	**250**	**251**	**247**
Ext	**/T2**	**/T**	**/T**	**/T**	**/T**	**/T+T2**
NRD	62	14	13	20	18	24
PNRD	51	23	17	17	19	26
ALPHARD	2	0	0	5	0	5
SEALPHARD	0	0	0	2	0	2
SRF	3	3	3	9	7	5
PSRF	7	6	5	12	12	10
NRF	4	4	5	12	11	6
PNRF	3	7	6	10	11	7
ALPHARF	0	0	0	0	0	0
SEALPHARF	0	0	0	0	0	0
SSA	13	14	17	26	18	20
PSSA	29	30	31	34	31	41
NSA	76	24	30	54	43	52
PNSA	63	40	39	45	44	57
ALPHASA	5	14	17	20	12	12
SEALPHASA	1	5	6	5	3	3
SSF	9	11	12	18	11	12
PSSF	20	23	22	24	19	24
NSF	33	13	19	40	31	39
PNSF	27	22	25	34	32	43
ALPHASF	4	0	0	13	6	6
SEALPHASF	1	0	0	3	2	2
SST	4	3	5	8	7	7
PSST	9	6	9	11	12	14
NST	43	11	11	14	12	12
PNST	36	18	14	12	12	13
ALPHAST	1	0	0	0	0	0
SEALPHAST	0	0	0	0	0	0
SSS	0	0	0	0	0	1
PSSS	0	0	0	0	0	2
NSS	0	0	0	0	0	1
PNSS	0	0	0	0	0	1
ALPHASS	0	0	0	0	0	0
SEALPHASS	0	0	0	0	0	0
SG	0	0	0	0	0	0
PSG	0	0	0	0	0	0
NG	0	0	0	0	0	0
PNG	0	0	0	0	0	0
ALPHAG	0	0	0	0	0	0
SEALPHAG	0	0	0	0	0	0

Context	**87669**	**87732**	**87793**	**88226**	**99879**	**All**
Sample	**254**	**253**	**256**	**257**	**294**	
Ext	**/T+T2**	**/T2**	**/T+T2**	**/T+T2**	**/T**	
S	73	46	21	75	32	216
N	146	67	25	178	36	1024
ALPHA	58	64	60	49	135	84
SEALPHA	8	16	31	6	69	4
SOB	14	9	6	20	11	74
PSOB	19	20	29	27	34	34
NOB	17	11	7	26	12	167
PNOB	12	16	28	15	33	16
ALPHAOB	0	0	0	41	0	51
SEALPHAOB	0	0	0	19	0	6
SW	2	2	0	0	2	8
PSW	3	4	0	0	6	4
NW	2	2	0	0	2	14
PNW	1	3	0	0	6	1
ALPHAW	0	0	0	0	0	0
SEALPHAW	0	0	0	0	0	0
SD	1	2	1	3	1	7
PSD	1	4	5	4	3	3
ND	2	4	1	5	2	21
PND	1	6	4	3	6	2
ALPHAD	0	0	0	0	0	4
SEALPHAD	0	0	0	0	0	1
SP	2	3	2	8	3	26
PSP	3	7	10	11	9	12
NP	2	3	2	10	3	55
PNP	1	4	8	6	8	5
ALPHAP	0	0	0	0	0	19
SEALPHAP	0	0	0	0	0	4
SM	0	0	0	0	0	0
PSM	0	0	0	0	0	0
NM	0	0	0	0	0	0
PNM	0	0	0	0	0	0
ALPHAM	0	0	0	0	0	0
SEALPHAM	0	0	0	0	0	0
SL	2	0	0	0	1	9
PSL	3	0	0	0	3	4
NL	2	0	0	0	1	14
PNL	1	0	0	0	3	1
ALPHAL	0	0	0	0	0	0
SEALPHAL	0	0	0	0	0	0
SRT	46	23	12	43	16	292
PSRT	63	50	57	57	50	135
NRT	113	41	15	139	18	719
PNRT	77	61	60	78	50	70
ALPHART	29	22	0	21	0	183
SEALPHART	4	6	0	3	0	11
SRD	12	5	5	8	3	75
PSRD	16	11	24	11	9	35
NRD	29	13	7	24	3	227
PNRD	20	19	28	13	8	22
ALPHARD	8	0	0	4	0	39
SEALPHARD	2	0	0	1	0	4

Context	**87669**	**87732**	**87793**	**88226**	**99879**	**All**
Sample	**254**	**253**	**256**	**257**	**294**	
Ext	**/T+T2**	**/T2**	**/T+T2**	**/T+T2**	**/T**	
SRF	7	2	3	6	3	51
PSRF	10	4	14	8	9	24
NRF	9	4	4	9	4	72
PNRF	6	6	16	5	11	7
ALPHARF	0	0	0	0	0	77
SEALPHARF	0	0	0	0	0	19
SSA	28	13	6	25	7	65
PSSA	38	28	29	33	22	30
NSA	77	25	8	94	8	491
PNSA	53	37	32	53	22	48
ALPHASA	16	11	0	11	0	20
SEALPHASA	3	4	0	2	0	2
SSF	20	10	5	16	6	42
PSSF	27	22	24	21	19	19
NSF	58	21	6	75	7	342
PNSF	40	31	24	42	19	33
ALPHASF	11	8	0	6	0	13
SEALPHASF	2	3	0	1	0	1
SST	8	3	1	7	1	20
PSST	11	7	5	9	3	9
NST	19	4	2	17	1	146
PNST	13	6	8	10	3	14
ALPHAST	0	0	0	0	0	6
SEALPHAST	0	0	0	0	0	1
SSS	0	0	0	2	0	3
PSSS	0	0	0	3	0	1
NSS	0	0	0	2	0	3
PNSS	0	0	0	1	0	0
ALPHASS	0	0	0	0	0	0
SEALPHASS	0	0	0	0	0	0
SG	0	0	0	0	0	0
PSG	0	0	0	0	0	0
NG	0	0	0	0	0	0
PNG	0	0	0	0	0	0
ALPHAG	0	0	0	0	0	0
SEALPHAG	0	0	0	0	0	0

Table 1.10. Percentages of categories of synanthropic fauna in the amalgamated assemblages from the Kaupang site and some other sites (see text). SA - all synanthropes; SF - facultative synanthropes; ST - species which are typically synanthropic; SS - strong synanthropes.

Property	Kaupang	Viborg	Coppergate	Oslo	DPF	Buiston
% SA	48	33	55	62	54	36
% SF	33	21	24	33	9	26
% ST	14	13	24	28	12	10
% SS	0	0	7	1	33	0

Table 1.11. Internal structure of the synanthropic fauna in the amalgamated assemblages from the Kaupang site and some other sites (see text). SA - all synanthropes; SF - facultative synanthropes; ST - species which are typically synanthropic; SS - strong synanthropes. Data for Deer Park Farms are strongly skewed by the abundant *Aglenus brunneus*: see Table 1.8.

Property	Kaupang	Viborg	Coppergate	Oslo	DPF	Buiston
SF as % SA	70	62	44	53	18	71
ST as % SA	30	37	43	46	21	29
SS as % SA	1	0	14	2	61	1

Table 1.12. Internal structure of the synanthropic fauna in the amalgamated assemblages from the Kaupang site and some other sites (see text), after removal of *Aglenus brunneus*. SA - all synanthropes; SF - facultative synanthropes; ST - species which are typically synanthropic; SS - strong synanthropes.

Property	Kaupang	Viborg	Coppergate	Oslo	DPF	Buiston
SF as % SA	70	62	48	53	44	71
ST as % SA	30	37	47	46	53	29
SS as % SA	0	0	5	1	3	1

Table 1.13. Wood samples from excavations at Kaupang 2003 (listed in Intrasis sample order).

Context/ Intrasis sample	**Sample**	**Identification and notes**
88220/ 88152	261	A few fragments of soft wood (to 20 mm) in a matrix of very wet and unconsolidated grey sandy clay; wood identified as willow/poplar/aspen, *Salix/Populus* sp(p).
88221/ 88153	262	Stake tip in three fragments (to 90mm); probably willow, cf. *Salix* sp(p).
88222/ 88154	263	Stake fragments to 85 mm, somewhat soft; cf. *Salix* sp(p).
88223/ 88155	264	Stake point, very soft, to 130 mm; cf. *Salix* sp(p).
88589/ 88156	265	A small (to 45 mm) fragment of wood, too soft to section, but could well be ?*Salix* as per other tentative identifications in this group.
88224/ 88157	266	Sample consisted of grey silty clay with a few fragments of brown, concreted material (to 30 mm), rich in grit; a trace of wood fragments to 15 mm, too soft to identify easily.
88225/ 88158	267	Small fragments (to 50 mm) of soft wood in clay, too soft to identify easily.
88660/?	268	Very soft stake remains (to 110 mm), probably *Salix* sp(p).
99879/?	-	There was a small fragment of ?bark which was, indeed, tree bark. A separate large bag contained chunks of wood to about 160 mm, apparently all oak (*Quercus*), to judge from a subsample; one block with a rectangular section exhibited clear axe/adze cut marks on the cut end and was in good condition, some other fragments being very soft and strongly eroded. The matrix contained some 'grassy' monocot rhizome fragments and celery-leaved crowfoot seeds as seen in the GBA sample from this pit (PG99948).

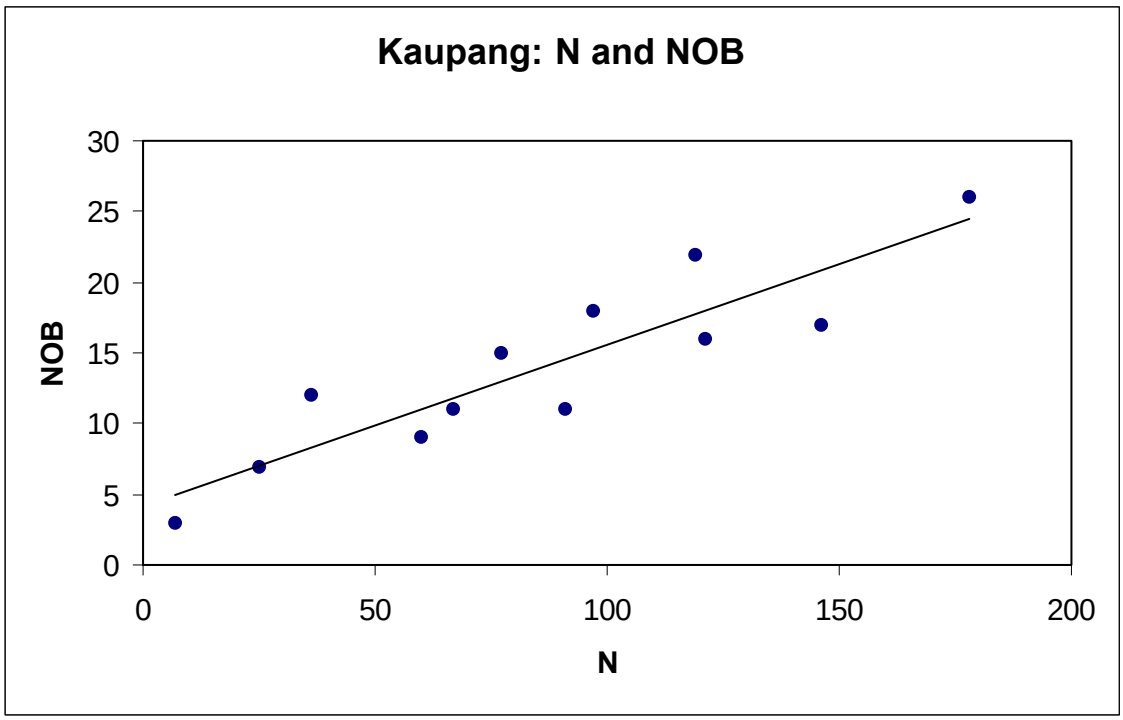

Figure 1.1. Plot of number of adult beetles and bugs (N) against number assigned to the 'outdoor' category (NOB) for the assemblages from the Kaupang site. $R^2 = 0.81$.

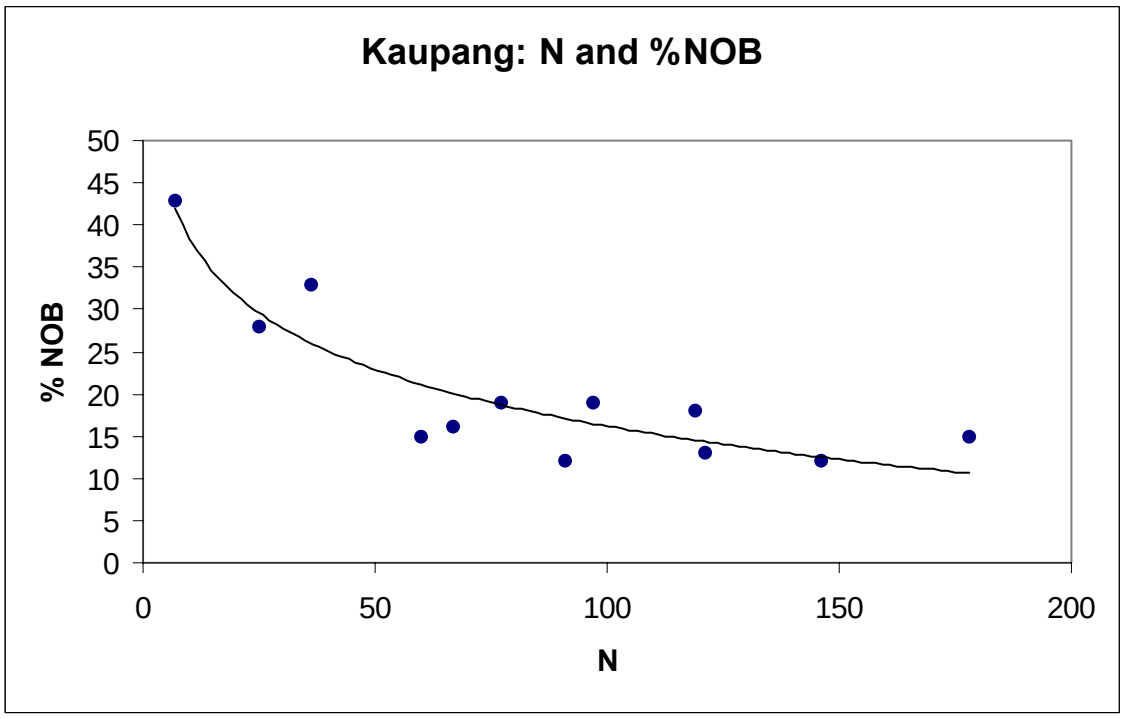

Figure 1.2. Plot of number of adult beetles and bugs (N) against percentage assigned to the 'outdoor' category (% NOB) for the assemblages from the Kaupang site. Logarithmic trend line added. $R^2 = 0.83$.

Part II: The mammal, fish and bird bone from excavations at Kaupang, Norway, 2002

James Barrett, Terry O'Connor and Steven Ashby

Introduction

This report presents an analysis of mammal, fish and bird bone from excavations carried out at Kaupang, a coastal Viking Age urban settlement in southern Norway, during the summer of 2002. Dagfinn Skre of the University of Oslo directed the work, with the assistance of Lars Pilø and Unn Pedersen. The Kaupang Excavation Project then commissioned the Department of Archaeology, University of York, to provide analyses of the bone, botanical and insect finds. The plant and insect remains are considered in Part I of this report, which should be read in conjunction with the present work.

For the purposes of analysis the material is variously divided into three main site periods (Pilø pers comm.) and 16 feature types (Table 2.1). Finer subdivision of the assemblage, in terms of plots, plot phases, houses and/or pits, is also employed in some cases (see also Part III regarding bench and floor layers). Given the small number of identifiable specimens, however, much of the discussion will consider the assemblage as a whole. With the possible exception of disturbed contexts such as the plough zone, none of which produced obvious (large and well preserved) intrusive specimens, the material should all be approximately 9th century in date (Skre *et al*. 2000). The vast majority of the analysed bone derived from site periods II and III, with only small amounts attributable to period I or to poorly phased contexts. Although 70845 specimens were examined and recorded, the extremely high fragmentation of the bone, most of which was burned, meant that only 1506 were identified beyond the level of class (see below).[1] Nevertheless, these specimens do provide some information regarding the economy and character of one of Europe's most important Viking Age settlements.

Sampling and recovery

The bone from Kaupang was recovered by on-site sieving of most excavated sediment to 2mm or 5mm (site riddled material), flotation of selected 'bulk sieved' (BS) samples using 1mm mesh to retain the residue or heavy fraction and the collection of whole earth 'general biological assemblage' (GBA) samples (see Dobney *et al*. 1992). In York, fish bone was extracted from both BS residues and GBA samples using 2mm mesh. Mammal and bird bone was extracted from the same samples using 4mm mesh. Of 102 boxes of site riddled material, 54 (numbers 1 to 50, plus numbers 54, 77, 80 and an unnumbered box randomly selected from the rest) were analysed. The site riddled material recovered to 5mm was analysed without further processing. The 2mm site riddled material was divided into fish and other bone, the later of which was only systematically recorded to 4mm (although the 2-4mm fraction was scanned for

[1] Note that this report supersedes Barrett *et al*. (2002) as it includes new material from additional samples and employs revised phasing.

possible rodent and other small bones, very few of which were found). In summary, all fish bone was recovered to 2mm or 5mm and all mammal and bird bone to 4mm or 5mm.

Methods

The assemblage was recorded following the York protocol, which is described by Harland *et al*. (2003). It entails the detailed recording of diagnostic elements, 17 for mammals, c.20 for fish (dependent on species) and eight for birds. These elements are identified to the finest possible taxonomic group and recorded in detail – typically including, as appropriate, element, side, count, measurements, weight, epiphyseal fusion, tooth wear, modifications (including burning and butchery), fragmentation, texture and estimates of fish size. Although identified as diagnostic elements, fish vertebrae are recorded in slightly less detail (measurements are not taken and texture is not scored, for example). 'Non-diagnostic' elements are only identified beyond class for special reasons. Examples include butchered specimens and bones of species otherwise missing from the assemblage. For mammals and birds, the principle elements in this category are ribs and vertebrae.

The assemblage has been quantified by number of identified specimens, including all bones or only the diagnostic elements as indicated. Tooth wear has been scored using the methods of Grant (1982) for pigs and cattle and Payne (1987) for caprines. The complete archive has been submitted to the Kaupang Excavation Project with this report, as a Microsoft Access database file and a series of text files which duplicate its content, and will be kept on file at the University of York. The small number of measurements in this archive follow von den Driesch (1976) and Harland *et al*. (1993), but they have not been analysed due to the shrinkage associated with burning (Shipman *et al*. 1984). A list of Latin and common names for all taxa in the assemblage is included in Appendix 2.1.

Preservation

The majority of the Kaupang assemblage was burned (Table 2.2), much of which reached a temperature high enough to turn it white (see Shipman *et al*. 1984; Nicholson 1993). This pattern applies to both the mammal (75% burned) and bird (63% burned) assemblages. Perhaps surprisingly, however, only 27% of the fish bone was clearly burned. This last pattern is partly explained by the high proportion of fish recovered from pits, the fills of which were waterlogged and exhibited slightly better preservation conditions (Table 2.3). For example, whereas only 21% of fish bones from pits were burned, 62% of the fish from ditches were heat altered. However, some other context types also produced relatively low proportions of burned fish bones (e.g. dumps = 21%) implying either that fish remains were less likely to be disposed of by burning or that they were more likely to be completely destroyed when they were burned. The predominance of burned mammal and bird bone is almost certainly due to poor preservation conditions. For complex chemical and mechanical reasons it has been found to survive in acidic soil conditions (e.g. Nicholson 1996).

The poor preservation at Kaupang is also evident from the high level of fragmentation of the bones. Based only on the identified diagnostic elements (the bones which were measured), among the largest specimens in the collection, the mean fragment size for mammal bones is only 27.2mm (Table 2.2). This is extraordinarily small in an assemblage dominated by large species such as pigs, cattle and caprines (sheep or goats). Moreover, the vast majority of identified specimens represented less than c.20% of a complete element (Table 2.2) and the unidentified bone typically consisted of very tiny fragments.

The preservation of the unburned bones can be assessed based on their texture in addition to their state of fragmentation. It is consistently poor (flaky or powdery areas cover over 50% of the specimen) or fair (flaky or powdery areas cover up to 50% of the specimen) rather than good (lacking fresh appearance, but otherwise solid with very localised flaky or powdery areas) or excellent (fresh in appearance) (Table 2.2). With the exception of fish bone from pits, where a few 'good' and one 'excellent' texture states were noted, there is no evidence that these patterns of poor preservation varied between phases or context types (Tables 2.2-2.3).

The Kaupang assemblage also showed evidence of carnivore (probably dog) gnawing. In better preserved assemblages, dogs are often considered to be a major agent of taphonomic damage (e.g. Walters 1984; Payne & Munson 1985). Thirty-two mammal and three fish specimens exhibited carnivore tooth impressions. A further 14 fish bones (11 herring, two cod and one cod family) were crushed, conceivably by mastication. Crushed herring bones have been interpreted as evidence of human cess in other contexts (cf. Wheeler & Jones 1989), but none of the Kaupang fish bones exhibited the complementary signs of partial digestion. The crushed bones may thus indicate trampling rather than ingestion.

In sum, preservation was poor across the site. These conditions will have reduced the absolute quantity of bone at Kaupang to a large, but unmeasurable, degree. The poor preservation conditions have also reduced the identifiable component of the assemblage to a tiny fraction of the total. More importantly, however, they will have had a major impact on the relative representation of taxa and elements which cannot be accurately modelled (Lyman 1994; but see also Costamagno *et al*. forthcoming). From what is known about bone survival, the combination of excellent recovery methods, high fragmentation, poor bone tissue preservation (texture) and preservation by burning is likely to produce unusual patterns where, for example, small robust bones are favoured over large ones (e.g. Nicholson 1995; Bond 1996). As discussed below, this is in fact what emerges from the Kaupang assemblage.

Inter-class comparison

In total, 70845 specimens have been examined and attributed to class. All phases and context types are dominated by mammal bone (69321), followed by fish (1497) and bird (27) in that order of abundance (Table 2.1). There are, however, some differences in the relative abundance of fish and mammal bone across the site (there being too few bird bones to recognize meaningful patterning in the distribution of this class). By feature type, pits and benches are particularly rich in fish bone – with ratios of fish:mammal of 0.1 and 0.09 respectively, compared to the site average of 0.02. In the

case of pits this may relate to slightly better preservation conditions, but the same cannot be said of bench fills (Table 2.3). Within the pits, it is particular contexts rather than all pit-fills that are rich in fish bone (Table 2.5). In pit 43852, for example, it is only contexts 61411, 87427, 87626 and 87669 that produced high ratios of fish:mammal. Similarly, in pit 65132 only context 86018 was unusually rich in fish. It may be relevant that in pit 43852 the largest fish assemblages came from layers relatively low in the pit stratigraphy and therefore presumably most consistently waterlogged.

By plot, phase 4 of plot 3 stands out as producing a relatively high number of fish bones (521, producing a ratio of fish:mammal of 0.14 compared to the site average of 0.02) (Table 2.4). Almost all of this is from pit 43852. By building, house 406 (plot 2, plot phase 2) has a more modest concentration of fish bone (210 specimens from floor and bench layers, producing a fish:mammal ratio of 0.12). By pit, it is feature 43852 (from plot phase 4 of plot 3 as noted above) which stands out as unusually rich in fish bone (with 517 specimens and a fish:mammal ratio of 0.18).

Of the large assemblage recorded, only 1506 specimens are identified diagnostic elements attributed to taxonomic categories below class (Table 2.6). A few specimens which were not diagnostic elements according to the York recording protocol were also identified in special circumstances (for birds, which are represented by only a few bones, and other taxa which would otherwise not be recorded). These are indicated as presence data in Table 2.6. Of the identified diagnostic elements, 855 were mammal, 639 were fish and 12 were bird.

The mammal bone

As noted above, a total of 69321 mammal bone fragments were examined and a subset of 855 diagnostic specimens were identified (Table 2.6). The assemblage is dominated by four domestic taxa: pigs (338), cattle (181), caprines (123, including both sheep and goats, although only the former were definitively recognised) and cats (36). Moreover, 91 pig or sheep sized (medium mammal 1) specimens can probably be divided disproportionately between these two taxa and 65 large mammal identifications are almost certainly cattle in the virtual absence of deer (represented only by one red deer antler tine and a worked antler comb tooth) and horse (represented by only three specimens). In sum, therefore, these common domestic taxa constitute approximately 98% of the mammal assemblage. The remaining trace species include the deer and horse just mentioned, four dog or wolf (probably large dog) specimens, two hare bones and one shrew bone (which can probably be considered a natural introduction to the site). Particular attention was paid to the possible inclusion of other wild taxa, such as the squirrel, fox pine marten and other fur-bearing species recovered at Birka (Wigh 2001), but it is clear that they were not present in the material analysed from Kaupang. All of these patterns are consistent with the smaller assemblage excavated at the site in 2000 (Hufthammer & Bratbak 2000).

The pigs are described above as domestic, and it is unlikely that any were wild boar. The material was not conducive to osteometric analysis (due to fragmentation and burning), but where it could be observed tooth size and morphology was entirely

consistent with domestic pigs (Payne & Bull 1988; Rowley-Conwy 1995). The Kaupang pigs are represented by most parts of the skeleton, with a quantitative bias towards small robust elements such as the metapodials, tarals and phalanges (Table 2.7). This pattern is consistent with preservation by burning and is unlikely to imply a distinctive butchery strategy. Cut marks on the pig bones, including a scapula, humerus, pelvis and femur, are most consistent with disarticulating whole skeletons.

Notable exceptions to the otherwise complete skeletal representation of pigs are the upper and lower canines. They are missing from the collection despite their distinctive appearance and the preservation of other pig teeth. They have not been separated from the assemblage as artefacts (Pilø pers comm.), leaving curation in the Viking Age or anomalous preservation as possible explanations. Given their recovery from the Kaupang harbour deposits, where preservation was slightly better, the latter interpretation seems most likely (see Part V below).

The aging evidence for all species, including pigs, is poor due to tiny sample sizes and the taphonomic impact on what elements are best represented (making epiphyseal fusion data of limited value). Nevertheless, it is worth noting that no pig deciduous fourth premolars were recovered and that almost all permanent forth premolars and first to third molars were unworn or in early stages of wear (Appendix 2.2). This may imply that the pigs were killed between their first and second year based on Silver's (1969 in Hillson 1986) tooth eruption data.

The species representation at Kaupang has inevitably been biased by the unusual preservation conditions of the site. If it is correct that small robust elements have been favoured, the high proportion of pigs relative to cattle is partly due to taphonomy (and the fact that pigs have four developed digits, compared with the two of cattle and sheep). However, this pattern is also consistent with Viking Age urban centres in the Baltic region such as Birka, Hedeby, Ribe and Menzlin (Reichstein & Tiessen 1974; Hatting 1991; Wigh 2001 and references therein). Its implications for the character of settlement at Kaupang are ambiguous. If the pigs were stall reared, they are consistent with a settlement relatively isolated from its hinterland. This hypothesis would be consistent with the paucity of wild mammal taxa and the impoverished synanthropic insect fauna from the site (see Part I above). Conversely, if they were forest herded pigs they may indicate managed integration with the site's wider environment - or even provisioning by farms in the countryside (cf. Crabtree 1994; Verhulst 2002). Given the presence of some forest taxa in the insect fauna (Part I above), and by implication the possible availability of local pannage, it is also conceivable that the abundance of pigs at Kaupang is simply a matter of environmental determinism. The evidence is, however, ambiguous. There were few woodland insects in the Kaupang deposits and no other forest animals were represented among the mammal and bird fauna.

The more recent finds from the Kaupang harbour excavation may shed additional light on the relative importance of pigs (Part V below). Here they were less abundant than cattle. This difference may simply reflect the tiny sample size of the harbour assemblage, or patterned refuse disposal practices, but given that preservation was better in the harbour the dominance of pigs in the rest of the site may well be a taphonomic bias. In this case, the similarity between Kaupang and the Baltic centres noted above would be more illusory than real.

Like the pigs, the cattle from Kaupang are represented by all parts of the skeleton, with a bias towards teeth and the small robust elements of the feet (Table 2.7). Cut marks on a radius, two femora and three metapodials are consistent with disarticulation and (in the case of the metapodials) hide removal. A single horn core indicates the presence of a horned 'breed', but it was too fragmentary to yield statistics regarding size or shape. The aging evidence suffers from the problems noted above regarding pigs, but once again it may be meaningful that no deciduous fourth premolars were recovered (Appendix 2.2). If this is not a taphonomic pattern, it implies that the cattle were butchered at some point after approximately two years of age (although a very few unfused early fusing elements, such as proximal phalanges, were present in this collection and a few juvenile cattle bones were also noted in the harbour assemblage (Part V)). The wear stages of the permanent teeth imply that the Kaupang cattle were not kept into old age either. For example, at least some were killed between 24 and 30 months based on unworn third molars. The one complete mandible from the site, found in pit 65132 of plot 1, included teeth with the most advanced wear states in the collection. Its third molar was in Grant's (1982) stage G, probably indicating an age of greater than 5 years (Grigson 1982). It would be inappropriate to infer too much from these observations. The paucity of calves could be due to poor preservation of juvenile bone or imply that the settlement was not raising cattle. In the latter case it would presumably have been provisioned from farms in its hinterland. In at least some cases (the individuals with unworn third molars) the cattle were killed as prime meat animals of near adult size.

Two of the caprine specimens, a skull fragment with horn core and a distal tibia, were positively identified as sheep. The rest were undifferentiated so it is not possible to indicate whether or not goats were present at Kaupang. As with the pigs and cattle, a range of skeletal elements was recovered implying the presence of complete caprine carcases at the site (Table 2.7). The familiar bias towards robust foot bones and teeth is also observable. No cut marks were noted on specimens identified as sheep or goat. Tooth wear could only be assessed on five isolated specimens, all of which are consistent with adult 'sheep' rather than old individuals or 'lambs' (Appendix 2.2). Most of the observable epiphyses were also fused, indicating mature animals.

Cats are relatively common finds from broadly contemporary sites in Europe (e.g. Crabtree 1989; Hatting 1990; Wigh 2001; O'Connor in Hall *et al*. 2004; Barrett & Oltmann forthcoming), serving as predators of commensal pests, a source of fur and presumably pets. Nevertheless, the abundance of this species at Kaupang is notable (if not a result of the taphonomic bias in favour of small bones at this site).

The cat bones are most abundant in site period II. All phased specimens derive from plot phases 2-4 of plot 3, and most of these are from ditch fills (e.g. contexts 68122, 68504 and 75386). Overall, the element distribution indicates that as few as two individuals could be represented (see Table 2.7), but the bones derive from a number of distinct contexts making it likely that they actually came from a much larger number of cats.

It was not possible to determine if the specimens were wild (*Felis silvestris*) or domestic (*Felis catus*) cats, but the latter is most probable in Norway. It is clear that they were not lynx (*Lynx lynx*). The range of cat elements present in the assemblage

as a whole indicates complete carcases (Table 2.7) and no cut marks were observed (although these are likely to be obscured on the heavily burned specimens). However, one group of cat bones from context AL 68122 (the fill of a plot division ditch in plot phase 3 of plot 3) is highly likely to represent skinning. It includes tarsals, metatarsals, phalanges and a caudal vertebra - presumably deposited while processing (or disposing of) a cat pelt. The importance of cats at Kaupang could thus relate to the absence of fur-bearing wild taxa (with the possible exception of hare discussed below). It might imply that the site was not an important entrepôt for the Viking Age fur trade, a hypothesis that conflicts with what would be expected based on the 9th century account of Ottar's trading expedition (Fell 1984). Alternatively, it is possible that most furs entered Kaupang in an entirely pre-processed state (in contrast to Birka, see Wigh 2001) and/or were then exported rather than serving local needs. This last hypothesis may be strengthened by the presence of unusually large numbers of *Omosita colon* beetles (attracted to dry animal matter such as skins or bones) at the site (see Part I).

The remaining taxa in the assemblage are all represented by very few specimens. The horse bones show no evidence of butchery or special deposition, despite their occasional role in Viking Age ritual contexts (e.g. Wamers 1995). The red deer antler tine may represent a poorly preserved artefact – similar tines probably saw use as handles in broadly contemporary settlements (e.g. MacGregor 1999) – or raw material from antler working. The antler comb tooth is clearly artefactual. The two hare bones, a metatarsal and a phalanx, may be rare examples of skinning a species other than cat at this site. Given the paucity of material and absence of cut marks, however, other explanations are equally plausible. The four canid specimens are entirely consistent with a domestic dog of large 'breed', but the possibility that they are wolf cannot be ruled out. The single shrew bone is an incidental representative of the local small mammal fauna.

With the exception of some patterning in the cat data discussed above, the broad characteristics of the mammal assemblage are repeated across those phases and context types for which sample sizes justify comparison (Tables 2.6 and 2.8). Structured deposition of animal bones is a characteristic of pits in some European contexts of the first millennium AD (e.g. Campbell 2000), but there is no evidence that particular mammal taxa or elements were assigned to specific pits at Kaupang. Overall, the rank order of pigs>cattle>caprines is repeated in most context types, including pits, with cattle and caprines occasionally reversing their order of abundance in cases where sample sizes are small (dumps, for example). As noted above, however, the importance of pigs may be exaggerated by preservation conditions favouring small robust foot bones. Cattle were more abundant in the better preserved harbour deposits, but in all cases sample sizes are very small.

The fish bone

A total of 1497 fish bones were examined and a subset of 639 diagnostic specimens were identified (Table 2.6). The assemblage is dominated by marine species, with eel and salmonids (which inhabit both marine and fresh-water environments) being the only possible prey of rivers, lakes or streams. Eleven main taxa were identified, but five species constitute most of the assemblage: herring (263), cod (113), saithe (73),

hake (24) and ling (19). Moreover, another 129 cod family specimens can probably be divided between cod, saithe and ling. These five taxa are thus likely to constitute c.97% of the fish assemblage. However, five mineralised vertebral centra from cartilaginous fish, perhaps dogfish, may under-represent the importance of this group as they produce few other ossified structures. The remaining taxa include the above mentioned salmonids (nine specimens, of which one was identifiable as trout), and one specimen each of eel, pollack, gurnard and wrasse. This assemblage is broadly similar to the collection from the 2000 excavation (Hufthammer & Bratbak 2000), but it has a higher proportion of herring and exhibits minor differences in the representation of trace taxa. Flatfish were not represented in the 2002 material for example, although they were present in the 2003 harbour assemblage (Part V).

Although a tiny assemblage compared to the coastal (and sometimes inland) settlements of northern Norway (Bertelsen 1992; Perdikaris 1999), Iceland (Amorosi 1991; McGovern *et al*. 1998) and Scotland (Barrett *et al*. 1999), it is similar in scale to many from Viking Age Europe and is better recovered than most (cf. Enghoff 1999; 2000; Barrett 2002). The site riddled material will be heavily biased by the poor preservation discussed above, but 38% of the fish assemblage was from pit fills which were at least partly water-logged and produced some good-quality fish bone. The Kaupang material may thus be of some interpretive value. Overall, it points to significant exploitation of the local maritime environment by the settlement's inhabitants.

The relative abundance of herring at Kaupang is consistent with other Viking Age urban centres, from the Baltic (where they are particularly important) to England (Enghoff 1999; 2000 and references therein; Barrett *et al*. in press). Although they may occasionally represent cured trade goods, at inland Dorestad for example (Prummel 1983), they could derive from local fishing in most cases. The Kaupang assemblage is too small to detect whether or not the specialised butchery sometimes indicative of herring curing was employed (Enghoff 1996). Few measurable elements were recovered, but fish of 150-300mm and 300-500mm were both represented (Table 2.9). Herring were probably taken in nets, although coastal traps can also be effective (von Brandt 1984).

The triumvirate of cod, saithe and ling, particularly of large sizes, is characteristic of Viking Age and medieval assemblages from Norway and the North Atlantic (Lie 1988; Amorosi 1991; Barrett *et al*. 1999; Perdikaris 1998). Kaupang conforms to this pattern, with many specimens (particularly of saithe and ling) representing individuals of >800mm or >1000mm total length (Table 2.9). The more distantly related hake is not always associated with these species, but does co-occur with them in some Viking Age assemblages (Barrett *et al*. 1999). These taxa were probably caught from boats using traditional hand lines in relatively deep water (cf. Vollan 1974). Ling and hake prefer particularly deep water, but can sometimes be found relatively close to shore – during summer in the case of hake (Whitehead *et al*. 1986). These four taxa represent a fishery distinct from the herring, which were probably caught by net, but could also be relatively local catches. Stockfish (dried cod and related species) were widely traded from Arctic Norway in the Middle Ages (Nedkvitne 1976; 1993) and evidence from areas of Norse settlement in Scotland imply that this commerce may have been active by the 11th century (Barrett 1997; Barrett *et al*. 1999; Barrett *et al*. 2000a). However, there is not yet convincing evidence that this trade existed on any scale

earlier in the Viking Age (Barrett *et al*. in press). Most importantly, the elements present at Kaupang suggest that whole fish were consumed (Table 2.10). All parts of the skeleton of cod, saithe, ling and hake are represented, rather than the cleithra, supracleithra and caudal vertebrae indicative of imported stockfish (Barrett 1997). The paucity of cleithra at Kaupang could be interpreted as the export of stockfish from the site, but is more likely to be a taphonomic pattern given the fragility of this element and the presence of supracleithra and caudal vertebrae.

Of the nine salmonid specimens identified, only one (a trout first vertebra) could be identified to species (Feltham & Marquiss 1989). The remainder could be trout or salmon. They could have been caught by hook, spear or net in either fresh or salt water (von Brandt 1984). Little can be said of the cartilaginous fish, as their mineralised vertebral centra could not be identified to species. If dogfish as suspected, however, they could have provided both food and oil (e.g. Fenton 1978). The remaining trace taxa probably represent incidental catches. The wrasse specimen (a vertebra which could only be identified to family) is interesting insofar as it may imply some fishing in the inter-tidal zone (Whitehead *et al*. 1986). The single gurnard, a common food of large gadids such as Ling (Muus & Dahlstrøm 1974), may be the only indication of gut contents in the assemblage. In the site riddled material this lacuna could be a recovery bias, but this seems unlikely in the pit fills where tiny herring bones were well represented (unless some of the herring themselves were gut contents from the large gadids). Fish may thus have been partly prepared off-site.

The sample size of the fish assemblage is very small to subdivide by phase and context type, but it is notable that the rank order of herring and cod (the two most abundant taxa) does differ across time and space. In particular, cod is the more abundant of the two in site period II, whereas herring is most common in site period III (Table 2.6). These differences can be explained in spatial terms. Most of the herring bones are from pit 43852 belonging to site period III (plot 3, plot phase 4).

The bird bone

Only 27 bird bones were recognised in the assemblage, and few of these could be identified beyond the level of class. Only 12 were diagnostic elements following the York recording protocol, but a few additional specimens were identified regardless given the tiny size of the collection (see Table 2.6). Overall, seven bird species have been identified, based on limb and girdle elements. No attempt was made to identify isolated vertebrae or hind limb phalanges.

Nine specimens were firmly identifiable as domestic fowl, and many of the specimens only identifiable as ‘bird’ were probably domestic fowl. The identifications were all made on elements on which this species can be clearly distinguished from other galliform birds such as pheasant (*Phasianus colchicus*) or black grouse (*Lyrurus tetrix*) (see Erbersdobler 1968).

The other species reflect Kaupang’s coastal location. Two specimens were identified to barnacle goose and one to brent goose. Both species breed in the Arctic and disperse around the coasts of north-western Europe outside the breeding season. They are only likely to have been in Oslofjord during the winter; that is between about

October and April. Two other waterfowl were identified: one specimen each of shelduck and of eider duck. Eider duck was quite numerous in the assemblage from Hedeby (Reichstein & Pieper 1986, 53-4). A single specimen of great black-backed gull (*Larus marinus*) probably represents an opportunistic scavenger.

The assemblage also produced a single specimen of little auk (*Alle alle*). This identification was made on the distal half of a left ulna, which was lightly charred. However, the morphology of the ulna is very distinctive in alcids, and the specimen was closely compared with other alcid species and with other birds of a similar size. Despite the imperfections of the specimen, the identification is made with confidence. Little auks breed in the Arctic, dispersing to sea at high latitudes during the winter (Stewart 2002).

Most of the small number of bird bones derive from site period II, but they are relatively evenly distributed between context types. In all, they have added just a few taxa to the site records. Coastal and marine birds predominate, with no taxa indicative of fowling undertaken inland from the site (observations consistent with the emphasis on marine fish and the virtual absence of wild mammal taxa). These records are important, however, as the only indicators of winter occupation at Kaupang in the zooarchaeological assemblage.

Stable isotope analysis

Twenty-two unburned specimens (six pig, 11 cattle and five caprine) were selected for stable Carbon and Nitrogen isotope analysis (Table 2.11). It was hoped that this work might shed light on husbandry practices. For example, it is straightforward to detect foddering with marine resources (seaweed or fish waste, see Vollan 1974; Barrett *et al*. 2000b) and theoretically possible to differentiate between pigs that have been stall-fed (omnivores) and those allowed to forage in a forest hinterland (largely herbivores) (Richards pers comm.). High $\delta^{13}C$ values would indicate the consumption of marine protein and high $\delta^{15}N$ values would indicate a relatively high trophic level (and thus the consumption of meat derived food scraps) (Katzenburg 2000). Unfortunately, however, only three of the specimens yielded any preserved bone protein (collagen) and none of these produced Carbon:Nitrogen ratios within the acceptable range of c.2.9-3.6 (Ambrose 1990). Preservation of the material from Kaupang is thus too poor for this kind of analysis.

Discussion

Although poorly preserved, the bone assemblage from Kaupang does provide some evidence regarding the economy and character of this important Viking Age settlement. The abundance of pigs resembles Viking Age towns from the Baltic region – such as Birka, Ribe and Hedeby – but this pattern is likely to be a product of the unusual preservation at this site. The pigs were probably domestic rather than wild. It is not possible to tell if they were stall reared on site, herded in a forest hinterland or provided by surrounding farms. However, the extensive use of local forest (other than for timber and firewood) is unlikely given the absence of wild mammals and birds characteristic of this habitat – despite careful attention to their

possible occurrence. The absence of fur-bearing species, other than cat and hare, is notable in this regard. If Kaupang participated in the Viking Age fur trade most of its objects of commerce arrived fully processed and/or were exported rather than serving local requirements.

If the aging evidence is not entirely biased by preservation and small sample sizes, the preference for young pigs, cattle and caprines which would have been nearing or at their adult size suggests a strategy aimed at meat production. The virtual absence of piglets, calves and lambs (or kids) at Kaupang could also imply that the settlement was provisioned by neighbouring farms rather than being engaged in livestock husbandry. In this case, however, poor preservation of young individuals is likely to play at least some role (Munson 2000).

The smaller, but slightly better preserved, fish assemblage was dominated by marine taxa, particularly herring, cod family species (cod, saithe and ling) and hake. A few salmonid bones and a single eel specimen provide the only evidence for possible freshwater fishing, but these could equally indicate saltwater catches of migratory fish. It is not possible to tell whether the herring were locally caught or imported as cured fish, but the former seems probable. The abundance of this species is common to Viking Age towns throughout the Baltic and North Sea regions. In contrast, the combination of cod, saithe and ling is a pattern characteristic of sites elsewhere in Norway and the Norse North Atlantic. The element distributions for these taxa, and for hake, are more consistent with local catches than with imported stockfish.

Very few bird bones were recovered, but the species identified are informative. The barnacle and brent geese and the little auk, for example, may be indicative of winter occupation. This observation is relevant to whether or not Kaupang was only seasonally occupied (Skre *et al*. 2000).

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Table 2.1. Distribution of all bone by phase and context type.

	Site Period						
Type	**I**	**II**	**III**	**I-III**	**Disturbed**	**Unphased**	**Total**
Bird							
Bench		3					3
Ditch		3		1			4
Dumping		1					1
Floor		1					1
Hearth		1					1
Layer	1	6					7
Occupation		2					2
Pit			5				5
?					3		3
Fish							
Agricultural horizon					5		5
Animal burrow					1		1
Bench		163	1				164
Ditch		58	11	82			151
Dumping		120					120
Feature		6					6
Floor		66					66
Hearth		20					20
Layer	40	214		2	2		258
Occupation	1	19					20
Passage		37					37
Pit	8	22	540	1			571
Posthole				1			1
Road					1		1
Stakehole				1			1
?					71	4	75
Mammal							
Agricultural horizon					1516		1516
Animal burrow					17		17
Bench		1641	252				1893
Ditch		4815	804	4163			9782
Dumping		7753					7753
Feature		615					615
Floor		1533					1533
Hearth		829					829
Layer	2376	21607		834	53		24870
Occupation	881	6842					7723
Passage		2951					2951
Pit	153	29	5248	235			5665
Posthole			100	115			215
Road					102		102
Stakehole				25			25
Stonepacking				27			27
?					3616	189	3805

Table 2.2. Bone preservation characteristics by phase.

		Site Period						
		I	II	III	I-III	Disturbed	Unphased	Total
Burning (all specimens)								
Bird	unburned		3	4	1	2		10
	burned	1	14	1		1		17
Fish	unburned	41	501	435	38	69	3	1087
	burned	8	224	117	49	11	1	410
Mammal	unburned	678	11553	1789	1850	1471	48	17389
	burned	2732	37062	4615	3549	3833	141	51932
Mean Fragment Size in Millimetres (diagnostic elements only)								
Bird			18.7	22.5		22.8		20.6
Fish		17.6	20.7	15.8	19.2	23.2		19.9
Mammal		39.5	26.4	28.9	27.2	25.6	17.7	27.2
Percent Completeness (diagnostic elements only)								
Bird	0-20%		3	3				6
	21-40%		3			2		5
	41-60%			1				1
	61-80%							
	81-100%							
Fish	0-20%	2	44	15	5	6		72
	21-40%	2	25	4	1	3		35
	41-60%		12	5	4	3		24
	61-80%		7	1				8
	81-100%							
Mammal	0-20%	23	333	81	49	40	1	527
	21-40%	7	76	14	6	15	1	119
	41-60%		51	7	6	6		70
	61-80%	1	27	2	3	7		40
	81-100%	3	55	11	8	11		88
Bone Texture (diagnostic elements only)								
Bird	excellent							
	good			1		1		2
	fair		2	2		1		5
	poor							
Fish	excellent			1				1
	good			4	1			5
	fair		13	5		2		20
	poor	3	41	6	1	7		58
Mammal	excellent							
	good	2	4	4	2	3		15
	fair	7	41	29	15	17		109
	poor	2	106	15	10	12		145

Table 2.3. Bone preservation characteristics by context type.

		Deposit Type										
		Bench	**Ditch**	**Dump**	**Floor**	**Hearth**	**Layer**	**Occup.**	**Pass.**	**Pit**	**Other**	**Total**
Burning (all specimens)												
Bird	unburned	1	1				2			4	2	10
	burned	2	3	1	1	1	5	2	0	1	1	17
Fish	unburned	120	58	95	36	14	195	12	36	450	71	1087
	burned	44	93	25	30	6	63	8	1	121	19	410
Mammal	unburned	397	2560	2173	139	199	5890	1060	1359	1815	1797	17389
	burned	1496	7222	5580	1394	630	18980	6663	1592	3850	4525	51932
Mean Fragment Size in Millimetres (diagnostic elements only)												
Bird			14.6				18.6	21.0		22.5	NA	20.6
Fish		19.3	17.7	24.6	27.4	15.4	20.6	19.7	27.0	16.6	NA	19.9
Mammal		28.8	23.7	29.3	19.7	50.5	25.1	23.4	28.6	35.7	NA	27.2
Percent Completeness (diagnostic elements only)												
Bird	0-20%		1				1	1		3	0	6
	21-40%						2	1			2	5
	41-60%									1	0	1
	61-80%											
	81-100%											
Fish	0-20%	7	12	6	1	3	19	4	1	13	6	72
	21-40%	2	3	4		1	16		1	4	4	35
	41-60%	3	7	2		2	1		1	5	3	24
	61-80%		1	2			4			1	0	8
	81-100%											
Mammal	0-20%	10	87	65	3	5	171	39	21	76	50	527
	21-40%	3	21	22		3	30	4	6	13	17	119
	41-60%	1	14	9			30	3		7	6	70
	61-80%	1	8	7			10	4		3	7	40
	81-100%	3	13	12		1	29	2	3	13	12	88
Bone Texture (diagnostic elements only)												
Bird	excellent											
	good									1	1	2
	fair		1				1			2	1	5
	poor											
Fish	excellent									1	0	1
	good		1							4	0	5
	fair	1	1	1		4	5	1	1	4	2	20
	poor	6	2	10			23	2	1	7	7	58
Mammal	excellent											
	good		3	1				1		6	4	15
	fair		32	8		3	10	4	2	30	20	109
	poor	2	9	38		5	43	10	10	15	13	145

Table 2.4. Distribution of all bone by plot and plot phase

		Plot Phase					
Common Name	**Plot**	**1**	**2**	**3**	**4**	**Unknown**	**Total**
Bird	1		2				2
Fish	1		207	18			225
Mammal	1	24	16502	1287			17813
Fish:Mammal	1	0.00	0.01	0.01			0.01
Bird	2	1	1	3			5
Fish	2	49	252	153			454
Mammal	2	3386	6077	9808	100	243	19614
Fish:Mammal	2	0.01	0.04	0.02	0.00	0.00	0.02
Bird	3		2	9	5	1	17
Fish	3		19	102	521	90	732
Mammal	3		1680	15320	3802	5250	26052
Fish:Mammal	3		0.01	0.01	0.14	0.02	0.03
Fish	4					1	1
Mammal	4					159	159
Fish:Mammal	4					0.01	0.01

Table 2.5. Distribution of all bone in pits by class and ratio of fish:mammal.

Pit	**Context**	**Bird**	**Fish**	**Mammal**	**Total**	**Fish:Mammal**
?	AL 94901			1	1	0.00
?	AL 43852			38	38	0.00
40814	AL 69516		1	159	160	0.01
43852	AL 61140			19	19	0.00
43852	AL 61237		8	406	414	0.02
43852	AL 61411	3	263	1766	2032	0.15
43852	AL 62471		2	258	260	0.01
43852	AL 65995		1	31	32	0.03
43852	AL 83799			198	198	0.00
43852	AL 87427		25	45	70	0.56
43852	AL 87626	1	45	44	90	1.02
43852	AL 87669		100	34	134	2.94
43852	AL 88226		73	81	154	0.90
43853	AL 60829	1	4	109	114	0.04
61931	AL 61932			19	19	0.00
61931	AL 62382		1	142	143	0.01
61931	AL 63684			2	2	0.00
61931	AL 63889			26	26	0.00
64891	AL 65189		6	578	584	0.01
64891	AL 87793		6	7	13	0.86
65132	AL 65159		1	460	461	0.00
65132	AL 66031			2	2	0.00
65132	AL 84282		5	240	245	0.02
65132	AL 86018		22	28	50	0.79
65132	AL 86813			1	1	0.00
65446	AL 66211			773	773	0.00
74095	AL 73950			45	45	0.00
99030	AL 99879		8	153	161	0.05

Table 2.6. NISP by site period of all species based on diagnostic elements (other records noted as present only).

	Site Period						
Common Name	**I**	**II**	**III**	**I-III**	**Disturbed**	**Unphased**	**Total**
Bird							
Barnacle goose		present	1				1
Brent Goose		1					1
Eider		present					
Shelduck		1					1
Domestic Fowl		3	3		1		7
Great Black-backed Gull					1		1
Little Auk		1					1
Subtotal		6	4		2		12
Fish							
Shark, Skate & Ray Orders		1	3				4
Dogfish Families			1				1
Eel		1					1
Atlantic Herring	1	66	177	12	7		263
Salmon & Trout Family		8					8
Trout		1					1
Cod Family	5	74	27	13	8	2	129
Cod		70	26	9	8		113
Ling		14	2	1	2		19
Pollack	1						1
Saithe	2	48	13	4	6		73
Hake		16	1	6	1		24
Gurnard Family		1					1
Wrasse Family			1				1
Subtotal	9	300	251	45	32	2	639
Mammal							
Large mammal	3	33	17	7	5		65
Medium mammal 1	6	47	18	10	10		91
Medium mammal 2		8		1			9
Shrew species			1				1
Dog family		1	present		3		4
Cat		26	2	5			33
Cat?		2		1			3
Horse		2		1			3
Pig	9	228	41	23	33	1	335
Pig?	1			1	1		3
Deer			1				1
Red deer			1				1
Cattle	10	116	22	17	16		181
Sheep/goat	5	84	13	7	11	1	121
Sheep		2					2
Hare		2					2
Subtotal	34	551	116	73	79	2	855
Total	43	857	371	118	113	4	1506

Table 2.7. Mammal element distribution (diagnostic elements only).

Common Name	Element	I	II	III	I-III	Disturbed	Unphased	Total
Large Mammal	Astragalus	1	1					2
	Calcaneum		1					1
	Femur	1	2	1	2			6
	Humerus		3	1	2	1		7
	Mandible		2					2
	Metacarpal			1				1
	Metapodial		13	6	2	2		23
	Pelvis			3		1		4
	Phalanx	1						1
	Phalanx 1		3	1				4
	Phalanx 2		2	1	1			4
	Phalanx 3		4	1				5
	Radius		1			1		2
	Tibia			1				1
	Ulna		1	1				2
Medium Mammal 1	Astragalus	1						1
	Femur	3	8	1		2		14
	Humerus		5	1	2			8
	Mandible		1					1
	Metacarpal	1						1
	Metapodial		5	7				12
	Pelvis		7	1		1		9
	Phalanx	1	4		2			7
	Phalanx 1		7	2	4	4		17
	Phalanx 2		5	4	1	1		11
	Phalanx 3		2					2
	Radius		1	1		1		3
	Tibia		1	1				2
	Ulna		1		1	1		3
	Femur		2		1			3
	Metatarsal		1					1
	Phalanx 1		4					4
	Phalanx 3		1					1
Shrew Species	Humerus			1				1
Dog Family	Metacarpal					1		1
	Phalanx 1					2		2
	Ulna		1					1
Cat	Astragalus		2					2
	Calcaneum		3					3
	Femur		3		1			4
	Humerus		1		1			2
	Metacarpal 2		1					1
	Metacarpal 3		1					1
	Metacarpal 4		1					1
	Metacarpal 5		1					1
	Metatarsal		1					1
	Metatarsal 2			1				1
	Metatarsal 3		2					2

Table 2.7 cont.

Common Name	Element	I	II	III	I-III	Disturbed	Unphased	Total
	Pelvis		1					1
	Phalanx			1				1
	Phalanx 1		2					2
	Phalanx 2		2		2			4
	Radius		2					2
	Scapula				1			1
	Tibia		1					1
	Ulna		2					2
Cat?	Femur		1					1
	Phalanx 2				1			1
	Phalanx 3		1					1
Horse	Femur				1			1
	Metapodial		1					1
	Phalanx 2		1					1
Pig	Astragalus		18	4	1	2		25
	Calcaneum	1	33	2	3	4		43
	Femur		8					8
	Humerus		2	1				3
	Mandible	2	16	9	1	2		30
	Metacarpal 2		2					2
	Metacarpal 3		1	1				2
	Metacarpal 4		4	1	1	1		7
	Metacarpal 5		1					1
	Metapodial	1	24	5		4	1	35
	Metatarsal 3			1				1
	Metatarsal 4		3	1				4
	Pelvis	1	3	3	2			9
	Phalanx 1		33	2	1	4		40
	Phalanx 2	2	34	4	6	4		50
	Phalanx 3		13	3		5		21
	Radius		9	3	3			15
	Scapula					1		1
	Tibia		10	1	3	2		16
	Ulna	2	14		2	4		22
Pig?	Femur	1				1		2
	Ulna				1			1
Deer	Antler			1				1
Red Deer	Antler			1				1
Cattle	Astragalus		10	3	1	2		16
	Calcaneum		4		1			5
	Femur	2	4	3				9
	Humerus		2		1			3
	Mandible	5	18	1	1	1		26
	Metacarpal	1	4			1		6
	Metapodial		5	1	1	1		8
	Metatarsal		8	1	2	2		13
	Pelvis		2	1	1			4
	Phalanx 1		15	2		2		19

Table 2.7 cont.

Common Name	Element	I	II	III	I-III	Disturbed	Unphased	Total
	Phalanx 2		20	1	6	3		30
	Phalanx 3	1	13	1	1	4		20
	Radius	1	1	2	2			6
	Scapula		2					2
	Skull		3					3
	Tibia		5	2				7
	Ulna			4				4
Sheep	Skull		1					1
	Tibia		1					1
Sheep/Goat	Astragalus	1	10	2		1		14
	Calcaneum		6					6
	Femur		2		1			3
	Humerus		5					5
	Mandible	1	14		2	1		18
	Metacarpal		3	2	1	1	1	8
	Metapodial		8	1	1	1		11
	Metatarsal		5			1		6
	Pelvis		2					2
	Phalanx 1	3	12	1		1		17
	Phalanx 2		4	2	1			7
	Phalanx 3		4	1	1			6
	Radius		3	2		3		8
	Tibia		4	1		1		6
	Ulna		2	1		1		4
Hare	Metatarsal		1					1
	Phalanx 1		1					1

Table 2.8. NISP by context type of all species based on diagnostic elements.

	Deposit Type										
Common Name	**Bench**	**Ditch**	**Dump**	**Floor**	**Hearth**	**Layer**	**Occup.**	**Pass.**	**Pit**	**Other**	**Total**
Bird											
Barnacle goose									1		1
Brent Goose							1				1
Shelduck						1					1
Domestic Fowl		1				1	1		3	1	7
Great Black-backed Gull										1	1
Little Auk						1					1
Subtotal		1				3	2		4	2	12
Fish											
Shark, Skate & Ray Orders	1	1						1	1		4
Dogfish Families									1		1
Eel						1					1
Atlantic Herring	13	18	6	13		18	2		186	7	263
Salmon & Trout Family			5			1	1	1			8
Trout			1								1
Cod Family	17	20	11	4	3	31	2	3	28	10	129
Cod	8	22	14	1	1	25	4	2	24	12	113
Ling	5	1	2	3		3	1		2	2	19
Pollack									1		1
Saithe	3	9	15		1	23	1	3	12	6	73
Hake	2	9	1			8	1		1	2	24
Gurnard Family					1						1
Wrasse Family		1									1
Subtotal	49	81	55	21	6	110	12	10	256	39	639
Mammal											
Large mammal		10	8			24	3	1	12	7	65
Medium mammal 1	4	19	4		1	28	6	2	17	10	91
Medium mammal 2		3	1			4		1			9
Shrew species									1		1
Dog family		1								3	4
Cat		31				1			1		33
Cat?		3									3
Horse			1			2					3
Pig	8	34	46	2	1	135	20	9	41	39	335
Pig?		1							1	1	3
Deer									1		1
Red deer									1		1
Cattle	2	27	22	1	6	55	10	13	27	18	181
Sheep/goat	4	17	32		1	25	13	4	11	14	121
Sheep			1			1					2
Hare		1	1								2
Subtotal	18	147	116	3	9	275	52	30	113	92	855
Total	67	229	171	24	15	388	66	40	373	133	1506

Table 2.9. Estimated total length of fish based on a comparison of diagnostic elements with reference specimens of known size.

Total Length	I	II	III	I-III	Disturbed	Total
Atlantic Herring						
151-300mm			2			2
301-500mm			2			2
Cod						
301-500mm		7	1	2		10
501-800mm		5	3	1	2	11
801-1000mm		4	1			5
>1000mm		3				3
Ling						
801-1000mm		5				5
>1000mm		1			2	3
Saithe						
501-800mm	1	1	2	1		5
801-1000mm		10	2		3	15
>1000mm		10		1	1	12
Hake						
501-800mm		2		2		4
801-1000mm		4		1	1	6
>1000mm		1				1
Gurnard Family						
301-500mm		1				1

Table 2.10. Fish element distribution (diagnostic elements only).

Element	I	II	III	I-III	Disturbed	Unphased	Total
Shark, Skate & Ray Orders							
Mineralized Vertebral Centrum		1	3				4
Dogfish Families							
Mineralized Vertebral Centrum			1				1
Eel							
Abdominal Vertebra		1					1
Atlantic Herring							
Abdominal Vertebra	1	30	78	6	4		119
Articular			1				1
Caudal Vertebra		26	85	4	3		118
First Vertebra		7	6	1			14
Opercular			1				1
Penultimate Vertebra			1				1
Quadrate			2				2
Ultimate Vertebra				1			1
Vertebra		3	3				6
Salmon & Trout Family							
Abdominal Vertebra		3					3
Caudal Vertebra		5					5
Trout							
First Vertebra		1					1
Cod Family							
Abdominal Vertebra	1	4		1		1	7
Abdominal Vertebra Group 1		13	5	3		1	22
Abdominal Vertebra Group 2		4					4
Abdominal Vertebra Group 3		9	3		2		14
Articular	2	3					5
Basioccipital		1	1				2
Caudal Vertebra		5		1	1		7
Caudal Vertebra Group 1	1	8	4	3			16
Caudal Vertebra Group 2		1	1	2	2		6
Ceratohyal		1	1				2
Dentary		1	1				2
First Vertebra			2	1			3
Infrapharyngeal			1				1
Maxilla	1	2		1			4
Opercular		1					1
Palatine		1	2		1		4
Posttemporal		6	1				7
Premaxilla		7	2		1		10
Preopercular			1				1
Quadrate		1	2		1		4
Supracleithrum		6		1			7
Vomer		1					1

Table 2.10 cont.

Element	I	II	III	I-III	Disturbed	Unphased	Total
Cod							
Abdominal Vertebra Group 1		9	3	1			13
Abdominal Vertebra Group 2		9	3	1	3		16
Abdominal Vertebra Group 3		11	7	2	1		21
Articular				1			1
Caudal Vertebra Group 1		13	8	1			22
Caudal Vertebra Group 2		6		1	2		9
Dentary		3		1	2		6
First Vertebra		1					1
Maxilla		4		1			5
Parasphenoid		1					1
Posttemporal		1					1
Premaxilla		8	2				10
Quadrate		2	2				4
Vomer		2	1				3
Ling							
Abdominal Vertebra		1	1				2
Abdominal Vertebra Group 1			1				1
Abdominal Vertebra Group 2		2					2
Abdominal Vertebra Group 3		1					1
Articular					1		1
Caudal Vertebra				1			1
Caudal Vertebra Group 1		2					2
Cleithrum		1			1		2
Dentary		2					2
Palatine		1					1
Parasphenoid		1					1
Vertebra		2					2
Vomer		1					1
Pollack							
Abdominal Vertebra Group 2	1						1
Saithe							
Abdominal Vertebra		1	1		1		3
Abdominal Vertebra Group 1		1					1
Abdominal Vertebra Group 2		6	1				7
Abdominal Vertebra Group 3	1	8		1			10
Articular	1	4					5
Basioccipital		1					1
Caudal Vertebra Group 1		7	5				12
Caudal Vertebra Group 2		2	2	1	1		6
Dentary		5	1		1		7
Maxilla		2	1		1		4
Posttemporal		1			1		2
Premaxilla		7	2				9
Preopercular		1					1
Quadrate		1					1
Supracleithrum				2	1		3

Table 2.10 cont.

Element	I	II	III	I-III	Disturbed	Unphased	Total
Hake							
Abdominal Vertebra		1					1
Caudal Vertebra		2		1			3
Caudal Vertebra Group 1		4	1				5
Caudal Vertebra Group 2		2					2
Dentary		1		2	1		4
First Vertebra				1			1
Maxilla		2					2
Premaxilla		4		1			5
Caudal Vertebra				1			1
Gurnard Family							
Opercular		1					1
Wrasse Family							
Abdominal Vertebra			1				1

Table 2.11. Stable isotope results for the best preserved unburned specimens.

Specimen	Context	Species	Element	Collagen Preserved	$\delta^{13}C$	$\delta^{15}N$	%C	%N	C:N	Comments
4171	75972	caprine	astragalus	no						
5878	67217	caprine	astragalus	no						
5886	68122	caprine	metapodial	no						
6500	74121	caprine	phalanx 1	no						
6528	68495	caprine	metacarpal	yes	-23.0	1.8	19.9	5.2	4.4	unusable, poor C:N ratio
3269	1022171	cattle	astragalus	no						
4098	68371	cattle	phalanx 2	no						
5502	67635	cattle	metapodial	no						
5861	67217	cattle	metatarsal	no						
5959	60027	cattle	phalanx 3	no						
6008	67635	cattle	radial carpal	no						
6185	68122	cattle	metacarpal	no						
6279	68495	cattle	calcaneus	yes	-23.2	3.5	29.7	8.7	4.0	unusable, poor C:N ratio
6472	74121	cattle	astragalus	no						
F1024402	63581	cattle	mandible	no						
from box 15	64144	cattle	mandible	no						
3231	61643	pig	ulna	no						
3281	60592	pig	phalanx 2	no						
6082	67217	pig	astragalus	no						
6276	68495	pig	calcaneus	yes	-22.8	8.7	33.4	9.9	3.9	unusable, poor C:N ratio
6294	68495	pig	mandible	no						
6301	68495	pig	astragalus	no						

Appendix 2.1. Common and Latin names of taxa identified at Kaupang.

	Common Name	Latin Name
Bird	Brent Goose	*Branta bernicla*
	Barnacle goose	*Branta leucopsis*
	Eider	*Somateria mollissima*
	Shelduck	*Tadorna tadorna*
	Swan, Goose & Duck Family	Anatidae
	Fowl	*Gallus gallus*
	Great Black-backed Gull	*Larus marinus*
	Little Auk	*Alle alle*
Fish	Shark, Skate & Ray Orders	Pleurotremata/Hypotremata
	Dogfish Families	Scyliorhinidae/Squalidae
	Eel	*Anguilla anguilla*
	Atlantic Herring	*Clupea harengus*
	Salmon & Trout Family	Salmonidae
	Trout	*Salmo trutta*
	Cod Family	Gadidae
	Cod	*Gadus morhua*
	Ling	*Molva molva*
	Pollack	*Pollachius pollachius*
	Saithe	*Pollachius virens*
	Hake	*Merluccius merluccius*
	Gurnard Family	Triglidae
	Wrasse Family	Labridae
Mammal	Shrew species	*Sorex*
	Dog Family	Canidae
	Cat	*Felis catus*
	Horse	*Equus caballus*
	Pig	*Sus domesticus*
	Deer	Cervidae
	Red Deer	*Cervus elaphus*
	Cattle	*Bos taurus*
	Sheep	*Ovis aries*
	Sheep/Goat	*Ovis aries* or *Capra hircus*
	Hare	*Lepus*

Appendix 2.2. Raw tooth wear data (after Grant 1982 for cattle and pigs and Payne 1987 for sheep or goats).

Common Name	Dp4	P4	M1	M2	M1/M2	M3
Cattle				G		
Cattle						D
Cattle				G		
Cattle					BKN	
Cattle		E				
Cattle		U				
Cattle						U
Cattle						U
Cattle						U
Cattle		C				
Cattle		BKN				
Cattle		B				
Cattle				J		
Cattle					BKN	
Cattle						BKN
Cattle		B				
Cattle				BKN		
Cattle						C
Cattle		F				
Cattle				F		
Cattle		F	K	J		G
Pig						U
Pig						BKN
Pig						U
Pig				U		
Pig		U				
Pig		U				
Pig			B			
Pig				U		
Pig				U		
Pig						U
Pig						C
Pig						U
Pig						U
Pig						A
Pig						BKN
Pig						U
Pig		U				
Pig		U				
Pig		BKN				
Pig		U				
Pig				U		
Pig			C			
Pig						U
Pig					BKN	
Sheep/goat		U				
Sheep/goat	16L					

Appendix 2 cont.

Common Name	Dp4	P4	M1	M2	M1/M2	M3
Sheep/goat			6A			
Sheep/goat				BKN		
Sheep/goat			2A			
Sheep/goat			BKN			
Sheep/goat			9A			
Sheep/goat				6A		

Part III: House floors, occupation layers and bench deposits

James Barrett and Allan Hall

Introduction

A selection of bulk sieved samples and their associated botanical and animal bone assemblages can be studied in order to evaluate the initial field interpretation of deposits identified as house floors, occupation layers (possibly also house floors) and side benches. The general characteristics of the samples will be considered first, followed by more detailed analysis of the botanical and faunal material. The samples derive from houses 301, 303 (both on plot 3) and 406 (on plot 2). All are from site period II. They are listed in Table 3.1. The botanical material comes from both the floating and heavy fractions of these samples. The relevant faunal assemblage is partly from these samples, but additional bone (including site-sieved, rather than sampled, material) from the same and related contexts is also included. Overall, despite small sample sizes, there are recognisable differences between the floors and benches that may be consistent with their original interpretations. However, the characteristics of the 'occupation' layers are more ambiguous.

The samples

The samples were recovered by flotation using a 1mm mesh (re-sieved to >4mm and 2-4mm in the lab) to retain the heavy fraction and 0.5mm mesh for the light fraction. The light fractions contained mostly botanical material, which is considered further below, and a few bone fragments and small fish vertebrae that were combined with the rest of the zooarchaeological assemblage. The heavy fractions were dominated by varying proportions of stone, charcoal and mammal bone. Smaller weights of fish bone and hazelnut shell were also recovered. With minor exceptions (e.g. a tiny glass bead) the samples were free of artefacts, but this observation is not meaningful as they had been carefully removed during excavation.

The general character of the sample residues differs for 'floors', but not for 'bench' and 'occupation' deposits. The two 'house floor' samples included larger stones and more stones – and less bone, charcoal and hazelnut shell – than the 'bench' or 'occupation' deposits (Figures 3.1-3.5). The contrasts between 'floors' and 'benches' could be interpreted as the laying of gravel living surfaces that were subsequently kept relatively clean. There is, however, no simple explanation for the broad similarity between bench and 'occupation' layers. This issue is considered further below.

The faunal assemblage

The house floor, bench and occupation layer contexts analysed (Table 3.2) produced a total of 4920 bone specimens, but most of these were small fragments that could only be

identified as mammal, fish or (in a very few cases) bird. The species represented conform to those from the site as a whole, but the small number of specimens identified beyond class (24 mammal, 73 fish and no bird) precludes interpretation of differences between deposit types based on the animals represented. The sample size is reasonable if one only considers broad differences at the class level (Table 3.3). In this case, however, differences between houses within the same context type are much larger than differences between context types.

Consideration of bone modification is more revealing. Of the three context types, only benches produced a few bones that were not highly fragmented (Table 3.4; Figure 3.6). Bone texture data could not be recorded for most specimens due to burning, but the incidence of burnt bone itself also varied by deposit type. It was more abundant in both 'floors' and 'occupation layers' than in 'benches' (Table 3.5). This pattern contrasts with the distribution of charcoal, which was rare in 'floor' deposits and common in both 'bench' and 'occupation' layers (see above).

The botanical assemblage

Plant remains from the 'washovers' of bulk-sieved samples from floors, occupation layers and bench deposits were very similar. They comprised mainly wood charcoal, with a little charred hazel nutshell and some charred cereals (mainly barley) and weeds likely to have been growing with the cereal crop, as well as a few remains which may have originated in burnt peat or turves. Other evidence of burning consisted of material variously recorded as 'ash beads', 'glassy ash' and 'ash concretions'—plant ash in small subspherical clasts or larger, more amorphous, whitish fragments, all no doubt originating in plant material. Insofar as the small amounts of material and small numbers of samples allowed, there seemed to be no particular pattern to the distribution of these remains between contexts within these categories, the same general kinds of assemblages occurring in each. This no doubt reflects the distribution of the relatively light material ash from fires throughout the deposits as they formed—indeed, much the same 'background' of charred material was seen in the pit fills, too. Full details regarding the relevant samples can be found in Part I of this report (see above).

Discussion

Contexts described as 'floors' in the field contained more gravel, a higher proportion of burnt bone, less bone in total, less charcoal and less hazelnut shell than deposits interpreted as 'benches'. These 'floors' also lacked any large or nearly complete bones. The 'benches' exhibited the opposite characteristics. Layers described as 'occupation' had densities of gravel, bone, charcoal and hazelnut shell most similar to 'bench' deposits. However, the proportion of burnt bone and the level of bone fragmentation in these contexts resembled the 'floors'. Little additional information was provided by analysis of the botanical material from flotation 'washovers'. Nevertheless, in sum, the three deposit types do appear to be distinct. The presence of higher proportions of fine

gravel in the ‘floor’ layers may imply purposeful deposition as a living surface, a practice documented in later Viking Age Dublin (Wallace 1992:35). Moreover, the high level of bone fragmentation and the low density of large (>4mm) charcoal may indicate a combination of trampling and cleaning that is also consistent with a living surface. The characteristics of the ‘benches’ are less obviously consistent with their assumed function. If correctly identified, they must have been constructed largely of re-deposited midden material – presumably retained in a wood or wattle frame (c.f. Wallace 1992:37). The occupation layers, which had characteristics of both ‘floor’ and ‘bench’ deposits, may simply have been trampled areas of midden material without the purposeful addition of fine gravel.

References

Wallace, P. F. 1992. *The Viking Age Buildings of Dublin, Medieval Dublin Excavations 1962-81, Part 1: Text*. Dublin: Royal Irish Academy.

Table 3.1. A selection of samples from house 'floor', 'bench' and 'occupation' deposits.

House	Deposit Type	Sample	Context	Plot	Plot Phase	Site Period	Original Sample Volume (l)	Heavy Fraction Volume (l)	% >4mm[1]	Density Stone (g/l, >4mm)	Density Bone (g/l, >4mm)	Density Charcoal (g/l, >4mm)	Density Hazelnut (g/l, >4mm)
301	Bench	66061	65556	3	3	II	10	0.63	31.75	35.80	2.30	0.82	0.03
301	Bench	71121	79806	3	3	II	10	0.61	33.06	34.24	2.85	0.84	0.05
301	Occupation	63864	62068	3	3	II	7.5	0.40	25.00	29.45	7.29	0.19	0.03
301	Occupation	63865	62023	3	3	II	9	0.60	28.57	42.35	1.94	0.26	0.01
301	Occupation	66400	66085	3	3	II	11	0.62	32.26	26.08	0.20	0.29	0.02
303	Floor	78923	64713	3	2	II	10	1.80	44.44	118.28	0.16	0.44	0.00
303	Floor	81537	64713	3	2	II	10	1.70	47.06	100.91	0.06	0.05	0.00
303	Occupation	82227	81762	3	2	II	10	1.67	23.95	71.30	1.13	0.33	0.00
303	Occupation	82228	81762	3	2	II	10	1.88	32.00	76.48	2.41	0.33	0.01
303	Occupation	82229	81762	3	2	II	10	1.61	31.06	101.63	1.78	0.22	0.00
406	Bench	68451	68378	2	2	II	10	1.35	37.04	68.64	2.30	3.58	0.00
406	Occupation	69305	69242	2	2	II	10	1.28	31.37	38.84	3.16	4.45	0.00
406	Occupation	69306	69242	2	2	II	10	0.85	35.29	31.16	4.75	3.90	0.00
406	Occupation	69307	69242	2	2	II	5	0.61	29.75	49.52	8.60	6.48	0.00
406	Occupation	69308	69242	2	2	II	9	0.73	41.10	57.17	3.28	2.01	0.00

[1]Based on heavy fraction volume.

Table 3.2. Contexts from house 'floor', 'bench' and 'occupation' deposits For which bone was analysed.

House	Deposit Type	Context	Plot	Plot Phase	Site Period
301	Bench	65556	3	3	II
301	Bench	79806	3	3	II
301	Occupation	62023	3	3	II
301	Occupation	62068	3	3	II
301	Occupation	62023	3	3	II
301	Occupation	66085	3	3	II
303	Floor	64713	3	2	II
303	Floor	64713	3	2	II
303	Occupation	81762	3	2	II
303	Occupation	81762	3	2	II
303	Occupation	81762	3	2	II
406	Bench	68378	2	2	II
406	Bench	68378	2	2	II
406	Occupation	69242	2	2	II
406	Occupation	69242	2	2	II
406	Occupation	69242	2	2	II
406	Occupation	69242	2	2	II

Table 3.3. Distribution of bone by class in house 'floor', 'bench' and 'occupation' deposits.

House	Deposit Type	Bird	% Bird	Fish	% Fish	Mammal	% Mammal
301	Bench	2	0.3	12	1.9	630	97.8
301	Floor	1	0.2	3	0.5	580	99.3
301	Occupation	1	0.1	4	0.3	1330	99.6
303	Floor	0	0.0	4	18.2	18	81.8
303	Occupation	0	0.0	3	0.8	369	99.2
406	Bench	1	0.1	151	15.6	817	84.3
406	Floor	0	0.0	59	5.9	935	94.1

Table 3.4. Level of fragmentation of identified bones from house 'floor', 'bench' and 'occupation' deposits.

		Completeness				
House	Deposit Type	0-20%	21-40%	41-60%	61-80%	81-100%
301	Bench	2		1	1	
301	Floor	2				
301	Occupation	6	1			
303	Floor					
303	Occupation					
406	Bench	10	5	3		1
406	Floor	2				

Table 3.5. Distribution of burnt bone in house 'floor', 'bench' and 'occupation' deposits.

House	Deposit Type	Unburned	Burned	% Burned
301	Bench	140	504	78.3
301	Floor	65	519	88.9
301	Occupation	32	1303	97.6
303	Floor	4	18	81.8
303	Occupation	10	362	97.3
406	Bench	360	609	62.8
406	Floor	106	888	89.3

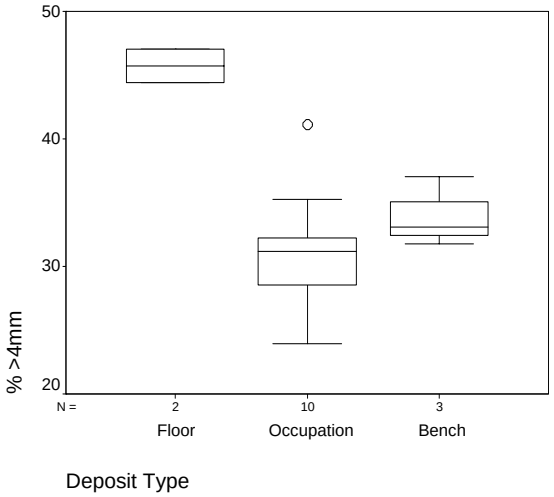

Figure 3.1. Percentage of heavy fraction in the >4mm size category for samples from house 'floor', 'bench' and 'occupation' deposits.

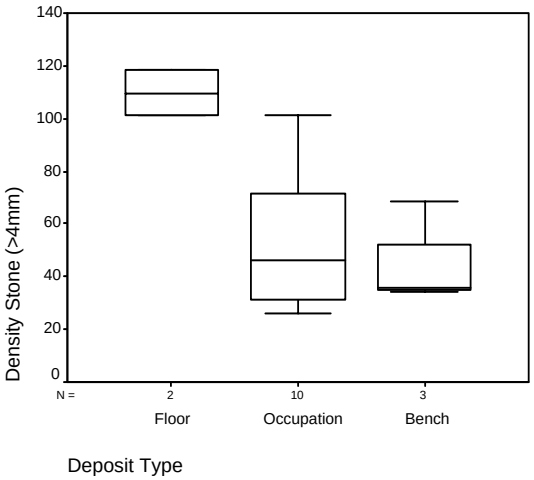

Figure 3.2. Density of stone (g/l in the >4mm size fraction) in samples from house 'floor', 'bench' and 'occupation' deposits.

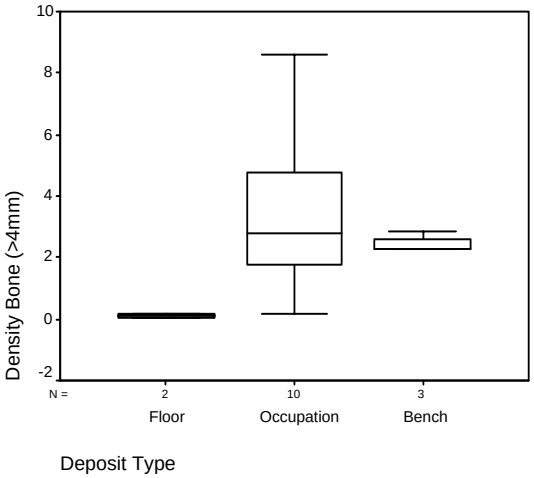

Figure 3.3. Density of bone (g/l in the >4mm size fraction) in samples from house 'floor', 'bench' and 'occupation' deposits.

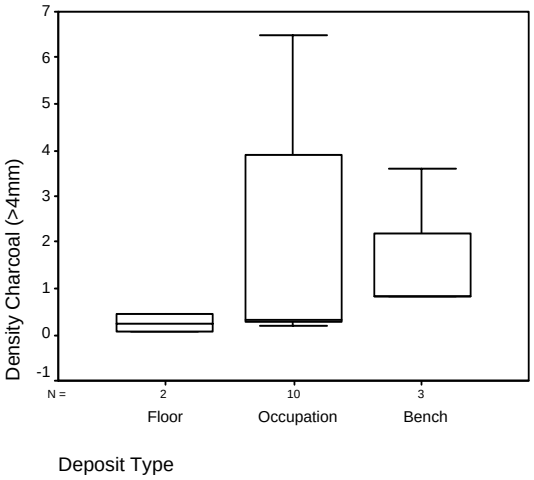

Figure 3.4. Density of large charcoal (g/l in the >4mm size fraction) in samples from house 'floor', 'bench' and 'occupation' deposits.

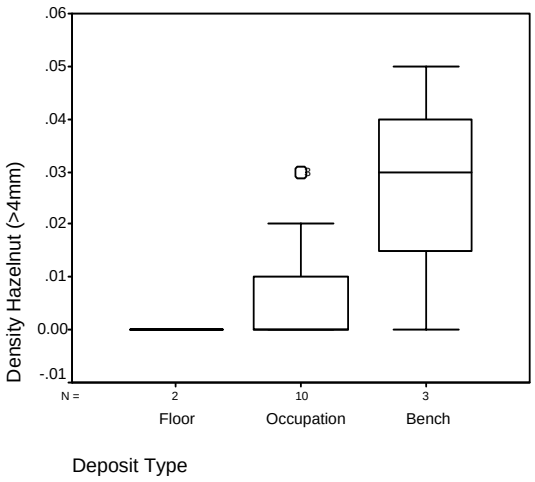

Figure 3.5. Density of hazelnut shell (g/l in the >4mm size fraction) in samples from house 'floor', 'bench' and 'occupation' deposits.

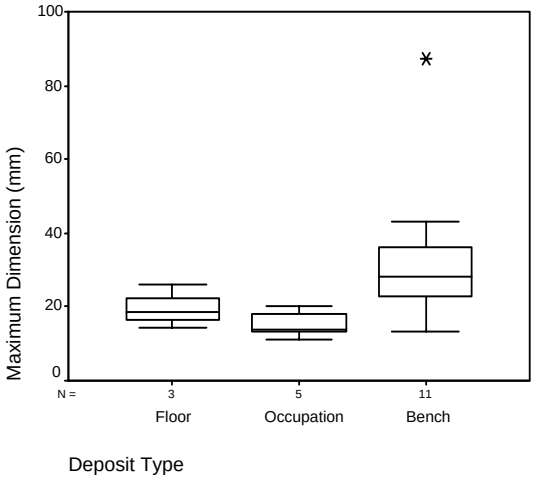

Figure 3.6. Maximum dimension of identified mammal bones from house 'floor', 'bench' and 'occupation' deposits.

Part IV: Assessment of macrofossil plant and invertebrate remains from four samples from the 2003 excavations at Kaupang, Norway

Allan Hall and Harry Kenward

Four samples from the 2003 season of excavations at Kaupang, S. Norway, were submitted for assessment of their content of plant and invertebrate macrofossil remains. On inspection in the laboratory, all appeared to have good preservation of woody detritus and subsamples of 1 kg were taken from each. These were processed as GBA subsamples, following the methodology of Kenward *et al.* (1980).

Subsamples of 1.0 kg were disaggregated in water and sieved to 300μm then subjected to paraffin flotation broadly using the techniques of Kenward *et al*. (1980). The flot was stored in alcohol (IMS). Insects in the flot were recorded using 'assessment recording' *sensu* Kenward (1992) creating a list of the taxa observed during rapid inspection of the flot, with a semi-quantitative estimate of abundance, and a subjective record of the main ecological groups. A record of the preservational condition of the remains was made using scales given by Kenward and Large (1998). This scheme provides scales for chemical erosion and fragmentation (0.5-5.5, the higher figure representing the greatest degree of damage), and colour change (0-4), in each case giving a range and a value for the position and strength of the mode (Kenward and Large 1998, tables 2, 3 and 5-7).

Plant remains (and the general nature of the residues) were recorded briefly by 'scanning', identifiable taxa and other components being listed directly to a PC using *Paradox* software. Notes on the quantity and quality of preservation were made for each fraction.

The results of the assessment are given in the table below. (Note that another sample of material from Context 4453 was examined previously, via a subsample of Sample 4901; the results are included below.)

All the samples yielded large components of woody debris, including fragments of wood, bark and twig, and with fragments bearing evidence of cut edges (wood chips) in all cases. Other plant remains were generally quite well preserved (though with a range from very decayed to very well preserved); concentrations of remains were quite low, however, perhaps a function of the large amount of woody debris.

Most of the taxa represented by identifiable macrofossils were woody plants, notably various remains of juniper—fragments of shoot, leaves, and seeds—as well as seeds of rose, blackberry and hazel nutshell. These might all be plants used at the site and discarded with woody debris (are these redeposited floor deposits?), but there was otherwise no strong component of foods and an origin in material brought as brushwood (e.g. for roofing or flooring) is another possibility.

Variable preservation of the insect remains may have been a result of taphonomic processes taking place before and during deposition, although post-depositional decay seems possible for 4762,the uppermost deposit.

The insect assemblages included small numbers of a wide range of species, some of them potentially difficult to identify. However, the overall impression is of fairly typical occupation-site deposits, with a restricted range of remains from natural or semi-natural habitats, and most of those (plant-feeders, deadwood associated species, aquatics) quite possibly imported with resources of some kind or another. Overall there was a subjective impression of very diluted stable manure insect fauna, from the mixture of foul decomposers, plant feeders perhaps imported in hay, and aquatics. Fuller analysis of the plant and insect remains from larger subsamples should illuminate this. The range of synanthropic beetles appeared limited, although the fairly small size of the assemblages seen here means that they provide only a limited view of the fauna of the site as a whole.

Overall the plant and insect evidence suggests that these are dumps of material from occupation, possibly from floors.

It is difficult to determine the best strategy for studying this material further. It appears that this dump can be used as a proxy for a part or parts of the site where preservational conditions were inhospitable, so that the *in situ* record is lost. The evidence from the assessment has not given any clear indication of distinct variation through the deposit, so there is probably little point in analysing a stratigraphic sequence of samples. Perhaps the most useful approach would be to examine plant and insect remains from substantial subsamples of two or three samples with the aim of clarifying the nature of the deposit, its likely origin, and conditions and activity at its source.

References

Kenward, H. K. (1992). Rapid recording of archaeological insect remains - a reconsideration. *Circaea, the Journal of the Association for Environmental Archaeology* **9** (for 1991), 81-8.

Kenward, H. K., Hall, A. R. and Jones, A. K. G. (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. and Large, F. (1998). Recording the preservational condition of archaeological insect fossils. *Environmental Archaeology* **2**, 49-60.

Table 4.1. Plant and invertebrate remains from four samples form the 2003 excavations at Kaupang, Norway; the order is stratigraphic, with the uppermost listed first.

Context/ Intrasis sample	**Sample**	**Notes**
4453/ 4758 [spit 2]	4762	The very large residue of about 600 cm^3 included about 100 cm^3 of sand and gravel, the remainder being rather angular, (superficially) well-preserved woody debris including some tentatively identified wood chips (to 10 mm) and fragments of twig. Closer inspection revealed some patchy decay of the wood (with some deposition of glossy orange iron oxides on surfaces and in patches of decay) and that a large proportion of the debris were actually bark rather than wood. Seeds and fruits were mostly moderately well preserved, though there was much variability. Again, stem fragments, leaves and seeds of juniper were all noted and blackberry and hazel were also present. Taxa from woodland and heathland were predominant in the small assemblage, though other habitats were represented; only remains of sedges (*Carex*) and ?tormentil (*Potentilla* cf. *erecta* (L.) Räusch.) were present at more than trace levels. The flot, of modest size, consisted of arthropod and plant fragments which had often formed clumps which were difficult to separate, making recording difficult. Preservation was very variable, and often poor, and there were numerous unidentifiable scraps of cuticle (E 3.5-5.0, mode 3.5 distinct; F 2.5-5.5., mode 3.5 weak). The remains frequently showed strong colour change (trend to brownish 2-4, mode 3 weak) and were generally somewhat unusual in appearance, with a biscuit-like texture, presumably as a result of the loss of a cuticular component. Insects were present in modest numbers, and there were a few mites. Beetle species were represented by single individuals. Most were typical of occupation deposits, and there was a subjective hint of the presence of stable manure from the range of decomposers and from plant-feeders which may have been brought in cut hay-like vegetation. There were very few aquatics. A subsample of 5 kg would probably provide an insect assemblage large enough for useful interpretation, though the evidence should be integrated with that from the plant remains.
4453/ 4900 [spit 4]	4901	A very large residue of 850cc of angular woody debris was obtained. The wood fragments (to 50 mm) were generally quite well preserved, though there were some softened and decayed areas and some channelling by invertebrates. Bark (to 55 mm), twigs and wood chips (to 25 mm) were all moderately frequent. Fragments of hazel nutshell had smooth outer surfaces but were not pristine. The charcoal present (to 10 mm) sometimes exhibited glossy iron oxide deposits. Seeds were moderately frequent and mostly slightly eroded, the moss shoots variable in preservation. Taxa present in more than trace amounts were sedges, hazel nut, toad rush (*Juncus bufonius* L.), juniper (seeds and stem fragments), knotgrass (*Polygonum aviculare* agg.), blackberry and annual nettle (*Urtica urens* L.); overall, the predominant habitat or use groups represented were weeds, woodland, heathland and some foodplants. As well as seeds, needles and jointed stem fragments of juniper were again noted. A small flot contained fairly large numbers of insects and numerous mites, which were generally fairly well preserved (E 1.5-3.0, mode 2.0

		weak; F 1.5-3.5, mode 2.5 weak). Most of the beetles were represented by single individuals, and a fairly wide range of habitats was represented, but most of the fauna was typical of occupation sites. Like that from sample 4762/T, this assemblage give a subjective impression that stable manure may have been one component contributing to it. Again there were few aquatics. A larger subsample would give a useful assemblage of insects, which together with the evidence from plant remains should allow the nature and origin of the deposit to be established. [Material from the same sample examined previously: The 2 kg subsample examined yielded a large residue of about 850 cm^3 of granular and flaky wood fragments, including wood chips (to 40 mm), the wood mostly rather well preserved (firm, with little erosion of surfaces or edges), once washed clean of silty matrix. Much of the matrix of the sediment was rather rich in very fine humic material which may relate to pre- or post-depositional decay, however. Some fragments of hazel nutshell were mostly (but certainly not all) very fresh looking. By contract, the charcoal present was often somewhat abraded, and sometimes encrusted with iron salts, as was a small component of the wood. Other plant macrofossils included some very well preserved material (especially some seeds of rose, *Rosa*, in one case with a little of the fruit (hip) attached. Other specimens were more strongly eroded. There were traces of two other potentially useful plants, also seen in the material from the main 2002 excavation: hop and woad, both rather well preserved. Invertebrates were present in appreciable numbers and included a few tens of beetles (minimum number), some mites, spiders and crustaceans. Preservation was moderately good (erosion 2.0-3.5, mode 2.5, weak; fragmentation 2.0-3.0 mode 2.5, weak, following the scheme of Kenward and Large 1998). The invertebrate support the archaeological interpretation that this deposit represents dumping into water, since there were appreciable numbers of ostracods and chironomid midge larvae, as well as cladocerans and water beetles. Detailed analysis would be required to determine salinity, although the cladocerans suggest minimal salinity. The terrestrial component of the insects is of considerable interest, for it includes a range of species likely to have occurred in decomposing organic matter on a surface, including the burrowing beetle *Aglenus brunneus* (Gyllenhal), of which there were two. There were body segments of a flea, a spider beetle (*Tipnus* sp.), *Lathridius minutus* group, and *Xylodromus ?concinnus* (Marsham), all hinting at floor litter. The material therefore seems to have lain on an occupation surface for a while before dumping (alternatively, floor litter or old deposits may have been a separate component of the dump, as might be interpreted from the evidence from plant material in the matrix for different levels of erosion). A hint that the surface may have received cut vegetation, such as hay, is offered by a single incompletely expanded elytron of an *Apion* weevil, regarded as a typical component of hay in stable manure associations (Kenward and Hall 1997). The plant remains do not seem to confirm this, unless the wood chips are a form of litter from a stable floor. Concentration of plant and invertebrate macrofossils was dilute in this deposit because of the abundance of woody debris; a larger subsample (of 4-5 kg) would provide an interpretatively useful invertebrate assemblage and increase the range of plant taxa recorded. Examination of a series of separate samples from different locations in the deposit would be worthwhile to determine how variable it is in context and whether it as multiple sources.]

4453/ 4933S [spit 5]	4934	This subsample resulted in a large residue of about 700 cm^3 of angular well-preserved woody fragments, including some strips of (presumably) birch bark (to 130 mm), wood (to 30 mm, including chips to 20 mm) and twigs (to 45 mm). A large fine fraction of woody material was noted. Charcoal was present (to 10 mm). Juniper remains were again present, one seed being attached to some anastomosing vascular traces presumably representing vestiges of the berry. The seeds and fruits were generally well preserved, sometimes very much so. The more abundant taxa were sedges, fat hen (*Chenopodium album* L.), hazel nut, toad rush, juniper (seeds), knotgrass, self-heal (*Prunella vulgaris* L.), blackberry and chickweed. Ecologically, the assemblage was dominated by taxa from woodland, cultivated land, and grassland, though no group was especially abundant. Foodplants, other than those mentioned above, included strawberry (*Fragaria* cf. *vesca* L.: a single achene), rose, and apple (*Malus sylvestris* Miller, at last one fragment of endocarp or 'core'). The small flot contained quite large numbers of insect remains, often in a good state of preservation (E 1.5-3.5, mode 2.0 weak; F 2.0-3.0, mode 2.5 weak). There were no aquatics, although *Notaris ?acridulus* (Linnaeus), represented by a single head, is typically found near water. There were fairly strong indications of foul matter; the assemblage was broadly like those from the other samples considered here. A larger subsample (3-5 kg) would provide an interpretatively useful group of insect remains, though integration with the botanical evidence would be essential.
4453/ 4950 [spit 6]	4951	This subsample yielded a large residue of about 750 cm^3 (though there remained quite a large component of undisaggregated sediment). The bulk of the residue was rather decayed granular woody debris including wood and bark (both up to 50 mm in maximum dimension) and some chips (to 15mm). There wer also some twig fragments. The wood showed quite a range of decay, the smaller chips perhaps mostly better preserved than the larger (non-worked) fragments. Seeds and fruits were mostly moderately well preserved and there were a few moss shoots in a reasonable or good state of preservation. The largest groups of taxa were weeds of cultivated land and waste places, with some probable foodplants and remains from woodland habitats, though only chickweed (*Stellaria media* (L.) Vill.) from the first group, and hazel nut (*Corylus avellana* L.) from the second were present in more than 'trace' amounts. Other potential food remains were barley (*Hordeum*), represented by charred grains, and rose (*Rosa*) and blackberry (*Rubus fruticosus* agg.), both present as seeds. The remains of juniper (*Juniperus communis* L.) seeds might also be related to food consumption—or at least flavouring—though the presence of needles and stem fragments of this plant perhaps suggest some other use, or simply the collection of juniper incidentally with other brushwood. Some remains of plants perhaps most likely to be from a swamp or fen might reflect part of the local flora if they were not brought with cut herbaceous vegetation. Another small group, probably from short turf, might also be of local origin. Charcoal was moderately abundant (in fragments up to 10 mm) but no other 'cultural' material was noted. The small flot contained significant numbers of insect remains, and many mites. Preservation was quite good (E 2.0-3.0, mode 2.5 weak; F 1.5-3.0, mode 2.0 weak). Most beetle species were apparently represented by parts of only single individuals, but the overall impression was of typical North West European occupation-site fauna. There was a human flea, *Pulex irritans* (Linnaeus), but no clear component from a building ('house fauna'). There were hints of rather foul decomposing matter. Only one aquatic was observed (an *Ochthebius*).

		A larger subsample, of 3-5 kg, should provide an interpretatively useful group. Integration with botanical evidence would be important in ascertaining the nature and origin of this deposit.

Part V: The mammal, bird and fish bones from excavations at Kaupang, Norway, 2003

Cluny J. Johnstone

Introduction

This report presents an analysis of mammal, fish and bird bone from excavations carried out in Kaupang, Norway during the summer of 2003. The excavation was directed by Dagfinn Skre of the University of Oslo and supervised on site by Irene Baug. The University of York was commissioned to undertake the analysis of the environmental remains by the Kaupang Excavation Project.

The 2003 season of excavation at Kaupang took place within the area believed to have been the harbour for this coastal settlement during the Viking Age. This was a relatively small-scale excavation and the material recovered has yet to be dated and phased. Also, information on the context types was unavailable at the time this report was prepared.

A total of nine 'ice-cream tub' sized boxes of bone were analysed. This amounted to 2289 fragments, however of these 2066 were so highly fragmented and/or burnt that they could not be identified beyond class level. However the small number of identified fragments showed similarities to the material recovered from the 2002 excavations in the main settlement area of Kaupang.

Sampling and recovery

The bone from Kaupang was recovered by on-site sieving of most excavated sediment to 2mm or 5mm. All the material recovered at the 5mm level was analysed for this report. For the material recovered at the 2mm level, only fragments >4 mm were recorded for the mammal and bird bones, but all fish were recorded. In practice, very few mammal or bird fragments in the 2-4 mm category were present; therefore almost all the recovered assemblage was recorded.

Methods

The assemblage was recorded following the York protocol, which is described by Harland *et al*. (2003). It entails the detailed recording of diagnostic elements, 17 for mammals and c. 20 for fish (depending on species) and eight for birds. These elements were identified to the finest possible taxonomic group. Detailed records typically include element, side, count, measurements, weight, epiphyseal fusion, tooth wear, modifications (including burning and butchery), fragmentation, texture and estimates of fish size as appropriate. 'Non-diagnostic' elements were only identified beyond class for specific reasons, such as butchered specimens or bones from species not represented by diagnostic elements.

The assemblage has been quantified by number of identified specimens using all recorded bones. MNI were not calculated because of the small sample size. Tooth wear has been recorded using the methods of Grant (1982) for pigs and cattle and Payne (1987) for caprines. Measurements were taken following von den Driesch (1976) with additional measurements following Harland *et al*. (2003) and are presented as an archive, as there were too few for analysis.

Preservation

A large proportion of the Kaupang assemblage was burnt (Table 5.1) and much of that was calcined (i.e. it had reached a temperature high enough to turn it white). Overall 55% of the bone fragments from this assemblage were burnt and most were calcined. By class, 56% of the mammal bone was burnt but only 7% of the fish bone was burnt. As there were only 2 bird bones (both of which were unburnt) this issue cannot be discussed for this class. The large proportion of burnt fragments is indicative of an aggressive burial environment, such as acidic soil conditions, that preferentially destroys unburnt bone. This was also noted in the assessment of the bone assemblage from the 2002 excavations on the Kaupang main settlement site (Barrett *et al*. 2003; see Part II above). In that instance the proportion of burnt material was even greater (74% of mammal fragments), suggesting that the burial environment on the harbour site was marginally less aggressive than on the main settlement site, perhaps as a result of waterlogging or marine influence.

The overall preservation of the unburnt fragments was poor, although there were a few very well preserved bones from a small number of contexts and also from a few grid squares within the largest context (AL4453). The preservation of these few contexts is highly suggestive of a waterlogged, anaerobic burial environment. In addition there were a number of bones that were flaky in texture, many were split along weaknesses in the bone structure and teeth were reduced to flakes of enamel. However, the internal bone structure exposed in this manner was remarkably intact, indicating recent degradation of the bones, suggestive of having been waterlogged in the past but been subjected to drying out more recently.

The degree of fragmentation of the bones was remarkable, with most of the unidentified fragments being between 5 and 10 mm in size (approximate values as these fragments were not routinely measured). The mean size of the identified fragments (those for which the maximum linear dimension was recorded) was 51.3mm. Considering that the main domestic mammals dominate the assemblage, this is quite a small fragment size. However it is almost twice as large as the mean fragment size from the settlement site assemblage (Barrett *et al*. 2003), which was only 27.3 mm. This suggests, together with the good preservation of some bones, that the overall preservation of this assemblage was better than that from the settlement site.

As discussed by Barrett *et al.* (2003) the poor preservation conditions at Kaupang have reduced the quantity of bones recovered by a considerable degree and has reduced the identifiable component to a very small fraction of the assemblage recovered. Given the excellent recovery procedures employed on site, recovery bias is not considered a contributory factor in the unusual representation of taxa and elements

likely to be found in this assemblage. Factors that are most likely to have caused these unusual patterns include, poor preservation of bone tissue, a high degree of fragmentation and preferential preservation of burnt material. This is in turn likely to lead to a preponderance of small robust elements being preserved at the expense of larger and more fragile ones.

The assemblage

A total of 2289 fragments of bone were examined from the 2003 season of excavation at the Kaupang harbour site. The assemblage was dominated by mammal bone fragments (2226 fragments), followed by fish (61) and bird (2), as detailed in Table 5.2. The assemblage was too small for any spatial or temporal analysis of class representation to take place. The total weight of bone was c. 2829 g of which the mammal bone weighed c. 2806 g, the fish 21.5 g and the birds 0.9 g.

Under reasonable preservation conditions an assemblage totalling over 2000 fragments would be expected to contain over 50% identifiable fragments. An illustration of the poor preservation conditions at Kaupang can be gained from the fact that just over 90% of the fragments from this assemblage were unidentifiable beyond the class level and a further 4.5 % were not identifiable to family or species. This leaves only 5.5% identifiable fragments from this assemblage and this includes specimens that were not diagnostic elements according to the protocol but were recorded for other reasons. Of the identified fragments 95 were mammal and 34 fish.

The mammal bone

The species present in this assemblage are given in Table 5.2 and show a very restricted range. Species present (in order of prevalence) include horse (44 fragments), cattle (27), pig (18) and caprine (5, although only sheep were definitively identified where the distinction could be made). There were no wild mammalian taxa represented in this assemblage and also no smaller mammals. This dominance of the domestic species is similar to that found in the 2002 assemblage (Barrett *et al*. 2003), with the exception that there was a far larger proportion of horse bones in this assemblage. However, because of the peculiarities of the preservation conditions, most of these horse bones were in fact tooth fragments belonging to 12 upper molars and 5 upper incisors of (probably) a single individual, and as such are inflating the species representation.

On sites with poor preservation but not the degree of fragmentation or burning seen in this assemblage, it would be expected that teeth would be the most dominant element. However in the Kaupang soil conditions, even the teeth have become so fragmented that they are little more than enamel fragments and as such could only be identified as large or medium mammal teeth, most probably cattle and sheep/goat respectively but could not be identified for sure. These enamel fragments form the majority of the fragments recorded as large and medium mammal. As expected from the element representations seen in the 2002 assemblage, the smaller and more robust elements dominate the element breakdowns of all three domestic species (Table 5.3).

For the cattle, carpals, tarsals and phalanges were most prevalent followed by distal humerus, proximal radius and acetabular fragments. Three maxillary molars were present but no lower teeth were conclusively identified as cattle, although the 31 isolated tooth fragments recorded as large mammal are most likely to be cattle as discussed above. Because of the lack of complete teeth and no mandibles the data available for age at death analysis was restricted to the very few surviving long bone epiphyses. Of the 27 cattle bones recorded 19 yielded ageing information of which 6 were recorded as having unfused epiphyses or as juvenile bones and the remaining 13 as fused or adult. Although these data cannot be translated into meaningful age at death patterning for the site, it does indicate that both young and adult animals were present on the site. Although it would not be appropriate to infer too much from this data it may indicate that some young animals were present on the site, which is slightly different to the 2002 assemblage where there was very little evidence for cattle less than 2 years of age on the site.

The few butchery marks discernible on the cattle bones, comprised chiefly chops through the pelvis and radius consistent with jointing of a carcass. Details are given in Appendix 5.2. Several ribs and vertebrae recorded as large mammal fragments also displayed chop marks suggestive of carcass division. From these few fragments it is impossible to detect any patterning to the butchery marks and the it is only possible to comment that it seems likely that the bones with chop marks represent food refuse rather than primary butchery or craft waste.

In contrast to the 2002 assemblage, a few bones were measurable and the results useable, as these particular fragments did not appear to have been subjected to any degree of heating and were well preserved. The individual measurements are given in Appendix 5.1. The size of these animals appears to be towards the lower end of the ranges from other Viking Age sites such as York (O'Connor 1989), and Birka (Wigh 2001).

A single incidence of pathology was noted on a cattle first phalanx. This displayed very slight splaying of the proximal articular surface, meriting a score of 1 on the scale employed by Bartosiewicz *et al*. (1997) in their extensive survey of such pathologies. Their interpretation of proximal articular splaying on the phalanges is as an indicator of the use of draught animals. Whilst this interpretation cannot be inferred from a single very slight case, the presence of this pathological condition is worth noting.

After cattle, the next most abundant species were the pigs. This is in contrast to the 2002 assemblage where pig bones were twice as numerous as the remains of other species. Barrett *et al*. (2003; see Part II above) suggested that this may either have been the result of the preservation conditions or was a pattern of Viking Age town settlements as seen at Birka, Riba and Hedeby. In this smaller assemblage the pigs have been relegated to second place in the abundance table, which suggests that the first theory may have been correct. The preservation conditions on this part of the site appear to have been slightly better than on the 2002 excavation, so perhaps the species representations in this assemblage are marginally nearer to that of the original death assemblage, this is however, impossible to say for definite.

The element representation amongst the pig fragments was very similar to that of the cattle with tarsals, carpals, metapodials and teeth providing most of the fragments. Other elements present include the more robust parts of the femur, humerus, tibia, scapula and fibula, together with an axis and a third phalanx. Because of the distinctive morphology of pig teeth in comparison to the other main domestic species, there were more teeth positively identified for pigs than for the cattle and caprines. Although metric analysis was not possible on such fragmentary material, the observed sizes of the bones and teeth were consistent with those of domestic pigs rather than wild boar. In particular the size of the male canine tooth was certainly not large enough to have come from a wild boar. The presence of this single canine tooth is important in relation to the 2002 assemblage, where canines were noteworthy by their absence (Barrett *et al*. 2003). Anomalous preservation or curation during the Viking Age were put forward as possible explanations for their absence, and the first could explain the presence of a canine in this assemblage where the preservation is slightly better.

Age at death data for the pigs was even more restricted than for the cattle as the number of identified fragments was smaller. Of the 18 pig bones, six yielded age information, all of which were unfused or juvenile bones. Also two of the recorded teeth were unworn molar crowns without roots. For some of the other bones age could not be determined due to burning. This pattern of younger bones is normal for pigs, as they were usually slaughtered for meat at a relatively young age and not kept for secondary products into adulthood. The age at death pattern seen in this assemblage is similar to that observed for the 2002 assemblage but cannot be conclusive when based on so few fragments.

A single incidence of butchery was noted on the pig remains. This was a femur with a chop just below the femoral head, and is probably indicative of the removal of the leg at the hip during jointing of the carcass. As a result of the proportion of young and burnt fragments, no measurements could be taken on the pig bones. Also no pathological conditions were noted.

Of the five caprine specimens recorded, a single second phalanx could be identified as sheep, the other four only as sheep/goat. As with the large mammal tooth fragments, it is suspected that most of the medium mammal 1 tooth fragments were from caprine teeth, in the absence of any wild ungulate species of this size. The four elements recorded as sheep/goat were an incisor, maxillary molar, radius and ulna. The low representation of caprines (most likely sheep) is consistent with that observed for the 2002 assemblage and some other Viking Age sites (e.g York (O'Connor 1989)). No ageing information or measurements were obtained from these few specimens and no evidence of butchery or pathological conditions observed.

As indicated at the beginning of this section, although the horse fragments appear to be the most numerous, it is most likely that all except one form the maxillary incisors and cheekteeth of a single individual. It seems likely that if preservation conditions had been better, these teeth would have been recovered still *in situ* in a skull. The I3 present exhibited a protuberance of the distal portion of the occlusal surface known as the '7 year hook' because of its appearance during the 7th year of the animal's life. The length and stage of development of the cheekteeth also indicate that this was a

young adult individual. The other bone, an astragalus was complete and measurable (see Appendix 5.1)

The fish bone

A total of 61 fish bone fragments were recovered from the 2003 excavations at Kaupang. Of these 30 fragments could be identified below class level. The range of dominant species represented is very similar to that from the 2002 assemblage but the trace taxa are fewer and slightly different. The main species present were saithe (9 fragments), cod (6) and hake (5). A further seven fragments were from the Gadid family, but could not be positively attributed to species. Single vertebrae of ling and herring were also identified. In addition a single vertebra was identified as cf. halibut, but was slightly too damaged for positive identification. This identification of a flatfish is consistent with those found in the 2000 assemblage, although none were identified from the 2002 assemblage. The salmonids were absent from this assemblage, resulting in a completely marine derived assemblage.

As with the 2002 assemblage the fish bone was in general better preserved than the mammal bone, with a far better ratio of identified to unidentified fragments at just under 50%. However, the abundance of the remains of larger species (e.g. Gadids) over smaller ones (e.g. herring) in the identified material perhaps suggests that the bones were not as well preserved as those from the 2002 excavations (recovery was equally good on both excavations). The extremely small size of the assemblage means that it can only be used to confirm some of the information gathered from the 2002 assemblage. It does confirm the exploitation of marine resources by the inhabitants of Kaupang. The paucity of herring in this assemblage in comparison to that from 2002 was striking, however, this might be a result of the differences in context types and preservation. Most of the herring bones in 2002 were recovered from pits with good preservation, whereas the 2003 material did not derive from pits and was less well preserved.

The Gadid family is well represented in this assemblage as in that from 2002 but the proportions of taxa are slightly different. Saithe and cod were most numerous followed by hake and then ling, however the numbers are so small that this is probably not a true reflection of species proportions. This dominance of Gadid species is typical of Viking Age coastal settlement sites from all around the North Atlantic and North Sea. The few more complete elements suggest that the trend of large specimens observed in the 2002 assemblage is also true here with one specimen in the over 1000 mm class. The presence of hake was noted in the 2002 assemblage as being rarer on Viking Age sites than cod, ling and saithe, because of the fact that it is usually only caught in deep water. However, it was noted that it could be caught closer in shore during the summer months. With such few fragments it cannot be convincing evidence of seasonal occupation of the site, but is something that could be borne in mind. The element representation was dominated by vertebrae (both abdominal and caudal present), with only a single cleithrum and quadrate from the head bones represented. This could be indicative of initial processing off-site, but is more likely to be a factor of preservation.

Discussion

The poor preservation and small size of the bone assemblage from the 2003 season of excavation at Kaupang have meant that very little could be stated about the economy of the site. The overwhelming factor in the analysis of this assemblage has been the taphonomic issues. Because of the acidic nature of the soil at Kaupang the preservation of bone is not good. In addition, the high degree of fragmentation and burning has lead to a particularly biased recovered assemblage, which most likely bears little resemblance to the original deposited assemblage. The scale of burning may suggest that bone refuse was routinely burnt on site, either as a means of rubbish disposal or as fuel, if wood was in short supply. The absence of defined midden areas on site (with one exception) may indicate that rubbish was disposed of by burning. The degree of fragmentation may be indicative of trampling, but the poor in-ground preservation conditions may also have contributed to such a high degree of fragmentation.

The information that could be gleaned was only meaningful in comparison with that from the 2002 assemblage. The mammal species proportions were slightly different with a higher proportion of cattle remains. However, this may well be attributable to the slightly better preservation of some of this assemblage, rather than differences between various areas of the settlement. Other differences between the two assemblages were the presence of young pig and cattle individuals and a pig canine tooth in the 2003, both noted as absent in that from 2002. In the case of the former, this may be a factor of the relatively better preservation of this assemblage allowing the survival of juvenile bones. These may indicate that animals were reared in close proximity to or within the settlement at Kaupang.

The fish assemblage was similar to that from the 2002 excavations, with the addition of one new species (c.f. halibut). The dominance of marine fish and gadids in particular is a feature seen from many Viking Age coastal settlements. The presence of hake bones, may indicate summer occupation of the site, but does not preclude year-round occupation.

Therefore, this small quantity of bone has provided a little new information about the economy of the settlement at Kaupang and, in general, confirms what has been found from previous analyses.

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Table 5.1. Numbers and percentages of burnt bone fragments.

	Unburnt		Charred	Calcined	Total burnt		Total
	No.	%	No.	No.	No.	%	No.
Mammal	971	43.6	149	1106	1255	56.4	2226
Fish	57	93.4	1	3	4	6.6	61
Bird	2	100			0	0	2
Total	**1030**	**45.0**	**150**	**1109**	**1259**	**55.0**	**2289**

Table 5.2. Numbers of fragments and weights by species.

Species	**Latin Name**	**Number of fragments**	**Weight (g)**
Horse	*Equus caballus*	44	364.03
Cattle	*Bos taurus*	27	681.15
Pig	*Sus domesticus*	18	56.17
?Pig	cf. *Sus domesticus*	1	0.44
Sheep/Goat	*Ovis aries* or *Capra hircus*	4	43.67
Sheep	*Ovis aries*	1	1.53
Medium mammal 1		22	18.09
Large mammal		43	233.41
Unidentified mammal		2066	1407.67
Subtotal		*2226*	*2806.16*
Bird		2	0.91
Saithe	*Pollachius virens*	9	5.91
Cod	*Gadus morhua*	6	4.51
Hake	*Merluccius merluccius*	5	4.09
Ling	*Molva molva*	1	0.69
Cod/saithe/pollack		4	0.85
Cod family	Gadidae	3	1.47
Herring	*Clupea harengus*	1	0.01
?Halibut	cf. *Hippoglossus hippoglossus*	1	0.02
Unidentified fish		31	3.92
Subtotal		*61*	*21.47*
Total		**2289**	**2828.54**

Table 5.3. Element representations for the main domestic mammals.

Element	**Cattle**	**Pig**	**Sheep/goat**
Mandible (including loose mandibular teeth)		4	
Maxillary molars	3		1
Incisor		1	1
Canine		1	
Axis		1	
Scapula		1	
Humerus	2		
Radius	4		1
Ulna			1
Carpal	1	1	
Metacarpal	2	1	
Pelvis	2		
Femur	1	2	
Tibia		1	
Fibula		1	
Astragalus	2	1	
Calcaneum	1	2	
Metapodial		1	
Phalanx 1	5		
Phalanx 2	3		1
Phalanx 3	1	1	
Total	**27**	**19**	**5**

Appendix 5.1. Measurement archive for the bone assemblage from Kaupang, Norway 2003.

Species	Element	Bone ID	Bd	Dl	GLl	GLm
Cattle	Astragalus	KP03-7711	35.58	29.55	57.86	53.30
			BFd	**GB**	**GH**	**LmT**
Horse	Astragalus	KP03-7713	49.91	62.91	57.56	57.33
			C	**C+D**	**DS**	**GL**
Cattle	Calcaneum	KP03-7687	22.76	38.35	34.60	110.16
			HT	**HTC**		
Cattle	Humerus	KP03-7617	34.41	27.48		
			GL	**SD**	**Bp**	**Bd**
Cattle	Phalanx 1	KP03-7710	54.13	21.24	26.04	25.88
Cattle	Phalanx 1	KP03-7733	50.90	22.47	25.05	27.70
Cattle	Phalanx 1	KP03-7778	51.93	19.35	25.55	21.39
			P2	**P3**	**P4**	**P5**
Pig	Mandible (M1)	KP03-7630	12.28	13.24		
Pig	Mandible (M2)	KP03-7632			12.44	12.34

Appendix 5.2. Butchery archive for the bone assemblage from Kaupang, Norway 2003.

Species	Element	Bone ID	Butchery type	Notes
Cattle	Pelvis	KP03-7764	chop	across pubis from ventral side
Cattle	Radius	KP03-7700	chop	longitudinally split
Cattle	Radius	KP03-7700	chop	chop through edge of proximal articulation
Cattle	Radius	KP03-7772	chop	diagonally across proximal joint and ulna
Cattle	Pelvis	KP03-7649	chop	saggittal plane
Large mammal	Vertebra	KP03-7662	chop	saggittal plane
Large mammal	Rib	KP03-7626	chop	transverse plane
Large mammal	Ulna	KP03-7686	chops	light chops diagonally across shaft
Large mammal	Sacrum	KP03-7731	chop	transverse plane
Medium mammal 1	Rib	KP03-7663	knife marks	2 fine transverse knife marks close together
Medium mammal 1	Scapula	KP03-7742	chop	through thick edge of scapula, transverse plane
Pig	Femur	KP03-7688	chop	transverse chop just below caput
Unidentified Mammal	Vertebra	KP03-7498	chop	through centroid
Unidentified Mammal	Rib	KP03-7620	chop	transverse plane
Unidentified Mammal	Rib	KP03-7623	chop	transverse plane
Unidentified Mammal	Scapula	KP03-7624	chop	can't orientate frag so chop direction unclear