

## Rapid recording of archaeological insect remains—a reconsideration

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### Summary

Methods for recording insect assemblages which have been employed in the Environmental Archaeology Unit (EAU) are outlined, with particular reference to those used for work on material from the 16-22 Coppergate, York, site. Rapid recording techniques have been adopted in order to examine sufficient samples to provide adequate representation of complex sites within available funding and realistic time-scales. The effectiveness and reliability of these methods are discussed; it is stressed that they require considerable experience and are not appropriate to the novice. Various semi-philosophical points concerning extensive and intensive studies of bioarchaeological remains are made in the hope of stimulating debate in this sensitive area.

### Introduction

In 1986 the EAU entomological team contributed to *Circaea* on the subject of the evolution of the rapid recording techniques adopted in the unit in response to the need to cope very quickly with large numbers of assemblages of insect fossils (Kenward *et al.* 1986). The first large site recorded using methods of this kind has now been published: the General Accident site, 24-30 Tanner Row, York (Hall and Kenward 1990), from which about 300 insect assemblages were recorded. For this site it was concluded that the recording method which was applied to most of the samples ('scan' recording, outlined below) was very satisfactory. The methods were developed, however, during work on material from 16-22 Coppergate, York. This huge corpus (well over 600 insect groups have been recorded by one method or another) has now been prepared for publication in *The Archaeology of York* (Kenward and Hall, forthcoming).

Coppergate was a typical 'waterlogged' urban site, with deep, very complicated stratigraphy covering a long time-span (Roman to medieval). Most phases presented a variety of feature types requiring insect analyses, and—for the Anglo-Scandinavian ('Viking') period—there were four tenements which needed to be considered separately. In order to obtain useful representation of this plethora of features, it was necessary to collect and process large numbers of samples; it was clearly essential to examine several pit fills per tenement per phase and to see a series of

representatives of the front and back of each tenement, for example. The numerous samples examined for insects just about provide an adequate cover of most of the excavated part of the site, although inevitably there were too few from certain phase/feature type combinations and unnecessary duplications from others.

During the final stages of practical work on the material from Coppergate, the majority of those insect assemblages which had initially been recorded using various rapid (but at the time not formalised) techniques were re-examined in order to search for some remains, such as fleas, lice, scale insects and beetle larvae, which had been poorly or erratically recorded on first inspection, and also to check and improve upon the recording of assemblages of which only a 'rough scan' (see below) had been made earlier. At about the same time a classification of recording methods was erected for use in the technical report (Hall and Kenward, forthcoming). This classification and definition of methods was obviously also desirable to ensure greater standardisation in future.

The EAU is increasingly being required to carry out 'evaluation' work on samples from preliminary excavations of sites threatened by development, and this necessitates even faster recording if it is to be completed sufficiently quickly to meet the very short contractual deadlines typically imposed, quite apart from the limited funding available. There is also a need to employ extremely rapid assessment methods in the early stages of post-excavation

work. It is thus timely to present a more systematic account of the range of recording methods employed in the EAU and to evaluate them, in terms of (a) accuracy of species lists and of the interpretations resulting from them, and of (b) relevance to work carried out within the stringent financial and time limits of the early 1990s.

This discussion is primarily intended to place the methods on record, together with my observations on their strengths and weaknesses. It cannot be an objective report on their precision, since project funds do not allow for large-scale methodological investigations. I hope to be able to consider some aspects of the accuracy of quantification and of calculated statistics elsewhere. I suspect that this discussion will have increasing relevance to the recording of archaeological plant and animal remains in general as more bioarchaeologists are obliged to some extent to forgo precision in favour of speed in their work. Publishing these methods may also prompt other workers to challenge their validity, but if such procedures—or something like them—are *not* considered appropriate and a return to immensely slow ones is advocated, then either some new source of funding must be found or the greater part of the material exposed during archaeological excavations will have to be left completely unexamined.

In judging any method of recording bioarchaeological remains it is necessary to consider the nature of the material and of the 'sample' being studied. Chance phenomena play a major part throughout the formation of short-lived insect communities and hence of the resulting death assemblages, in their recovery through archaeological excavation, and in their examination in the laboratory. In living communities of insects, there is great spatial variation on a small scale. Whether or not insects living at any depositional locus are preserved depends on luck, a large proportion of them probably emigrating and being lost to the record. Sample location is largely a matter of chance, as is the subsequent removal of the particular subsample of material analysed in the laboratory. The 'sample' is a single lump of deposit which is assumed to be representative of a layer, not a series of collections such as that upon which a field ecologist would expect to base quantitative observations. Remains, many identifiable, capable of passing through a 300  $\mu\text{m}$  mesh, are likely to be lost during sieving. Extraction by paraffin flotation from the sieved material is probably at least

95% efficient in MNI (minimum number of individuals) terms in most cases. A small proportion of the fossils are inevitably overlooked during sorting unless and inordinate amount of time is devoted to the task. It may be argued, therefore, that to place great significance on minor variations in recovered assemblages is foolhardy, and that strongly characteristic or consistently reproducible assemblages are required before archaeological information may be deduced. Against such a background, is it important to record the exact identity of every single fragment (as was averred by the author early in his career) when *many* more assemblages can be recorded by using cruder methods? Ten assemblages recorded tolerably well will give a better picture of the consistency or variability of past conditions than one recorded to what is probably a spurious level of accuracy, surely?

### The recording methods

The range of quick recording methods currently employed for insect remains in the EAU evolved slowly and erratically from very rapid recording (here termed *rough scanning*) of 'test' subsamples (Table 5). This was designed to provide only enough information for a decision to be made as to whether to process a sample for what was then the conventional recording method (now termed *detailed recording*, see below). In rough scanning, recording was restricted to noting the approximate abundance of the taxa seen during a quick inspection of the flot (*sensu* Kenward *et al.* 1980), and writing down a general impression of the nature of the material and its potential for interpretation. Rough scanning was very crude, rather subjective, but it was never intended to be any more thorough and was wholly successful in achieving its intended purpose.

It has been shown by re-examination of a large number of assemblages that, as anticipated, many remains were missed during rough scanning, and that quantification was occasionally very poor. Indeed, as few as half the taxa present were noted during the rough scanning of some of the samples. This method has proved generally reliable in capturing the ecological 'flavour' of assemblages. Although not used any more *as such*, it has survived in a modified and more explicitly subjective form as *assessment recording* (see below); *rapid scanning* (fully or

semi-quantitative) may often be more appropriate, however, providing as it does a more complete record and permitting the calculation of assemblage statistics, albeit only approximate.

The advantages and limitations of the crude early 'scanning' lead to the adoption of *scan recording*, employed as the standard method at present, and *semi-quantitative scan recording*, still found useful when time is short or material is of low priority.

The recording methods employed at some stage of the Coppergate project are outlined below (a description of assessment recording is added, since it is frequently employed in current work). These techniques apply to those insect groups upon which the 'main statistics' used for interpreting sample assemblages are based, namely adults of beetles and the majority of bugs (for the time being, those which in about 1987 it was feasible to quantify); other groups are mostly recorded semi-quantitatively. The methods are discussed in approximately descending order of precision, and are summarised in Table 5. It is not intended to imply that all the material from any one site should be recorded by any one of these methods; they need to be applied according to the nature and importance of particular phases or feature types, for example. Thus all the first priority samples might be scan recorded, but the remainder assessment recorded to ensure that no significant assemblages were overlooked; subsequently a few of the samples might be re-examined by detailed recording of sub-samples fully processed (in the way described by Kenward *et al.* 1980) to address particular problems.

It must be re-emphasised that these methods, other than the traditional 'detailed' recording (the spirit of which was absorbed while working in the Coope-Osborne school in the Department of Geology, University of Birmingham) and assessment recording, arose in an informal way during work on the Coppergate site. All were formalised and named at a late stage of the project. Material recorded earlier formed a strongly noded continuum and most of the lists could be fitted fairly confidently into the classification, doubtful cases being assigned to the lower level of recording. For those methods where remains were recorded in alcohol (IMS), squared or lined paper was stuck to the underside of the Petri dish in

which the flot was examined to facilitate systematic inspection.

*Detailed recording:* Normally applied only to 'fully processed' material, extracted using the methods outlined by Kenward *et al.* (1980, 8–14), and not by the abbreviated paraffin flotation method discussed by Kenward *et al.* (1986). An attempt is made to identify as far as possible every sclerite (of adult Coleoptera and Hemiptera, at least) retained by a sieve of 300 µm mesh aperture. This method can be very time consuming, taking one to several weeks for a single assemblage in some cases (Kenward *et al.* 1986, table 9); to set the perspective, a single sclerite (a head, for example), or set of genitalia, might sometimes take half a working day or more to identify, involving the preparation or dissection of reference material, obtaining literature, or a museum visit. Chasing the identity of more obscure material (beetle larvae, lice, aliens of any group) may involve weeks of work, gaining access to reference material, liaising with specialists and becoming familiar with the group concerned. Enjoyable and educational as such work is, it is now quite obviously generally impracticable to use detailed recording in projects which are funded by developers or by English Heritage; I feel it is, in any case, inappropriate to the aims of much of our work.

*(Fully quantitative) scan recording:* Normally applied to flots extracted using 'test' processing, with one paraffining stage (Kenward *et al.* 1986). An attempt is made to record every individual but identifications are carried only as far as is compatible with rapid working; rare or difficult specimens are not identified *unless they appear to be of importance in archaeological interpretation* (the contradiction seemingly implied by this last statement is recognised; the point is discussed below). Scan recording can be carried out either on successive aliquots of the flot in alcohol in a Petri dish, when all sclerites must be recorded, or on assemblages which have been picked out on to damp filter paper and arranged roughly into taxonomic groups (typically by a technician), and which can then be quantified using a minimum number (MNI) estimation, when there is, of course, no need to record sclerites. The first method is considerably faster overall, but remains are more likely to be overlooked and the whole task requires a high skill level; the second method requires a greater total time, but fewer fossils will be missed and the recording stage (demanding

Name	Method	Comment
Detailed	Attempt to identify every sclerite as far as possible and to calculate precise MNI	Very time consuming, applicable only to some research work; essential in training
Scan	Record MNI by noting sclerites in IMS or by quick count on damp filter paper	Standard method in EAU; can be almost as accurate as detailed recording. Fast. Statistics very reliable
Semi-quantitative scan	As scan, but using a five-point scale of abundance	Useful for many applications. Fast. Statistics can be used with some confidence
Rapid-scan	Recording in IMS, making best approximation feasible without recording individual sclerites	Very fast. Sometimes appropriate. Many remains may be missed. Statistics may be used, but with care
Semi-quantitative rapid-scan	As rapid scan, but using a five-point scale of abundance	As rapid scan, but even more care needed in use of statistics
Rough-scan	Very rapid inspection of flot, recording subjective impression and approximate abundance of observed species	Results variable, useful for choosing samples for further work, but now redundant. Statistics to be treated with great care
Non-quantitative scan	No attempt to make a full species list. Primarily for incorporation of notable records in databases when only (subjective) general nature of assemblage otherwise recorded	Sometimes useful for noting important taxa in other unrecorded assemblages but superseded by assessment recording for other purposes
Assessment	Flot examined in IMS, major or significant taxa and abundance of ecological groups noted subjectively	Very useful for ensuring that there is a record of material from evaluations and assessments. Limited interpretation is possible. Danger of excessive subjectivity.

Table 5. Summary of recording methods used for insect remains during the 16–22 Coppergate project. Assessment recording—adopted subsequently—is included for completeness. The ‘pilot’ samples of Kenward et al. (1986, table 9) are subsumed in ‘rough scans’ (now replaced by assessment recording), while the term ‘test’, used in that paper, is now reserved for a processing rather than recording method.

specialist skills) is much faster (the specialist must scan the flot quickly, however, as a check and to record fossils which cannot reasonably be picked out). Quantification is normally absolute, but numbers of very abundant taxa (with, say, 30 or more individuals) may occasionally be estimated approximately to save time.

*Semi-quantitative scan recording:* The methodology is essentially as for scan recording, except that quantification is on a five-point scale of abundance: 1, 2 or 3 individuals, or ‘several’ (estimated 4–9) or ‘many’ (estimated 10 or more). The last two are converted to 6 and 15 respectively for the calculation of statistics (see below for a discussion of this apparently dubious process). In practice, a mixture of scanning and

semi-quantitative scanning has often been applied, with absolute counts or approximate estimates being made where practicable, and ‘several’ or ‘many’ estimates being used where quantification is more difficult or it is necessary to finish recording a sample quickly for some reason. There is obviously little point in using semi-quantitative recording when assemblages have been picked out on to filter paper, since (at least fairly accurate) MNI estimation is then easy. For certain kinds of material, especially large urban decomposer-dominated groups, semi-quantitative scanning, with approximation of very large numbers, is perhaps often the most appropriate response to the stringencies of poorly funded projects.

*Rapid-scan recording:* Applied where lack of time or low priority of the material means that

more accurate recording cannot be justified, rapid-scan recording is an improved direct successor to the original rough scanning. The flot is examined in aliquots in a Petri dish and the remains quantified approximately, to the best standard practicable without listing individual sclerites. Sorting is not as meticulous as for the previous three methods and it is accepted that some fossils will be overlooked, that the oversights may not be wholly random, and that the estimation of numbers will sometimes be wrong. The resulting lists may be used, albeit cautiously, for the calculation of approximate statistics (see below). There are reservations, discussed below, concerning this and the next method.

*Semi-quantitative rapid-scan recording:* In practice this rather than rapid scanning has normally been used. The methods are the same, but quantification is on the five-point scale. Assemblages can be recorded extremely quickly, but with an obvious penalty in accuracy of the lists and (probably to a lesser extent) of the statistics calculated from them.

*Rough-scan recording:* Discussed above; now redundant. Rough-scan lists for samples from 16–22 Coppergate have been re-recorded to a higher level where practicable, the remainder being demoted to non-quantitative status.

*Non-quantitative scanning:* Sometimes employed as a way of noting the general nature of an assemblage in a very crude way, but originally introduced to allow interesting species records to be incorporated into the site database (prepared using a system, described by Kenward, unpublished software and user guide), usually in the case of odd samples (duplicates, perhaps, or 'spot finds') from sites otherwise mainly recorded by one of the methods previously listed. It is useful for the second purpose but generally not used otherwise since the advent of assessment recording.

*Assessment recording:* This represents a development of rough scanning, designed for application to assessments prior to the main phase of work, either to material collected from exploratory 'evaluation' excavations (of developer-funded sites) or to selected samples from a large corpus in store in the post-excavation assessment stage of an excavated site, following 'MAP2' (English Heritage 1991). Such material must be dealt with extremely quickly. It must be emphasised that the method demands that the recorder is

sufficiently familiar with the material to identify most remains at a glance and to recognise ecological groupings subjectively. The flot, or part of it, is examined in aliquots in alcohol. A note is made of common or ecologically significant species, and of the communities present, quantification being restricted to expressions such as 'dominant' or 'a few'. Most flots can be recorded in a few minutes in this way, and the results have been found satisfactory for the preparation of evaluation reports (which include a crude interpretation), for the selection of deposits requiring further investigation, and for determining the scale of work likely to be required in the main post-excavation stage. There can be no objection to using this method for strictly exploratory work, but the dangers of employing records made in this way for report preparation are recognised. Unfortunately, I fail to see an alternative which is feasible given the time-scale and funding of evaluations of sites threatened by development. Few of the sites so recorded will receive any further funding for archaeological excavation, so it is better to have a subjective record of this kind than none at all.

## Discussion

Most of the methods listed above might be considered a poor or very poor substitute for 'doing the job properly' (i.e. detailed recording). In fact, while I believe that for some research applications there is certainly a place for 'detailed' recording, and while adoption of that method is essential during the training of every researcher, there are good reasons for applying the less time-consuming techniques in the great majority of cases.

For most purposes, especially where acquisition of *archaeological* information from large and complex sites is paramount, I have argued that recording numerous assemblages from many and diverse archaeological deposits in a small amount of time is the primary requirement. For this, quantitative scan recording is in my view ideally suited. Where work is essentially routine it is often hard to justify more than semi-quantitative scan recording, which can provide a reasonably reliable basis for the calculation of statistics. I do feel that it is desirable to detail- or, perhaps more realistically, very carefully scan record, a range of material from a major site early in any full study, if only in order to become

acquainted with its fauna; the assemblages from most occupation sites, particularly urban ones, tend to be qualitatively rather uniform, so this process of 'learning' the fauna is entirely practicable. I should perhaps confess that the lists from my current scan recording are probably at least as accurate as those I made by detailed recording in the 1970s, as a result of gradually increasing familiarity with the range of taxa encountered on occupation sites in general.

One problem which arises from scan recording in IMS is related to 'difficult' groups which would normally be divided into (probably) monospecific 'types' for quantification purposes. These include, for example, *Cryptophagus* species and Aleocharinae. It is relatively easy to divide these up into types on filter paper, where they can be seen *en masse*, but hard to retain an image of all the types when they are seen in isolation while being recorded in spirit. In practice, a brief description has generally been noted, and the likelihood of some inaccuracy is accepted as inevitable.

The matter of employing data from assemblages recorded other than fully quantitatively requires some consideration. Semi-quantitative recording of organisms is, of course, not new. Phytosociologists have used such scales for recording plant cover for decades (e.g. Shimwell 1971, 109–20).

At first sight, the calculation of an index of diversity or of relative proportions of ecological groups from assemblages recorded on a five-point scale may appear practically shaky, if not theoretically absurd. The numbers 6 and 15 as translations of 'several' and 'many' were, however, chosen on the basis of an inspection of the distribution of numbers of individuals in the ranges 4–9 and 10 or more, and considerable experience has proved that statistics based on such methods are generally—or at least acceptably—close to those from fully quantitative recording. Comparison of statistics from fully and semi-quantitative records, based on conversion of numbers, will it is hoped be presented in a future paper. In addition, a selection of assemblages has been recorded by both fully and semi-quantitative scanning, in some cases by more than one operator. The statistics calculated from these records have almost always proved similar, and certainly there would not be any difference in the interpretation placed on the material. The exceptions were mainly where several taxa

were extremely abundant but had been recorded only as 'many', converted to 15. The solution to this problem is, of course, crude estimation of numbers, perhaps as 50, 100, or more, as appropriate. There is not room to argue this out in detail, but some simple arithmetic applied to species lists such as those from Tanner Row (Hall and Kenward 1990) or Coppergate (Kenward and Hall, forthcoming), or even to some made-up numbers, will show that the semi-quantitative method provides a remarkably robust basis for the estimation of statistics, at least for typical urban assemblages.

A disadvantage of scan recording lies in the many remains which may not be fully identified in order to save time. It has been stated above that species represented by few remains (usually single sclerites or fragments thereof) which would be difficult to identify are *not* identified unless it is believed that they are of importance in archaeological interpretation. This is not as illogical a statement as might at first appear—in almost all cases the remains are identifiable on first inspection sufficiently closely to allow their potential importance to be judged. If it is suspected that, for example, they have climatic significance, they will be identified, or at least set aside for future consideration. What is lost, of course, is a large amount of information about the distribution of hard-to-identify rarer species in space and time—but devoting resources to such problems cannot be justified unless funded from an appropriate source, such as the Natural Environment Research Council.

Over a thousand insect assemblages from York have now been scan recorded by the writer and co-workers, and the method is believed to be much the most appropriate for most applications. Even for 'rural' material it has proved useful. The writer now generally scan records with the material in alcohol, noting sclerites as they are seen in the Petri dish. Any remains needing further inspection are picked out onto damp filter paper. Remains likely to require future access (for further identification, for photography, or as vouchers) are put into a small vial within the jar containing the flot. If time is especially short, sclerites of each taxon are recorded until 'several' or 'many' individuals are represented, and that taxon is ignored thereafter unless it becomes clear that an estimate of a much larger number is needed. Re-recording has shown that some remains are missed by recording flots in IMS in this way,

but not with a frequency which has a important effect on the statistics or interpretation.

Where there is time, justification, and funding, the remains are picked out on to filter paper by an assistant and sorted into groups of similar remains. This is the method currently preferred. The writer checks the flot quickly, recording 'other orders' (e.g. Diptera puparia, beetle larvae, water-flea ephippia and mites) during the process, then the material on the filter paper is quantified. There is not much point in using semi-quantitative recording when fossils have been picked out in this way, as counts can be made quickly unless numbers are huge, when an approximation can be used, rather in the way the size of bird flocks is estimated (by counting individuals in a representative area and multiplying up). In practice, common and easily identified taxa are often picked out into a vial of alcohol and recorded by the assistant. Another variation is for the author to sort the remains from the flot, recording them and passing them directly to a vial, only difficult remains being placed on filter paper. The precise method will be determined in any case by personal taste, experience, the nature and importance of the material and other circumstances.

Although the writer has re-examined a very large number of rough- or rapid-scanned samples, it was with the aim of improving recording, not of making a systematic study of the efficiency of the methods. However, some useful observations may be made.

In contrast to the records made by scanning, some early rapid scanning lists have proved, on re-recording at a higher level (scanning), to have produced inaccurate statistics. These have generally changed from interpretatively bland to significant, where species associated with foul matter were under-recorded, for example. In perhaps two or three cases (in well over a hundred) an assemblage which appeared to have interpretative significance on the basis of the rapid-scan record was shown to be otherwise when re-assessed, principally because the 'several' and 'many' records for some species proved to be exaggerations. Such cases appear to have been aberrations, and were doubtless the result of fatigue and boredom towards the end of an over-long recording session, or were caused by interruption during recording. It should be remembered that, in the early stages of 'scanning' the Coppergate material, there was

a gradual and largely undocumented transition from what is here called 'rough' to what is now defined as 'rapid' scanning, and in some cases there may have been confusion between at the re-assessment stage as to which had been employed; lists *explicitly* recorded as rapid scans were very reliable. In the great majority of cases the statistics from rapid scanning—properly carried out—represent the fauna of the subsample passably well, in other words well enough to provide a reliable archaeological interpretation. The emphasis here is on the phrase *properly carried out*, and where this is not practicable, 'assessment' recording is preferable since it is explicitly subjective. I feel intuitively uncomfortable about employing rapid scanning, but rationally must accept that its use is sometimes justified by circumstances.

A few minor points are worthy of mention. It has been found that recording can be affected by such small methodological details as whether the forceps or writing instrument are generally held in the free hand during scan recording in alcohol. When the pencil is held, a more thorough written record tends to be made; when the forceps are mostly in the hand fewer remains seem to be missed as the dish is more thoroughly explored. It has been found difficult to record beetles and bugs and 'other orders' at the same time, and finding rarities in a dish tends to lead to blindness to common taxa. Similarly, insects tend to be overlooked in flots rich in plant remains. When a long series of samples is rapid-scan recorded, there is a marked tendency to under-record common remains, because they have been seen so often. This is particularly true of remains such as mites, fly puparia and other groups not employed in calculating statistics, but common beetle species have occasionally been overlooked too. This problem, parallels to which are well known to animal behaviourists and industrial psychologists, applies to assessment recording also; an antidote would be to spend a few minutes on some other task between samples, dealing with the associated paperwork or doing a little light administration. It is, in any case, essential to re-examine each dishful at least quickly; I also find it useful to examine a small part of the flot under a higher power. Finally, I have found it necessary to complete the whole of the rapid-scan recording of any subsample in one unbroken effort—so much needs to be held in the mind that any interruption may lead to considerable inaccuracy if recording is not re-started.

## Conclusions

Detailed recording will in some applications be desirable, will remain intellectually more satisfying, and is an essential stage in the development of palaeo-entomological skills. This last statement may seem to carry the arrogant implication that, once trained, the 'expert' can be given a free hand to record subjectively. This is not intended, and one reason for writing this paper has been to present the dilemma faced by those who work within the constraints of contract archaeology. In the face of present-day funding and time-scales more rapid methods of recording are essential if sufficient information is to be retrieved within time and cost limits. Scan recording, fully- or semi-quantitative, has proved very useful in this respect, and can be adopted with few reservations; it is certainly essentially objective. Where time is very short, during post-excavation assessments or for samples from preliminary excavations, assessment recording has been found satisfactory; the degree to which it is subjective parallels that manifested by almost any 'expert', a doctor during diagnosis, or a jobbing builder assessing carrying loads, for example. The clear separation of these two techniques (scan recording and assessment recording) has the advantage of making it plain that the one is reasonably objective, the other essentially subjective. Rapid-scan recording can be resorted to for certain applications, but the resulting species lists must be used with considerable caution since the level of accuracy is not entirely certain.

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to adopt in order to work economically. The reader is left to decide whether I have followed the right course...

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