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**Plant and invertebrate remains from post-Conquest deposits
at 16-22 Coppergate, York (site code 1976-81.7):
assessment of bioarchaeological potential and draft project design**

by

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Summary

The large body of extant sediment samples and bulk-sieved material from post-Conquest deposits at 16-22 Coppergate, York, has been assessed for its potential in reconstructing site environment and activity over a period of nearly four centuries (late C11th-C15th). The sequence consists essentially of over 3 m (at the rear of the site) of deposits representing many phases of construction and occupation, alternating with levelling/dumping, with numerous pits.

A representative subset of the sediment samples has been assessed by means of 'test' subsamples examined for plant and invertebrate macrofossils, with 'squashes' used for assessment of microfossils. In addition, material from a large number of subsamples processed prior to the assessment has been quickly reviewed. Sievings from bulk samples and a corpus of 'spot' samples have also been considered.

Preservation of biological remains by anoxic waterlogging was generally very good, considering the long period of storage after excavation. Almost all of the samples have at least some value for bioarchaeological interpretation, and many are considered to be of very high priority for detailed examination. Many archaeological issues can be addressed and this material is regarded as a corpus of the highest priority for analysis, especially in relation to material from the Anglo-Scandinavian phases at Coppergate and 6-8 Pavement (Lloyds Bank site, both already published) and from the adjacent excavation at 22 Piccadilly.

An extensive programme of further work is recommended, and it is proposed that this should be carried out as soon as possible (to avoid further degradation of the samples), and that it should be linked with analysis of material from 22 Piccadilly.

Keywords: 16-22 COPPERGATE; YORK; ASSESSMENT; NORMAN CONQUEST; MEDIEVAL; POST-MEDIEVAL; OCCUPATION DEPOSITS; SEDIMENTS; PLANT REMAINS; PARASITIC WORMS; INSECT REMAINS; MOLLUSCS; TIME TRENDS

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Introduction

Excavations at 16-22 Coppergate, in the heart of the City of York (Figs. 1, 2), were undertaken by York Archaeological Trust, under the direction of Dr R. A. Hall, between 1976 and 1981. Although a very large part of the sequence revealed evidence for intensive occupation in the mid 9th to mid 11th centuries (Anglo-Scandinavian period) and provided a huge corpus of bioarchaeological information (summarised by Kenward and Hall 1995), approximately one-third of the samples collected for biological analysis were from post-Conquest levels, mainly in the period between the late 11th and 15th centuries. A brief summary of the development of the site at three phases is shown in Figs. 3-5. Essentially, the sequence consists of over 3 m (at the rear of the site) of deposits representing many phases of construction and occupation, alternating with levelling/dumping, with numerous pits. The transition from deposits assigned to Period 5 (latest 'Anglo-Scandinavian' occupation) and those from Period 6 is arbitrary, with no clear effect of the Norman Conquest despite the historical evidence for a major impact on the city in general (an example of the latter which may be relevant to this site is the construction of the Castle and King's Fishpool, Fig. 7). The investigation of this transition period is one of many significant questions which can be addressed using the biological evidence. This assessment explores the value of the post-Conquest samples for further analysis of plant and invertebrate remains.

Work on plant and invertebrate remains from the post-Conquest part of the sequence at 16-22 Coppergate was undertaken sporadically throughout the period 1976-95. Initially, subsamples from GBAs (*sensu* Dobney *et al.* 1992) were examined during excavation to provide feedback for the formulation of sampling policy. Subsequently, some further subsamples from GBAs from these later deposits were processed as part of the large-scale analysis of Anglo-Scandinavian levels, the provisional dating then proving to have been incorrect. A further group was processed by Gary Haley (then a student at the University of Bradford), and others, in the late 1980s, in order to provide material for a project dealing with insects from pit fills, but

the work was not completed. For the current assessment project, samples have been selected on a rational basis to provide a representative view of the material as a whole.

The bulk-sieved (BS) samples were processed during excavation and preliminary records of their content of plant and other remains made prior to 1995. A large number of 'spot' samples was recovered from the post-Conquest levels at this site; these, too, were superficially examined incidentally to work on the Anglo-Scandinavian deposits.

As noted above, the Anglo-Scandinavian material from this site has been investigated in considerable detail (Kenward and Hall 1995) and the present assessment is inevitably set against that work. The existence of this existing body of data and the work carried out in the past on the post-Conquest samples indicated the need for a critical consideration of the approach to assessment. The broad character of the material was already established, as was its superficial homogeneity. It has thus been felt that the very precise estimation of resource requirements, sample by sample, as adopted for the assessment of material from excavations at 22 Piccadilly (ABC Cinema, Carrott *et al.* 1995b; for location, see Fig. 2), would be inappropriate. Instead, the approach has been broader, coupling a very rapid review of a large number of processed samples to establish similarities to and differences from the Anglo-Scandinavian assemblages, with time estimates for further work based on experience with those assemblages.

The importance of the post-Conquest material from 16-22 Coppergate is seen as lying primarily in (a) enabling detailed reconstruction to be made of living conditions and activity, including the site's resource base, in the medieval period; and (b) observing the timing and nature of changes (if any) consequent upon the Norman Conquest, and further changes through the medieval period.

Selected groups of bones from post-Conquest deposits at Coppergate were recorded by Dr T. P. O'Connor but the information remains in archival form, on paper with no electronic version, so that the data cannot be retrieved and interrogated easily. For this reason, it is

regrettably not possible to integrate an assessment of the bone record with that for other biological remains.

Mollusc remains from this site have received some attention in the past: oyster shells were counted (as left and right valves) during excavation and the record subsequently transferred to a database. Molluscs from samples were recorded by EAU staff and the data transferred to computer files; a version of the data file produced by Dr O'Connor in 1988 has been salvaged from the University of York central Computing Service's archives and used as a guide for assessment.

Identifications of timbers of all kinds (as well as of wooden artefacts) from post-Conquest deposits at Coppergate were made during and after the life of the excavation. All the records are stored on a database; some identifications require checking.

A database of information relating to the samples from this site and their history of treatment within the EAU has been maintained throughout, and YAT have provided a full context listing for post-Conquest material, together with a 'Level III' account for this period and a simple matrix at the level of context groups within tenements (the layout of these in the preceding, Anglo-Scandinavian, period is shown in Fig. 6).

Methods

GBA samples

The GBA material examined included those subsamples which had already been processed for various reasons in the period before 1995 and a second group selected in order to increase representativeness across phases, tenements and feature types.

For plant and insect remains, a selection of the earlier-processed flots has been examined for insects, and all of them scanned briefly for plant remains (it was not possible to locate most of the residues in the YAT store and they were, in any case, dried and thus of limited value; some of the flots had dried and 'caked'—see below—and these, too, were ignored). Some of the insect groups had been sorted, and a few listed; the former were

examined in their storage vials and the latter assessed from the written record. The 51 subsamples specifically selected for processing for this assessment have been examined for plant and insect remains, the former through both flots and residues (obtained using methods described by Kenward *et al.*, 1980; 1986), and the latter through flots alone. In addition, 'squashes' (*sensu* Dainton 1992) have been made to check for the presence (and, crudely, abundance) of parasite eggs, diatoms and phytoliths.

The material has been examined in order to determine the broad character, quantity, and quality of preservation of fossils. Although more detailed records exist for a few samples examined during the earlier stages of work on this site (before 1995), no attempt has been made to record species composition in the present assessment—it has been considered sufficient to place the assemblages into classes established during work on the Anglo-Scandinavian material (cf. Kenward and Hall 1995). Thus, for example, plant assemblages might be described as 'faecal food remains' and insect groups as 'house fauna', a classification of more immediate value in determining the archaeological significance of the material than a record of species.

For the 51 samples examined afresh for this assessment (Table 6), each subsample assemblage of plants and invertebrates has been assigned a priority for further analysis, using the following scale: 1—high priority, should be examined; 2—middle priority, should ideally be examined but not likely to be crucial; 3—low priority, usually containing few and undiagnostic or uninformative remains, not likely to provide much archaeological information but of use in building up an overall picture of the site; and 0—barren of identifiable macrofossils. Normally in assessment of insect remains the amount of sediment which should be processed in order to recover what is considered to be an interpretable assemblage is indicated. In the present case, almost all of the samples were considered to require re-examination through subsamples of 3 kg (rarely, more).

For the samples processed prior to this project (Table 7), a similar approach has been taken for the plants, but for the invertebrates the priority scores include an indication of the need for processing larger subsamples (using the prefix 'L') since rather more of the groups were already of sufficient size for useful analysis (albeit requiring re-processing because of the long period of storage of the flots and their sometimes uncertain history).

During excavation, all of the GBA samples from Coppergate were collected in polyethylene bags, most of which had become holed through the vicissitudes of storage over a 15-20-year period, and many of which had become brittle. The opportunity was taken during assessment to place all of the available samples in 10 l plastic tubs as recommended by Dobney *et al.* (1992) and Association for Environmental Archaeology (1995).

BS samples

As noted above, BS samples were processed during excavation and were recorded cursorily (primarily for plant remains, but also for other major components) along with the pre-Conquest material (about 15% of the samples initially thought to be from Period 6 deposits have proved subsequently to be pre-Conquest).

SPOT samples

At least a preliminary record of many of the post-Conquest objects or deposits sampled as 'spot' finds during excavation was made during work on the Anglo-Scandinavian material. They were a diverse assortment of biological and geological 'finds', mostly of very limited interpretative significance, and are not considered further as a body in this assessment.

Results and potential for further analysis

Table 8 shows the material collected and the analyses undertaken so far. Table 6 presents the results of assessment of plant and invertebrate remains in 51 GBA samples selected for the current exercise and Table 7

parallel results for some of the samples processed prior to this.

Condition of material processed prior to 1995

GBA samples

Approximately 11% of the 328 GBAs collected were not available for assessment in 1995. It is likely that most of these have been lost during the protracted period of storage or are very small samples stored separately but not located (and probably too small to be of much use for further analysis). Subsamples from 184 GBA samples (56%) have been processed at some stage for examination of macrofossil remains. However, observations made both during this assessment and during work on the Anglo-Scandinavian material give rise to considerable doubts as to the adequate survival of fossils extracted many years ago:

(i) Most of the flot jars had dried out during prolonged storage, causing the flot particles to adhere, sometimes into hard 'biscuit-like' blocks which were extremely difficult to break up, even using hot water and detergent. Flots in this condition are best abandoned, unless there is no fresh sediment.

(ii) Flots from Anglo-Scandinavian samples first recorded in the late 1970s and early 1980s as containing appreciable numbers of lice contained no such remains when checked during the early 1990s. It is believed that the delicate lice had broken up as a result of drying and rewetting.

(iii) A number of flots processed in the early years of work on this site contained invertebrate fossils in a reddened state when re-examined, although they had been considered to be in a typical state of preservation for this site when first seen. It is suspected that this change is a result of oxidation, perhaps within an acid environment created by breakdown products of the alcohol.

(iv) It is uncertain whether some flots containing few remains had been sorted in the early 1980s (by temporary staff) and the tube containing the remains lost, or whether they, in fact, contained few remains.

(v) A large proportion of the residues for subsamples from GBAs processed prior to this assessment could not be traced and would, in any case, be of somewhat limited value since it was necessary to dry the material prior to storage.

In view of all this, it is considered advisable to treat with considerable circumspection all material processed but not recorded fully before the current phase of assessment, unless no sediment remains in a good enough condition for it to be reasonably certain that the contained fossils are representative of the biota originally present. The previously processed material will be of value principally as an indication of within-sample variation and perhaps as a source of records of additional taxa. It will also allow some record to be made of the general nature of the biota of some contexts for which detailed analysis cannot be carried out.

BS and Spot samples

Neither BS nor Spot samples were inspected for this assessment, given the amount of work carried out on them previously and the fact that little further processing is likely to be needed. Residues and washovers from BS samples were stored dry after processing. Most should be in a stable condition, though a few residues rich in organic material which were not inspected during the earlier phase of work may not have been completely dry and a little decay can be expected. It is quite likely that the quality of preservation of some of the smaller spot samples, where these consisted of uncharred organic material, may have declined over the period since they were sampled. Many of the spot samples were labelled 'eggshell' or 'snails' by the excavators; the rest include diverse material of plant and animal (both vertebrate and invertebrate) origin and some samples whose interest at the time of excavation was essentially sedimentological (e.g. 'ash', '?vivianite').

Condition of unprocessed samples in store

Inspection of the samples showed that many had dehydrated and had been disaggregated by mechanical damage through repeated

movement between stores over a 20-year period. Some, indeed, had been reduced to fine powder (it is unlikely that any of the samples were dry when collected). Those samples which had remained moist generally showed some oxidation effects on exposed surfaces, and in some cases it was clear that there had been biodegradation, producing 'frass'. In the latter cases, there can be no question that vegetative plant remains, at least, had suffered considerable decay and consequently the affected parts of samples should ideally be rejected. All this having been said, the good condition of many of the samples should be emphasised, and the body of samples as a whole remains suitable for analysis. The authors are concerned, however, that the continued survival of the samples in a usable state cannot be guaranteed despite their having been placed into plastic tubs—a substantial proportion of them appear sufficiently oxidised for biological remains to be threatened.

Nature of the plant and invertebrate assemblages

GBA samples

Most of the subsamples examined contain appreciable numbers of plant and invertebrate macrofossils and preservation (primarily by anoxic waterlogging is generally rather good—indeed, only one of the 51 subsamples processed specifically for assessment was barren and preservation was of sufficient quality to permit identification in all other cases. Subjectively, the concentration of fossils was somewhat lower, and their preservation marginally less good, than for the Anglo-Scandinavian material, but this will not have a significant effect on analysis, beyond requiring processing most of the samples by means of larger subsamples, 3 kg probably being the most practicable compromise between recovery of large enough numbers of remains (particularly insects) and the difficulty of processing bulky, richly organic, material. Loss-on-ignition data were collected for a selection of samples during the work on Anglo-Scandinavian material and found to be a useful adjunct to interpretation of the biota, as well as in simply objectifying the inevitably unreliable subjective assessments of organic content made prior to processing for macrofossils. It is

suggested that similar data should be collected for the post-Conquest material and the two data-sets combined and analysed in relation to preservation and the broad nature of the biota: in particular, an attempt should be made to determine whether some estimate can be made of the balance between organic input and decay during and following deposition. Does a high organic content confer protection from decay?

In many respects the biota were reminiscent of those from the Anglo-Scandinavian deposits at this site, but subjectively there were some systematic differences. Thus there was a lack of assemblages with pronounced woodland, heathland or dyeplant components. However, many samples were rich in plant remains interpreted as indicating faecal material, often accompanied by rather characteristic insect assemblages and large numbers of parasite eggs. Amongst the regularly recorded plant foods in these deposits, fig was prominent as a taxon not recorded in more than a very few cases from the Anglo-Scandinavian levels. Particularly notable were the many samples with an appreciable component of grassland plant remains and/or cornfield weeds and insects suggesting stable manure; these often also contained many phytoliths. Amongst the insects, a subjective impression was gained that the assemblages were less varied than those from Anglo-Scandinavian deposits, this being in part accounted for by the rarity of 'house fauna'-dominated assemblages and lack of groups suggesting the natural infilling of pits. Grain pests (effectively absent before the Conquest) were present in a large proportion of the samples and occasionally abundant, and the spider beetle *Tipnus unicolor* appeared to be very much more abundant than in the earlier material. These changes reflect a pattern which, on the basis of rather limited evidence, seems to be emerging as a general one for medieval British occupation sites. At Coppergate, it may be that the site saw a reduction in the range of crafts and industries carried out (reducing the range of waste materials for disposal), so that the proportion of pit fills consisting of human or perhaps horse faeces rose.

BS samples

Many of the BS samples have provided useful numbers of the larger plant remains, such as fruitstones, nutshell, and charred cereals; they also provide the only evidence for some remains present in very low concentrations (such as some arable weeds not noted from earlier deposits at this site). Again, some exotics such as grape, fig, black mulberry, and walnut, rare or absent from the pre-Conquest deposits, were recorded from several contexts, some occasionally in appreciable quantities.

Suitability of material for further analysis

Assessment, and work carried out prior to this exercise, have shown that the state of preservation and quantity of remains in the post-Conquest GBA and BS samples is generally similar to those recorded for the Anglo-Scandinavian material. This means that most of the samples still represent an excellent resource for further study. However, a proportion of the GBA samples have dried out in storage, or apparently suffered biological degradation, and are likely to be of more limited value. Although recent work on a corpus of samples from The Lanes, Carlisle, showed that dehydration does not *inevitably* destroy insect fossils (Carrott *et al.* 1995a), there were rare cases for the present material where it was believed that degradation had taken place in storage. The material has been placed in plastic tubs, but it is still considered that all the samples are at risk of biological degradation in the short term. The tubs offer greater protection from mechanical damage and evaporation than polythene bags, but the very act of moving sediment into the tubs (usually necessary as the bags were bulkier than could be accommodated whole by the tubs) involved considerable disturbance and consequent aeration, doubtless initiating or accelerating decay, at least temporarily.

Potential for context and feature interpretation

The extant samples have enormous potential for interpretation at the context and feature level. It will be possible to:

(i) identify the broad nature of layers (e.g. as containing human faeces, food preparation waste, stable manure, waste from craft processes, or deposited by random accumulation) and thus their implications concerning many aspects of human activity and living conditions;

(ii) make more detailed identification of materials contributing to layers (e.g. the precise food resources utilised);

(iii) determine the condition of pit fills and their implications for waste disposal regimes and consequences for health and hygiene;

(iv) reconstruct ecological conditions and human activities on yard surfaces.

Potential for spatial differentiation within the site

The four tenements (Fig. 6) are not evenly represented by the samples (the volume of sediment excavated differed considerably), either in absolute numbers or in the distribution of samples between deposit types (Tables 1-5). There is, however, significant potential for comparison between tenements, allowing some insights into differences in usage and perhaps even in attitudes to hygiene, providing care is taken to ensure adequate representation at the processing and recording stages.

Potential for detecting changes through time

The bulk of the samples are, on the basis of provisional pottery spot dates, of 11th-15th century dates, with sufficiently large numbers of samples within each approximate century to permit analysis of time trends. It is reasonable to assume that dating can be refined, taking account of stratigraphy, other artefacts, and likely residuality, and that those contexts which currently have no pottery date can be dated with respect to underlying and overlying layers.

Analysis of time trends should not be restricted to the post-Conquest material. Such analysis has only been carried out in a very

simple way for the Anglo-Scandinavian samples, and it is essential that all the material from the site is considered in future work. In particular, it will be important to examine change (or the lack of it) across the period of the Norman Conquest, and the timing of the appearance of grain pests (probably reflecting major changes in storage and trading patterns of cereals) and exotic foods. The main limitation on analysis of long-term time trends will be the rarity of post-Conquest floor and internal occupation deposits (only 11 have been identified amongst the samples, despite the evidence for the existence of a considerable number of buildings, e.g. in Figs. 3-5).

Significance at site and city level

Analysis of the biota will provide a broad view of site utilisation and environment through more than four centuries. The data from Coppergate will provide an important standard for comparison with other sites in York, both contemporaneous and of other periods. Here, too, the post-Conquest corpus has the limitation of poor representation of internal occupation surfaces.

Wider significance

This large body of samples is undoubtedly of great significance as a source of information about English medieval life and as comparanda for material from throughout north-west Europe.

Potential for further research

Like the Anglo-Scandinavian material, which has already been extensively used for such purposes (e.g. Hall and Kenward, forthcoming; Kenward and Allison 1994; Kenward and Hall 1995; Hall *et al.* 1984; Kenward and Large in press; Kenward 1996; Tomlinson 1985), the post-Conquest samples are likely to provide an important resource for future synthesis and analytical research.

Recommendations

It is essential that this most significant body of material is investigated soon, before further decay occurs to the stored samples.

It is also strongly recommended that the material from 16-22 Coppergate is investigated in relation to that from 22 Piccadilly (ABC Cinema) site (assessed by Carrott et al. 1995b), because the two sites are effectively contiguous (Fig. 2) and may represent complementary activity areas.

GBA samples: sediments

Careful descriptions of the sediments should be made before processing of those samples selected for extraction of macrofossils, and brief descriptions be made for those samples not selected. The selected samples should be submitted to loss-on-ignition analysis to determine their organic content (Tasks S1-2, G1).

GBA samples: microfossils

*It is recommended that all well-stratified samples are surveyed for microfossils using the 'squash' technique (Task G4). This should be directed towards producing a basic semi-quantitative record of diatoms, phytoliths, and the eggs of parasitic worms. For the last of these, it will be necessary to make multiple squashes of a selection of samples (perhaps 50) in order to make more precise estimates of concentrations and preservation and to provide sufficient measurements for specific identification of trichurids (Task G5p). Following this, a selection of samples should be subjected to concentration techniques in order to search for a wider range of taxa, for example species associated with rodents, and the horse parasite *Oxyurus equi*.*

It is anticipated that only a small number of detailed analyses of diatoms will be necessary in order to determine depositional conditions (aquatic or terrestrial) of a few sediments containing abundant valves (Task G5d). A small number of analyses could also be made in order to attempt to determine whether there is evidence for the importation of river water

for use on the site; these results should be correlated with those from analyses of plant and invertebrate macrofossils which may have a similar origin.

Further squashes should be used to improve the record of the distribution and abundance of the main types of phytoliths within particular samples, especially in order to improve the detection of very humified stable manure or turf, and perhaps in order to cast additional light on vegetation developed on the site.

Permanent mounts of selected microfossil subsamples should be made as vouchers for the archive.

GBA samples: macrofossils

The biota of sufficient of the samples to provide statistically significant comparison with the Anglo-Scandinavian material and to allow meaningful analysis of time trends from the ninth to the fifteenth centuries at Coppergate should be recorded. Apart from material which can reasonably be rejected on the grounds of uncertain dating or provenance, or a high probability of a large content of residual fossils, or where the remaining sediment has degraded in storage or is of insufficiently large quantity, all of the samples not processed for this assessment should be processed using 1 kg test subsamples and following an initial inspection and routine sediment description. It is estimated that it will be necessary to process approximately 225 subsamples (Tasks G1-2).

Following this, material should be selected for listing on the basis of an initial inspection of the flots and residues (Tasks G3), so as to provide the most useful representation of the range of periods, tenements, feature types, and plant and insect assemblage types for data analysis above context level. It is anticipated that a large proportion of the samples (approximately 225, cf. the ~650 GBAs recorded from Anglo-Scandinavian levels) will need to be recorded (Tasks G3, G5) to provide this level of representation, and that, at most, it will be advisable to reject some pit fills from some tenements as redundant (this assumes that the biota of the pits will prove not to be as

variable as for the Anglo-Scandinavian material).

On the basis of the assessment and experience of the Anglo-Scandinavian material from this site, about 10% of the plant and insect assemblages will be very small and will be recorded in a few minutes. The remaining samples will have a concentration of remains sufficiently high to provide useful assemblages from either the 1 kg test subsamples, or from 2-3 kg additional subsamples. The range of assemblage types appears, on the basis of assessment, to be fairly limited, and the taxa present to be (in the main) ones which are familiar from work on the Anglo-Scandinavian groups. Recording should thus not need to be protracted. An average of one hour per plant subsample assemblage is suggested to be a reasonable time for basic recording. For the insect assemblages, an average of two hours, again for basic recording, is suggested, allowing for identification of selected material from 'difficult' groups such as lice and scale insects where they have interpretative value.

Mites are present in small to large numbers in many of the samples and it is regarded as *highly desirable to record a selection of the assemblages of mites (say 20) in detail* (Task G5m) in order to broaden the range of evidence for ecological conditions in small areas. This will require an external consultant, Dr Jaap Schelvis, University of Groningen, Netherlands, who has previously collaborated successfully with the EAU.

Fly puparia are present in almost all of the samples and sufficiently abundant for analysis in a substantial proportion; they will provide invaluable information about small-scale and ephemeral habitats such as carrion and faeces left on surfaces. The presence and broad nature of the assemblages of puparia should be noted during routine recording of insect remains, but *selected assemblages of puparia (perhaps 30) should be submitted to full analysis, following a survey* (Task G5f). It would be prohibitively expensive to undertake systematic identification of all of the remains, but care should be taken not to overlook any characteristic or unusual groups. This work will require some input from an external consultant; currently, Peter Skidmore, formerly of Doncaster Museum, is retained to

provide expert advice concerning fly puparia. *Molluscs* are so rare in the GBA samples as to require no systematic investigation. *Any assemblages of land or freshwater snails which appear likely to be of interpretative significance should be recorded*; this work requires no more than a very modest allowance (Task M1). Similarly, should concentrations of small marine shells be found, they should be investigated, but the large shells will warrant no further work unless of species not otherwise recorded.

It is suggested that further time (under Task G5) should be allowed for the pursuit of a small number of particularly critical identifications of plant and invertebrate remains from GBAs (including museum visits and consultation with other specialists), which will provide significant archaeological or other information. *An allowance should also be made for processing a small number of samples in order to address specific problems of interpretation which arise during the main part of the analysis* (Tasks F1-4).

When the rest of the project has been completed, *the bulk of material for long-term storage should be reduced as far as reasonable by selecting voucher samples* (Task F5). Vouchers will need to be packaged so as to minimise degradation; the quantity retained will vary according to the nature and content of the material. *Excess sediment from voucher samples and samples rejected at this stage should be bulk-sieved, and the sievings sorted to recover significant components, particularly artefacts* (Task F6).

An important lesson learnt from work on Anglo-Scandinavian samples from Coppergate was that the usefulness of analyses is greatly reduced where only plant or invertebrate remains have been investigated. *It is strongly recommended for the post-Conquest material that any sample regarded as of high priority for analysis of either plant or invertebrate macrofossils or microfossils should be examined for all three categories of evidence in order to maintain comparability and ensure an adequate database for further analysis.*

Additional pre-Conquest material which should be recorded (Tasks AS1-4)

A number of GBA samples which were assigned to Period 6 at the time the text for the report on Anglo-Scandinavian material was being prepared have now been reassigned to Period 5 (late 10th-later 11th century). Some of these are of considerable importance because they evidently fall on the Period 5/6 boundary and thus may be particularly useful in terms of tracing change at the time of the Norman Conquest, and others may be valuable as representatives of rather rare context types. *It will thus be essential to record a selection of these re-phased samples* as part of the post-Conquest project. As stated in the report on the Anglo-Scandinavian material (Kenward and Hall 1995), *certain phase/feature type combinations are under-represented in the material recorded and it is highly desirable to undertake a limited programme of further analysis to rectify this*, where suitable samples are available. It is estimated that there are about 10 samples from re-phased deposits which should be processed, and about 10 samples needed to fill in 'gaps' in the Anglo-Scandinavian database (these estimates are necessarily rather vague at this stage).

It will also be necessary to re-examine some Anglo-Scandinavian material where it is suspected that certain classes of remains were poorly recorded early in the project—some vegetative remains fall in this category, for example, and phytoliths and diatoms were not included amongst the groups whose presence was sought. For re-examination of samples already processed, there should be a time allowance for re-processing where the flots or residues have degraded or been lost, as well as for inspection. (Task AS5)

BS samples

All the post-Conquest BS samples were examined incidentally during the main phase of work on Anglo-Scandinavian samples, though for a proportion of them (probably about one third) only those remains removed during general 'sorting' were recorded; *it is recommended that time is allowed for checking of certain identifications and the re-examination of samples (perhaps about two-*

thirds) where it is suspected that certain components may have been poorly recorded (Task B1). Some time should also be allowed for examination of residues from 'excess' GBA samples submitted to bulk-sieving to reduce the quantity in store (Task B2).

Spot samples

There is a record of the general nature, and sometimes more specific identification, of many of the spot samples, but *it is recommended that all of the extant spot samples should be examined briefly before carrying out further work on a limited, carefully targeted, selection* (Task Sp1). Many of the spot samples, including those numerous ones labelled 'eggshell', are unlikely to be of much value and can probably be disregarded. It is estimated that approximately 30 spot samples will require further analysis for plant remains but that only about 10 will be of value for insect analysis. It is believed that a small number of the spot samples are large enough to provide sediment for 'GBA' analysis and these may allow analysis of plant and invertebrate macrofossils for contexts where there is no extant GBA sample. These have been allowed for in the estimates for work on GBAs.

Wood and timber

Identifications of wood and timber, including wooden artefacts, have already been made, but a small contingency has been included for identifications of samples or objects which have been 'missed' or where the original identification was tentative or requires reconsideration (Task W1).

Bones

A small amount of bone will be recovered through processing of GBA samples and a contingency should be allowed for its analysis and reporting (Task Bo1).

Analysis and reporting (Tasks D1-7)

Times for analysis of data should allow for (a) full treatment of individual 'material' data-sets and integration of all the material data-sets, as well as analysis in relation to the archaeological record, and (b) analysis of changes and trends throughout the Anglo-Scandinavian and post-Conquest periods. *A detailed 'Technical Report' should be prepared* in order to facilitate synthesis for the publication report and to place data on record and reveal the interpretative reasoning applied. This should be made available on request, for example through the EAU Reports series and perhaps also in electronic form. This component of the project should include preparation of well-structured paper archives and accessible databases of all raw data. Where practicable, the Anglo-Scandinavian and post-Conquest databases should be amalgamated.

Other tasks

Time allowances will be necessary for the following: administration and support time, internal project monitoring and maintenance of databases (Tasks A1-3, G5ca); preparation of illustrative material, including drawings, graphs and photographs (Task I1).

For the initial and final stages of project design it will be necessary to incorporate tasks carried out by York Archaeological Trust staff, principally related to provision of archaeological information at a level of detail not appropriate to the 'Level III' report, to refinements of dating and phasing, and to the movement of samples from and to store.

Consumables

Table 10 gives a costing for necessary consumables and other non-staff elements. The figures include an allowance for replacement of computers, assuming a 4-year life and on the basis that approximately 3.5-person years of work are anticipated.

Publication report

It is assumed that estimates for preparation, revision and proof-reading of any ensuing publication report will be required at a later date. Publication in some form by York Archaeological Trust is assumed, but it may be desirable to produce journal articles dealing, for example, with some aspects of time trend analyses.

Archiving

The written and electronic archives should be prepared for museum accession (Task AR1); the material archive should be catalogued, checked for condition, and prepared for museum storage (Task AR2). An allowance should be made for the cost of museum accession if appropriate.

Resources required for recommended programme of further work

Tables 9-11 present a summary of the work recommended and its resource implications. The minimum duration of the project (excluding publication stages) is indicated in Table 12. In addition to these tables, those given by Carrott *et al.* (1995b) should be consulted for resource requirements for recommended further work on the 22 Piccadilly site.

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