Reports from the Environmental Archaeology Unit, York **94/9**, 15pp.

Integrated assessment of biological remains from excavations at Flixborough, S. Humberside

by

Keith Dobney, Allan Hall, Harry Kenward and Annie Milles

Summary

The results of assessments of plant and animals remains from sediment samples and from hand-collection are brought together to offer an indication of their potential to meet a series of academic objectives for the post-excavation project as a whole. Recommendations for further work are presented, together with a draft outline for a work programme.

Authors' address

Environmental Archaeology Unit
University of York
Heslington
YORK YO1 5DD

Telephone: (0904) 433843-51
Fax: (0904) 433850

Prepared for:

Humberside Archaeology Unit
Estates and Property Management Department
Humberside County Council
County Hall
BEVERLEY
N. Humberside HU17 9BA

28 February 1994

Integrated assessment of biological remains from excavations at Flixborough, S. Humberside

Introduction

This report draws together conclusions from three assessments of biological remains from deposits at Flixborough: those for material from sediment samples and hand-collected bone, shell and charcoal (Dobney *et al.* 1993, Hall and Milles 1993; Dobney and Milles 1994). These reports should be referred to for detailed information concerning the work undertaken.

Here, we indicate the likely potential of the different kinds of remains from the various sampling procedures to address academic objectives for the post-excavation work at this site, and bring together recommendations concerning the further work which should be carried out.

Potential of the material

This can perhaps best be presented in tabular form (Table 1), following the scheme for academic objectives provided by the excavator, D. G. Tomlinson.

Discussion and recommendations

(i) Biological remains from GBA/BS samples (excluding bones)

Although superficially most of the contexts examined appeared to be brown sand (with a variable proportion of bone), a surprising number proved to have a content of macrofossils (mostly plant or mollusc), and a few gave remains with interpretative potential. It was notable that sediments of very similar appearance, even from within the same context (e.g. 5983), produced substantially different suites of inclusions once sieved. *This emphasises the need to investigate as much of the material as possible in a very quick way to establish which samples are of value; it is clear that this cannot be done by simple inspection of the sediment. Clearly context type will determine the scope of this work, there being a need to concentrate on pit fills and dumps and to exclude contexts such as post-pit fills. This survey could be carried out by sieving 1 kg GBA subsamples to 300 μm and extracting the less dense fraction by means of a `washover' and by a brief review of the BS residues and washovers.*

On the question of differential preservation, it may be stated simply that the deposits were inhospitable to the more delicate organic remains, although they were sufficiently alkaline to favour mollusc preservation (as well as bone, dealt with elsewhere). The reasons for the high base status of the sediments are discussed by Canti (1992).

Macroscopic remains of plants were limited to charcoal (regularly present in small amounts, occasionally in large, easily identified fragments), a few charred `seeds' (including seed pods of sea plantain and rushes and a few charred cereals and pulses), some characteristic charred herbaceous stem fragments, and a few uncharred seeds, some of them very fresh-looking (and probably modern). Roots, also likely to be modern, were present in most of the layers examined.

Identifiable plant remains likely to offer information concerning environment or economy were sparse, *but at least a proportion, perhaps 30%, of the samples from closely-dated contexts should be recorded fully, aiming to produce a representative selection from each phase and the major feature types. A particular effort should be made to identify the charred herbaceous stem fragments, using modern prepared reference material and scanning electron microscopy as appropriate.* The stratigraphic distribution of these fragments appeared to be strongly positively correlated with deposits rich in white concreted `ash' and *a special effort to examine these ash-rich deposits is thought to be important.* The charcoal offers some potential for exploring the species of tree and kinds of wood (roundwood, timber) used for structures or fuel *and charcoal from the GBA subsamples and BS residues should be recorded systematically*.

Insect remains were extremely sparse and mostly clearly intrusive, some modern. The few `fossils' were too poorly preserved to suggest that any of the deposits at the site are likely to give useful assemblages preserved by anoxic waterlogging. Charred insect material may be present in a small number of samples, but it would not be possible to process sediment on a large scale with the care needed to recover such remains in good condition; it would be too time-consuming. There are some hints that mineralisation occurred to a limited extent in a few of the deposits. *The presence of insects preserved by mineralisation should be monitored during sorting of samples for plant remains, non-marine molluscs and bones*.

Snails were regularly encountered in small numbers in these deposits and were occasionally quite numerous. Preservation was sufficiently good for them to be useful in interpretation. Although there were regular occurrences of the burrowing snail *Cecilioides acicula*, this does not impose a limitation on the potential of the assemblages since other snails are unlikely to have intruded to any extent. The snails offer the only substantial source of information about conditions on and near to the site. Interpretation will be complicated, however, by the fact that at least a proportion were clearly imported: the freshwater species perhaps originating locally but the salt-marsh species evidently from further afield. *The snails should be investigated in a systematic manner from a large proportion of the well-dated contexts*.

Marine molluscs were usually rather sparse in the BS residues and most of the hand-collected assemblages were also too small to warrant detailed investigation. *It is recommended that a programme of work be carried out to record the largest assemblages of marine shell, following consultation with a specialist with an interest in such material from archaeological sites.*

In addition to the groups of organisms considered here, it may be worthwhile to pursue the analysis of diatoms from samples where sediment finer than sand-grade was present in appreciable amounts; diatoms may offer evidence for importation of clay from particular sedimentary environments, such as salt-marsh, and for the location of areas with impeded drainage on the site. *It may be appropriate to carry out assessment of a small number of carefully selected samples for diatoms, although it is emphasised that the number of contexts likely to contain such remains will be very small.*

Although not routinely assessed from the GBA samples examined so far (not reported by Dobney *et al.* 1993), plant silica bodies (`phytoliths') were present in at least some of the white concreted `ash' seen in many samples. These remains may be significant as the most durable component of grasses and some other plants which were imported to the site. *A selective programme of review and analysis should be carried out on phytoliths.*

The biological investigations carried out by the EAU will need to be integrated with any studies of sediments, as well as, of course, with the excavation record. Material recovered from environmental samples may be relevant to studies of, for example, slag, hammer scale and other artefactual material, as well as studies of building materials, industries and crafts and trade and communications, although this potential is rather slight. *It is recommended that a programme of recovery of material derived from metalworking or other processes, if thought worthwhile, is included early in the post-excavation phase.*

(ii) Bone (from all sources)

The quantity of bone, coupled with the quite superb preservation and systematic sampling procedures undertaken on site, makes the material from Flixborough one of the largest and most important Middle Saxon assemblages so far recovered from England. Evidence for the economy of the Middle Saxon period is scant, not only for the North East, but for the country as a whole; the Flixborough assemblage will therefore provide a baseline for the period. *This faunal assemblage is therefore not merely of regional but of international importance.*

Thus a detailed study of the animal bones from Flixborough will provide much specific information regarding the extent to which wild resources were utilised, both locally and further afield; the range of husbandry regimes employed for the various domestic species at the site; techniques of butchery; and specialist industrial activities; as well as information regarding the immediate and surrounding environment. Artefactual and architectural information may point to Flixborough being a monastic or high status settlement. This may well be corroborated by zooarchaeological data in terms of the range of species present, the types of husbandry regimes and whether there is any evidence of trade in livestock and the introduction of improved breeds.

The two categories of bone require separate consideration:

(a) Hand-collected bone

Since the material will form a baseline for this period, *it is recommended that all 'A' bones (*sensu *Payne forthcoming) from all well provenanced contexts are systematically recorded* using the EAU's computerised bone recording system (based on Oracle). The details are presented in an appendix to this report.

(b) Bone from BS samples

Recording of bone from BS residues should be targeted towards material from contexts described by the excavator as `dark soil', dumps, occupation deposits, pit fills, ditch fills and at least some of the contexts designated as post-pit fills and those

currently of unknown type. For these, the bone should be `scanned' and on the basis of this a selection (perhaps 30% of approximately 600) made for detailed recording following sorting.

(iii) Other materials

Other components included material which may have been lime or tufa, and some which was probably concreted ash, as well as small amounts of possible daub and brick/tile. *The `tufa' and ash material require systematic but rapid recording, and in some cases more detailed investigation,* since it is likely to cast light on the formation of at least some of the layers and on aspects of activity. *It may also be useful to examine larger daub samples (not examined during the assessment) for the presence of structural timber or other plant materials.*

Work programme (see Table 2)

Sediments

Analysis of sediments may have considerable significance in gaining an understanding of the means of deposition and subsequent history of certain of the deposits—in particular the sediments which appeared, during routine inspection in the EAU, to consist of ash, and those in the putative `damp hollow' and certain cut features. This requires discussion between EAU, HAU and AML.

Plants and invertebrates

Review and recovery of plant, mollusc and vertebrate remains from bulk samples should be co-ordinated to avoid unnecessary re-examination of samples, but it is most unlikely that all three categories of remains will be assigned high priority for the same samples. This has been taken into account in making the estimates presented below. Although there is a need to make a basic record of the plant material from a substantial selection of the samples, the main purpose of the projected work will be to locate and identify the charred herbaceous material seen during the assessment. Identification will require considerable effort since the remains are not of a kind routinely encountered. Molluscs will provide a modest amount of information, but the work programme reflects a highly selective approach. A small contingency has been included for other invertebrates, since any remains recovered may be of disproportionate significance. It has been suggested that an assessment is made of a small carefully selected group of samples for diatoms. In the unlikely event that significant numbers are present in any deposit, a modest amount of specialist time will be required.

Time has been included for two of the Fellows to familiarise themselves with the special problems of obtaining the maximum amount of information from sites lacking anoxic waterlogging; this should be carried out prior to detailed practical work in order to assist the formulation of the most appropriate lines of investigation. Clearly this process should be carried out in consultation with the sedimentologist (see above). Further time has been allowed for development of skills in identification of

plant silica bodies (`phytoliths') and for a programme of selective investigation of these remains.

Vertebrate remains

In view of the large size of the vertebrate assemblage from Flixborough, the presence of diverse bird and fish remains, and other commitments of the EH Research Fellows, additional staff and expertise should be employed to avoid extending the project excessively, with concomitant dangers. It is therefore recommended that an additional technician and fish bone specialist be employed, the former for the duration of the project and the latter for part of the time, concentrating on the bulk-sieved fish assemblage.

References

Canti, M. (1992). Research into natural and anthropogenic deposits from excavations at Flixborough, Humberside. *Ancient Monuments Laboratory Report* **53/92**.

Dobney, K. and Milles, A. (1994). Material assessment of the animal bone assemblage from Flixborough. *Reports from the Environmental Archaeology Unit, York* **94/6**.

Dobney, K., Hall, A., Kenward, H. and Milles, A. (1993). Material assessment of sediment samples (GBA and BS) from Flixborough. Assessment Report prepared for Humberside Archaeology Unit.

Hall, A. and Milles, A. (1993). Material assessment of hand-collected non-vertebrate remains from Flixborough. Assessment Report prepared for Humberside Archaeology Unit.

Table 1. Potential of biological remains from Flixborough

Objective	**Potential of macrofossils (from GBA/BS samples)**	**Potential of bone (from BS samples and hand-collected material)**	**Other materials**
(i) Site-specific questions (primarily concerned with use of resources and conditions on the site)			
(a) Ground plans and structural details of buildings and other features	small potential for identification of structural materials (timber, ?turves, roofing) from charcoal and charred herbaceous material and for imported sediments (e.g. in daub, turves) from non-marine molluscs; evidence for selection and conversion of timber from charcoal and ?from daub	none	small potential for identification of structural materials and for selection and conversion of timber from hand-collected charcoal; ?evidence for imported materials from analysis of diatoms and phytoliths
(b) Living conditions and diet; domestic and industrial activity, social organisation	small potential from charred cereals and other plant remains for information about diet; some evidence for fuel from charcoal and other charred material; some evidence for diet from marine shell; evidence for on-site environment from land snails	huge potential for evidence of diet, husbandry, hunting and butchery; some evidence for craft activity from worked bone; some evidence for living conditions from small vertebrates	evidence for fuel and diet from hand-collected charcoal and shell: ?evidence for on-site environment (wet areas) from diatoms
(c) Specific functions of/activities in buildings or areas	very limited; further investigation of occupation deposits may differentiate domestic/industrial use from charred plant remains	some evidence from distribution of species and elements, and from fragmentation and preservation	very limited unless dumps containing large marine shell assemblages can be related to individual buildings; identification of tufa and plant remains from ash concretions may be valuable
(d) Dates of foundation and demise of settlement, identification of periods	^{14}C dates could be obtained from charred plant material	^{14}C dates could be obtained from bone; some evidence for	^{14}C dates could be obtained from charcoal

Objective	**Potential of macrofossils (from GBA/BS samples)**	**Potential of bone (from BS samples and hand-collected material)**	**Other materials**
of discontinuity		periods of abandonment may be forthcoming from distribution of species and elements, and from fragmentation and preservation	
(e) Evidence for planning or organisation of the layout and function of the site	nothing additional to (i)(c) above	large potential for evidence for management of refuse disposal	nothing additional to (i)(c) above
(f) Determination of status of settlement	probably none	large potential from range of species	probably none
(ii) The settlement in its local and regional context			
(a) Place in the local manorial, administrative, and ecclesiastical structures	none	large potential for evidence of animal husbandry and exploitation of local resources under the control of this ecclesiastical site	none
(b) Establish stages of development of road, field and settlement patterns to set site in local topographical and environmental context	none	none	none
(c) Ecclesiastical connexions	none		none
(d) Position of settlement in regional economy: locally and regionally traded goods	very limited evidence for plant and animal resources from charred plant remains and shell	large potential for evidence of both economy and trade	very limited evidence for plant and animal resources from charcoal and shell
(e) Political history of Lindsey in M. Saxon period	none	limited evidence as under (i)(f) and (ii)(a)	none
Additional objective: **The site in local and regional environmental context**	very limited evidence from charred plant remains and shell; some evidence from non-marine molluscs	large potential through range of domesticated and (particularly) wild species	very limited evidence from charcoal and shell

Objective	**Potential of macrofossils (from GBA/BS samples)**	**Potential of bone (from BS samples and hand-collected material)**	**Other materials**
(iii) Relevance and importance of site to wider understanding of Anglo-Saxon culture			
(a) Comparison of structure and stratigraphy with sites of similar type and period	very limited (see (i)(a) above)	very limited through evidence for disposal patterns	very limited (see (i)(a) above)
(b) The site in relation to contemporaneous literature and illustration	very limited	some potential	very limited
(c) Building techniques in relation to substratum; life-expectancy of buildings; reconstruction of buildings	none	none	none
(d) Chronology	limited to use of charred remains for ^{14}C dating	limited to use of bone for ^{14}C dating	limited to use of charcoal for ^{14}C dating
(e) Comparison of finds as evidence of activities with those from other sites	very limited evidence of activities from charred plant remains and shell	potential as in (i)(b) and (c)	very limited evidence of activities from charcoal and shell
(f) Cultural, trading and political links with Mercia, Northumbria and other regions of Britain and mainland Europe	none unless non-native taxa identified	none unless non-native taxa identified	none unless non-native taxa identified
(g) Flixborough in the context of UK and continental *wics*, monastic and royal sites	very limited	large potential for comparison of bone assemblage with those from other sites (although there is relatively little non-urban material from other Anglo-Saxon sites of exactly the same period as Flixborough)	very limited

Table 2. Provisional estimates of time and staff resources required for recommended post-excavation programme for environmental investigations at Flixborough. RF = research fellow (1 - plant remains and sample databases; 2 - molluscs and bone databases; 3 - bones; 4 - insects); RA - research assistant (fish bones).

Task	**Component**	**Staff**	**Contact time (weeks)**
(i) Survey of GBA samples (including monitoring for insect remains)	Select material for processing	Technician 1 RF1 RF4	1 0.5 0.5
	Process selected samples	Technician 1	6
	Survey product	Technician 1 RF1 RF4	0.3 0.1 0.1
(ii) Detailed examination of plant remains (and insects) from selected GBA and BS samples	Review BS material (simultaneous with review of molluscs)	Technician 1 RF1	3 0.5
	Make basic record (GBA and BS)	RF1	1.5
	Detailed investigation of specific remains	Technician 1 RF1	1 8
	Contingency for charred/mineralised invertebrates	RF4	1
(iii) Survey of snails from GBA and BS samples	Review material	Technician 1 RF2	(see under (ii) above) 0.5
	Sort selected samples	Technician 1	1
	Record molluscs	RF2	1
(iv) Investigation of marine molluscs from BS samples and hand-collected material	Review material	Technician 1 RF2	(see under (ii) above) 0.5
	Make basic record	RF2	2
	Make detailed record of selected material	RF2	1

Task	Component	Staff	Contact time (weeks)
(v) Diatoms	Assess preservation from selected samples	Technician 1	0.2
	Carry out analyses	Specialist	?
(vi) Recovery of artefactual materials from GBA and BS samples	Routine return of finds (sorting covered under (ii) above)	Technician 1	1
	Recovery of hammer-scale, etc. (amount to be determined by excavator/appropriate specialists)	Technician 1	?1
(vii) Identification of tufa; examination of daub	Tufa: examination by competent specialist	Specialist	?0.4
	Daub: examination by AH (depends on quantity - DGT to advise)	RF1	?0.4
(viii) Bone from BS samples	Review material	Technician 2 RF3	3 1
	Sort residues	Technician 1	6
	Record non-fish bone	Technician 2 RF3 RF2	4 3 1
	Record fish bone	RA RF2	10 1
(ix) Hand-collected bone	Record bone	Technician 2 RF3 RF2	40 24 10
(x) Sediment analyses	to be established	(RF)	?
(xi) Analysis and report writing	Sediments	(RF)	?

Task	**Component**	**Staff**	**Contact time (weeks)**
	Background research (including familiarisation with problems of deposits with poor plant and invertebrate macrofossil preservation)	RF1 RF4	2 2
	Plant remains	RF1	4
	Molluscs	RF2	3
	Insects (contingency)	RF4	1
	Bones	Technician 2 RF3 RF2 RA	30 18 11 7
(xi) GBA/BS sample databases	Routine maintenance	Technician 1 RF1	2 2
(xii) Project administration, meetings, liaison with other post-excavation workers		RF1 RF2 RF3 RF4 RA Technician 1 Technician 2	1 1 1.5 1.5 0.5 0.5 0.5

Table 3. Total staff resources

Staff	Contact time (weeks)	Contingency (weeks)	Contact +contingency	% effort	Leave attributable to project (weeks)	Total costable (weeks)	Minimum duration	Cost (£)
RF1	**20**	**1**	**21**	**50**	**2.6**	**23.6**	**44.6**	
RF2	**32**	**1**	**33**	**50**	**4.3**	**37.3**	**70.3**	
RF3	**47.5**	**2**	**49.5**	**50**	**6.5**	**56.0**	**105.5**	
RF4	**6.1**	**-**	**6.1**	**50**	**0.8**	**6.9**	**13.0**	
RA	**17.5**	**0.5**	**18**	**50**	**2.3**	**20.3**	**38.3**	
Tech. 1	**23**	**1**	**24**	**50**	**3.1**	**27.1**	**51.1**	
Tech. 2	**77.5**	**3**	**80.5**	**100**	**10.5**	**91**	**91**	

Estimated duration of project

RF3 will be the critical path. It is estimated that RF3 can spend 60% effort on project work, but some time must be kept in reserve for other English Heritage projects (particularly assessments and small projects with short deadlines). Current experience and what is known of forthcoming English Heritage commitments suggest that 50% effort on Flixborough would be a realistic estimate. This brings project duration to **105.5 weeks**

Table 4. Estimate of consumables required

Item	**Cost (£)**
350 x 10 l plastic tubs for bulk storage of voucher samples, and washovers and residues	
300 Glass jars for washovers	
2000 polyethylene bags for storage of residues, vouchers, BS components	
600 Tyvek labels	
Marker pens, paper, pencils, etc.	
30 l laboratory alcohol	
120 pairs surgical rubber gloves	
2000 glass specimen tubes	
Computer consumables (disks, paper, ink/ribbons)	
Travel	
Cost of SEM work	
Consumables for sedimentological/diatom work	

Appendix

Detailed recommendations concerning work on vertebrate remains

(i) Hand-collected bone

All bones have been washed and bagged thus no pre-treatment is needed prior to analysis. Some time will be needed to mark unusual specimens that are removed and re-bagged during the first analysis.

Primary detailed recording: Since the material will form a baseline for this period, it is recommended that all 'A' bones (*sensu* Payne forthcoming) from all well provenanced contexts are systematically recorded using the EAU's computerised bone recording system (based on Oracle). The details are as follows:

- Identification of species and elements (including birds, small mammals and fish) will be undertaken using the EAU comparative collection and where necessary the AML collection (London),the FRU collection (Southampton) or the BM(NH) bird collection at Tring.

- The recording of ageing information on mandibles with teeth and isolated mandibular teeth (using Payne 1973 for Sheep and goat and Grant 1982 for cattle and pig), and epiphysial fusion for long bones (using Silver 1969).

- The recording of detailed biometrical data on all 'A' bones (using Von den Driesch 1976), with additional measurements of distal humeri, tibiae and proximal and distal metapodials.

- Detailed recording of butchery and pathology, i.e type, position, orientation (and severity for pathological conditions only).

In addition semi-quantitative data dealing with preservation, colour, integrity, and fragmentation of each context should be undertaken.

Analysis will undertake, by site/phase and in some cases context type:

- comparison of the frequency of various species

- comparison of skeletal element representation

- comparison of age-at-death data for the major domesticates (including a detailed comparison of mandibular and epiphysial data for possible evidence of castration)

- comparison of biometrical data for additional information on species, sex and breed differentiation

- comparison of the frequency and distribution of butchery and common pathology in the most common domestic animals.