Reports from the EAU, York **95/26**, *8 pp. + 11 pp. Appendix*

Project design: biological analysis of the fills of a reredorter at St John's Hospital, Canterbury, Kent

by

Allan Hall[1] and Harry Kenward[1]

with contributions by Peter Clark[2], Keith Dobney[1], Brian Irving[1], Ailsa Mainman[3], Annie Milles[1], and Patricia Wiltshire[4]

Summary

A design for further analysis of and reporting on important groups of plant and animal remains from the fills of a reredorter at the Hospital of St John, Canterbury, Kent, is presented.

Authors' addresses:

[1] Environmental Archaeology Unit
University of York
Heslington
York YO1 5DD

[2] Canterbury Archaeological Trust
92a Broad Street
Canterbury CT1 2LU

[3] York Archaeological Trust
Piccadilly House
55 Piccadilly
York YO1 1PL

[4] Institute of Archaeology
University College London
31-4 Gordon Square
London WC1H 0PY

Prepared for:

Archaeology Division
English Heritage
23 Savile Row
London W1X 1AB

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Background

During repair and consolidation in 1991 of the remains of one of two reredorter buildings associated with St John's Hospital, Canterbury, Kent, excavation staff from Canterbury Archaeological Trust (CAT) alerted English Heritage's Ancient Monuments Laboratory to the existence of a sequence of fills in the subterranean part of the structure in which there was excellent preservation of organic remains by 'waterlogging' (Bennett 1991; Parfitt 1991).

A visit by AML staff and contractors in April 1991 confirmed that there was great potential for biological analysis of these deposits, and CAT were asked to sample as much of the deposit (a total of approximately 1.5 m^3) as possible. The GBA and BS samples (*sensu* Dobney *et al.* 1992) were transported to the Environmental Archaeology Unit, University of York, in August 1991 and funds for an assessment stage released approximately one year later. A separate series of four samples for pollen analysis were taken during excavation by P. E. J. Wiltshire.

The results of the assessment exercises on the GBA and BS samples (Carrott *et al.* 1994) and of pollen (Wiltshire 1994) are appended. It was clear that a wide range of biological remains was preserved in these deposits, many of them reflecting the original function of the reredorter and providing a rare opportunity to examine a long sequence of deposition in a single specialised structure. Clearly much of the biological material originated in human faeces but other components are certainly present in the samples and there are some interesting challenges regarding the taphonomy of the assemblages.

The research value of this material in terms of tracing the changing diet through several centuries of a human population which can be related to an institution of known function is very great. We seek now to make more detailed analysis, to publication standard, of selected biological material. Further work on the stratigraphy and finds analysis, including refinement of dating by pottery and other artefacts, is also included here to provide the necessary framework for a consideration of the plant and animal remains, but full analysis and synthesis of the archaeological work relating to structures and stratigraphy at this site lies in the future. This work would contribute particularly to English Heritage's (1991, 34ff.) academic objectives of 'processes of change (transition from medieval to post-medieval traditions)'.

Proposals for further work (tasks refer to Appendix Table 2)

A. Archaeological/dating work (mainly by Canterbury Archaeological Trust)

(i) Detailed account of reredorter fills

Thirty-eight contexts were recorded, comprising the stratigraphic sequence immediately pertinent to the environmental samples (Figure 1). These will be described and discussed, paying particular attention to deposit formation and post-deposition processes. This will require comparison with the stratigraphic archives of other excavations in and around the reredorter which will not form part of this study. . . . . Task C1

(ii) General description and history of the reredorter; its relationship to the hospital and its water systems

In advance of a detailed study of the hospital, it will be important to present the historical and archaeological context of the reredorter fills. . . . . Task C2

(iii) Supporting illustrations

These will include: a site location plan; a phase plan of the building and its associated leats; a detailed plan of the reredorter structure; and elevations and sections through the building and its fills, including the positions of the sample columns. (Note: this task does *not* include illustrative material consequent upon the biological analyses, cf. Table 2, Tasks E22 and E24). . . . . Task C3

(iv) Photographic processing

Preparation of publication photographs of the excavations, the reredorter and its fills, and the sampling process. . . . . Task C4

(v) Finds analysis and conservation

Ninety-seven registered finds were recovered from the sampled deposits, 27 of them from samples already processed during the assessment. These will be catalogued and dated where possible to enhance the assemblage analysis of each context and perhaps contribute to our understanding of deposit formation processes. No illustration will be required. Full consideration of the registered finds and their illustration, where appropriate, will form part of a future post-excavation programme. Some conservation work on the iron objects is recommended in the form of re-packaging to provide support for the artefacts. . . . . Task Y1

(vi) Pottery analysis

A total of 1,963 pottery sherds, weighing 67.673 kg, was recovered from the stratigraphic sequence. This material will provide useful dating information, and a study of sherd size, abrasion, and assemblage composition may enhance our understanding of deposit formation processes. The specific goals of this exercise exclude a study of the ceramics in their own right, so no illustration will be necessary. Full consideration of the ceramics and their illustration, where appropriate, will form part of a future post-excavation programme. . . Task C5

(vii) Clay pipe analysis

Ninety-two fragments of clay pipe were recovered, of which about 50% were bowl fragments. The chronological sensitivity of clay pipe typology will allow an important enhancement of our understanding of context dating. Again, the specific goals of this exercise exclude a study of the pipes in their own right, so no illustration will be necessary. Full consideration of the clay pipes and their illustration, where appropriate, will form part of a future post-excavation programme. . . Task C6

(viii) Integration

The results of the artefact studies and stratigraphic analysis will be discussed at a project meeting and an integrated report prepared. . . . . Task C7

B. Biological analyses (by EAU and P. E. J. Wiltshire)

The assessment report suggests the nature and value of further analyses of biological remains.

The aim of the this part of the project is to make more detailed analysis of selected samples and selected biological remains to establish the full range of taxa present as the basis for understanding the nature and formation history of the deposits, and to chart changes through the four centuries or so represented by the stratigraphic sequence.

The tasks planned are:

(i) Examination of contexts from the reredorter fills which were not examined in the assessment

(These were contexts not represented in the sequence from column 2, labelled column 200 in Figure 1.) These will be examined at least cursorily by means of GBA 'test' and BS subsamples to establish that they are not substantively different in their content of macrofossil and microfossil remains from those already examined. The numbers of samples to be examined are: approximately 30 GBA and 20 BS (these sample designations follow Dobney *et al.* 1992)

. . Processing/sorting: Tasks E1, and E3-4

(ii) Plant macrofossils

The minimum amount of work that will be carried out on the macrofossil plant remains is a closer examination of at least one sample from each context, both from the GBA and BS sequences, to produce a full species list for each level and to follow up unidentified material from the samples examined during the assessment. Although no residues from the subsamples processed to date have been dried, the passage of time since processing (early in 1993) and the lack of adequate cold storage facilities means that they may not be in a very good condition and fresh subsamples will be processed (using techniques outlined by Kenward *et al.* 1980; 1986). This will require the processing of approximately 10 more GBA subsamples and examination of these and approximately 10 of the BS residues already processed.

. . . . . Processing: Task E2
Analysis: Task E8
Report: Task E10

(iii) *Prunus* fruitstones

The rich assemblages of *Prunus* (plum/bullace) fruitstones will be subjected to detailed recording of size and shape, using computer-based image analysis to make a record and to provide the raw data for multivariate statistical analyses.

The emphasis here will lie in observing changes in the size and shape of stones through the sequence, rather than attempting identification to infra-specific level (which poses considerable difficulties); such changes are likely to be related to the exploitation of new races resulting from recombination of genetic material from different stocks. This is of importance in understanding the history of development of these cultivated plants and in particular the deliberate improvement of primitive varieties.

The development of image analysis techniques should also provide a protocol for future work on similar material. A study of some modern material to investigate within-variety variability of stone size and shape will be undertaken as an exercise additional to the work originally recommended by Carrott *et al.* (1994, 8).

The detailed results of this work would probably be best submitted for publication to the journal *Vegetation History and Archaeobotany* or to *Journal of Archaeological Science.*

. . . . . Analysis: Task E9
Report: Task E10

(iv) Parasite eggs

Further investigation of eggs of intestinal parasites will be made, employing a semi-quantitative survey of eggs from each of 50 selected samples, using replicate 'squashes' (as described by Dainton 1992), and measurement of some groups to ensure that the trichurid remains are *Trichuris trichiura*, the whipworm of humans.

. . . . . Analysis: Task E11
Report: Task E12

(v) Insect and non-marine mollusc remains

Insect and non-marine mollusc remains from one sample in each context (about 20 samples in all) will be fully analysed. It is possible that detail of episodes of water flow and rubbish dumping might emerge from rapid recording of a subsample from each 'layer' within each context, and this approach is recommended. Providing dating is reasonably secure, identification of rarer taxa is desirable, to allow reconstruction of environment in the catchment and to provide records in space and time for future synthesis.

. . . . . Processing: Task E2
Analysis and reporting: Tasks E13-15

(vi) Marine molluscs

A record of the marine molluscs, principally from BS samples, will be made to complement information concerning diet from plant and vertebrate remains.

. . . . . Analysis and reporting: Task E16

(vii) Fish remains

The remaining samples from these deposits (apart from vouchers to be kept in case of the need for further analyses) will be sieved to 1 mm to provide additional fish (and other) bone. The analysis of the fish remains will take the form of species identifications, live-weight reconstructions and interpretation of butchery practices. This will be followed by an analysis of fishing techniques, habitats exploited, and the seasonality of each fishery identified.

. . . . . Processing and sorting: Tasks E3-5
Analysis: Task E17
Report: Task E18

(viii) Strontium analysis of fish bones (cf. Carrott *et al.* 1994, 7)

Analysis of strontium in the bones of euryhaline fish is also recommended, in order to determine the habitat in which the fish concerned was living at the time of death. This is of importance in understanding the fishery regime (estuarine, marine). This should result in a publication in a major journal (*Journal of Archaeological Science*, or perhaps *International Journal of Osteoarchaeology*).

. . . . . Analysis and reporting: Task E19

(ix) Other vertebrate remains

The modest amounts of mammal and bird bone from the assessment exercise and the further processing recommended here will be examined in more detail to make an accurate record, especially of food remains.

. . . . . Processing/Sorting: Tasks E3-5
Practical work, analysis and
reporting: Tasks E20-21

(x) Artefact recovery

The sieving of the remaining sediment for vertebrate remains will, of course, produce a corpus of further small finds. (A 'watching brief' on plant remains will be maintained in case important specimens are brought to light, although of course only the larger remains are likely to be recovered in this way.)

. . . . . Processing: Task E6

(xi) Analysis of sediments

The nature of the fine mineral component of the deposits will provide clues to the mode of deposition, and this in turn will cast light on the pattern of water flow through the reredorter.
. . . . . Analysis and reporting: Task E7

(xii) Pollen analysis

Pollen analyses at assessment level have been carried out on four samples from the upper part of the sequence. Wiltshire's (1994) samples at 2, 27, 27.5 and 37 cm came from contexts 22, 27, 53 and 55 respectively. Further analyses are required to establish the pollen content of the lower deposits, and for this a series of up to five samples will be taken from GBA samples from contexts 49 and 55 (lowermost part). It is particularly important to compare the pollen flora of layer 49 with the plant macrofossil evidence since this deposit was clearly very different from the fills above and appears to pre-date the construction of the reredorter.
. . . . . Analysis and reporting: Task: W1

Further analysis of the sediments, of plant and invertebrate macrofossils and of parasite eggs in GBA and BS samples, and of the bone and shell, will be undertaken at the EAU, York; pollen analyses will be undertaken by P. E. J. Wiltshire and Judy Webb, Institute of Archaeology, University College London. The tasks are listed in Appendix Table 2.

C. Project meetings and supervision

(i) Project meetings (CAT, EAU, PW)

A preliminary meeting between the project supervisor, stratigraphic analyst, EAU team members and PW to discuss the project prior to the main phase of work
. . . . . Task A1

A second meeting between the stratigraphic analyst and EAU/PW to discuss the implications of the analysis to the project before the completion of reporting.
. . . . . Task A2

Internal meetings to monitor and co-ordinate progress on the work will be held on a regular basis within the EAU and the project will also be considered automatically at the Unit's weekly project monitoring meetings. . . . . Task E25

(ii) Project supervision/report editing

The project will be managed overall by CAT; within the EAU, responsibility for day-to-day management will rest with Allan Hall with monitoring by Harry Kenward . . . . . Task A3

Timescale

Present commitments mean that it would be impossible for practical work at EAU to start before April 1996; work the stratigraphic record and on illustrations at CAT could take place during the last third of 1996, providing final dating framework well in advance of the data analysis phase (summer 1997). Table 5 presents a schedule assuming a starting date of 1st April 1996.

Product and publication proposals

Apart from the research papers for publication in specialist journals mentioned above, we currently anticipate publication in an English Heritage monograph. Journal publication is an alternative possibility. Funding for this would be sought separately in due course. A detailed account of the biological remains, which would form the basis for

the publication text but allow presentation of full data, would be prepared as a *Technical Report* in the EAU's *Reports* series.

Personnel

Staff identified in Appendix Table 2 by abbreviations, together with daily employment rates are given in Appendix Table 1.

Health and safety

All work will at CAT be carried out according to the guidelines specified by the Canterbury Archaeological Trust Health and Safety Policy Document (CAT 1993). It is the intention of CAT to ensure that its work will be carried out in accordance with the relevant statutory provisions. Management and supervisory staff have a responsibility for implementing this Policy. All employees and sub-contractors are expected to adhere to the Policy to ensure that their own work is carried out without risk to themselves or others.

The CAT has appointed Geoff Fox, C. Eng., M.I.C.E., as Safety Consultant to advise upon the requirements of the relevant statutory provisions and safety matters. A copy of the CAT Health and Safety Policy Document is available for inspection.

The work proposed here to be undertaken at the EAU and Institute of Archaeology, UCL will conform to the respective Universities' guidelines on employment practice and health and safety standards.

Archive

All material related to this work will eventually be archived at the Canterbury Museum with copies of bioarchaeological data being held at the EAU, York.

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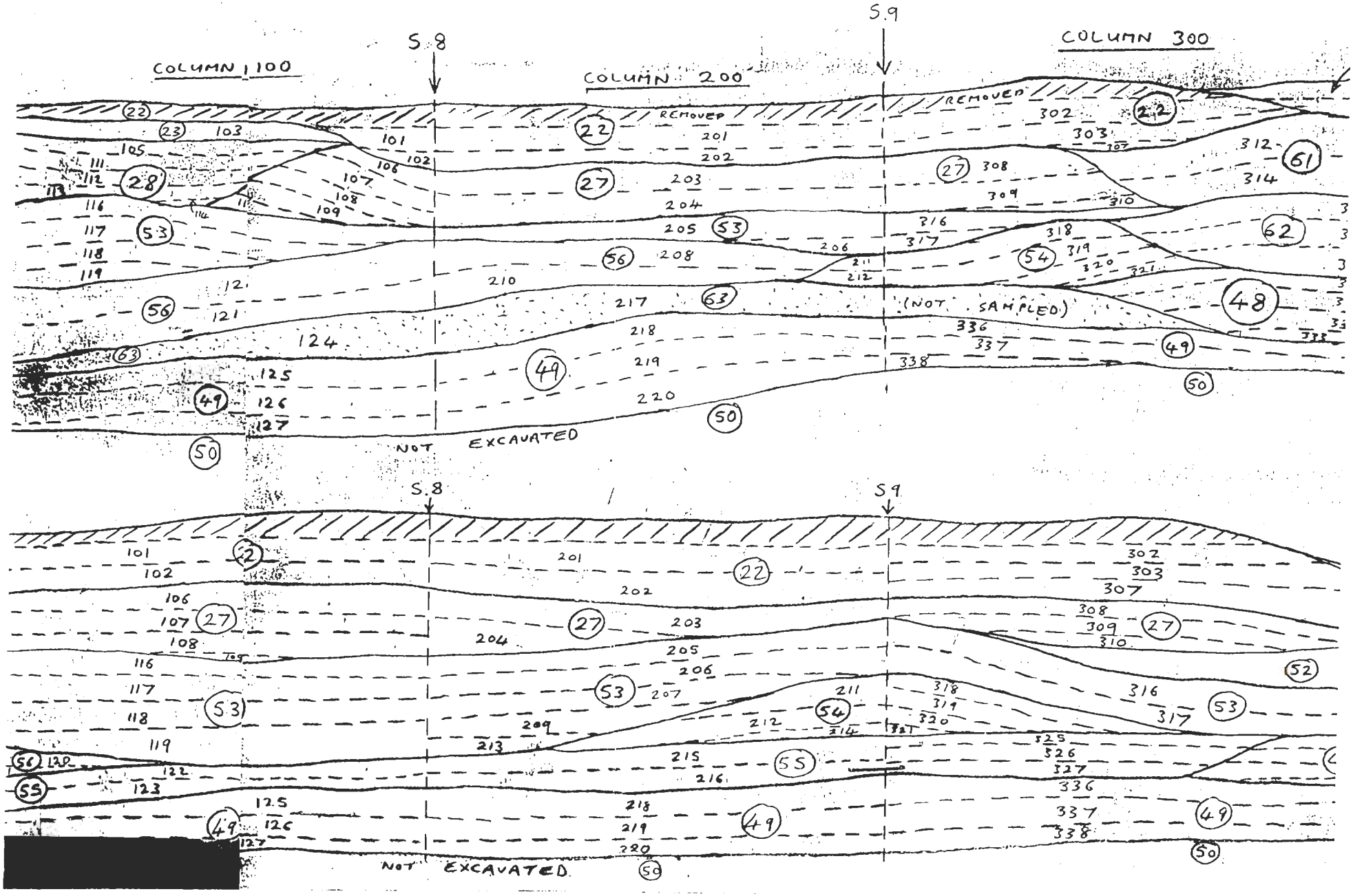
Figure 1. Stratigraphic sequence recorded for the fills of the reredorter at St John's Hospital, Canterbury.



Appendix

*Table 1. Personnel and daily salary costs. *—currently EH/AML-funded*

Abbrev.	Organisation	Staff name	Daily rate (£)
PC	Canterbury Archaeological Trust	Peter Clark	119.57
JCo	do.	John Cotter	67.33
MDa	do.	Mark Davey	50.77
MDu	do.	Mark Duncan	78.77
KP	do.	Keith Parfitt	78.77
IR	do.	Ian Riddler	113.60
AS	do.	Andrew Savage	67.33
DH	Private individual	David Higgins	120.00
NR	York Archaeological Trust	Nicola Rogers	128.00
AH	EAU, University of York	Dr Allan Hall	*
HK	do.	Harry Kenward	*
AM	do.	Dr Annie Milles	*
KD	do.	Dr Keith Dobney	*
RU	do.	Dr Raimonda Usai	*
FL	do.	Frances Large	80.13
DJ	do.	Deborah Jaques	80.13
JCa	do.	John Carrott	80.13
RAp	do.	Research Assistant (plants), to be appointed	80.13
RAb	do.	Research Assistant (fish bones), to be appointed	80.13
Tech.	do.	from a pool of technical staff in the EAU; costed at grade C3	52.00
tba	do.	staff for drafting	52.00
PW	Institute of Archaeology, UCL	Patricia Wiltshire	*
JW	do.	Dr Judy Webb	75.00

Table 2. Resources required for further work recommended on material from the St John's Hospital reredorter fills at (a) Canterbury Archaeological Trust; (b) EAU, York; (c) Institute of Archaeology, London. VAT is ***not*** *included. Costs are for the financial year 1995/6. *—EH/AML-funded. See Table 3 for consumables. N.B. These tasks supercede those presented by Carrott* et al. *(1994, Table 5).*

(a) Canterbury Archaeological Trust/York Archaeological Trust

Task	Staff	Time (days)	Cost £
C1 Detailed account of reredorter fills	KP	3	(totals are presented at the foot of the table)
C2 General description and history of the reredorter; its relationship to the hospital and its water systems	KP	10	
C3 Supporting illustrations	MDu	15	
C4 Photographic processing	AS	2	
Y1 Finds analysis (including administrative tasks)	IR Remainder of task sub-contracted to York Archaeological Trust	0.5	
C5 Pottery analysis	JCo MDa	15 15	
C6 Clay pipe analysis	DH	1	
C7 Integration/report amendment	PC JCo MDa MDu KP AS DH NR	1 1 1 1 2 1 2 2	

Task	Staff	Time (days)	Cost £
A1-2 Project meetings with EAU/PW	PC KP KD AH HK AM DJ FL JCa RAp RAb PW	2 4 1 1 1 1 1 1 1 1 1 1	 * * * * *
A3 Project supervision/report editing	PC	3	
Totals (figures for EAU staff are included in totals for Table 2 (b))	CAT staff (incl. DH) YAT (Task C7) YAT (Task Y1)		5667.68 256.00 585.15

(b) Environmental Archaeology Unit

Material	Task	Staff	Time (days)	Cost £
GBA samples	E1 Process and describe 'test' subsamples from contexts not examined during assessment (approx. 30 samples) E2 Process fresh subsamples from a selection of those already examined for plant/insect analysis (20)	Tech. AH HK RU Tech.	22.5 1 1 1 13.5	(totals are presented at the foot of the table)

Material	Task	Staff	Time (days)	Cost £
BS samples	E3 Process all remaining material as BS samples (approx. 140 tubs representing 85 samples), sieving to 500 microns, and retaining vouchers	Tech.	28	
	E4 Sort selected BS samples (approx. 30) in detail	Tech.	22.5	
	E5 Recover artefacts and bone from remaining 55 BS samples	Tech.	7	
	E6 'Watching brief' for plant and invertebrate remains from sievings	AH	2	
Sediments	E7 Carry out particle size analyses on selected samples; prepare report	RU	11	
Plant remains	E8 Detailed analysis of selected GBA and BS samples (including pursuing difficult identifications)	AH RAp	10 136	
	E9 Image analysis of *Prunus* fruitstones (including preparation of journal paper)	Tech. AH RAp	7 15 28	
	E10 Data analysis and technical and publication reports	AH RAp	20 16	
Parasite eggs	E11 Practical work on 50 selected samples, including measurements	JCa	17	
	E12 Technical and publication reports	HK	3	
Insect remains	E13 Practical work: rapid examination of 50 GBA subsamples, followed by scan-recording of approx. 30 subsamples (including pursuing difficult identifications as appropriate)	Tech. FL HK	7 22.5 11	
	E14 Data analysis and technical and publication reports	Tech. FL HK	7 11 11	
Non-marine molluscs	E15 Processing, identification, technical and publication reports	Tech. AM	3.5 7	

Material	Task	Staff	Time (days)	Cost £
Marine molluscs	E16 Recording selected material, technical and publication reports	AM	5	
Fish bone	E17 Practical work	RAb	22.5	
	E18 Technical and publication reports	RAb KD	22.5 2	
	E19 Strontium analyses and preparation of journal paper	RAb KD	17 7	
Mammal and bird bone	E20 Practical work	DJ	4.5	
	E21 Analysis and technical and publication reports	DJ KD	5.5 4.5	
General	E22 Support tasks throughout the project: assistance with computers; general laboratory duties; storage and labelling of extracted materials; arranging material for archive; photographic and SEM work	Tech. FL DJ JCa RAp RAb	10 5 5 5 5 5	
	E23 Administration (including maintenance of databases)	RAp AH HK	8 3.5 1	
	E24 Drafting of figures/graphs, etc. for environmental report (costed at Tech. rate)	tba	5	
Contin-gency		Tech. DJ FL JCa RAp RAb KD AH HK AM RU	17 6 5.5 2 7 2 5.5 6 5.5 2 2	

Material	Task	Staff	Time (days)	Cost £
Totals	N.B. Includes totals for EAU staff included under Task A1-2 in Table 2(a)	Tech. RAp FL DJ RAb JCa drafting KD AH HK AM RU	145 201 45 22 70 25 5 20 58.5 34.5 15 14	7540.00 16106.13 3605.85 1762.86 5609.10 2003.25 260.00 * * * * *
Grand Total				36887.19

(c) Institute of Archaeology

Material	Task	Staff	Time (days)	Cost £
Pollen	W1 Preparation and counting	JW	6	500.00
	W2 Administration and report writing	PW	5	*
	A1-2 Project meetings with CAT/EAU	PW	2	*

Table 3. Materials and consumables, travel and other costs for (a) CAT; (b) YAT; (c) EAU, York and (c) Institute of Archaeology, London.

(a) Canterbury Archaeological Trust

Item	Cost (£)
Materials	266.68
Copying	35.00
Travel: 4 x return trips Canterbury/York (Tasks C7, A1-2)	464.00
Travel: 1 return trip Liverpool/Canterbury	56.00
Accommodation (5 nights, Tasks C7, A1-2)	225.00
Total	1046.68

(b) York Archaeological Trust

Item	Cost (£)
Materials	46.00
Travel: 1 return trip York/Canterbury	116.00
Accommodation (1 night, Task C7)	45.00
Total	180.00

(c) Environmental Archaeology Unit

Item	Cost (£)
Reagents	40.00
Safety and protective equipment	20.00
Glass specimen tubes	20.00
Microscope slides and cover slips	10.00
Computer consumables and maintenance	500.00
Beatson jars	15.00

Item	Cost (£)
Stationery, including photocopying and inter-library loans	100.00
Postage	25.00
Telephones/faxes	30.00
Polyethylene bags	5.00
Labels and markers	5.00
Miscellaneous, including repairs to equipment	150.00
Photographic materials and processing costs	150.00
Image Analysis of *Prunus* fruitstones (costs for use of equipment in Department of Biology, University of York: 111 hours at £12 per hour)	1332.00
Strontium analysis (costs for use of electron microprobe equipment in Department of Physics, University of York: 10 days at £200 per day)	2000.00
Travel (visits to museums, colleagues)	200.00
Total	4602.00

(d) Institute of Archaeology

Item	Cost (£)
Reagents and other consumables required for pollen analysis	50.00
Travel, 1 return trip London/York	100.00
Total	150.00

Table 4. Summary of costs. EAU overheads are at 25%, the minimum accepted by the University of York by special dispensation. The same overhead applies to the other organisations.

Organisation	**Sums requested**			
	Staff	Materials/ consumables	Overheads	Total
CAT (including DH)	5667.68	1046.68	1416.92	8,131.28
YAT	841.15	207.00	210.29	1,258.44
EAU	36887.19	4602.00	9221.80	50,710.99
Institute of Archaeology	500.00	150.00	125.00	775.00
Totals	43,896.02	6,005.68	10,974.01	60,875.71

*Table 5. Key: ■ — major task in period; + — minor task in period or task spread over a long period; contingency for EAU tasks is spread through whole project. The tasks which follow the completion of the project (connected with the main publication) have not been included. Double lines at the right of a cell indicate task completion. * indicates tasks relevant to the whole project for which there are currently no fixed points.*

Task	Time needed (days)	Staff	A 96	M	J	J	A	S	O	N	D	J 97	F	M	A	M	J	J	A	S	O	N	D	J 98	Task
C1	3	KP						+	+																C1
C2	10	KP						■	■																C2
C3	15	MDu						■	■	■															C3
C4	2	AS						+	+																C4
Y1	0.5 [~4.5]	IR YAT			+ +	+																			Y1
C5	15 15	JCo MDa						■	■	■															C5
C6	1	DH						+																	C6
C7	1 each 2 each	PC, JCo, MDa,MDu, AS KP, DH, NR									+ +														C7
A1-2	2 4 1 each	PC KP KD, AH, HK, AM, RU,FL, DJ, JCa, RAp, RAb, PW		■ +																	■ +				A1-2
A3	3	PC*																							A3
E1-4	86.5 1 each	Tech AH, HK, RU	■ +	■ +	■ +	■ +	■ +																		E1-4
E5	7	Tech.					+																		E5
E6	2	AH	+	+	+	+	+																		E6
E7	11	RU					+	+	+											+	+	+			E7
E8	10 136	AH RAp					+ ■	+ ■	+ ■	+ ■	+ ■	+ ■	+ +	+ +	+ +	+ +										E8

Task	Time needed (days)	Staff	A 96	M	J	J	A	S	O	N	D	J 97	F	M	A	M	J	J	A	S	O	N	D	J 98	Task
E9	7 15 28	Tech. AH RAp											+ + +	+ + +	+ + ■	+ + ■	+ + ■	 ■ ■							E9
E10	20 16	AH RAp																	■ ■	■ ■	■ ■	+ +			E10
E11	17	JCa						■	■																E11
E12	3	HK																	+	+	+				E12
E13	7 22.5 11	Tech. FL HK						+ ■ +	+ ■ +	 ■ ■															E13
E14	7 11 11	Tech. FL HK																	+ + +	+ + +	+ ■ ■	+ + +			E14
E15	3.5 7	Tech. AM									+ +	+ ■										+ 			E15
E16	5	AM											■									+			E16
E17	22.5	RAb							■	■	+														E17
E18	22.5 2	RAb KD																	■ +	■ +	+ +	+ +			E18
E19	17 7	Rab KD										■ +	■ +	+ +				■ ■							E19
E20	4.5	DJ							+	+	+	+	+	+											E20
E21	5.5 4.5	DJ KD																	+ +	+ +	+ +	+ +			E21
E22	10 5 each	Tech. FL, DJ, JCa, RAp, RAb	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			E22
E23	8 3.5 1	RAp AH HK	+	+	+	+	+	+	+	+	+	+	+	+											E23
E24	5.5	tba																			+	+			E24
W1	6	JW								■															W1
W2	5	PW								■															W2