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Invertebrate remains from excavations at Low Hauxley, Northumberland (site code: LH94): an assessment

by

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Summary

Marine erosion of dunes at Low Hauxley, Northumberland, has revealed an extensive humic horizon interpreted as a buried soil. This passes laterally into waterlain peats and muds in places and is associated with Bronze Age, and tentatively identified Mesolithic, human activity,

Fifteen of the forty General Biological Analysis (GBA) samples submitted to the EAU, representing different areas of the site, have been analysed for invertebrates. A substantial proportion contained appreciable numbers of insect and other invertebrate remains, sufficiently well-preserved for identification. From the assemblages as a whole, the fauna consisted of a mixture of aquatic and terrestrial species. The former will provide a definition of the nature of the depositional basin, with a guide to water quality. The terrestrial species, if recovered in sufficiently large numbers, will allow reconstruction of vegetation and land-use (if any) of nearby 'dry land'.

The molluscs from spot samples do not appear to represent the debris of human activity, the evidence suggesting that they arrived through some natural or incidental mechanism. Several routes are possible, including conflation of thinly distributed material as dunes were blown out, deposition of seaweed by humans, or the throwing up of shells or seaweed by storms.

Further analysis of the available samples is recommended, together with an outline strategy in the event of further excavation.

Keywords: Low Hauxley, Northumberland; Mesolithic; Bronze Age; marine erosion; buried soil; peat; dune sands; insects; molluscs

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Introduction

Marine erosion of the dunes at Low Hauxley, Northumberland, has revealed an extensive humic horizon at their base. This layer has been interpreted as a buried soil, running laterally into waterlain peats and muds in places. Erosion and excavation also revealed evidence for tentatively identified Mesolithic and Bronze Age human activity, including two cists associated with cairns of the latter period and a midden believed to date to the former. An evaluative excavation by the Lancaster Universit of Archaeology Unit, on behalf of English Heritage, was carried out in 1994 (LUAU 1994), and sediment samples of various kinds were collected from a variety of locations.

Forty samples of sediment (General Biological Analysis (GBA) samples *sensu* Dobney *et al.* (1992) were submitted to the EAU. A selection of these, representing different areas of the site, was made to allow range and quality of material preserved to be assessed: three samples from the putative old ground surface; seven from the peats; and five from the clays underlying the peats. There were also some spot samples; those containing molluscs are considered below. Bulk-sieving samples (BS, again in the sense used by Dobney *et al.* 1992) were collected from some layers and processed under the supervision of Jacqui Huntley in the Department of Archaeology, Durham University, and will be reported elsewhere (Huntley, forthcoming). Bone, too, was examined at Durham (Stallibrass 1995).

Field observations of the sediments and an assessment of their potential as a source of archaeological information will be reported by Usai (forthcoming).

Methods

The samples were inspected in the laboratory and a description of their lithology recorded using a standard *pro forma*. Subsamples of 1 kg were taken for extraction of macrofossil remains, following procedures of Kenward *et al.* (1980; 1986). Many samples had been collected as a series of tubs of material; in order to identify these, '01', '02', etc., has been appended to the sample number, the suffix corresponding to the tub number.

The flots were examined for insects remains using 'assessment recording' as defined by Kenward (1992). Records of invertebrates seen and ecological groups represented were kept using a standard form, and an estimate made of the quality of preservation, using five-point scales for chemical erosion and fragmentation. A priority for further work was assigned to the samples on the basis of their invertebrate content. Some of the flots were very large, and only a proportion of each of these could be examined; where this was the case it is noted below.

In an attempt to estimate the amount of sediment which it would be necessary to process to recover an assemblage of adult beetles and bugs adequate for reliable interpretation, a multiplication factor was applied to the approximate MNI recorded during assessment. The factor applied to the Low Hauxley material was x 1.75 for each doubling of sample weight (see Appendix).

Results

The GBAs: sample-by-sample account

The sampling locations are discussed in the order used in the Interim Report (LUAU 1994). OGS = Old Ground Surface.

The cliff face sections

Cliff Section 22: (about 50 m NE of the cairn, to the NE end of Area A)

Stratigraphy relevant to samples: (below) 2138 (**121**)/ /2051 (**22**)/2136 (**24**)/2135 (**24**) (above)

Context 121 [Clay]
Sample 213804

Moist, light olive green plastic clay with some twigs; appeared to include contamination from another layer.

Insects: The flot was of moderate size and contained a small group of invertebrates. *Daphnia* ephippia (water flea resting eggs) were abundant, but insects rare. Deposition was in water, but nothing can be said of the terrestrial environment without processing a larger subsample.

Context 22 [OGS]
Sample 2051

Moist, mid (slightly olive) grey-brown, cheesy-brittle (working plastic), slightly humic clay which contained inclusions of pale olive-grey clay at the cm scale, and roots (probably ancient), wood and (?) charcoal.

Insects: The flot was very large, and only part could be examined for assessment. A small group of insects was recorded, together with abundant *Daphnia* ephippia. Aquatic beetles and bugs, together with the *Daphnia*, suggested aquatic deposition. Terrestrial forms included plant-feeders, species associated with mud and open ground, and a few found in decomposing matter.

Context 24 [Lower part of peat]
Sample 213602

Moist, dark brown, just crumbly (working crumbly), slightly sandy amorphous organic sediment, in which roots (probably ancient) were present.

Insects: The flot was very large. A modest-sized group of arthropods was noted, including abundant *Daphnia* ephippia. There were some aquatic insects, together with a range of terrestrial forms: plant feeders; ground beetles; and decomposers including dung beetles.

Context 24 [Upper part of peat]
Sample 213501

Moist, mid to dark brown, crumbly (working soft), slightly sandy amorphous organic sediment, which was dark grey externally, presumably a result of oxidation on exposure to air. It included traces of herbaceous detritus, and roots (probably ancient) were present.

Insects: The large flot gave a small group of insects and moderate numbers of Cladocera ephippia. Insects also indicated aquatic deposition, but there were a few beetles from terrestrial habitats. Preservation was variable.

Area C1: section 20v, the first dune section to the north of the site

Stratigraphy relevant to samples: (below) 2145 (**97**)/2144 (**96**) (above)

Context 97 [Clay]
Sample 214504

Moist, mid greyish-brown, stiff to just crumbly (working plastic) silty clay with charcoal, woody detritus and twigs present, with patches of peat, presumably from adjacent horizons.

Insects: No invertebrate remains were seen in the flot, which was not large.

Context 96 [Peat]
Sample 214403

Moist, dark (slightly orange) brown, cheesy-brittle (working slightly plastic), amorphous organic sediment with plant detritus as inclusions, perhaps as faint layers.

Insects: The flot was extremely large, and consisted mainly of fibrous plant remains. Only about a tenth of it could be examined. The few insects seen were terrestrial forms. It is likely that the flot contained sufficient remains to permit a limited reconstruction of ecological conditions, but a substantially larger subsample would be needed for reliable interpretation.

Area C2: dune section to the farthest north of the site

Section 21 (iii)

Context 101 [Peat]
Sample 214901

Moist, mid to dark orangish-brown to dark brown, slightly layered, crumbly (working almost plastic), slightly sandy peat of noticeably low density, with abundant fragments of plant detritus.

Insects: Macro-invertebrate remains were present in modest numbers in the large flot. Mites and *Daphnia* ephippia were abundant, and there was a mixture of aquatic and terrestrial insects. The latter represented waterside/damp ground habitats, with a few taxa from drier conditions. Preservation was varied, but some very delicate remains were preserved.

Section 21 (ii)

Context 108 [Peat]
Sample 214703

A dark brown deposit, grading from sandy amorphous organic sediment through finely layered peat, which contained roots which may have been modern.

Insects: The flot was very large. A modest-sized assemblage of beetles and bugs was noted, with aquatic and terrestrial taxa present in about equal numbers. Preservation was rather good.

The evaluation excavation

Test pit D1A (at SW end of trench)

Context 144 [OGS]
Sample 216201

Wet, slightly heterogeneous, mid orange-brown, crumbly (working just plastic) clay sand, including lumps of firm sediment (peds) and grey-orange sandy clay, and iron nodules on the mm scale, with some stones in the size range 2-20 mm.

Insects: No remains were seen in the washover.

Test pit D1C (just NE of middle of trench)

Context 169 [OGS]
Sample 212602

Moist, slightly heterogeneous, mid to dark grey, crumbly (working plastic), slightly humic sandy clay which contained light buff sandy lumps several cms in maximum dimension, and in places showed mid-orange-brown mottles on the 10 mm scale. Flint in the size range 2-6 mm and roots (probably ancient) were also present.

Insects: Nothing was recovered by paraffin flotation.

Test pit DE (at NE end of trench)

Stratigraphy relevant to samples:

(below) 2132 (**189**) / 2131 Lancaster (**188**) / 2160 (**186**) / 2130 (**183**) / 2129 (**180**) (above).

The soil horizon classification (provided by Dr R. Usai) is given in parentheses at the end of the sediment description where relevant.

Context 189 [Lowest clay underlying the peat]
Sample 2132

Moist, very heterogeneous, stiff, plastic clay which varied in colour and sand content, ranging from pale blue-grey clay through olive green clay to olive green clay with slightly orange suffusion, to pale orange brown clay sand locally. Roots were present.

Insects: The washover, which was quite large, included only a very small number of invertebrate remains; even a very large subsample would not be certain to provide an interpretable group.

Context 188 [Sandy clay]
Sample 213102

Moist, very heterogeneous, mid grey, plastic sandy clay which included patches (1-10 mm) of grey brown sand, yellower sand and olive green sand, with charcoal and plant roots (probably ancient) present.
Insects: No invertebrate remains were seen in the large washover.

Context 186 [Clay immediately underlying the peat; OGS]
Sample 2160

Moist, mid to dark grey plastic, slightly humic, slightly sandy clay with pale brown, pale olive green and turquoise, slightly sandy lumps at the cm scale and red flecks at the mm scale. Flint in the size range 2-6 mm, charcoal, and roots which appeared ancient, were present. (Eg)

Insects: Although large, the flot contained few insect remains. It is likely that even a much larger subsample would give an assemblage which was only on the borderline of interpretability.

Context 183 [Peat]
Sample 213001

Moist, dark, slightly purplish-brown, crumbly (working almost plastic), very slightly sandy amorphous organic sediment with traces of herbaceous detritus. (bOh_2)

Insects: The flot, which was large, contained modest numbers of insect remains. These included aquatic and terrestrial forms, the latter perhaps mostly from marshland.

Context 180 [Peat]
Sample 212901

Moist, dark grey, slightly layered, cheesy, slightly sandy amorphous organic sediment with fine plant debris as inclusions, which included patches of bright orange and which was paler and distinctly brown internally (reduction/oxidation?). (bOh_1)

Insects: The flot was very large and consisted mostly of fibrous plant remains. Macro-invertebrate remains were present in moderate numbers. There were some aquatics, but the assemblage principally represented marshland and damp soil.

Molluscs from the spot samples

Context 54 [hand-picked shells from Section 20(iii)]
Sample 2046

This spot sample contained six individuals of the edible periwinkle *Littorina littorea* (L.), over 20 individuals of the flat periwinkle *Littorina littoralis* (L.), and four individuals of the topshell *Gibbula* sp.

Context 90 [shells from sieving from section 20(iv)]
Sample 2047

This spot sample contained 32 individuals of *Littorina littoralis*.

Context 142/143 [hand collected shell from D2 context 142]
Sample 2057

This spot sample contained a fragment of *Ostrea edulis* (L.) (oyster), nine individuals of *Littorina littorea*, and ten of *Littorina littoralis*.

Molluscs from the sediment samples

Context 54 [a shell layer from section 20(iii)]
Sample 2045

The residue from this bulk sediment sample contained two fragments of *Ostrea edulis*, some individuals of *Littorina littorea*, and many of *Littorina littoralis* and *Gibbula* sp. The assemblage was dominated numerically by shells of *Littorina littoralis* and *Gibbula*, and a wide range of sizes of shells including juveniles was noted. This suggests that the shells were either a natural assemblage, or gathered indiscriminately by very fine nets or on seaweed.

Discussion

A substantial proportion of the samples contained appreciable numbers of insect and other invertebrate remains, sufficiently well-preserved for identification. From the assemblages as a whole, the fauna consisted of a mixture of aquatic and terrestrial species. The former will define the nature of the depositional basin, with a guide to water quality. The terrestrial species, if recovered in sufficiently large numbers, will allow reconstruction of vegetation and land-use (if any) of nearby 'dry land'.

In order to recover sufficient insect remains (mostly Coleoptera and

Hemiptera) for a reliable reconstruction, it would be necessary to process much larger samples than the 1 kg subsamples used for assessment. The priority assigned to each sample, and a crude estimate of the amount of sediment needed to recover an interpretatively useful assemblage, are given in Table 1.

Of the mollusc species recorded, only the edible periwinkle *(Littorina littorea*) and oyster *Ostrea edulis* are commonly eaten by humans. Topshells (*Gibbula)* and the *Littorina* species are found on rocks and stones or under weed on the middle shore. It is possible that there were oyster beds locally. The recorded molluscs do not appear be debris from human activity. The species present and the range of sizes noted in some taxa suggests that some natural or incidental mechanism was responsible for their presence. Several routes are possible, including conflation of thinly distributed material as dunes were blown out, deposition of seaweed by humans, or the throwing up of shells (alone, or in seaweed) by storms.

Provisionally, it may be stated that there is no evidence from the invertebrates of human exploitation of the area, beyond perhaps the grazing of stock and consequent modification of vegetation.

Questions to be addressed

Further work, using a range of techniques, might address questions including the following:

Was human use of the area in the Mesolithic or Bronze Age contemporary with the existence of the 'lake' in the valley to the north, and thus was this useful resource available? Was this a Mesolithic lakeside site? Or was there progressive (probably NE-SW) advance of the dunes so that the aquatic habitats were sealed before this phase (or by the Bronze Age)?

What was the date of the lake? Was it a postglacial feature, or a result of Late Bronze Age hydrological changes as seen in the Humber area further south? Was settlement related to drainage? Is there any evidence for variation in water-tables through time, especially in the later part of the Bronze Age?

Is there a relationship between surface topography and the underlying bedrock, which appears to form ridges? Are there inter-tidal deposits extant between the ridges on the foreshore which might be of archaeological value?

What evidence can be recovered for exploitation of marine resources?

What was the origin of the shell-rich lenses? Were they the product of conflation of shells introduced into sand by natural agencies, or the result of some human activity?

If the lake was contemporary with occupation, the site presents a rare opportunity to carry out landscape reconstruction from anoxic waterlogged deposits adjacent to an area of human activity in the prehistoric period, using a wide range of techniques in an integrated approach.

If large insect assemblages can be recovered it may be possible to obtain evidence for contemporaneous climates.

The OGS, anoxic deposits, and some others, might be investigated to determine whether there is any evidence for agricultural activity of any kind, arable or pastoral.

Did human activity contribute to the destabilisation of soils and lead to the overwhelming of the site by dunes?

What was the pattern and rate of dune development? Was it of sudden onset, intermittent, or sufficiently gradual for the area to retain vegetation suitable for human exploitation?

Does the OGS represent a short-lived episode or a surface which was stable over a long period? Has it been truncated?

If there was gradual encroachment by dunes, can a lateral sequence of samples locations be used to reconstruct a time-sequence for ecology and activity at the site? Do any of the vertical sequences cover a sufficient time span to enable such changes to be followed?

Statement of potential

Potential for site interpretation

The existing samples have some potential for site reconstruction using invertebrate analysis *provided* they can be set into an appropriate archaeological and time framework.

A well-planned programme of sampling over a wide area of the site, using columns with a narrow sampling interval where appropriate and followed by processing of subsamples large enough for recovery of interpretable insect assemblages, is essential should further excavation be considered appropriate.

Potential for addressing wider issues

If the 'waterlogged' deposits are associated with Mesolithic or Bronze Age occupation then they have considerable potential for providing information of wider importance for these periods, poorly known in terms of detailed reconstruction of ecologies influenced by human activity. Even if the conclusion drawn is that human activity in the area was of a limited kind, this would be useful information in a wider context.

There may also be a potential for elucidation of the problem of water-table changes in the Late Bronze Age. The site is clearly of some interest in relation to wider studies of the past exploitation of coastal environments.

Recommendations

The existing material (Table 2)

Provided an adequate archaeological and dating framework can be established, selected samples representing the full North-South spread of deposits from the higher parts of the OGS down into the lowest basin should be investigated for insect remains, using vertical sequences of samples at locations where the 'waterlogged' deposits were thick. A substantial proportion of the samples not examined in the present study (perhaps all of them) should be processed using 1 kg subsamples and reviewed rapidly in order to detect all those with good organic preservation. Work on insect remains should be carried out in close co-ordination with investigations of plant remains and sediments.

If there is further excavation

The study area should be extended as far as the OGS and other associated deposits can be traced N-S, and further inland. It may, however, be desirable to concentrate on the 'lake margins', areas likely both to have been heavily exploited by humans *and* to give organic preservation. If further investigations take place, there should be very intensive sampling followed by rapid review and selection. Sampling should be carried out even of the deposits shown to have poor preservation, in the hope of detecting local concentrations of insect remains.

If further, larger, assemblages of molluscs are recovered, they should be examined to determine the means of deposition.

Radiocarbon dating of the organic deposits is recommended in order to clarify the chronology of the deposits; both vertical and horizontal sequences will be required (perhaps 10-15 dates).

Retention and disposal

All material should be retained pending decisions as to further stages of work on the site. Sediment now in plastic bags should be re-packaged in tubs as soon as possible.

Archive

All extracted fossils from the test subsamples, and the residues and flots are currently stored in the Environmental Archaeology Unit, University of York, along with paper and electronic records pertaining to the work described here. Unprocessed sample material will be returned to LUAU.

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Table 1. Prioritisation of insect assemblages from Low Hauxley. Priority is based on interpretative potential. Minimum quantity of sediment required to be processed (for method of estimation see Appendix). Times for processing, sorting and recording only; note that figures do ***not*** *represent time needed for project execution, but are used as a basis for estimating that figure. Key: P1 (high)..P3 (low); P0 (no content of invertebrate remains).*

Context and sample number	Priority	Minimum quantity of sediment required (kg)	Time to process (days)	Time to sort (days)	Minimum time to record (days)
22 - 2051	P1	4	1	2	3
24 (base) - 2136	P1	4	1	3	4
24 - 213501	P1	8	1	2	3
94 - 2145	P0	-	-	-	-
96 - 124403	P1	8	1	2	2
101 - 214901	P1	6	1	1.5	2
108 - 2147	P1	5	1	2	4
121 - 2138	P2	10	1	0.5	2
144 - 216201	P0	-	-	-	-
169 - 212602	P0	-	-	-	-
180 - 212901	P1	6	1	2	3
183 - 213001	P1	6	1	2	3
186 - 2160	P2	10	0.2	0.75	1
188 - 21302	P0	-	-	-	-
189 - 2132	P3	not practicable	-	-	0.1
Totals	-	-	9.2	17.75	27.1
Means for P1 and P2 samples			0.9	1.8	2.7

Table 2. Time estimates for investigation of macro-invertebrate remains from existing samples from Low Hauxley. Recording includes data entry. Figures are calculated pro rata using data from Table 1, with additional time for associated tasks. Costs are provided separately. Note that it is impossible to estimate cost for work on material from any further excavations without precise details of the project envisaged.

	Staff	Time required	Cost
General tasks			
General laboratory tasks, sample movement, etc.	Tech.	5	
Maintain databases	Tech. RA	2 1	
Administration, project meetings, obtaining and organising archaeological information	Tech. RA insects RF insects (including project management) RF molluscs	2 2 3 2	
Further work on insects (etc.) from GBA samples chosen on the basis of assessment and discussion with other project members			
Select and describe 25 samples	Tech. RA (insects) RF (insects) RF (molluscs)	1 0.5 0.5 0.5	
Process subsamples	Tech.	25	
Sort flots	Tech	50	
Record insect remains	RA insects RF insects	60 20	
Molluscs from BS samples			
Record mollusc remains from selected BS samples	RF molluscs	3	
Spot samples			
Inspect and record spot samples	RF molluscs	1	
Data analysis and Technical Report preparation	Tech. RA insects RF insects RF molluscs	5 10 5 2	
Preparation of publication report, including graphics, etc.	Tech. RF insects RF molluscs	3 5 2	

	Staff	Time required		Cost
Contingency	Tech. RA insects RF insects RF molluscs	5 5 3 2		
Totals: (a) contact days and (b) converted to weeks, after allowing for leave and rounded to nearest 0.5 weeks)	**Tech.** **RA insects** **RF insects** **RF molluscs**	**(a) days** **98** **78.5** **36.5** **12.5**	**(b) weeks** **22** **18** **8.5** **3**	

Table 2. Consumables required for work on invertebrate remains from Low Hauxley. Costs are provided separately.

Item	Cost (£)
Reagents	
Glass specimen tubes	
Microscope slides and cover slips	
Computer consumables and maintenance	
Beatson jars	
Stationery	
Postage	
Telephones/faxes	
Polyethylene bags	
Labels and markers	
Miscellaneous, including repairs to equipment	
Photographic materials and processing costs	

Appendix: Estimation of sediment weight required for recovery of interpretable insect assemblages

An essential component of work on archaeological insect remains, whether during assessment *sensu stricto* or during the process of continuing review needed throughout the main phase of a project, is estimation of the amount of sediment which must be processed to produce an assemblage likely to provide a useful 'interpretation' of conditions and human activity at the point of deposition.

It is not possible simply to estimate a minimum number of individuals (MNI) for the remains from the subsample (usually 1 kg) processed during assessment, and multiply up to obtain the required subsample size. This is because minimum numbers do not double with a doubling of sample size; some of the new fossils will be 'lost' into individuals already recorded but not represented by the new parts recovered. A species may, for example, be recorded from a single head in the first subsample. A subsequent subsample of the same size may add an elytron; two more subsamples, the other elytron and a pronotum, but the MNI remains the same. Thus some conversion factor must be applied.

Empirical observations suggest that doubling sample size increases MNI by a factor of about 1.25 to 1.75 according to the nature of deposits. The increase will be low if the parts of single individuals lie close to one another in the deposit, and so are likely to be included in the sample. It will be high if the remains of each individual were dispersed in the past before the deposit was sealed.

The increase will be low if the number of species is small, so that new fossils will be of the same species as those already found, even if they may not be of the same individual. If the number of species in the deposit is high, then the MNI will increase more rapidly, since parts of new taxa will be found, and these obviously must add to the MNI.

If a subsample of 1 kg yields 20 individuals, then increasing sample size will have the effect shown in Table A1

For all of the fossiliferous deposits at the site at Low Hauxley, it is predicted that (a) the remains will have been dispersed by bioturbation during deposition and (b) very many taxa will be present, derived from species-rich semi-natural or natural habitats in the vicinity at the time of deposition. The factor of 1.75 has thus been adopted.

It has been assumed that most of the fossils present were noted during assessment, so that the rough estimate of numbers in the flot was a good enough basis for calculation.

Table A1

Factor	1 kg	2 kg	4 kg	8 kg	16 kg	32 kg
1.25	20	25	31	39	49	61
1.5	20	30	45	68	101	152
1.75	20	35	61	107	187	327