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**Evaluation of biological remains from
excavations at Welham Bridge, East Riding of
Yorkshire (site code: ERYMS 2004.19)**

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Evaluation of biological remains from excavations at Welham Bridge, East Riding of Yorkshire (site code: ERYMS 2004.19)

by

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Summary

Ten bulk sediment sample and four column samples, recovered from deposits encountered during excavations at Welham Bridge, East Riding of Yorkshire, were submitted for an evaluation of their bioarchaeological potential. The site comprised two main areas, the first associated with a boat and trackway of Anglo-Saxon date, and the second of features associated with a medieval moated site and later field divisions.

The investigation of the column samples from Welham Bridge (associated with the boat and trackway area of the site) demonstrated that both sequences were conformable and contain high concentrations of well preserved pollen. Both pollen sequences suggested very similar environments of open, sedge dominated fen vegetation. Few trees and shrubs can have been present, and grassland appears to have been prevalent, with scattered scrubland nearby or perhaps more substantial areas of woodland at distance from the site. Despite this largely open aspect, direct evidence for habitats strongly affected by anthropogenic activity was lacking, although there were hints of the cultivation of hemp. There was no other clear palynological signal of cultivation, either in the form of cereal pollen grains or weeds of arable fields.

Well-preserved plant and invertebrate remains were present in the samples associated with the boat and trackway and—perhaps not surprisingly—indicated open-water and swamp habitats with very few remains derived from dry land. There was nothing unusual or archaeologically significant about this material.

Plant macrofossils were present in all eight of the evaluated samples from deposits associated with the medieval moated site, but mostly in rather low concentrations. Remains preserved by both charring and anoxic waterlogging were present (though some remains were clearly modern contaminants). Little information was forthcoming about the range of cultivated plants used by the people that lived at or near the site. Some charred cereal grains and a charred seed of flax might hint that these crops were processed in the surroundings. Some of the wild plant taxa indicated the wet conditions occurring at the site, but little could be determined about the terrestrial environment. No ancient invertebrate remains were recovered from this area of the site.

Evidence for later Holocene palaeoenvironments is very thin for East Yorkshire, and it is thus difficult to suggest to what extent the environments represented by the pollen sequences are typical or atypical. For this reason, the Welham Bridge monoliths should be seen as having the potential to provide valuable information regarding both the local context of the archaeological remains as well as the character of later Holocene environments in this area. It is recommended that further analyses are carried out on these sequences to provide a fuller picture of environmental changes on and around the site and to amplify the tentative conclusions drawn. No further study of the plant and invertebrate remains from deposits associated with the boat and trackway is warranted. The plant macrofossil remains from some of the samples from features associated with the medieval moated site have the potential for environmental reconstruction. The concentrations of remains seen in this evaluation were, in general, rather low and large samples would need to be processed, however.

KEYWORDS: WELHAM BRIDGE; EAST RIDING OF YORKSHIRE; EVALUATION; ANGLO-SAXON; MEDIEVAL; POST-MEDIEVAL; PLANT REMAINS; POLLEN; CHARRED PLANT REMAINS; CHARRED GRAIN; INVERTEBRATE REMAINS; INSECTS; SNAILS; VERTEBRATE REMAINS

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Evaluation of biological remains from excavations at Welham Bridge, East Riding of Yorkshire (site code: ERYMS 2004.19)

Introduction

An archaeological watching brief and evaluation excavation was carried out by York Archaeological Trust, at Welham Bridge, East Riding of Yorkshire (centred on NGR 792 342), between the 8th of March and the 9th of July 2004. The works were undertaken in advance of construction of a new road and bridge over the River Foulness.

The site divided into two distinct areas. The first of these was characterised by a log boat, trackway and series of timber posts, located on the north side of the river within alluvial silt and 'peat' deposits. Radiocarbon dates (2-sigma calibrated) obtained from the boat and the trackway were AD 455 +/- 105 (Beta 191781) and AD 610 +/- 80 (Beta 191780), respectively. The timber post were on a different alignment and thought to be of a later date—a radiocarbon sample from one of the posts duly returned a date of AD1310 +/- 90 (Beta 191779).

The second area was approximately 300 metres south of the river on a low ridge (formed by a spur of levy sand) and comprised a primarily medieval moated site (11th to 16th/early 17th century), a group of possible timber buildings (14th century occupation indicated) and later (17th/18th century) field divisions.

Ten bulk sediment samples ('GBA'/'BS' *sensu* Dobney *et al.* 1992) and four column samples were submitted to Palaeoecology Research Services Limited (PRS), County Durham, for an evaluation of their bioarchaeological potential.

Methods

Bulk sediment samples

The sediment samples were inspected and their lithologies were recorded, using a standard *pro forma*. For each of the samples, a subsample was disaggregated in water and sieved to 300 microns then subjected to either paraffin flotation or washover, broadly using the techniques of Kenward *et al.* (1980; 1986). Flots were stored in alcohol.

Plant remains and the general nature of the various fractions (residues, flots and a washover) were recorded briefly by 'scanning', identifiable taxa and other components being listed either on paper or directly to a PC using *Access* software.

Insects in the flots were recorded using 'assessment recording' *sensu* Kenward (1992), creating a list of the taxa observed during rapid inspection of the flot, with a semi-quantitative estimate of abundance, and a subjective record of the main ecological (e.g. aquatics, grain pests) or indicator/activity (e.g. for stable manure, Kenward and Hall 1997) groups present. A record of the preservational condition of the remains was made using scales given by Kenward and Large (1998). This scheme provides scales for chemical erosion and fragmentation (0.5-5.5, the higher figure representing the greatest degree of damage), and colour change (0-4), in each case giving a range and a value for the position and strength of the mode (Kenward and Large 1998, tables 2, 3 and 5-7).

Where the residues were primarily mineral in nature they were dried, weighed and the components recorded in brief. Vertebrate remains recovered from the samples were scanned and records made concerning the state of preservation, colour of the fragments, and the appearance of broken surfaces

(‘angularity’). Other information, such as fragment size, dog gnawing, burning, butchery and fresh breaks, was noted, where applicable. Fragments were identified to species or species group using the PRS modern comparative reference collection.

Column samples

Subsamples for pollen assessment were extracted from each sequence, nine from Column 1 (0.99 m total depth; all measurements given assume the top of each sampled sequence is 0.0 m) and seven from Column 4 (0.50 m total depth). Sampling concentrated on sediment with the highest apparent organic content. Pollen preparations followed standard procedures (Moore *et al.* 1991). At least 125 total land pollen grains (TLP) excluding aquatics and spores were counted for each sample where possible, although for samples with low pollen concentration at least one complete slide was counted. Pollen nomenclature follows Moore *et al.* (1991), with the modifications suggested by Bennett *et al.* (1994). The pollen sum is based on percentage of TLP including aquatics and spores.

Column samples 2 and 3 were examined and divided into subsamples, to provide sequential sediment samples to be processed for the recovery of plant and invertebrate microfossils (again following Kenward *et al.* 1980; 1986).

Results

Deposits associated with the boat/trackway

Bulk sediment samples

Context 3014 [backfill of 3013 (?part of boat), probably 5th-6th century]

Sample 301401/T (1.85 kg sieved to 300 microns with paraffin flotation; approximately 2 litres of unprocessed sediment remain)

Moist, very dark brown (mid brown internally), crumbly, slightly silty amorphous organic sediment (to very humic silt), with fine and coarse herbaceous detritus.

The moderately large residue of about 400 ml consisted of woody and (mainly) herbaceous detritus, including some short (less than 25 mm) twig fragments, the texture of the residue being rather granular; there were at least a couple of ‘straw-like’ fragments which looked as if they might be recent, though preservation in general was very good (some seeds were in a superb state), so they were perhaps ancient. There was also some charred culm (stem) material of grass/cereal/reed that was presumably ancient, and a nutlet of persicaria (*Polygonum persicaria* L.) which had split to reveal a starchy interior (part of the perianth was also preserved)—this is likely either to represent a contaminant of recent date or fossil material in a remarkably good state of preservation.

The plant remains were essentially all representative of swamp and open water with some alder carr not far away (fruits, twig fragments and female cone axes of *Alnus* were all noted); the more frequent taxa were sedge (*Carex*), saw-sedge (*Cladium mariscus* (L.) Pohl), pondweed (*Potamogeton*) and *Sphagnum* (represented by detached leaves not identified further, but clearly not the acid mire species *S. papillosum* Lindb. or *S. imbricatum* Hornsch. ex Russ.). As well as pondweeds, water-lilies (both *Nuphar lutea* (L.) Sibth. & Sm. and *Nymphaea alba* L.) represented areas of open water. The traces of wood and herbaceous charcoal (to 5 mm) and perhaps also the very rare seeds of taxa of disturbed places presumably either point to the presence of debris from occupation or are the result of a natural fire at some modest distance from the site of deposition.

The flot was very large, and invertebrate remains hard to distinguish among the mass of plant detritus. Preservation was rather good, though some remains were fairly fragmented (E 1.5-2.5, mode 2.0 weak; F 1.5-3.5, mode 2.0 weak). Aquatics dominated, but there were various species likely to have exploited swampy conditions including mud and litter. It seems likely that this deposit formed in a drier area than did Context 32550 (see in ‘Column samples’, below), for example.

This material has potential for environmental reconstruction, especially in making comparison with other contexts at the site.

Context 3039 [lowermost peat recovered from sondage]

Sample 7/T (3 kg sieved to 300 microns with paraffin flotation; approximately 5 litres of unprocessed sediment remain)

Moist, very dark grey brown to mid to dark brown (internally), crumbly (working soft and slightly sticky), slightly sandy amorphous organic sediment (with a sulphide smell). Twigs, herbaceous detritus, freshwater mollusc fragments and modern rootlets were all present.

This subsample yielded a smallish residue of about 250 ml of granular woody detritus, amongst which some iron-rich concreted material (to 5 mm) might represent natural deposition of iron salts. Preservation was generally good but less spectacularly so than in the sample from Context 3014. The same general range of plant taxa was present though only sedge and stinging nettle (*Urtica dioica* L.) were present in more than trace amounts (in the overall context of the assemblage—which included alder, saw-sedge, gipsywort (*Lycopus europaeus* L.) and bittersweet (*Solanum dulcamara* L.)—this is consistent with an origin in fen woodland and does not necessarily indicate human occupation or disturbance). There were clearly also areas of open water in which pondweeds and water-lilies flourished. Traces of wood charcoal (to 10 mm) were noted, but no grass/cereal/reed culm material (cf. Context 3014).

The flot, of modest size, consisted of herbaceous detritus, seeds and invertebrate fragments. The last were fairly well preserved (E 1.5-2.5, mode 2.0 weak; F 2.0-3.0, mode 2.5 weak), but remains of value in environmental reconstruction were rare. There were some aquatics and a few beetles indicative of terrestrial conditions, but even a large subsample would not provide enough remains for a useful reconstruction.

Column samples

Pollen

The results of the pollen analyses are presented as percentage pollen diagrams (Figs. 1 and 2, for column samples 1 and 4, respectively). Pollen preservation was good and pollen concentrations were sufficient to attain a count of 125 palynomorphs in every sample, with the exception of that from the very base of the sequence in column 4.

Column 1

The pollen spectra were very consistent and little variation was observed up the sequence. Herbs were dominant, with both Cyperaceae (sedges) and Poaceae (wild grasses) recorded at around 20% throughout. Other herbs including Apiaceae (carrot family), Asteraceae (daisies etc.), Chenopodiaceae (fat hen family), *Plantago lanceolata* L. (ribwort plantain), *Cannabis*-type (cannabis, hops), *Ranunculus acris*-type (buttercups) and *Rumex*-type (docks) were recorded, although values were sporadic and rarely rose above 1%. Tree and shrub pollen tended to be rather low, with *Corylus avellana*-type (hazel, sweet gale) (approximately 20%) the best represented and *Quercus* (oak) present at values up to and slightly above 10%. Other trees such as *Pinus* (pine), *Tilia* (lime) and *Ulmus* (elm) were present at trace levels only, and whilst higher and more consistent values for *Alnus glutinosa* L. Gaertn. (alder) and *Betula* (birch) were apparent, these taxa never exceeded 10%. *Fraxinus excelsior* L. (ash) and *Salix* (willow) appeared slightly better represented in the upper half of the diagram. Spores were also rare, with Pteropsida (monoletes) (ferns) reaching 10% at most, whilst aquatics were represented by grains of *Nymphaea* (white water lily) which disappear towards the top of the sequence, and by a steady *Potamogeton* (bur-reeds) curve.

The sequence reflects a largely open environment around the site, with grasses and sedges the dominant vegetation in the near vicinity. These may have been forming fen vegetation in the wetland areas as well as open, damp grassland around the site. Few trees can have been present, although the *Corylus avellana*-type curve (probably referable to *Corylus avellana* L. entirely in this instance) probably reflects some hazel scrub in which oak might also have been present. Wetland and trees typical of damper/poorer soils, such as birch and alder, were scarce locally, although given its typically poor palynological representation, some willow could have been present. *Fraxinus* also tends to be under-represented, so the increase in this species suggests ash might have been expanding locally somewhat towards the upper part of the sequence. The presence of *Nymphaea* in the lower half of the diagram and the representation of *Potamogeton* reflects areas of open water with water-lilies and aquatic plants such as bur-reeds. The other herbs recorded may have derived from wetland vegetation, such as *Filipendula* (meadowsweet), Apiaceae and *Ranunculus acris*-type (meadow buttercup), but indicators of open, disturbed ruderal habitats are poorly represented. *Plantago lanceolata*, *Rumex*-type and *Cannabis*-type may be included in this group, with the latter possibly indicating the cultivation/processing of hemp in the catchment, although values are insufficient to suggest that this was taking place locally. The overall impression is thus of an open, species poor grassland

around a wet sedge fen, with at best scattered wood/scrub land and little evidence for anthropogenic disturbance in the wider landscape.

Column 4

This sequence was very similar to the previous one, and dominated by herbs in the form of Poaceae (up to 30%) and Cyperaceae (up to 40%). Other herbs were scarce, with Apiaceae, *Artemisia*-type (mugwort), Caryophyllaceae (pink family), *Plantago lanceolata* and *Rumex*-type present at generally trace values. *Cannabis*-type was relatively well represented. Trees and shrub values were subdued—*Corylus avellana*-type reaching a maximum of 20%, whilst *Quercus* was below 10% for much of the diagram and *Alnus glutinosa* recorded at up to 15% but falling somewhat by the close of the sequence. Spores were also scarce, although *Thelypteris palustris* Schott (marsh fern) increases towards the middle of the diagram. Aquatics are represented by low values for *Nuphar* (yellow water lily) and *Potamogeton*.

The impression is of a very similar environment to the previous sequence, with open, sedge dominated fen vegetation on the sampling site. Few trees and shrubs can have been present, and grassland appears to have been prevalent, with scattered scrubland nearby or perhaps more substantial areas of woodland at distance from the site. Despite this largely open aspect, direct evidence for habitats strongly affected by anthropogenic activity is lacking, although once again the *Cannabis*-type curve may reflect the cultivation of hemp. There is no other clear palynological signal of cultivation, either in the form of cereal pollen grains or weeds of arable fields, although some of the taxa recorded, such as Chenopodiaceae, can include such plants.

Macrofossils

Context 20020 [Column sample 2, 0-20 cm]

Sample 20020/T (1.55 kg sieved to 300 microns with paraffin flotation; no unprocessed sediment remains)

Moist, very dark brown (with some lighter brown bands and occasional pale flecks), brittle to crumbly, detritus 'peat', with fragments of ?reed and modern rootlets present.

The modest-sized residue of about 275 ml comprised herbaceous detritus with a little woody material. The moderately frequent pondweed fruits were pale and well-preserved whilst some other seeds and fruits were pale but also rather eroded. There was a little charred grass/reed/cereal culm, but no wood charcoal. Overall,

the assemblage is likely to have formed in a swamp or marsh; there were only slight hints of disturbance.

The flot was rather large, consisting of herbaceous detritus and invertebrate fragments. The latter were fairly well chemically preserved, but often fragmentary (E 1.5-3.5, mode 1.5 weak; F 1.5-5.0, mode 2.5, weak). The insect fauna consisted of aquatics and species able to exploit swampy conditions, with sufficient of the latter to suggest litter which was not permanently submerged. Many of the fossils could not easily be named and further work would only be justified if there were a specific question to be addressed.

Context 22035 [Column sample 2, 20-35 cm]

Sample 22035/T (1.42 kg sieved to 300 microns with paraffin flotation; no unprocessed sediment remains)

Moist, very dark brown, brittle to crumbly (and layered in places), detritus 'peat', with a light grey-brown 'shelly' marl lens. Very rotted remains of freshwater snails (including *Bithynia* sp. and ?*Valvata* sp.) and bivalves (*Sphaerium* and *Pisidium* species) and modern rootlets were present. The mollusc remains were extremely fragile and did not survive processing.

The rather small residue of about 275 ml was of herbaceous detritus, almost all less than 4 mm; there was quite a lot of undisaggregated sediment. The pondweed pyrenes were a mixture of very well preserved and very eroded. Very few taxa were noted—beyond pondweeds, just sedge and birch (*Betula*, represented by an eroded female catkin-scale), and *Sphagnum* (leaves, as before).

The flot, of moderate size and primarily of herbaceous detritus, contained small numbers of invertebrate remains whose condition varied from fairly good to poor (E 2.5-5.0, mode 3.0 weak; F 2.0-4.0, mode 3.0 weak). The larger beetles were particularly highly comminuted. Aquatics predominated, and the few non-aquatics probably exploited swamp conditions. There is little potential for more detailed reconstruction.

Context 23550 [Column sample 2, 35-50 cm]

Sample 23550/T (0.85 kg sieved to 300 microns with paraffin flotation; no unprocessed sediment remains)

Moist, very dark brown, brittle to crumbly, detritus 'peat', with some modern rootlets present.

The small residue of about 150 ml consisted of woody and herbaceous detritus, the wood was as very decayed fragments, up to 50 mm, which were strongly burrowed and the burrows full of arthropod frass (perhaps representing recent decay). There were modest numbers of very well preserved pondweed fruits (probably, as in other samples from this site, all of one species).

Otherwise, only two other taxa, both consistent with a swamp or fen environment, were noted.

The small flot, consisting mainly of herbaceous detritus, contained very few invertebrates, although their preservation was rather good (E 2.0, F 2.5). Aquatics predominated. This sample has little potential for further analysis, even if a very large subsample were available, although its fauna does clearly indicate aquatic conditions.

Context 32550 [Column sample 3, 25-50 cm from base]

Sample 32550/T (2.8 kg sieved to 300 microns with paraffin flotation; no unprocessed sediment remains)

Moist, very dark brown to mid brown (internally), brittle to crumbly, fine and coarse herbaceous detritus and amorphous organic sediment and silt (with a sulphide smell). Wood and twigs were common, and 'straw', seeds and freshwater molluscs (including ?*Bithynia* sp. and succineids, these last of waterside plants) were present. The mollusc remains were, again, very fragile and did not survive processing.

The very large residue of about 2000 ml comprised woody and herbaceous detritus, of which only a few hundred ml were checked for this assessment. The wood (to 50 mm) was rather decayed, somewhat soft, except for one pale and well-preserved wood chip. Charred, part-charred and uncharred grass/reed/cereal culm and culm-node material was present, perhaps the most likely source for such a mixture being the burning of a body of cut vegetation such as for example thatch, although it is possible such remains might originate from the deliberate or accidental firing of a reed-bed some distance from the site of deposition. There was also a trace of wood charcoal.

A modest range of identifiable plant taxa was present, the more frequent being alder (female cone axes), sedge, cowbane (*Cicuta virosa* L.), bogbean (*Menyanthes trifoliata* L.), white water-lily (*Nymphaea alba* L.) and bulrush (*Scirpus lacustris sensu lato*), with *Sphagnum* leaves quite frequent in the finest fraction. Overall, a swamp or fen is indicated, with a moderately high base-status indicated by the presence of saw-sedge. Preservation of fruits and seeds was generally good or very good, sometimes superb, with some specimens showing a little deposition of iron pyrites.

The flot was very large and consisted mainly of filmy plant detritus and seeds, with appreciable quantities of invertebrate remains whose preservational condition was variable but generally good (E 1.5-3.0, mode 1.5 weak; F 1.5-3.5, mode 2.5 weak). The fauna was primarily composed of aquatics and waterside forms, the rich diversity of species (including, for example, numerous examples of the tiny surface-living bug

Microvelia) suggesting well-established vegetation and good water quality. There was nothing to suggest flowing water. Almost no fully terrestrial insects (as opposed to those able to exploit swamp conditions) were noted. There was a single bark beetle, probably *Leperisinus*, usually associated with ash (*Fraxinus*), and traces of dung beetles (*Aphodius*, though apparently not one of the species commonly found in rural archaeological deposits). This material would give a good reconstruction of conditions at the point of deposition, but little could be learned of the wider area.

Deposits associated with the moated medieval site

All of the washovers from the samples were small (from 5 to 40 ml) and, in general, mostly of modern rootlets. Notes on the other biological remains present in the washovers are given in the following sections.

No ancient invertebrate remains were recovered from these samples.

Context 4038 [medieval – basal fill of west side of moat]

Sample 12/T (3 kg sieved to 300 microns with washover; approximately 7 litres of unprocessed sediment remain)

Moist, mid to dark grey-brown, soft to slightly sticky (working more or less plastic), slightly sandy clay silt, with a little ?mortar/plaster present and charcoal common.

Charred plant remains were noted in the washover including some cereal grains and a single spike-rush (*Eleocharis*) seed. There were also numerous uncharred elder (*Sambucus nigra* L.) seeds.

There was a small residue (dry weight 0.19 kg) of charcoal (to 5 mm) and some sand, with a trace of brick/tile (4 fragments) and bone. This last comprising four unidentifiable calcined fragments weighing less than one gram.

Context 4044 [medieval – large sub-rectangular pit of uncertain function]

Sample 9/T (3 kg sieved to 300 microns with washover; approximately 8 litres of unprocessed sediment remain)

Just moist, mid to dark grey-brown (mottled with small patches of dark orange), stiff to crumbly (working soft and somewhat plastic), slightly sandy silty clay, with some flecks of ?charcoal and modern rootlets present.

Charred plant remains representing one cereal grain and a single sedge (*Carex*) were present in the washover. The uncharred component of the plant assemblage included parsley-piert (*Aphanes*), water-plantain (*Alisma*), elder and abundant ?duckweed (cf. *Lemna*). A single beetle elytron and an earthworm egg capsule were noted but both appeared to be of modern origin.

The small residue (dry weight 0.33 kg) was of stones (most to 4 mm, some to 10 mm), with some sand and a trace of charcoal (to 8 mm, <1 g).

Context 4056 [medieval – fill of inner ditch]

Sample 10/T (3 kg sieved to 300 microns with washover; approximately 7 litres of unprocessed sediment remain)

Just moist, light to mid grey-brown to light to mid orange-grey-brown, crumbly to unconsolidated (working soft), sandy silt, with no obvious inclusions.

Charred plant macrofossils present in the washover included a broken cereal grain and one wild strawberry (*Fragaria vesca* L.) fragment. Uncharred remains, representing violet (*Viola*), ?hemp/hop (cf. *Cannabis/Humulus* – seed fragment) and elder, were also present

The small residue (dry weight 0.28 kg) was of stones (to 12 mm) and sand, with traces of /wood and charcoal (both <1 g).

Context 4091 [medieval – pit, possibly near a building]

Sample 14/T (3 kg sieved to 300 microns with washover; approximately 6 litres of unprocessed sediment remain)

Moist, light to mid brown to mid grey-brown (with some patches of mid orange-brown), stiff (working plastic), slightly sandy clay, with some flecks of charcoal, fragments of bone and ?shell and modern rootlets present.

There was a very small washover of about 30 ml of what appeared to be granular organic debris. On closer inspection, the bulk of the coarser fraction consisted of elder (*Sambucus nigra* L.) seeds. The few other propagules present comprised taxa consistent with vegetation in an area of scrub or a riverbank, of which only stinging nettle was present in more than trace amounts. There was also a little charcoal (to 5 mm) and a few charred grass caryopses which appeared to be oat (*Avena*) grains. There was only a very small trace of insect cuticle in the finest fraction.

The small residue (dry weight 0.21 kg) was mostly of stones (to 15 mm, but most to 5 mm) and sand, with a little charcoal (to 10 mm, 3 g) and bone. The vertebrate remains from this sample amounted to over 320 fragments and weighed 27 grams. All of the material was less than 50 mm at its greatest length and included some large mammal rib and two calcined fragments.

Context 4148 [medieval – rubbish pit with high concentration of animal bone]

Sample 17/T (3 kg sieved to 300 microns with washover; approximately 7 litres of unprocessed sediment remain)

Just moist, light to mid orange-brown to light to mid grey-brown (with patches of light brown and orange), crumbly (working soft), sandy silty clay (more sandy in places). Fragments of bone were common and modern rootlets were present.

Uncharred remains of annual meadow-grass (*Poa annua* L. – possibly modern) and elder were present in the washover.

There was a small residue (dry weight 0.37 kg) of stones (to 10 mm), with some sand and bone and a little charcoal (<1 g). This sample produced approximately 380 fragments of bone, weighing 227 grammes. A cattle mandible with the M2 and M3 molars present and a loose upper molar were identified, and much of the rest of the material consisted of small mandible fragments, many less than 10 mm at their greatest length. A few large mammal shaft fragments were also present.

Context 4456 [medieval – basal fill of south side of moat]

Sample 23/T (3 kg sieved to 300 microns with washover; approximately 6 litres of unprocessed sediment remain)

Moist, mid to dark grey (with an orange-brown cast and mottling), crumbly to slightly sticky (working soft), sandy clay silt, with some stones (6 to 20 mm) and modern rootlets present.

Ancient plant remains in the washover were confined to a single flax (*Linum usitatissimum* L.) seed. There were also many small (to 2 mm) unidentified bone fragments.

The small residue (dry weight 0.18 kg) was mostly stones (to 30 mm, but most to 10 mm), with some sand and a little brick/tile (six fragments), ?wood (<1 g) and charcoal (to 8 mm, ~3 g).

Context 4520 [medieval – fill of small ditch, possibly associated with buildings]

Sample 24/T (3 kg sieved to 300 microns with washover; approximately 7 litres of unprocessed sediment remain)

Moist, light to mid yellow-brown to mid grey-brown (with some patches mottled orange), brittle to crumbly or unconsolidated (working soft), silty sand, with no obvious inclusions.

Other than modern rootlets, the plant remains in the washover were restricted to some uncharred goosefoot (*Chenopodium*) fruits, also probably of modern origin.

The small residue (dry weight 0.13 kg) was of sand, with a few stones (to 3 mm) and a little brick/tile, ?pot and charcoal (to 8 mm, ~3 g).

Context 4659 [medieval – back fill of pit 4658]

Sample 27/T (3 kg sieved to 300 microns with washover; approximately 8 litres of unprocessed sediment remain)

Just moist, light to mid orange –brown to mid grey-brown, crumbly to unconsolidated, slightly clay silty sand, with some stones (6 to 20 mm) present.

The only probably ancient plant remain noted was a single unidentified charred cereal grain. Modern contaminants, other than rootlets, included uncharred goosefoot (*Chenopodium*) fruits and some fragments of beetle cuticle.

The small residue (dry weight 0.23 kg) was mostly stones (to 20 mm), with a single fragment of brick/tile (of 15 by 18 mm) and traces of charcoal (~1 g), ?wood (<1 g) and charred grain (<1 g).

Discussion and statement of potential

Deposits associated with the boat/trackway

Pollen

The pollen sequences from Welham Bridge are probably an accurate reflection of the vegetation around the site, although the representation of the on-site sedge fen might be ‘drowning out’ the representation of the extra-local vegetation somewhat. Although Column 4 would seem to be earlier than Column 1, there is no clear sign of this in, for

example, higher percentages of tree and shrub pollen in the former. The sequences clearly date to a later Holocene context and both reflect very similar open, relatively species poor grassland/damp pasture. Trees must have been scarce, with some willow possible locally near to the sampling site, and scrubby hazel-oak cover on the dry land. More extensive woodland at greater distance from the site cannot be ruled out. The range of pollen taxa which are recorded in all the samples tend to be very similar but are distinguished by low percentages of ‘anthropogenic indicators’ (*sensu* Behre 1981). Although the open environment was evidently largely a result of human clearance activity, there is in fact little direct evidence of the nature of any local settlement/agriculture which was clearly responsible for maintaining the open situations for the duration of time represented by the diagrams. This may reflect a steady but unintensive pressure on the land resource, most probably in the form of pastoralism, with herbs such as ribwort plantain, docks and dandelions possibly deriving from such habitats rather than local wetland vegetation. As pointed out above, much of the other pollen taxa such as meadowsweet, buttercups, and members of the fat hen, bedstraw and pink families may all derive from local fen/wetland vegetation, although some of these may also have been growing in the wider environment.

The presence of *Cannabis*-type in both diagrams, which is taken to represent the cultivation of hemp (*Cannabis sativa* L., which seems more likely than hops, *Humulus lupulus* L.) is the only clear indication for land use other than pastoralism. *Cannabis*-type is also recorded in other pollen records from East Yorkshire from the early medieval period onwards, although in these examples there is good evidence that the records reflect on-site hemp processing. (Gearey and Lillie, 1999, Bradshaw *et al.* 1981). In this case, the cultivation of hemp somewhere in the pollen catchment is attested, but there is no way of identifying precisely where this might have been on the basis of the current data.

Evidence for later Holocene palaeoenvironments is very thin for East Yorkshire, especially in lowland contexts (see Van de Noort and Ellis 1999) and it is thus difficult to suggest to what extent the environments represented by these sequences are typical or atypical. Where data does exist, it tends to be in the form of 'snapshots' of short or fragmentary sediment sequences. For this reason, the Welham Bridge monoliths should be seen as having the potential to provide valuable information regarding both the local context of the archaeological remains as well as the character of later Holocene environments in this area.

Macrofossils

Well-preserved plant and invertebrate remains were present in all but one of the samples and—perhaps not surprisingly—indicated open-water and swamp habitats with very few remains derived from dry land. There was nothing unusual or archaeologically significant about this material.

Deposits associated with the moated medieval site

Plant macrofossils were present in all eight of the evaluated samples, but mostly in rather low concentrations. Remains preserved by both charring and anoxic waterlogging were present—some samples contained very well preserved uncharred remains that are probably modern contaminants (e.g. annual meadow-grass (*Poa annua*) from Context 4148, and goosefoot (*Chenopodium*) from Contexts 4520 and 4659).

Little information was forthcoming about the range of cultivated plants used by the people that lived at or near the site. Some charred cereal grains (not yet identified to species level) and a charred seed of flax might hint that these crops were processed in the

surroundings. More detailed information could only be gathered if large sediment samples were analysed.

Some of the wild plant taxa indicated the wet conditions occurring at the site, e.g. water-plantain (*Alisma*) and spike-rush (*Eleocharis*). Little could be determined about the terrestrial environment; parsley-piert (*Aphanes*) occurs as a weed of arable crops and was probably accidentally transported to the site with cereals. Seeds of elder were relatively numerous. These could have been collected for human consumption, but might also be from plants growing near the site (as they prefer nitrogen-rich and not too dry places).

Recommendations

The investigation of the column samples from Welham Bridge has demonstrated that both sequences are conformable and contain high concentrations of well preserved pollen. It is recommended that further analyses are carried out on these sequences to provide a fuller picture of environmental changes on and around the site and to amplify the tentative conclusions drawn. This should include closer resolution sampling (0.04 m) supported by radiocarbon dating of critical horizons.

Plant and insect remains from some of the samples associated with the boat and trackway would give a useful reconstruction of ecological conditions at the point of deposition, but the flora and fauna were so completely dominated by aquatic and swamp species that little could be learned of 'dry land' further afield even if very large samples of sediment were to be processed. The more impoverished samples might, however, be of value in a general reconstruction of the site, if only to provide hints of any variations in conditions. In view of this no strong case can be made for further investigation.

The plant remains from some of the samples from features associated with the medieval

moated site (Contexts 4038, 4044 and 4056) have the potential for environmental reconstruction. The concentrations of remains seen in this evaluation were, in general, rather low and large samples (of 20 kg or more) would need to be processed.

Retention and disposal

All of the current material, together with the remains extracted from the processed sediment subsamples, should be retained for the present.

Archive

All material is currently stored by Palaeoecology Research Services (Unit 8, Dabble Duck Industrial Estate, Shildon, County Durham), along with paper and electronic records pertaining to the work described here.

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