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Technical report: Biological remains from excavations at a site to the rear of 26 Market Place, Bedale, North Yorkshire (site code: BED03)

by

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Summary

Following an evaluation and subsequent assessment, a sequence of early Holocene deposits, representing a localised area of ancient wetland, encountered at 26 Market Place, Bedale, North Yorkshire, was examined in detail to characterise the ancient environment and gain absolute dates for organic accumulations.

Radiocarbon dates gave a timeframe for the deposits ranging from 8770 +/- 40 BP to 7290 +/- 40 BP (conventional radiocarbon age), with the earliest peat layers being dated to 7940 +/- 40 BP. The pollen record, supported by evidence from plant and invertebrate macrofossils, reflected a sequence of early Holocene vegetation changes on and around a shallow body of water which infilled through natural processes of hydroseral succession, resulting in a wetland area of sedge fen/swamp. The study has provided a 'snapshot' of local processes of vegetation change in this area over a period of about 1500 years, which tend to be invisible in sequences from larger sampling sites. No indications of human activity were found.

The slightly higher mean temperatures (~2.5 °C) of the Atlantic period of Holocene northern Europe were indicated by the presence of the bug Hebrus pusillus *in two of the deposits of the upper part (within the peat layers) of the sequence.*

KEYWORDS: 26 MARKET PLACE; BEDALE; NORTH YORKSHIRE; TECHNICAL REPORT; MESOLITHIC; EARLY HOLOCENE; PREHISTORIC; PLANT REMAINS; POLLEN; PEAT; INVERTEBRATE REMAINS; HYDROSERAL SUCCESSION; CLIMATIC INDICATOR

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Introduction

An archaeological excavation was carried out by Pre-Construct Archaeology Ltd (Northern Office) (PCAN) at a site to the rear of 26 Market Place, Bedale, North Yorkshire (NGR SE 265 881), in 2003.

A previous field evaluation, undertaken by PCAN in 2002, revealed evidence relating to medieval, post-medieval and modern occupation of the site. In addition, an accumulation of peat material was encountered across the central portion of the site, suggesting the presence of a localised area of ancient wetland. An assessment study of the pollen indicated an early Holocene, broadly mesolithic, origin for the peat and this was confirmed by radiocarbon dating. In evaluation Trench 2, a deep sequence of alluvial silts, overlain by a peat formation, was recorded. These deposits were associated with the prehistoric wetland.

Further excavation was undertaken to identify the full extent of the ancient wetland area, examine any possible evidence of anthropogenic activity at its margins and to recover further material (through bulk sampling) to characterise the ancient environment and gain absolute dates for organic accumulations.

Four column samples (two parallel columns in each of two sections, Sections 17 and 18) and six related sediment samples for radiocarbon dating, together with two bulk sediment samples ('GBA'/'BS' *sensu* Dobney *et al*. 1992) from medieval ditches, were recovered from the deposits and submitted to PRS for an assessment of their palaeoecological/ bioarchaeological potential in 2004.

Additional radiocarbon dating undertaken for the assessment confirmed and refined the dating of the deposit sequence for Section 18. The investigation of the deposits determined that interpretatively valuable assemblages of pollen (from the column samples) and plant and invertebrate macrofossils (from both the column samples and bulk samples) were present and conditionally recommended some more detailed study (see Carrott *et al*. 2004).

This report presents the results of the detailed investigations of the deposits from Section 18. The assessment results for those deposits not examined more closely are restated in the Appendix, together with some additional notes regarding the plant remains from the medieval ditch samples.

Methods

During the assessment stage the samples were inspected in the laboratory and their lithologies recorded. For the column samples the deposits were recorded following the sediment classification system of Troels-Smith (1955), together with a brief written description.

For the assessment, a total of 15 subsamples for pollen analysis were taken from Section 18 (Column Sample 4). Ten of these were from the peat layer (Contexts 71, 171, 172, 173) at 0.08 m intervals and five from the laminated organic silts/muds (Contexts 175 and 176) at 0.16 m intervals. For the analysis, further subsamples for pollen were extracted to reduce the previous sampling intervals to 0.04 m and 0.08 m, respectively. A closer sampling interval was used for the upper half of the sequence as the pollen assessment had indicated that there were more fluctuations in the spectra here. Pollen preparation followed

standard procedures including HF treatment and acetylation (Moore *et al*. 1991). At least 300 total land pollen grains (TLP) excluding aquatics and spores were counted for each sample where possible. However, pollen concentrations were found to be too low for reliable counts at the following points: 0.17 m, 0.21 m, 0.41 m, 0.45 m, 0.49 m, 0.85 m and 0.89 m. These data are not plotted on the pollen diagram (Fig. 1). 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 excluding obligate aquatics and spores. Percentages for these excluded groups are calculated as percentage of the basic sum plus sum of the relevant group.

The other column sample from Section 18 (Column Sample 3) was divided into subsamples according to the excavators' allocated contexts and observed variations within them (for Context 176). This resulted in eleven subsamples, of varying size, which were processed following the procedures of Kenward *et al*. (1980; 1986), for the recovery of plant and invertebrate macrofossils (with the exception of some of the sediment from Contexts 71 and 172 used for radiocarbon dating, see below). Samples initially processed for the assessment are suffixed '/T' and those only processed for the analysis '/T2'.

Plant remains in the processed subsample fractions (residues and flots) were recorded briefly using a low-power microscope, identifiable taxa and other components being listed on paper. The remains were recorded semi-quantitatively on a three-point scale of abundance: 1 – present, i.e. one or relatively few remains or less than 10% by volume; 2 – common, or about 10-50% by volume; 3 – abundant, or more than 50% by volume. The residues were primarily of uncharred organic remains (preserved by anoxic waterlogging) and were recorded wet. Nomenclature for plant taxa follows Stace (1997).

The flots were examined for the presence of insects and other invertebrates. Beetle and bug remains were removed onto moist filter paper for identification using a low-power binocular microscope (x10 to x70). Identification was by comparison with modern insect material and by reference to published works. Numbers of individuals and taxa of beetles (Coleoptera) and bugs (Hemiptera) were recorded. Other invertebrate taxa were noted if present and their abundance recorded on a semi-quantitative three-point scale (as for the plant remains, see previous paragraph). The insect material recovered from each subsample is currently stored with the rest of the flot in industrial methylated spirits. Nomenclature for beetles and bugs follows Kloet and Hincks (1964-77) and snails follow Kerney (1999).

A total of seven radiocarbon dates were obtained for the sequence of deposits – six at the assessment stage and one additional date during analysis (from ~90 g of organic sediment taken from the top of the laminated silts/muds, Context 175, in Column Sample 4). For four of the deposits radiocarbon dated for the assessment plant macrofossils (for dating via accelerator mass spectrometry – AMS) were recovered from the processed subsamples prior to the application of paraffin flotation. Two of the subsamples extracted from Column Sample 3 (from Contexts 71 and 172) were not processed for assessment as they appeared of very similar composition to those above, and above and below, respectively, in the sequence. For these, 50 mm slivers of raw sediment (from 10 to 60 mm from the lowest point of each deposit) where sent for dating. After pre-treatment, Context 172 gave 1.6 g of organic remains which were dated by AMS. Context 71 gave rather more organic material (7.4 g) and radiometric dating with extended counting was employed. All of the radiocarbon dating was undertaken by Beta Analytic Inc. (Miami, Florida, USA). The remaining sediment from Contexts 71 and 172 was processed and the recovered plant and invertebrate macrofossils

recorded (as referenced above) for the analysis phase of the investigations.

Results

The sequence of deposits analysed (Section 18) comprised approximately 1.5 metres of muds/organic silts (the lower half of the sequence) and detritus peat layers (the upper half) sampled via two parallel series of four overlapping 0.5 metre column tins (Column Samples 3 and 4, Tins A to D). Outline descriptions of the sediment sequence (as seen in Column Sample 3) are given in Table 1.

The lower deposits were investigated for the presence of diatoms during the assessment (subsamples at 1.02 m, 1.22 m, 1.29 m and 1.49 m, all within Context 176; preparations following Battarbee *et al*. 2001) but none were detected and no further analysis was possible. The presence of copulae (girdle bands connecting the diatom frustules) in some samples indicated that diatoms had once been present, but it is difficult to draw further conclusions based on this evidence alone. The absence of identifiable remains may be a result of the acid environment causing dissolution of the silica based frustules. Further information regarding preservation and taphonomic processes may be found in Lowe and Walker (1998, p. 177) and Battarbee (1986).

For the subsamples for plant and invertebrate macrofossils the uppermost contexts are considered first in each case. These subsamples varied considerably in size depending upon the thickness of the deposit.

Dates quoted in the text sections following refer to the conventional radiocarbon age obtained, unless stated otherwise.

Radiocarbon dates

The radiocarbon dates gave a timeframe for the deposits ranging from 8770 +/- 40 BP to 7290 +/-40 BP (the earliest peat layers being dated to 7940 +/- 40 BP). Interestingly, three of the dates returned, those from Contexts 171, 172 and 173, were effectively the same but represent around 0.25 metres of deposit suggesting a rapid development of the peat at this time. The individual results from radiocarbon dating of the selected deposits are detailed in Table 2.

Pollen

The Bedale Section 18 diagram reflected a sequence of early Holocene vegetation changes on and around a shallow body of water which infilled through natural processes of hydroseral succession. The diagram could be divided into five Local Pollen Assemblage Zones (LPAZ) prefixed 'BED' and based on changes in the biostratigraphy; the main features of these zones are summarised in Table 3.

The radiocarbon dates indicated that sediment accumulation began at 8770 +/- 40 BP (Beta-187370). The basal zone, BED-1 corresponds to the laminated organic silts/muds and reflects sediment accumulation within a body of water such as a pool or lake. High percentages of *Corylus avellana*-type pollen imply a hazel dominated wood/scrub land around the sampling site. Other trees and shrubs were recorded at lower percentages but it seems likely that birch formed a secondary component of the local vegetation, with elm also growing as a subordinate tree on better-drained soils in the wider landscape. Scots pine was not present to any great extent and, perhaps more surprisingly, neither apparently was oak (see below).

Little herbaceous pollen was recorded suggesting a dense canopy with a depauperate understorey; an impression that was maintained for the entire diagram. The occasional grains that were observed included *Filipendula* (meadowsweet), Caryophyllaceae (pink family), Apiaceae (carrot family) and *Succisa* (devil's bit scabious); these taxa probably represent wetland/tall herb vegetation communities on the damper soils at the edge of the basin, and the ferns *Thelypteris palustris* Schott (marsh fern) and *Equisetum* (horsetail ferns) would probably also have grown in this habitat. Only a single grain of *Typha latifolia* L. (reed-mace) indicated aquatic taxa in this zone.

BED-2 opens at a date of 8190 +/- 50 BP (Beta-216398) with a marked expansion of sedges and ferns, whilst hazel displays a concomitant decline. However, it is unlikely that this represents the actual replacement of hazel by these taxa. The stratigraphic transition from laminated organic silts to peat at a depth of around 0.90 m indicates that the water body in which these sediments were accumulating was infilling as a result of hydroseral succession. Sedges and ferns were probably spreading onto the surface of the peat, and hence the pollen record becomes strongly biased in favour of these local plants and away from the vegetation growing

in the wider landscape. This process also explains the reductions in oak, elm and birch across this zone since these trees would have also been present largely on the dry land areas. The rise in pine reflects the ability of this tree to expand onto the damper/poorer soils that became available at this time near to the sampling site.

The opening of BED-3 was dated to just after 7960 +/- 50 BP (Beta-187368). The pollen record continues to be dominated by local vegetation with sedges and ferns remaining established on the sampling site. There was evidence for some fluctuations in the arboreal populations, with oak showing a small increase at the base of the zone, apparently at the expense of pine. Establishing the precise nature and sequence of changes in the upper section of this zone and the basal part of BED-4 is complicated by the absence of countable concentrations of pollen from 0.57 m after a date of 7490 +/ - 60BP (Beta-187366). This may be the result of a dry mire surface; the marked peaks in pine and then birch following the hiatus in the biostratigraphy in BED-4 indicating that the water tables had fallen sufficiently to allow the surface of the peat to be colonised by these trees. Reductions in sedges at this time also support the inference of a drier local environment.

Owing to the low concentrations of pollen, there was also a hiatus in the pollen record in the final zone BED-5. By the close of the diagram shortly after 7290 +/- 40 BP (Beta-187365), pine, hazel and alder all appear to be expanding. The fall in sedges following a recovery at the opening of the zone again suggests a drier local environment; pine was probably benefiting directly from this on the peat soils near to the sampling site.

Plant and invertebrate macrofossils

Context 67 [Tin A: 18.0 to 50.0 cm]
Sample 311/T (1.75 kg sieved to 300 microns with paraffin flotation)

Dark brown, crumbly, woody detritus peat. Troels-Smith: Dl2Dh/Dg2.

There was a large residue (of about 120 ml) of granular woody detritus, including some largish wood fragments (these were very crumbly and proved impossible to identify using hand-cut thin-sections). There were also some small, squarish, shiny bark fragments which were selected for radiocarbon dating. The large fine fraction was essentially an undisaggregated amorphous peaty matrix, with wood and bark fragments and a few rootlets. The only identifiable (to genus at least) plant remains were trace amounts of birch (*Betula*) fruits.

The flot from this sample was small. It contained a small and rather fragmented assemblage of insects and a few mites (Acarina) and cladoceran ephippia. The majority of the beetles were from aquatic and swamp habitats. A single fragment of a wood boring beetle *Grynobius planus* (Fabricius) may be an indication of trees growing locally.

Context 71 [Tin A: 0.0 to 18.0 cm; Tin B: 32.0 to 50.0 cm]
Sample 310/T2 (2.4 kg sieved to 300 microns with paraffin flotation))

Dark brown, somewhat crumbly, organic detritus peat. Troels-Smith: Dh/Dh3Ld1.

The large residue (2.2 litres) was of woody and herbaceous detritus, mostly tiny fragments of plant fibres with some wood fragments and rather few identifiable botanical remains. Wingless nuts of silver/downy birch (*Betula pendula* Roth/*B. pubescens* Ehrh.) were frequent, with nutlets of sedge (*Carex*) and oogonia of muskgrass (*Chara*) both present in small numbers.

Insect remains were quite well represented in the flot, and cladoceran ephippia and mites were common. The beetle remains were highly fragmented and many sclerites were pale and crumpled. The beetles and bugs recovered indicated an area of mossy swamp with pools. Two species of *Cyphon* found in moss, and plants and debris in and around shallow water, were particularly numerous. *Hydraena palustris* Erichson is also a typical inhabitant of swampy moss in clear shallow water (Hansen 1987, 57). The tiny water bug *Hebrus ruficeps* Thomson is found in wet moss by acidic pools. There may also have been mud: *Ochthebius minimus* (Fabricius) was common and is usually found in mud by still water (Friday 1988, 151), as is *Dryops*. Other vegetation was indicated by the froghopper *Aphrophora major* Uhler, typically found on bog-myrtle (*Myrica gale* L.), and the weevil *Limnobaris* sp. found on *Carex*.

Several species of ground beetle were present, including *Trechus rivularis* (Gyllenhal) which is found at moist and shady sites. Lindroth (1985, 121) describes its typical European habitat as 'peaty' woods' with a growth of birch, alder and willow, and with an underlying vegetation of moss and sedges. *Pterostichus diligens* (Sturm) and *P. nigrita* (Paykull) are both indicators of moist sites.

Context 171 [Tin B: 20.0 to 32.0 cm]
Sample 309/T (0.7 kg sieved to 300 microns with paraffin flotation)

Dark brown, rather crumbly, mix of mud and fine detritus peat. Troels-Smith: Ld3Dg/Dh1.

There was a large residue (approximately 375 ml) of woody and herbaceous detritus, mostly very fine roots (presumably ancient) and monocotyledonous stem/leaf fragments, with some unidentifiable wood fragments to 10 mm (all rather heavily decayed and seemingly largely of roots rather than twigs or stem wood). The large fine fraction was remarkably free of identifiable remains; only a few poorly preserved birch fruits were recorded.

The flot contained a modestly sized and highly fragmented insect assemblage, cladoceran ephippia, mites, and a few ostracods. A swamp environment with pools was, again, indicated. The beetle and bug assemblage was dominated by at least two species of *Cyphon*, most of which were *C. padi* (Linnaeus). Aquatic taxa were well represented and included *Acilius* and *Coelostoma orbiculare* (Fabricius). The weevil *Tanysphyrus lemnae* (Paykull) points to the presence of duckweed (*Lemna*).

Context 172 [Tin B: 8.0 to 20.0 cm]
Sample 308/T (0.8 kg sieved to 300 microns with paraffin flotation))

Dark brown mud with fine organic detritus peat. Troels-Smith: Ld3Dg/Dh1.

There was a relatively large residue (about 0.9 litres) of herbaceous detritus consisting of small plant fibres (epidermal fragments) and very fine roots (presumably ancient), with a few fragments of wood and frequent sedge (*Carex*) nutlets. Overall, the quantity of identifiable plant remains was rather small (in common with the other deposits of the upper part of the sequence). There were several birch female catkin-scales and nuts of silver/downy birch, and also a few hazel (*Corylus avellana* L.) nut shell fragments.

The flot contained a reasonably sized insect assemblage, cladoceran ephippia, mites and several spiders (Araneae). Beetles and bugs from mossy swamp and aquatic habitats were predominant; the most numerous beetle remains being of at least two species of *Cyphon*. *Ochthebius minimus* was well represented and *Tanysphyrus lemnae* again indicated the presence of duckweed. There were two *Pterostichus minor* (Gyllenhal), a hygrophilous ground beetle found in wet habitats with rich vegetation (Lindroth 1986, 253). No strictly dry land (as opposed to swamp/marsh) taxa were recorded.

Context 173 [Tin B: 0.0 to 8.0 cm; Tin C: 38.0 to 48.0 cm]
Sample 307/T (1.35 kg sieved to 300 microns with paraffin flotation)

Mid to dark brown (somewhat 'banded'), mix of mud and fine detritus peat. Troels-Smith: Ld4?Dg+.
There was a very large residue (1.3 litres) consisted of herbaceous detritus rich in fine rootlets, with some small woody fragments, and frequent sedge nutlets (with more in the flot). Other well-preserved identifiable remains included some fragments of hazelnut shell and remains of other woody taxa (birch female catkin-scales, with traces of fruits and buds/bud-scales and oak (*Quercus*) bud/bud-scales) and a little moss (some identified as *Hypnum* cf. *cupressiforme* Hedw.). Traces of fern shoots (small emerging fronds, perhaps a species such as marsh fern, *Thelypteris palustris*, and fern tracheids were also noted. One whole hazelnut recovered from this sample showed evidence of rodent gnawing.

Insect remains were common in the flot and there were some cladoceran ephippia. Preservation was rather variable and many of the insect sclerites were chemically eroded and pale. The most numerous beetles were *Cyphon* species, which, together with many of the other taxa recorded, would have lived in moss and litter in a swamp. This group included the tiny predacious water bugs *Hebrus pusillus* Fallén and *H. ruficeps* Thomson. These species live chiefly amongst moss but *H. pusillus* is also found on duckweed (Macan 1956). The former is of particular note in that it has a southern distribution in England at the present day. Aquatic beetles were numerous and, although the majority suggested still well-vegetated water conditions, there was a single *Elmis aenea* (Müller) indicating an input of flowing water.

The froghopper *Aphrophora major* indicates the presence of its usual host plant *Myrica gale*. Fragments of several ground beetles were present. They included *Pterostichus diligens* which is confined to wet habitats (Lindroth 1986, 254).

Context 174 [Tin C: 36.0 to 38.0 cm]
Sample 306/T (0.2 kg sieved to 300 microns with paraffin flotation)

Mid to dark brown, 'moss-rich' detritus. Troels-Smith: Dh4.

This very small sample, representing a thin layer, yielded a relatively huge residue of about 1.2 litres of fine herbaceous detritus which proved to be a mass of matted fine moss (*Drepanocladus*) fragments, pale and rather decayed, with some fine roots, and some well-preserved birch fruits. Sedge nutlets were frequent, but no other identifiable plant remains were noted.

The flot from this sample was also relatively large considering the small amount of sediment processed

and contained a moderately sized assemblage of beetles and bugs. This was the only sample from the sequence from which no cladoceran ephippia were recorded. Overall, the implication of the fauna was of a swamp environment with abundant moss. The water bug *Hebrus pusillus* was particularly numerous with sclerites representing 18 individuals. Aquatic beetles included *Ochthebius minimus*, *Coelostoma orbiculare* , *Limnebius aluta* (Bedel), *Bidessus unistriatus* (Schrank), *Hygrotus inaequalis* (Fabricius) and *Suphrodytes dorsalis* (Fabricius). There were two individuals of *Ancylophorus glaberrimus* von Nordmann, a rove beetle found amongst moss in bogs and not recorded in other samples from the sequence.

Apart from moss, other local vegetation appears to have included bog-myrtle indicated by the presence of *Aphrophora major*. There was a single fragment of the wood boring beetle *Grynobius planus*, presumably from local trees, and the weevil *Tanysphyrus lemnae* indicated the presence of duckweed.

Fragments of the bug *Cymus* were recovered from all but one of the samples in the upper part of this sequence. The remains were somewhat better preserved in this sample and a diagnostic mark on a wing could faintly be seen showing that they were referable to *Cymus glandicolor* Hahn. This species is a common inhabitant of marshy places with a rich vegetation and various sedges (*Carex*) are its host plants (Southwood and Leston 1959, 120).

Context 175 [Tin C: (34.0-36.0) to 36.0 cm]
Sample 305/T (0.28 kg sieved to 300 microns with paraffin flotation)

Dark brown, soft mud, with a little herbaceous detritus. Troels-Smith: Ld3Dg1.

A moderate-sized to large residue of about 80 ml of organic debris was obtained from this small subsample. It was quite rich in identifiable plant remains, mainly birch fruits (with buds/bud-scales and female catkin-scales), together with tree leaf fragments and unidentifiable (rather decayed) moss (though some material that could be determined as *Drepanocladus*, typical of bogs, fens and marshes, was also present). There were also traces of saw-sedge nutlets (*Cladium mariscus* (L.) Pohl) and bog-bean (*Menyanthes trifoliata* L.) seeds representing waterside or fen habitats. Preservation was generally good or very good. Indicators of open water were traces of hornwort (*Ceratophyllum*) fruits and Characeae oogonia, but most of the other remains were from terrestrial plants, including oak (*Quercus*) and rowan (*Sorbus aucuparia* L.).

Although the sediment sample available from this context was small a fair sized flot was produced. It contained a modestly sized insect assemblage, and a few cladoceran ephippia and ostracods. The insect remains were highly fragmented, however.

The beetle and bug assemblage was notable in that there were only two *Cyphon* individuals (this moss/plant debris dwelling taxon being rather more strongly represented in all bar the uppermost of the higher layers of the sequence and in the upper part of the underlying Context 176 – Sample 304 – see below). The most numerous species was *Ochthebius minimus* with 16 individuals. Although taxa exploiting swamp habitats were present there may have been more areas of open water at the time of formation of this deposit, which would have attracted the pond skaters (*Gerris*), for example. A single individual of the elmid water beetle *Esolus parallelepipedus* (Müller) was present suggesting an input from running water.

Tanysphyrus lemnae again implied the presence of duckweed, and local trees with crumbling wood were indicated by *Rhinosimus*.

Context 176 [Tin C: 12.0 to 34.0 – 36.0 cm]
Sample 304/T2 (2.1 kg sieved to 300 microns with paraffin flotation)

Dark grey-brown, soft (working more or less plastic), mud, with some fine laminations/partings. Some snail shell was present. Troels-Smith: Ld4test mol.+.

The medium-sized residue (1.05 litres) was principally of herbaceous detritus, but also contained cladoceran ephippia, snail shell and unidentifiable bark fragments and buds/bud scales. Large numbers of female catkin-scales and fruits of silver/downy birch were recorded, whereas fruits and utricles of sedge, hazel nutshell fragments and fruits of rowan (*Sorbus aucuparia* L.) were present but only in small quantities. In addition, there were numerous aquatic plant remains including large numbers of muskgrass (*Chara*) oogonia and several seeds of white water-lily (*Nymphaea alba* L.).

The large flot from this sample was very rich in highly fragmented insect remains and cladoceran ephippia were frequent. The majority of the insect fragments were of large to very large beetles and much of the fragmentation appeared to have been caused during processing of the sediment rather than as a result of the depositional conditions. Smaller taxa were much less fragmentary, but difficult to detect among the very numerous remains of the larger species that (except for countable parts) were not picked out due to time constraints.

The majority of beetle and bug taxa were aquatic and the deposit was obviously waterlain. There was a striking group of beetles found in running well-aerated water – four species of elmids, *Esolus parallelepipedus*, *Oulimnius*, *Limnius volkmari* (Panzer) and *Elmis aenea* (Müller), and also *Hydraena gracilis* Germar. The last of these is found in clear unpolluted running water (Hansen 1987, 63). *Cyphon* species were once again well represented in this deposit but were only present in small numbers in the lower portions of this context (Samples 303, 302 and 301, see below).

Plant-associated taxa were *Tanysphyrus lemnae* and several individuals of *Phyllobius* or *Polydrusus*. The latter are generally polyphagous.

Terrestrial insects were poorly represented but there were three species of *Aphodius* dung beetles, and a distinctive bark beetle (Scolytidae).

Snail shell recovered from both the flot and the residue was mostly unidentified fragments. However, there were also moderate numbers (20 or more) of apex fragments that could be identified as the freshwater species *Valvata cristata* Müller. The presence of this snail accords well with the evidence from the insect remains and the deposit's lithology—it is a species restricted to well-oxegenated, slowly flowing (or still) water, with a strong preference for richly vegetated places on muddy substrates (Kerney 1999).

Context 176 [Tin D: 0.0 to 9.0 cm]
Sample 303/T (3.6 kg sieved to 300 microns with paraffin flotation)

Dark grey-brown, soft (working more or less plastic), mud, with some fine laminations/partings. Snails were present. Troels-Smith: Ld4test mol.+.

The rather large residue (1.75 litres) was very similar to that recorded for the previous sample (Sample 304, Context 176) being principally of herbaceous detritus, with some cladoceran ephippia, snail shell and unidentifiable bark fragments and buds/bud scales. Female catkin-scales and fruits of silver/downy birch were recorded, and fruits and utricles of sedge (*Carex*) and hazel nutshell fragments were present in small quantities. In addition, there were numerous aquatic plant remains including large numbers of muskgrass (*Chara*) oogonia and several seeds of white water-lily.

The flot was large and rich in insect remains, particularly aquatic forms. Cladoceran ephippia were very abundant and ostracods common. Aquatic deposition was clearly indicated. As with the previous sample, there were many fragments of large beetles from a pond/lake habitat, *Colymbetes fuscus* and *Acilius* sp. being particularly common, and again, a group of elmids (*Limnius*, *Esolus*, *Elmis* and *Oulimnius*) indicated running well-aerated water.

The few terrestrial beetles recorded included the damp ground species *Pterostichus diligens* and phytophages included the leaf beetle *Lochmaea*. The latter could not be identified to species, as its remains were in poor condition, but some species of the genus feed on hawthorn (*Crataegus*) and willows (*Salix*). *Cerylon fagi* Brisout indicated the presence of trees in the locale. There was also a fragment of the click beetle *Melanotus* which is found in rotten wood; though it could probably also exploit peat which provides a similar habitat. There was a single *Aphodius* dung beetle.

Tiny and mostly unidentifiable fragments of snail shell were noted, but, as seen in the previous sample, some were apex fragments of *Valvata cristata*.

Context 176 [Tin D: 9.0 to 27.0 cm]
Sample 302/T2 (1.9 kg sieved to 300 microns wioth paraffin flotation)

Mid grey-brown, soft (working more or less plastic), mud, with some snail shell present. Troels-Smith: Ld4test mol.+.

The medium-sized residue (0.85 litres) was mostly of herbaceous detritus, with some cladoceran ephippia and snails also noted. The detritus included small unidentifiable fragments of bark, buds/bud scales and wood fragments (including twigs). Of the identifiable waterlogged plant remains female catkin-scales and fruits of silver/downy birch were the most abundant. The preservation was, in general,. very good, enabling the identification of some winged nuts of birch as silver birch (*Betula pendula* Roth). This fraction was rather rich in oogonia of the freshwater green alga muskgrass (*Chara*). Other plant remains observed were restricted to traces of white water-lily and hazelnut shell.

The fairly large flot was rich in insect remains, mainly representing aquatic taxa. Cladoceran ephippia were very abundant and ostracods were common – the deposit was clearly laid down in water. By far the most abundant beetle taxon was *Ochthebius minutus* with 57 individuals. Taxa of running water were common: there were four species of elmid (*Limnius*, *Elmis*, *Oulimnius* and *Esolus*) and also *Stictotarsus duodecimpustulatus* (Fabricius). Local trees were indicated by *Cerylon fagi* and there was an *Aphodius* dung beetle.

Most of the snail remains recovered consisted of tiny and unidentifiable shell fragments. Some apex fragments of *Valvata cristata* were recorded, however, and there was also an occasional freshwater bivalve (*Pisidium*) valve; the latter could not be determined to species.

Context 176 [Tin C: 0.0 to 12.0 cm; Tin D: 27.0 to 50.0 cm]
Sample 301/T (1.0 kg sieved to 300 microns with paraffin flotation)

Mid yellowish-brown (oxidising mid to dark grey-brown), soft (working more or less plastic), mud, with moderate numbers of snails present. Troels-Smith: Ld4test mol.+.

There was a medium-sized residue (~200 ml) of herbaceous detritus and (mostly) very fine mollusc shell fragments. The former included tree leaf fragments (to 5 mm in maximum dimension), with moderate numbers of fruits, buds/bud-scales and female catkin-scales of birch. Preservation of plant material was generally good. Other plant remains observed were restricted to traces of saw-sedge nutlets and poplar/aspen (*Populus*) buds/bud-scales; the fine fraction was rather rich in oogonia of the freshwater green alga stonewort (Characeae). A lacustrine to base-rich fen environment is indicated with trees fringing the wetland area.

The flot was fairly large and rich in insect remains, particularly fragments of immature insects. The deposit was clearly waterlain – the majority of the beetles and bugs present were aquatics, cladoceran ephippia were common and there were smaller numbers of ostracods. In addition to a rich pond/lake fauna, flowing water was indicated by the elmids *Limnius*, *Oulimnius*, *Elmis*, *Esolus*, and either *Riolus* or *Normandia*.

Swamp taxa were represented but other 'terrestrial' insects were rare. They did however include an *Aphodius* dung beetle, *Cerylon fagi*, and the leaf beetle *Lochmaea*.

There were numerous small fragments of snail some of which were, perhaps, of unidentified freshwater planorbids and others of *Valvata cristata*, but most were not identifiable.

Discussion

Pollen

The Bedale Section 18 diagram reflects a sequence of early Holocene vegetation changes on and around a shallow body of water which infilled through natural processes of hydroseral succession. The picture is of a closed, hazel-dominated, woodland environment with some birch and elm present. This is typical of the general regional picture of vegetation development in this area during the earlier Holocene (Day 1995). However, oak does not seem to have been a significant component of the woodland at Bedale. This is perhaps hard to explain on ecological grounds since this tree was well established in northern England by this time (Birks 1989), but interpretation was hindered by the fact that for much of the sequence, and particularly from BED-2, the pollen record is strongly biased towards vegetation growing locally. Following the growth of peat on the sampling site from around 8190 BP, a sedge fen developed and this vegetation dominates the pollen record for much of the diagram.

This was evidently a relatively 'dry' peat-accumulating environment, with abundant ferns but few other wetland plants indicated. As mentioned above, phases of dry mire surface may very well be responsible for the poor pollen preservation in two parts of the sequence.

The fluctuations in the arboreal taxa appear largely to reflect localised processes of competition between birch and pine connected to the growth of peat rather than competitive interactions in the wider landscape (see, for example, Bennett 1986). Following the spread of the main arboreal taxa at the opening of the Holocene, competitively inferior taxa such as birch and pine were excluded to poorer or wetter soils such as those that were present at and around the sampling site. The Bedale Section 18 diagram therefore provides a 'snapshot' of local processes of vegetation change in this area over a period of about 1500 years, which tend to be invisible in pollen sequences from larger sampling sites (see Day 1995).

Plant and invertebrate macrofossils

Plant macrofossil remains (Table 4) preserved by anoxic waterlogging were, generally, well preserved and usually reasonably abundant;

though identifiable macrofossils were often of quite restricted diversity and the bulk of the remains formed by herbaceous and woody detritus, as might be expected in deposits which were largely detritus peats. Preservation of invertebrate remains (Table 5) was very varied within and between deposits. Some assemblages gave the subjective impression that there may have been general decay, so perhaps the deposits as a whole may be at risk from dewatering. The concentration of invertebrates varied, too, from very low to moderately high (extremely high if crustaceans are included), probably reflecting ecological conditions, rate of sediment accumulation and (in the case of the 'pond/lake' deposits – samples from Contexts 175 and 176) distance from the shoreline.

Many of the plant and insect remains from the two lowest deposits (Context 176, Samples 301-304 and Context 175, Sample 305, corresponding to LPAZ BED-1) were of aquatic taxa. Most of the plants remains identified were those that float on or grow submerged in fresh water (e.g. muskgrass/stonewort – *Chara*/Characeae, white water-lily – *Nymphaea alba* L.) or grow in very wet terrestrial places (sedges – *Carex*). A record of the weevil *Tanysphyrus lemnae* (Paykull) provided indirect evidence of the presence of duckweed (*Lemna*). The rest of the invertebrate fauna was also predominantly aquatic and indicated a rich environment, with abundant vegetation (e.g. by the snail *Valvata cristata* Müller). A wide range of beetles and bugs living in a pond/lake environment were recorded and beetles found exclusively in running water were also well represented. The elmids, four species of which were recorded here (*Esolus parallelepipedus* (Müller), *Oulimnius*, *Limnius volkmari* (Panzer), *Elmis aenea* (Müller) and *Riolus*/*Normandia*), have a system of respiration that requires the very well-oxygenated water found in streams and rivers and also, though more rarely, on the stony shores of lakes. In addition to the elmids there were several other taxa that live in running water and the water conditions generally would have been clear and unpolluted. A range of swamp dwelling taxa were represented but open areas of water must also have been present to attract insects such as pond skaters (*Gerris*)—all of the records for pond skaters were from the lower parts of the sequence (Contexts 175 and 176). *Aphodius* dung beetles were also represented in four samples from the two lowest deposits. Members of this genus are typically found in herbivore dung in the open, but some species are also attracted to foul decomposing plant material. Unfortunately, none of the remains could be identified to species and their presence does not necessarily imply the presence of grazing animals nearby. However, their consistent occurrence in these lowest samples, albeit in small numbers, was of interest and it is likely that if larger sediment samples had been available for study more useful information would have been obtained.

From Context 174 upwards (corresponding with the beginning of BED-2), beetles and bugs that would have exploited moss and litter in a swamp became predominant in the assemblages and, indeed, the thin deposit Context 174 was largely composed of matted *Drepanocladus* moss. Another moss, *Hypnum* cf. *cupressiforme* Hedw., was represented amongst the identifiable plant remains from Context 173. There were shallow, unpolluted well-vegetated pools supporting a substantial aquatic fauna, again including *Tanysphyrus lemnae* (Contexts 174, 172 and 171, but not recorded from Context 173) which implies the presence of duckweed. Apart from moss and duckweed, there were few indications of other vegetation, although some taxa feeding on sedges (*Carex*) were present and remains of these plants were common in Context 174 and the two immediately overlying deposits (Contexts 173 and 172). There were records of the froghopper *Aphrophora major* from three of the samples (from Contexts 174 and 173, and the next to uppermost Context 71) in the upper part of the sequence, implying the presence of its host plant bog-myrtle (*Myrica*

gale L.), although remains of the plant itself were not identified.

For all of the deposits, the plant remains of terrestrial vegetation were dominated by birch (determined as silver/downy birch – *Betula pendula* Roth/*B. pubescens* Ehrh. where better preserved). Silver birch forms woods on light, mostly acid soils, especially heathland, and usually in drier places than downy birch. In particular, Context 176 (Samples 301-304) gave large quantities of birch female catkin-scales and nuts. The pollen record indicates that hazel dominated the local woodland at this period, with birch as very much a secondary component, but the macrofossil evidence shows the reverse with only a few nut shells confirming the presence of hazel. This may simply be a reflection of the greater mobility of the delicate birch structures, however. Oak (*Quercus*), which was surprisingly poorly represented in the pollen record, was similarly sparsely represented in the botanical macrofossil assemblages by small numbers of buds/bud scales in just two deposits (Contexts 175 and 173). Small numbers of wood-associated invertebrate taxa were also recorded consistently throughout the sequence, but, other than this, there were few indications of terrestrial habitats other than swamp. Several ground beetle taxa (e.g. *Pterostichus diligens* (Sturm) and *P. nigrita* (Paykull)) were typical inhabitants of moist ground and *Trechus rivularis* (Gyllenhal) was recorded from Context 71 close to the top of the sequence. This last is found on moist shady peat sites often with a growth of birch, alder and willow (*Salix*), and an underlying vegetation of moss and sedges (Lindroth 1985, 121).

The pollen spectra for the upper third or so of the sequence (LPAZs BED-5, BED-4 and the upper part of BED-3) suggested a relatively 'dry' peat accumulating environment (though the area is still clearly 'swampy' with very wet areas and probably shallow bodies of standing, though perhaps not all permanent, water) and this was also reflected in the macrofossil assemblages (Contexts 67, 71, 171 and 172). Concentrations of identifiable plant and invertebrate remains were reduced in these upper layers and aquatic and wetland species decline or were absent (e.g. Characeae spp., sedges, white water-lily). At the same time, there was an increase in wood fragments (including twigs) culminating in these being abundant (with some bark also present) in the uppermost deposit (Context 67) which corresponds with the expansion of pine, hazel and alder evinced by the pollen in BED-5. A single fragment of a wood boring beetle *Grynobius planus* (Fabricius) from Context 67 may also be an indication of trees growing locally.

The distribution of many insects in England is heavily influenced by temperature and consequently the distributions of various species in the past can be used as indicators of climatic change. The bug *Hebrus pusillus* Fallén is of interest in this regard as it is confined to southern England at the present day (Macan 1956; Southwood and Leston 1959, 341-2). It was recorded from the samples from Contexts 173 and 174, and was especially common in the latter. The presence of this species may indicate that the climate of the area at the time the deposits formed was somewhat warmer than at present, perhaps with similar mean temperatures to those of the far south of Britain. Palaeoclimatology's Atlantic period of Holocene northern Europe, with mean temperatures perhaps 2.5 degrees Centigrade higher than today, begins between BP 9000 and 8000 calibrated (ending around BP 4300 calibrated and punctuated by a cooling event at around BP 8200), with some regional variation (this period is still in the process of definition). It seems likely then that the sudden change in the biostratigraphy seen in Bedale Section 18 at around 0.93 metres depth (from BED-1 to BED-2 and dated sometime after 9290 BP calibrated and before 8620 BP calibrated) marks the beginning of the Atlantic period at this site. Contexts 173 and 174 would then have been deposited during this time of warmer climate which

would have allowed *Hebrus pusillus* to extend its range to more northerly locales. It may also be that the less dramatic changes in the biostratigraphy seen for the starts of BED-4 and BED-5 are related to the cooling event of around 8200 BP calibrated.

Overall the plant and insect assemblages supported the pollen evidence indicating aquatic deposition throughout, though in the upper (peat) layers of the sequence this was in a swamp environment rather than the open water implied by the assemblages from the lower (mud/organic silt) layers. The insect assemblages in particular mirrored the pollen evidence for a natural hydroseral succession leading to swampy sedge fen with *Myrica* (though there was no specific evidence for this plant in the botanical material). There was no evidence of human activity from the biological remains at any point through this sequence of deposits.

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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Table 1. 26 Market Place, Bedale, North Yorkshire: summary of the column sample descriptions for Section 18. The deposits are listed in stratigraphic sequence from top to bottom with their positions within the individual monoliths recorded from the base of each tin. Where the overlapping of the monoliths has resulted in the same deposit being present in two tins the positions within each are given. The 'Troels-Smith' column gives descriptions following Troels-Smith (1955).

Position in column	Context	Sample number	Troels-Smith	Transition	Description	Notes
Tin A: 18.0 to 50.0 cm (depth ~0.07 to 0.39 m)	67	311	Dl2Dh/Dg2	grades to…	Dark brown, crumbly, woody detritus peat	
Tin A: 0.0 to 18.0 cm Tin B: 32.0 to 50.0 cm (depth ~0.39 to 0.57 m)	71	310	Dh/Dh3Ld1	grades to…	Dark brown, somewhat crumbly, detritus peat	
Tin B: 20.0 to 32.0 cm (depth ~0.57 to 0.69 m)	171	309	Ld3Dg/Dh1	grades to…	Dark brown, rather crumbly, mix of mud and fine detritus peat	
Tin B: 8.0 to 20.0 cm (depth ~0.69 to 0.81 m)	172	308	Ld3Dg/Dh1	grades to…	Dark brown mud with fine detritus peat	softer and less crumbly than Sample 309
Tin B: 0.0 to 8.0 cm Tin C: 38.0 to 48.0 cm (depth ~0.81 to 0.89 m)	173	307	Ld4?Dg+	grades to…	Mid to dark brown (somewhat 'banded'), mix of mud and fine detritus peat	
Tin C: 36.0 to 38.0 cm (depth ~0.89 to 0.91 m)	174	306	Dh4	grades to…	Mid to dark brown, 'moss-rich' detritus	mostly matted moss
Tin C: (34.0-36.0) to 36.0 cm (depth ~0.91 to 0.93 m)	175	305	Ld3Dg1	sharp boundary to…	Dark brown, soft mud, with a little herbaceous detritus	
Tin C: 12.0 to (34.0-36.0) cm (depth ~0.93 to 1.15 m)	176	304	Ld4test mol.+	grades to…	as 303 but locally paler brown	
Tin C: 0.0 to 12.0 cm Tin D: 27.0 to 50.0 cm (depth ~1.15 to 1.38 m)	176	303	Ld4test mol.+		Dark grey-brown, soft (working more or less plastic), mud, with some fine laminations/partings. Snails were present	some fine laminations / partings
Tin D: 9.0 to 27.0 cm (depth ~1.38 to 1.56 m)	176	302	Ld4test mol.+	grades to…	Mid grey-brown, soft (working more or less plastic), mud. Snails present	lighter shade of grey-brown
Tin D: 0.0 to 9.0 cm (depth ~1.56 to 1.65 m)	176	301	Ld4test mol.+		Mid yellowish-brown (oxidising mid to dark grey-brown), soft (working more or less plastic), mud, with moderate numbers of snails present	yellow-brown in colour

Table 2. 26 Market Place, Bedale, North Yorkshire: summary of the radiocarbon dates from Section 18.

Context	Sample	Location in column sample monoltih	Beta Number	Submitted material	Measured radiocarbon age	13C/12C ratio	Conventional radiocarbon age	Calibration of radiocarbon age to calendar years @ 2-sigma
67	311/T	Tin A: 18.0 to 50.0 cm (depth ~0.23 m)	Beta-187365	Bark fragments, probably birch (*Betula*): 335 mg	7340 +/- 40 BP	-28.1 o/oo	7290 +/- 40 BP	Cal BC 6230 to 6050 (Cal BP 8180 to 8000)
71	310	Tin A: 1.0 to 6.0 cm (Tin B: 33.0 to 38.0 cm) (depth ~0.50 m)	Beta-187366	Organic sediment: 220 g	7550 +/- 60 BP	-28.8 o/oo	7490 +/- 60 BP	Cal BC 6445 to 6225 (Cal BP 8395 to 8175)
171	309/T	Tin B: 20.0 to 32.0 cm (depth ~0.61 m)	Beta-187367	Small wood and bark fragments: 65 mg	8020 +/- 40 BP	-29.7 o/oo	7940 +/- 40 BP	Cal BC 7040 to 6670 (Cal BP 9000 to 8620)
172	308	Tin B: 9.0 to 14.0 cm (depth ~0.79 m)	Beta-187368	Organic sediment: 115 g	8010 +/- 50 BP	-28.0 o/oo	7960 +/- 50 BP	Cal BC 7055 to 6670 (Cal BP 9005 to 8620)
173	307/T	Tin B: 0.0 to 8.0 cm Tin C: 38.0 to 48.0 cm (depth ~0.85 m)	Beta-187369	Three small fragments of well preserved hazel (*Corylus avellana* L.) nutshell: 70 mg	7980 +/- 40 BP	-27.7 o/oo	7940 +/- 40 BP	Cal BC 7040 to 6670 (Cal BP 9000 to 8620)
175	305	Tin C: (34.0-36.0) to 36.0 cm (depth ~0.93 m)	Beta-216398	Organic sediment: ~90 g	8250 +/- 50 BP	-28.6 o/oo	8190 +/- 50 BP	Cal BC 7340 to 7070 (Cal BP 9290 to 9020)
176	301/T	Tin D: 0.0 to 9.0 cm (depth ~1.60 m)	Beta-187370	Tree bud-scales, birch female catkin scales, dicotyledonous leaf fragments: 27 mg	8810 +/- 40 BP	-27.2 o/oo	8770 +/- 40 BP	Cal BC 7970 to 7650 (Cal BP 9920 to 9600)

Table 3. 26 Market Place, Bedale, North Yorkshire: Summary of LPAZs for Section 18. All values are TLP unless otherwise stated.

Zone	Depth-m	Main characteristics
BED-5	0.14-0.27	*Pinus* increases to ~35%, *Corylus* to 25% and *Alnus* to 9%. *Betula* reduced to 5%, *Quercus* to trace (<1%) values and Cyperaceae to 20%.
BED-4	0.27-0.45	An equally sharp peak of 50% in *Betula* follows a pronounced peak of 50% in *Pinus*. *Corylus* increases to ~20% but falls to ~2% by close of zone. Cyperaceae drops steadily to 35%. Pteropsida increases to 90%TLP+spores.
BED-3	0.45-0.75	*Pinus* drops at the opening of the zone before rising to 25% before dropping to 12%, *Quercus* also shows an increase to 10% at the opening of the zone. *Corylus* at ~10%. High Cyperaceae percentages (60%) throughout, whilst Pteropsida rises to 70%.
BED-2	0.75-0.95	*Pinus* increases to around 15%, but other trees including *Quercus*, *Ulmus* and *Betula* all decline and *Corylus* shows a significant fall to ~35%. Cyperaceae rises to 30%.
BED-1	0.95-1.65	Dominated by *Corylus* (70-80%), with other trees including *Betula* (10%), *Ulmus* (5%). *Quercus* (2-3%) and *Pinus* (3-4%) recorded at lower values.

Table 4. 26 Market Place, Bedale, North Yorkshire: Complete list of plant macrofossils from the column samples of Section 18. Nomenclature follows Stace (1997). Abundances have been recorded semi-quantitatively on a three-point scale as follows: '1' = present, i.e. one or relatively few remains or less than 10% by volume; '2' = common, or about 10-50% by volume; '3' = abundant, or more than 50% by volume. Samples suffixed '/T' were also included in the assessment, those suffixed '/T2' were only processed and recorded for the analysis.

Context			**67**	**71**	**171**	**172**	**173**	**174**	**175**	**176**	**176**	**176**	**176**
Sample			311/T	310/T2	309/T	308/T2	307/T	306/T	305/T	304/T2	303/T	302/T2	301/T
Volume of residue (litres)			0.12	2.20	0.375	0.90	1.30	1.20	0.08	1.05	1.75	0.85	0.20
Identified plant remains	**Vernacular name**	**Parts recorded**											
Betula pendula Roth/*B. pubescens* Ehrh.	silver/downy birch	female catkin-scale				1				2	2	2	
Betula pendula/pubescens	silver/downy birch	wingless nut		2		1				3	2	2	
Betula pendula Roth	silver birch	winged nut								3	2	2	
Betula sp.	birch sp. indet.	buds/bud scales					1		1				2
Betula sp.	birch sp. indet.	female catkin-scale					1		1				2
Betula	birch sp. indet.	fruits	1		1		1	1	3				2
Carex	sedge	nut, utricle		1		2	2	2		1	1		
Ceratophyllum	hornwort	fruits							1				
Chara/Characeae	muskgrass/stonewort	oogonium		1		1			1	2	3	3	3
Cladium mariscus (l.) Pohl	saw-sedge	nutlets							1				1
Corylus avellana L.	hazel	nut shell					1			1		1	
Drepanocladus	moss							3	1				
Hypnum cf. *cupressiforme* Hedw.	moss						1						
Menyanthes trifoliata L.	bog bean	seed							1				
Nymphaea alba L.	white water-lily	seed								1	1	1	
Populus	poplar/aspen	buds/bud scales											1
Quercus	oak sp. indet.	buds/bud scales					1		1				
Sorbus aucuparia L.	rowan	fruit							1	1			
?*Thelypteris palustris* Schott	marsh fern	shoots					1						
Other plant remains													
bark			1							1	1	1	
buds/bud scales										2	1	1	

Context			**67**	**71**	**171**	**172**	**173**	**174**	**175**	**176**	**176**	**176**	**176**
Sample			311/T	310/T2	309/T	308/T2	307/T	306/T	305/T	304/T2	303/T	302/T2	301/T
Volume of residue (litres)			0.12	2.20	0.375	0.90	1.30	1.20	0.08	1.05	1.75	0.85	0.20
moss									2				
plant fibres (epidermis)				3		2					2		
rootlets					3	3	3	1					
stem fragments					2							1	
tree leaf fragments									2				2
wood fragments (incl. twiglets)			3	1	1	1	1					1	

Table 5. 26 Market Place, Bedale, North Yorkshire: Complete list of invertebrate remains from the column samples of Section 18. Nomenclature and taxonomic order for beetles and bugs follows Kloet and Hincks (1964-77). Snails follow Kerney (1999). Figures are minimum numbers of individuals represented. The abundance of other orders has been recorded semi-quantitatively on a three-point scale as follows: '+ ' = present, i.e. one or relatively few remains or less than 10% by volume; '++' = common, or about 10-50% by volume; '+++' = abundant, or more than 50% by volume. Samples suffixed '/T' were also included in the assessment, those suffixed '/T2' were only processed and recorded for the analysis.

Context	**67**	**71**	**171**	**172**	**173**	**174**	**175**	**176**	**176**	**176**	**176**
Sample	311/T	310/T2	309/T	308/T2	307/T	306/T	305/T	304/T2	303/T	302/T2	301/T
Taxon											
Cladocera spp. (ephippia)	+	+	++	++	+	-	+	++	+++	+++	++
Ostracoda sp.	-	-	+	-	-	-	+	-	+	++	+
Lygaeidae spp.	1	2	-	1	-	-	-	-	-	-	-
Cymus glandicolor Hahn	-	-	-	-	-	3	-	-	-	-	-
Cymus ?glandicolor	1	3	-	2	6	-	1	-	-	-	1
Saldidae sp.	-	-	-	-	3	1	-	-	-	-	-
Hebrus pusillus Fallén	-	-	-	-	1	18	-	-	-	-	-
Hebrus ruficeps Thomson	-	1	-	-	3	2	1	-	-	-	-
Gerris sp.	-	-	-	-	-	-	1	4	-	4	2
Corixidae sp.	-	-	-	-	-	-	1	3	1	1	1
Heteroptera spp.	-	-	-	-	1	1	-	-	3	1	-
Aphrophora major Uhler	-	1	-	-	1	1	-	-	-	-	-
Delphacidae spp.	2	22	-	21	12	-	1	4	1	2	3
Auchenorhyncha spp.	-	2	1	4	2	-	-	1	-	1	1
Psyllidae sp. indet.	-	-	-	-	-	-	-	1	-	-	-
Aphidoidea sp.	-	-	-	-	-	-	+	-	-	-	-
Bibionidae sp.	+	-	-	-	+	-	-	+	-	-	+
Diptera spp. (adults)	-	-	-	-	-	+	-	-	-	-	+
Diptera spp. (puparia)	-	-	+	+	+	-	-	+	-	-	+
Formicidae sp.	-	-	-	-	-	-	-	-	-	-	+
Hymenoptera Parasitica spp.	-	-	-	-	-	++	-	-	-	-	-
Leistus sp.	-	-	-	-	-	-	1	-	-	-	-
Clivina sp.	-	1	-	-	-	-	-	-	-	-	-
Trechus rivularis (Gyllenhal)	-	3	-	-	-	-	-	-	-	-	-
Bembidion (*Philochthus*) sp.	-	-	-	-	2	-	-	-	-	-	-
Pterostichus diligens (Sturm)	-	3	-	-	1	-	-	-	1	-	-

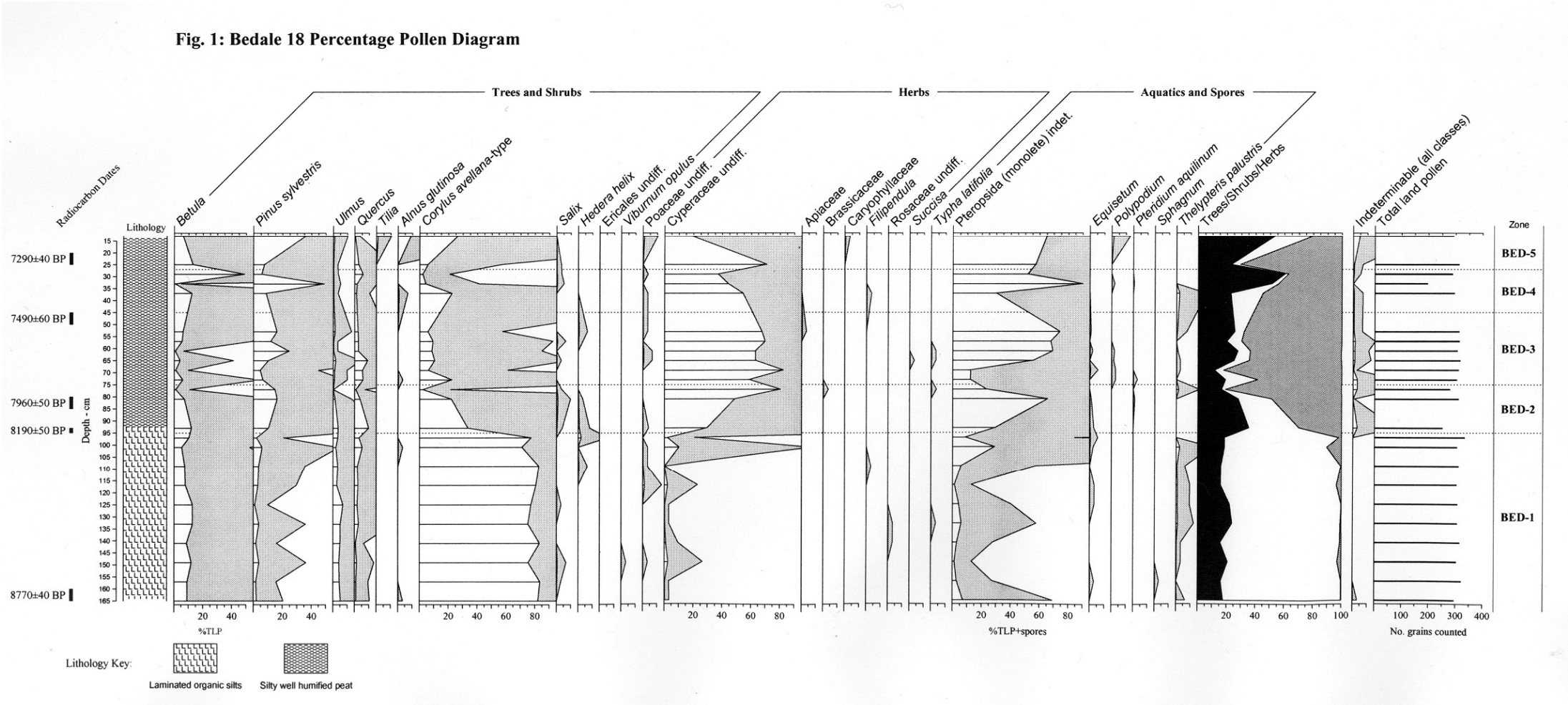
Context	**67**	**71**	**171**	**172**	**173**	**174**	**175**	**176**	**176**	**176**	**176**
Sample	311/T	310/T2	309/T	308/T2	307/T	306/T	305/T	304/T2	303/T	302/T2	301/T
Taxon											
Pterostichus minor (Gyllenhal)	-	-	-	2	-	-	-	-	-	-	-
Pterostichus nigrita (Paykull)	-	1	-	-	-	-	-	-	-	-	-
Pterostichus spp.	-	1	-	-	-	-	-	1	-	-	-
Agonum sp.	-	3	-	-	-	-	-	1	-	-	-
Carabidae spp.	1	1	1	-	3	2	-	1	2	-	2
Haliplus spp.	-	-	-	-	-	-	1	1	-	3	3
Noterus sp.	-	-	-	-	-	-	-	1	-	-	-
Bidessus unistriatus (Schrank)	-	-	-	-	-	4	-	-	-	-	-
Hygrotus inaequalis (Fabricius)	-	-	-	-	-	4	-	2	1	-	-
Suphrodytes dorsalis (Fabricius)	-	-	-	-	-	2	1	-	-	-	-
Hydroporus spp.	-	-	-	4	14	6	-	9	3	2	-
Stictotarsus duodecimpustulatus (Degeer)	-	-	-	-	-	-	-	-	-	1	-
Hydroporinae spp.	1	12	-	-	-	-	7	5	-	3	3
Agabus bipustulatus (Linnaeus)	-	1	-	1	-	-	-	3	1	1	-
Agabus sp.	-	3	-	1	-	-	-	3	-	-	1
Agabus or *Ilybius* spp.	2	3	1	-	1	2	1	8	3	4	1
Colymbetes fuscus (Linnaeus)	-	1	-	-	-	-	1	10	7	3	2
Colymbetinae sp.	-	-	-	-	-	-	-	-	-	2	-
?*Hydaticus transversalis* (Pontoppidan)	-	-	-	-	-	-	-	-	-	1	-
Acilius sp.	-	1	1	-	-	-	2	8	7	3	2
Dytiscus sp.	-	-	-	-	-	-	-	2	1	1	-
Dytiscidae spp.	1	-	-	-	-	-	-	1	-	-	1
Gyrinus sp.	-	1	-	-	-	-	-	-	2	2	1
Hydrochus brevis (Herbst)	-	1	-	1	1	2	-	-	1	-	-
Helophorus spp.	-	-	-	-	-	-	-	1	1	2	-
Coelostoma orbiculare (Fabricius)	1	1	1	1	6	5	1	3	-	-	-
Cercyon spp.	-	3	-	1	4	-	-	1	-	-	-
Hydrobius fuscipes (Linnaeus)	-	1	-	1	1	-	1	6	3	1	-
Anacaena spp.	-	4	-	-	1	-	-	-	-	2	-
?*Hydrophilus piceus* (Linnaeus)	-	-	-	-	-	-	-	2	-	-	-
Hydrophilinae spp.	2	3	1	2	3	6	4	9	2	2	-
Ochthebius minimus (Fabricius)	2	15	-	8	-	7	16	74	49	57	23

Context	**67**	**71**	**171**	**172**	**173**	**174**	**175**	**176**	**176**	**176**	**176**
Sample	311/T	310/T2	309/T	308/T2	307/T	306/T	305/T	304/T2	303/T	302/T2	301/T
Taxon											
Hydraena gracilis *Germar*	-	-	-	-	-	-	-	3	-	-	-
Hydraena ?palustris *Erichson*	-	5	-	1	4	1	4	2	3	2	2
Hydraena sp.	3	7	2	1	3	3	7	12	14	9	12
Limnebius aluta (Bedel)	-	7	-	3	9	9	3	2	1	-	2
Limnebius spp.	-	-	-	-	-	-	1	6	2	3	4
Ptenidium sp.	-	1	-	-	-	-	-	-	-	-	-
Acrotrichis sp.	-	2	-	-	-	-	-	-	-	-	-
Catopinae sp.	-	-	-	-	-	-	-	1	-	-	1
Silpha atrata Linnaeus	-	-	-	-	-	-	-	1	1	-	-
Micropeplus tesserula Curtis	-	-	-	-	1	-	-	-	-	-	-
Micropeplus sp. indet.	-	-	-	-	-	1	-	-	-	-	-
Metopsia retusa (Stephens)	-	1	-	-	-	-	-	-	-	-	-
Olophrum piceum (Gyllenhal)	-	-	-	-	1	-	-	1	-	-	-
Olophrum sp.	-	1	-	-	-	-	-	-	-	1	2
Eusphalerum sp.	-	1	-	-	2	-	-	-	-	-	-
Omaliinae spp.	-	3	1	-	2	2	-	1	-	-	-
Carpelimus sp.	-	1	-	-	1	-	2	-	1	-	1
Aploderus caelatus (Gravenhorst)	-	-	-	-	-	-	-	1	-	-	-
Platystethus capito or *nodifrons*	-	-	-	-	1	-	-	-	-	-	-
Anotylus sp.	-	-	-	-	-	-	-	1	-	-	-
Stenus spp.	-	8	1	4	3	1	1	1	1	1	1
Paederus sp.	-	-	-	-	2	1	-	-	-	-	-
Lathrobium sp.	-	2	2	1	1	-	-	-	-	-	-
Ochthephilum fracticorne (Paykull)	-	-	-	-	-	-	1	-	-	-	-
Paederinae spp.	-	2	-	-	-	-	-	1	-	-	-
Erichsonius cinerascens (Gravenhorst)	1	1	-	1	2	1	-	-	-	-	-
Philonthus sp.	-	-	-	-	-	-	1	-	-	-	-
Staphylinus ?caesareus Cederhjelm	-	-	-	-	-	-	-	1	-	-	-
Quedius sp.	-	-	-	-	-	-	-	1	-	-	-
Acylophorus glaberrimus von Nordmann	-	-	-	-	-	2	-	-	-	-	-
Staphylininae spp.	-	2	-	-	2	1	1	1	2	-	-
Aleocharinae spp.	2	9	4	10	18	7	2	4	3	3	2
Amauronyx maerkeli (Aubé)	-	4	1	1	5	1	1	-	-	-	1

Context	**67**	**71**	**171**	**172**	**173**	**174**	**175**	**176**	**176**	**176**	**176**
Sample	311/T	310/T2	309/T	308/T2	307/T	306/T	305/T	304/T2	303/T	302/T2	301/T
Taxon											
Pselaphus heisei (Herbst)	-	1	-	-	-	-	-	-	-	-	-
Pselaphidae spp.	2	3	-	1	2	-	-	-	-	1	-
Aphodius spp.	-	-	-	-	-	-	1	3	1	-	1
Cyphon padi (Linnaeus)	-	-	22	23	28	13	-	13	5	1	2
Cyphon spp.	4	39	5	14	19	8	2	12	-	3	1
Dryops sp.	-	1	1	1	1	-	-	-	-	1	-
Elmis aenea (Müller)	-	-	-	-	1	-	-	7	5	5	2
Esolus parallelepipedus (Müller)	-	-	-	-	-	-	1	6	3	4	1
Limnius volkmari (Panzer)	-	-	-	-	-	-	-	3	9	11	3
Normandia or *Riolus* sp.	-	-	-	-	-	-	-	-	-	-	1
Oulimnius sp.	-	-	-	-	-	-	-	3	4	4	1
Melanotus sp.	-	-	-	-	-	-	-	-	1	-	-
Elateridae spp.	-	3	-	-	-	-	-	1	-	-	1
Elateridae sp. (larval apices)	-	2	-	-	-	-	-	-	-	-	-
Cantharidae spp.	-	-	-	-	-	-	1	4	2	4	1
Grynobius planus (Fabricius)	1	-	-	-	-	1	1	-	-	-	-
Cerylon fagi Brisout	-	-	-	-	-	-	-	-	1	1	1
Corticariinae spp.	-	1	-	-	1	-	-	2	1	-	-
?Corylophidae sp.	1	10	-	3	-	-	-	-	-	-	-
Rhinosimus sp.	-	-	-	-	-	-	1	-	-	-	-
Plateumaris sp.	-	-	-	-	-	-	-	2	-	1	-
Donacia sp.	-	-	-	-	-	-	-	1	-	1	-
Donaciinae sp.	-	-	-	1	-	-	1	-	1	-	1
Lochmaea sp.	-	-	-	-	-	-	-	-	1	-	1
Altica spp.	-	-	-	-	2	-	-	-	-	-	-
Halticinae spp.	-	-	-	1	-	1	-	-	-	-	-
Chrysomelidae sp.	-	-	-	1	-	-	-	-	-	-	-
Apion spp.	-	-	-	-	-	-	1	2	1	-	1
Phyllobius or *Polydrusus* sp.	-	-	-	-	-	-	-	3	1	1	1
Tanysphyrus lemnae (Paykull)	-	-	1	1	-	1	1	1	-	-	-
Ceutorhynchinae sp.	-	-	-	-	-	-	-	1	-	-	-
Limnobaris sp.	-	1	-	-	-	-	-	-	-	-	-
Curculionidae spp.	4	17	3	3	2	-	1	1	-	2	2

Context	**67**	**71**	**171**	**172**	**173**	**174**	**175**	**176**	**176**	**176**	**176**
Sample	311/T	310/T2	309/T	308/T2	307/T	306/T	305/T	304/T2	303/T	302/T2	301/T
Taxon											
Scolytidae sp.	-	-	-	-	-	-	-	1	-	-	-
Coleoptera spp.	2	2	-	3	2	2	1	-	5	6	-
Insecta spp. (larva)	-	++	-	++	+	++	++	-	+	-	-
Acarina spp.	+	++	++	++	++	++	-	+	-	-	++
Araneae spp.	-	-	-	-	+	+	-	-	-	-	-
Valvata cristata Müller								++	++	++	++
?planorbid sp. indet.											+
Pisidium sp.										+	
Mollusca spp.								++	++	++	++

Figure 1. 26 Market Place, Bedale, North Yorkshire: Percentage pollen diagram for Section 18.



Appendix

This Appendix restates the results and preliminary discussion of those samples included in the assessment which were not investigated further during the analysis. Records for insect preservation follow Kenward and Large (1998). Full details of the assessment processing and recording methods can be found in the assessment report (Carrott *et al*. 2004). References cited within the Appendix which are not also within the main body of the text are given below.

Results

Section 17 – columns samples 1 and 2

Pollen and diatoms

No diatoms were present in the samples. As with the samples from Section 18, the presence of copulae in some samples indicated that diatoms were once present, but, again, it is difficult to draw further conclusions based on this evidence alone.

The results of the pollen analyses are presented as a percentage pollen diagram (Figure A1). With the exception of the samples from 0.47 m and 0.51 m, all the samples assessed contained adequate concentrations of pollen. The samples from 0.47 m and 0.51 m contained only trace organic residues with few palynomorphs present. Preservation was assessed as poor to moderate for the samples from this sequence, but, on the whole, the pollen spectra made ecological sense and it is thought likely that the samples were largely unbiased.

The pollen spectra from the organic silts (0.67 m, 0.83 m and 1.05 m) were dominated initially by *Betula*, which attained 80% in the basal sample, falling to around 40% as percentages of Poaceae increased to 30%. Other trees and shrubs included *Pinus sylvestris* (up to 6%), *Corylus avellana*-type (1-2%) *Salix* (2-3%) and *Juniperus communis* L. (juniper, 1-3%), but these were not dominant components. A sparse range of herbaceous taxa was recorded, including Cyperaceae, *Rumex* (docks), *Artemisia*-type (cf. mugwort), *Thalictrum* (meadow rue), *Helianthemum* (rock-rose) and Caryophyllaceae (pink/campion family). Low peaks of 4% in *Helianthemum* at 0.83 m and *Thalictrum* at 0.67 m represented the highest values for herbs other than Cyperaceae or Poaceae. *Betula* remained dominant following the transition from organic silts to peat at around 0.44 m, with the most marked change being the increase in *Pinus sylvestris* to as much as 16%. A marked rise in Pteropsida (monolete) indet. to up to 70% TLP+spores was also observed at this point. The representation of *Corylus avellana*-type was also enhanced slightly to 3-5%. Few herbs were present, although Lactuceae undiff. was recorded at 2-3% at 0.35 m and 0.39 m.

The Section 17 sequence reflects the presence of birch scrub/woodland around the sampling site. Few other trees were present, aside possibly from some willow and limited extents of juniper, with the *Pinus* curve probably reflecting long distance transport. Some open grassland and sedge communities are suggested, although the Poaceae may also derive from local wetland grasses such as *Phragmites*. The likelihood of the latter source being favoured by the sparse record for other herbs. Those herbs which were recorded include mugwort rock rose, meadow rue and species' of dock typical of 'open steppe' communities on disturbed, possibly skeletal soils. The marked increase in Pteropsida (monolete) indet. at 0.43 m indicates a local expansion of ferns, possibly related to processes associated with the hydroseral succession from open water to semi-terrestrial conditions as the basin infilled. Pine also seems to have begun to expand locally at this time, possibly also as a result of the availability of suitable peaty soils around the basin.

Plant and invertebrate macrofossils

Context 158 [Tin A: 7.5 to 16.0 cm; Tin B: 45.0 to 50.0 cm]
Sample 209/T (1.55 kg sieved to 300 microns with paraffin flotation)

Dark brown, firm (to crumbly), well humified (?slightly woody), detritus peat. Troels-Smith: Ld/Dg4?Dl+.

The small residue of barely 50 ml comprised clasts of undisaggregated humic material with a little gravel (to 10 mm), and coal, cinders and charcoal (all to 3 mm). A single charred barley grain (*Hordeum*) was also noted. Uncharred plant

remains included small numbers of Characeae oogonia, with traces of other aquatics (white water-lily, *Nymphaea alba* L., seed fragments and pondweed, *Potamogeton* sp., fruits) and traces of poplar/aspen buds/bud-scales.

The flot consisted mostly of decayed plant material, with only traces of insect remains. No other invertebrates were noted.

Context 159 [Tin A: 0.0 to 7.5 cm; Tin B: 30.0 to 45.0 cm]
Sample 208/T (1.85 kg sieved to 300 microns with paraffin flotation)

Light yellow-brown (locally mid to dark brown), soft to crumbly (working slightly plastic), slightly humic marl, flecked but not clearly banded with mollusc shell. Troels-Smith: Lc4As/Ag+test mol.+.

The residue of about 330 ml was of moderate size for the size of the subsample. It comprised undisaggregated marl with abundant snails (largely fragmentary and unidentified). Not surprisingly, given the nature of the sediment, Characeae oogonia were frequent, other aquatic taxa including white water-lily and pondweed. The only truly terrestrial remains were traces of poplar/aspen buds/bud-scales.

The small flot consisted predominantly of numerous planorbid (most probably *Planorbis planorbis* (L.)) and other aquatic snails (including many *Lymnaea peregra* (Müller), some *Valvata piscinalis* (Müller) and a few ?*Bithynia leachii* (Sheppard)), and there were only traces of other invertebrate remains. The latter showed variable preservation (E 2.5-4.0) and had no potential for interpretation. As a whole, the snails suggest slow moving or still, thickly weeded (consistent with the aquatic plant remains), hard water.

Context 161 [Tin B: 0.0 to 17.5 cm; Tin C: 30.5 to 50.0 cm]
Sample 206/T (4.4 kg sieved to 300 microns with paraffin flotation)

Very pale to light to mid grey-brown, finely banded, silty marl, with some amorphous organic material. Troels-Smith: Lc3Ld1As/Ag+.

The small residue of about 250 ml consisted of herbaceous plant detritus and a little undisaggregated marl. There were a few rather eroded birch fruits and poplar/aspen buds/bud-scales and a small range of other taxa essentially representing aquatic and marsh habitats, though there was no very large and coherent assemblage.

The flot was large (not unexpected in view of the large subsample processed), and contained of the order of several thousand carapaces (as opposed to ephippia) of cladocerans, as well as numerous chironomid (midge) larval head capsules, placing deposition in water. There were a few aquatic beetles, but the terrestrial component was limited. Overall, the impression was of a lake or deep pond sediment. Although chemically in fairly good condition, the beetle remains were often very fragmentary and difficult to see amongst the other debris in the flot (E 2.0-3.0, mode 2.5 weak; F 2.0-5.0, mode 3.0 weak). While the insect remains (other, perhaps, than Chironomidae) have little potential for detailed interpretation (although of some use in a stratigraphic series), the cladocerans from this layer may be valuable as a source of information regarding water quality, and they should perhaps be assessed by an appropriate specialist.

Context 164+165+166 [Tin C: (14.0-14.5) to 22.0 cm]
Sample 203/T (0.8 kg sieved to 300 microns with paraffin flotation)

Dark brown (Context 165 forming a paler band between 164 and 166 but otherwise identical), firm to brittle, silty amorphous organic sediment/mud. Troels-Smith: Ld3As/Ag1 to Ld4As/Ag+.

This small subsample yielded a very large residue of about 525 ml of fine plant detritus, the coarser fraction consisting of flakes of undisaggregated humic silt (probably best interpreted as a silty nekron mud). The fine fraction contained some Characeae oogonia and traces of birch fruits and female catkin-scales.

The flot was rather large bearing in mind the small subsample processed, and included abundant midge (Chironomidae) larval head capsules, modest numbers of beetle remains, and a few cladocerans (mostly *Daphnia*). Preservation was rather poor and the remains generally pale and fragmented (E 3.0-4.5, mode 2.5 weak; F 2.0-5.5, mode 3.5 weak, trend to pale 1-4, mode 3 weak). While deposition was clearly aquatic (from the chironomids and cladocerans) there were only traces of aquatic insects, most representing waterside or terrestrial habitats. This fauna would probably have been of

considerable interest if better preserved and larger, but, even allowing for the processing of a very large subsample, the invertebrates remain of borderline value except as general indicators and as part of a series.

Bulk sediment samples

Archaeological information, provided by the excavator, is given in square brackets. A brief summary of the processing method and an estimate of the remaining volume of unprocessed sediment follows (in round brackets) after the sample number.

Context 38 [medieval ditch fill]
Sample 5/T (3 kg sieved to 300 microns with paraffin flotation and washover; approximately 15 litres of unprocessed sediment remain)

Moist, mid to dark brown to mid to dark grey-brown, stiff and brittle to crumbly (working soft), very humic silt and fine herbaceous detritus. Fragments of wood and fresh water molluscs were present.

The washover of about 80 ml taken to concentrate mollusc consisted mainly of (presumably ancient) fine rootlets with well-preserved achenes of water-crowfoot (*Ranunculus* Subgenus *Batrachium*), snails and quite a lot of beetles not extracted by paraffin flotation. The small residue of about 300 ml was mainly woody and herbaceous detritus with a little sand and moderate amounts of whole and fragmentary snail shell, wood fragments (to 25 mm) and (presumably reworked) peat fragments (to 10 mm). Quite a lot of the wood could well be from twigs; all were rather eroded. The seeds present were mostly well-, sometimes very well-preserved, however, the assemblage being dominated by water crowfoot, with Characeae, saw-sedge and celery-leaved crowfoot (*Ranunculus sceleratus* L.). Other taxa, present in smaller amounts, included a number typical of wet ditches though some may have arrived from disturbed habitats in the vicinity. Traces of bone (unidentified fragments) and charcoal were present, but there was otherwise no very strong evidence from the plant remains for human activity, however. The identifiable snail remains were all of freshwater planorbids, most probably *Planorbis planorbis* (L.) typically found in ditches and small ponds containing weeded hard water.

The flot contained quite large numbers of insects, which were chemically well preserved but often comminuted (E 1.5-3.0, mode 2.5 weak; F 2.0-5.0, mode 3.0 weak), as well as of the order of 100 *Daphnia* ephippia (probably two species at least) and numerous ostracods. A range of aquatic beetles and bugs was noted, all being fairly tolerant of stagnant water, and there were several larval cases of caddis flies (Trichoptera). There were appreciable quantities of terrestrial insects, with hints of grassland (e.g. the chafer *Hoplia philanthus* (Fuessly)) and dung (*Aphodius* and *Geotrupes* species). Dead wood was indicated by *Ptilinus pectinicornis* (Linnaeus) and *Grynobius planus* (Fabricius), both of which occur in structural as well as natural timber. The addition of insects from a further subsample should provide a good range of evidence concerning local environment and land use.

Context 139 [medieval ditch fill]
Sample 6/T (3 kg sieved to 300 microns with paraffin flotation; approximately 16 litres of unprocessed sediment remain)

Moist, mid to dark brown to mid to dark grey-brown (to black internally – giving a sulphide smell when lumps were broken open), brittle to crumbly (working soft), very humic, slightly sandy silt, with fine and coarse herbaceous detritus. Occasional patches of pale grey clay silt (to 12 mm) were present as were fragments of wood (or ?woody root).

The moderately large residue of about 450 ml was of woody debris with many snail shell fragments. Preservation of the plant remains was good, with some sulphide blackening and (in some specimens) pyritisation. Although the more frequent remains (Characeae, rush (*Juncus*), white water-lily, persicaria (*Polygonum persicaria* L.), water crowfoot and docks (*Rumex*)) pointed to damp ground and standing water the presence of seeds of cultivated flax (*Linum usitatissimum* L.), with material which may well be stem fragments and stem epidermis of this plant, suggests human activity—most probably in the form of flax retting.

Preservation of invertebrates was variable, from good to poor (E 1.5-4.0, mode 3.0 weak; F 1.5-5.0, mode 3.5 weak). Ostracods were very abundant (order of 10^3), and there were numerous ephippia of *Daphnia* and a second characteristic cladoceran (order of 10^2 in both cases). Further evidence of aquatic deposition came from some pond snails (?*Lymnaea* sp.) and a modest range of insects, the latter including an Elminthid, suggesting flowing water (probably an inflow, not at the point of deposition). There were some waterside and terrestrial insects, the latter indicating herbaceous vegetation and

(somewhere) dung. An additional subsample of perhaps 5 kg would give an interpretatively useful group of insect remains, although fragmentation would slow identification. Very careful processing might allow recovery of less damaged remains, although the fossils may have been broken during deposit formation (drying or the activity of scavengers?) or subsequently (compression of the deposits by overburden or machinery?).

Discussion

Column samples

The pollen spectra from both Sections 17 and 18 record early Holocene vegetation changes, but there are very good grounds to believe that Section 17 reflects a slightly earlier phase of landscape development. Birch (*Betula*) woodland spread rapidly over the landscape in the earliest Holocene; with a date for this expansion of 10120+/-180 BP (Birm-405) available from the Bog at Roos in Holderness (Beckett 1981). Pollen evidence from the nearby site of Star Carr in the Vale of Pickering indicates that hazel (*Corylus*) arrived in this area at around 9400 BP, replacing the *Betula* woodland, with elm (*Ulmus*) and then oak (*Quercus*) arriving *circa* 7500 BP (Day and Mellars 1994). The dominance of *Betula* in the Section 17 diagram, and low values for other tree taxa, thus suggests that this sequence is earlier than that of Section 18. Indeed, it is possible that the sequence reaches back into the Late-glacial. The few herbs recorded in the samples from the laminated organic silts include *Artemisia*, *Helianthemum* and *Thalictrum*, taxa which are typical of the bare, disturbed soils of the Loch Lomond Stadial (Day 1995). Radiocarbon dating would be required to support this hypothesis.

No identifiable diatom remains were recovered from the subsamples and the potential for further study is clearly very low.

Plant macrofossil remains preserved by anoxic waterlogging were generally well preserved and usually reasonably abundant and the assemblages often of quite restricted diversity, as might be expected in deposits which were largely detritus peats. Preservation of invertebrate remains was very varied within and between deposits. Some assemblages gave the subjective impression that there may have been general decay, so perhaps the deposits as a whole may be at risk from dewatering. The concentration of invertebrates varied, too, from very low to moderately high (extremely high if crustaceans are included), probably reflecting ecological conditions, rate of sediment accumulation and (in the case of the lake deposits) distance from the shoreline.

All the plant and insect assemblages indicated aquatic deposition, though in some cases in swamp rather than open water.

The only evidence of possible human activity from the subsamples from the columns was the small quantity of charred plant remains and cinder recovered from Context 158 (Section 17, Column Sample 2). Context 158 lay immediately beneath a 19th century dump deposit (Context 157, not assessed) and the possibility of contamination from this layer cannot be discounted.

Bulk sediment samples

The plant and invertebrate remains from the medieval ditch fills indicated that these features held water. In one case (Context 139), some evidence of human activity was suggested, namely flax retting. Additional information regarding local land use and the immediate environment would

almost certainly be forthcoming from detailed study of the remains (particularly of insects) from larger subsamples.

[Although both of the medieval ditch fills contained assemblages of well preserved plant and invertebrate remains, detailed analysis was initiated but not pursued beyond the processing of additional larger subsamples (each of 5 kg) and the initial recording of the recovered plant remains. The analysis was discontinued for two reasons; firstly, the deposits remained only rather broadly dated as 'medieval' (probably 13th to 15th century) and, secondly, because the assemblages were essentially 'natural' and hence of some value for the reconstruction of the local environment but not for archaeological interpretation of the possible purpose/use of the ditches.

The bulk of the biological remains recovered from Sample 5 (Context 38) consisted of woody and herbaceous plant detritus, but identifiable botanical macrofossils, preserved by anoxic waterlogging, were also present and in very good condition. The assemblage was dominated by crowfoot (*Ranunculus* subgenus *Batrachium*) and celery-leaved buttercup (*Ranunculus sceleratus* L.) typical of the damp conditions associated with wet ditches, and there were some other species of this environment (e.g. fool's-water-cress (*Apium nodiflorum* (L.) Lag.)). Smaller numbers of remains of taxa of waysides and waste places (e.g. dock (*Rumex*) and common nettle (*Urtica dioica* L.)) were also present; these plants often indicate significant human or animal disturbance and, usually, a nitrogen-rich soil. More substantial 'woody' vegetation was represented by records of elder (*Sambucus nigra* L.) and silver/downy birch (*Betula pendula* Roth/*B*. *pubescens* Ehrh.). The invertebrate remains clearly showed that the ditch held water; perhaps rather stagnant (as indicated by the aquatic beetle fauna) and subject to drying out (cladoceran ephippia, including *Daphnia*, and *Planorbis planorbis* (L.) snails). There were also hints of animals grazing from dung beetles (*Geotrupes* and *Aphodius* species) and the grassland chafer *Hoplia philanthus* (Fuessly). Dead wood was indicated by *Ptilinus pectinicornis* (Linnaeus) and *Grynobius planus* (Fabricius), both of which can occur in structural as well as natural timber.

The assessment subsample from the second of the ditch fills, Context 139 (Sample 6), had given some flax (*Linum usitatissimum* L.) seeds which suggested the possibility that the feature had been used for flax retting. However, the larger analysis sample recovered only a single additional flax seed. The bulk of the recovered biological remains were, again, mainly waterlogged plant remains including wood (notably small twigs and bark fragments) and tiny plant fibres, with identifiable botanical macrofossils preserved in very good condition; some showed sulphide blackening and pyritisation. The more frequent remains, muskgrass (*Chara*), crowfoot (*Ranunculus* subgenus *Batrachium*) and celery-leaved buttercup (*Ranunculus sceleratus*), once again pointed to damp ground and standing water, with other wetland species, such as compact/soft/hard rush (*Juncus conglomeratus* L./*J. effuses* L./*J. inflexus* L.), sedge (*Carex*), tasteless water-pepper (*Persicaria mitis* ((Schrank) Opiz ex Assenov), present too, but in relatively small numbers. There were also some indicators of disturbed habitats (e.g. rough and waste ground, waysides) in the form of chickweed (*Stellaria media* (L.) Vill.), henbane (*Hyoscyamus niger* L.), nipplewort (*Lapsana communis* L.) and prickly sow-thistle (*Sonchus asper* (L.) Hill), providing hints of possible human or animal activity. Aquatic invertebrates, including abundant ostracods and numerous ephippia (of *Daphnia* and at least one other cladoceran) showed that this ditch also held water. The latter and the snails present (some were the dwarf pond snail, *Lymnaea truncatula* (Müller), but most of the remains were unidentified shell fragments) suggesting that the ditch was subject to drying out. There was also a rather modest range of insects, some of which were additional aquatics, including an Elminthid (suggesting flowing water, probably from an inflow not located at the point of deposition). There were some waterside

and terrestrial insects, the latter indicating herbaceous vegetation and, somewhere in the vicinity, dung.

No other remains which might provide further insight into human activities in the vicinity of these features were recorded (there were no crop plants present, for example) and the full analysis was halted prior to the detailed recording of the invertebrate assemblages. The plant remains were recorded in more detail and the results are presented in Table A2 of the appendix to the technical report (Gearey *et al*. 2006), however.

The plant taxa recorded from these additional samples are shown in Table A2.]

References (Appendix only)

Beckett, S. C. (1981). Pollen diagrams from Holderness, North Humberside. *Journal of Biogeography* **8**, 177-198.

Day, P. and Mellars, P. A. (1994). 'Absolute' dating of Mesolithic human activity at Star Carr, Yorkshire: new palaeoecological studies and identification of the 9600BP radiocarbon 'plateau'. *Proceedings of the Prehistoric Society* **60**, 417-422.

Kenward, H. and Large, F. (1998). Recording the preservational condition of archaeological insect fossils. *Environmental Archaeology* **2**, 49-60.

Table A1. 26 Market Place, Bedale, North Yorkshire: summary of the column sample descriptions for Section 17. The deposits are listed in stratigraphic sequence from top to bottom with their positions within the individual monoliths recorded from the base of each tin. Where the overlapping of the monoliths has resulted in the same deposit being present in two tins the positions within each are given.

Position in column	Context(s)	Sample number	Troels-Smith	Transition	Description	Notes
Tin A: 16.0 to 50.0 cm	157	210	Gg1As1Ag2	grades over lower 5 cm to…	Dark grey-brown, crumbly (working slightly plastic), stony clay silt	humic in lower 5 cm
Tin A: 7.5 to 16.0 cm Tin B: 45.0 to 50.0 cm	158	209	Ld/Dg4?Dl+	very sharp boundary to…	Dark brown, firm (to crumbly), well humified (?slightly woody), detritus peat	
Tin A: 0.0 to 7.5 cm Tin B: 30.0 to 45.0 cm	159	208	Lc4As/Ag+test mol.+	very sharp boundary to…	Light yellow-brown (locally mid to dark brown), soft to crumbly (working slightly plastic), slightly humic marl, flecked but not clearly banded with mollusc shell	
Tin B: 17.5 to 30.0 cm	160	207	As/Ag4	very sharp boundary to…	Mottled light to mid grey and brown, soft (working plastic), clay silt to silty clay	
Tin B: 0.0 to 17.5 cm Tin C: 30.5 to 50.0 cm	161	206	Lc3Ld1As/Ag+	very sharp boundary to…	Very pale to light to mid grey-brown, finely banded, silty marl, with some amorphous organic material	
Tin C: 29.5 to 30.5 cm	162	205	Ld3As/Ag1 to Ld4As/Ag+	very sharp boundary to…	as 203 but less 'rubbery'	
Tin C: 22.0 to 29.5 cm	163	204	Lc3Ld1test mol.+	very sharp boundary to…	Pale yellow/mid to dark brown banded marl and mud	
Tin C: (14.0-14.5) to 22.0 cm	164+165+166	203	Ld3As/Ag1 to Ld4As/Ag+	fairly sharp boundary to…	Dark brown (Context 165 forming a paler band between 164 and 166 but otherwise identical), firm to brittle (and somewhat 'rubbery'), silty amorphous organic sediment/mud	Context 165 appears to be just a lighter coloured band
Tin C: (8.0-11.5) to (14.0-14.5) cm	168	202	As/Ag4?Sh+	fairly sharp boundary to…	Mid grey-brown, soft (working plastic), ?slightly humic, silt	
Tin C: 0 to (8.0-11.5) cm	169	201	Ga/Gs2As/Ag1Gg1		Light grey plastic clay with abundant sand and gravel	

Table A2. 26 Market Place, Bedale, North Yorkshire: Plant remains from the 5 kg analysis (/T2) subsamples from the medieval ditch deposits, with brief notes on other remains present. Nomenclature follows Stace (1997). Abundances have been recorded semi-quantitatively on a three-point scale as follows: '1' = present, i.e. one or relatively few remains or less than 10% by volume; '2' = common, or about 10-50% by volume; '3' = abundant, or more than 50% by volume.

Context			**38**	**139**
Sample			5/T2	6/T2
residue size (litres)			1.1	2.1
flot size (ml)			10	13
Taxon	**Vernacular name**	**Part recorded**		
Apium graveolens L.	celery	mericarp	1	1
Apium nodiflorum (L.) Lag.	fool's water-cress	mericarp	1	
Betula pendula Roth/*B. pubescens* Ehrh.	silver/downy birch	nut	1	
Carex	sedge	nut, utricle		1
Chara	muskgrass	oogonium	1	3
Cirsium arvense (L.) Scop.	creeping thistle	achene		1
Hyoscyamus niger L.	henbane	seed		1
Juncus conglomeratus L./*J. effusus* L./ *J. inflexus* L.	compact/soft/hard rush	seed		1
Lapsana communis L.	nipplewort	achene		1
Linum usitatissimum L.	flax	seed		1
Persicaria	knotweed	achene		1
Persicaria mitis (Schrank) Opiz ex Assenov	tasteless water-pepper	achene		1
Poa annua L.	annual meadow-grass	caryopsis		1
Poa pratensis L./*P. trivialis* L.	smooth/rough meadow-grass	caryopsis		1
Ranunculus acris L./*R. repens* L.	meadow/creeping buttercup	achene	1	
Ranunculus subg. *Batrachium*	crowfoot	achene	3	2
Ranunculus sceleratus L.	celery-leaved buttercup	achene	2	2
Rumex sp. (not *R. acetosella*)	dock	achene	1	2
Sambucus nigra L.	elder	seed	1	1
Sonchus asper (L.) Hill	prickly sow-thistle	achene		1
Stellaria media (L.) Vill.	chickweed	seed		1
Urtica dioica L.	common nettle	achene	1	
Unidentified plant remains				
bark 10-30 mm				1
plant fibres				1
prickles			1	1
twig fragments 10-20 mm				1
Invertebrates				
earthworm egg capsules			1	1
insect remains			3	1
snail shell fragments (mostly unid. fragments)			2	2
water flea (cladoceran) resting eggs (ephippia)			2	2

Figure A1. 26 Market Place, Bedale, North Yorkshire: Percentage pollen diagram for Section 17.