Trent Valley Geoarchaeology 2002

ADVANCING THE AGENDA IN ARCHAEOLOGY AND ALLUVIUM

Component 11a: EXTENDING AND PROTECTING PALAEOENVIRONMENTAL DATA: DEPOSIT SAMPLING

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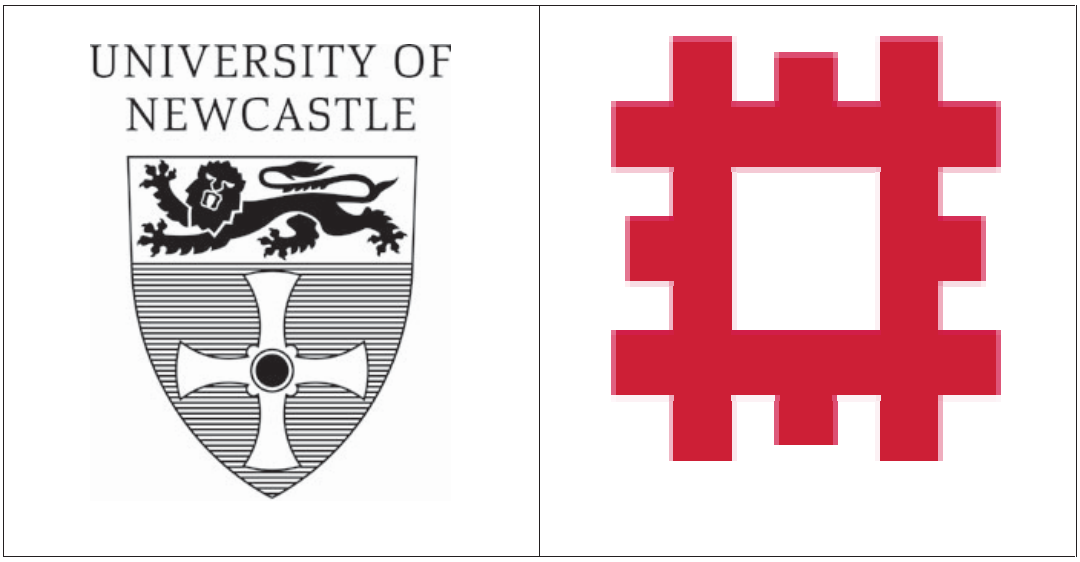

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Trent Valley Geoarchaeology 2002

Component 11a: Extending and protecting palaeoenvironmental data: deposit sampling

A limited programme of coring and sampling deposits in palaeochannels outside of allocations for mineral extraction in the Nottinghamshire sector of the Trent Valley, to enhance the palaeoenvironmental record derived from developer funded work and to examine feasibility and implications of extending such a programme to the whole of the Trent Valley area.

(Components 11a Project Outline May 2002)

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1. INTRODUCTION

This document provides a final **DRAFT** report on Component 11a of Trent Valley Geoarchaeology 2002 and should be read in conjunction with the interim report provided immediately following borehole drilling and sample collection of organic material from nine localities: Great Haywood; lower Dove Valley; Old Trent Water; Mill Plantation; Barton in Fabis south; Barton in Fabis north; Bulcote Farm; Seymour Drain; and Holme Pierrepont. (Havelock and Howard, 2003; Appendix 1).

This document describes the results of palaeoenvironmental assessment (pollen, macroscopic plant, insect and mollusc remains) and radiocarbon dating and places these findings within a geoarchaeological framework for future research. At the time of submission, the results of radiocarbon dating on core 9 and a single sample from core 5 (Barton in Fabis south) are outstanding, due to technical problems with analytical equipment (P. Marshall, pers. comm.). Once received, these results will be included in a separate appendix (A 2) and incorporated into publication associated with this work.

2. METHODS

2.1. Macroscopic Plant and Insect Remains

To provide samples that were deemed large enough to yield sufficient insect material (and macrofossils for dating), it was necessary to aggregate material from the parallel cores at each of the eight cored sites. Details of core amalgamation are provided in Appendix 3.

Samples were prepared initially by disaggregation in water and sieving to 0.3 mm. Residues were checked for material suitable for dating by AMS and then subjected to paraffin flotation (Kenward *et al.*, 1980; 1986) to extract and concentrate insect remains. The resultant 'flots' were checked quickly for plant remains, but the bulk of these were examined by means of the residues, which were resieved into a series of fractions for easier scanning. Molluscs were also examined in those residues where they were present.

Quantity and quality of preservation of plant remains was recorded directly into a PC using simple descriptions and a four-point semi-quantitative scale for abundance. Insect preservation was recorded using the scheme of Kenward and Large (1998); only a part of the larger flots was examined. The flots (and subsamples of the residues from the samples from Core 9) were scanned for snails and these remains were identified to species (main source, Kerney and Cameron, 1979) where possible within the constraints of a rapid assessment. Approximate numbers of individuals of molluscs were recorded on a 4-point semi-quantitative scale as: f = few (up to 3 individuals); s = some (4 to 20); m = many (21 to 50); v = very many (more than 50).

Complete tabulated datasets for insect and mollusc remains are provided in Appendix 3.

2.2. Pollen

Samples for pollen preparation were extracted from the top, base and middle from each sequence. Table 1 lists the sequences and the sample depths. Pollen preparation followed standard techniques including KOH digestion and acetylation (Moore *et al*., 1991). At least 125 total land pollen grains (TLP) excluding aquatics and spores were counted for each sample where possible. 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 data is presented as pollen diagrams produced using TILIA and TILIA*GRAPH (Grimm, 1991) and included in Appendix3.

Table 1: Position of pollen samples from the ground surface in individual cores

Sequence/site	Samples/depth (m)
Lower Dove Valley	Top: 0.87 Middle: 1.11 Base: 1.35
Lower Dove Valley	Top: 0.87 Middle: 1.11 Base: 1.35
Old Trent Water	Top: 0.33 Middle: 0.75 Base: 1.16
Mill Plantation	Top: 0.85 Middle: 1.25 Base: 1.69
Barton in Fabis North	Top: 1.59 Middle: 2.05 Base:2.55
Barton in Fabis South	Top: 0.74 Middle: 1.10 Base: 1.40
Bulcote Farm	Top: 2.87 Middle: 3.12 Base: 3.50
Seymour Drain	Top: 1.93 Middle: 2.01 Base: 2.20

2.3. Dating

Samples selected by Dr Allan Hall were processed and measured by Accelerator Mass Spectrometry at the Oxford Radiocarbon Accelerator Unit. Procedures used at the laboratory are described by Bronk Ramsey and Hedges (1997) and Bronk Ramsey *et al*. (2000).

The results are conventional radiocarbon ages (Stuiver and Polach, 1977), and are quoted according to the standard known as the Trondheim convention (Stuiver and Kra, 1986). The corresponding calibrated date ranges were calculated by the maximum intercept method (Stuiver and Reimer ,1986), using the INTCAL98 data set (Stuiver *et al*., 1998) and the program OxCal v3.5 (Bronk Ramsey 1995; 1998). Full details of Radiocarbon analyses are provided in Appendix 4.

3. RESULTS OF ENVIRONMENTAL ASSESSMENT
3.1. Site 1, Great Haywood, Upper Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 1			Dating: Post-medieval (latest 15th-19th C)
	11	1.25	The moderate-sized residue of about 200 cm^3 of granular organic detritus, including woody and herbaceous stem fragments and small twigs; amongst these were some concreted ?root casts. The fruits and seeds present were mostly somewhat damaged - tending to be broken rather than eroded. The assemblage was unusual and the presence of some rather fresh-looking seeds thought to be tomato (*Lycopersicon esculentum* Miller) and at least one rather modern-looking grape (*Vitis vinifera* L.) pip and fig (*Ficus carica* L.) seeds suggest some contamination by recent material. In the flot, chironomids were abundant, with some caddis and *Dryops*, so deposition was presumably aquatic. There were modest numbers of insects, from a range of terrestrial habitats: decaying matter, herbaceous plants including nettles and probably clovers/vetches. A larger subsample would give an interpretatively useful group.
	12	1.20	The moderate-sized residue of about 175 cm^3 of (mainly) fine herbaceous detritus, but with the coarsest fraction containing some pale, herbaceous stem fragments having the character of material that has dried and not fully rewetted. Further specimens of seeds which are thought likely to be tomato were noted and there were some fragments which appeared to be from modern cereal culm-bases. Some of what are presumed to be ancient remains were somewhat silted or iron salt-stained/-encrusted or rather worn. There was a fragment of aluminium foil of the kind used in cigarette packaging. The invertebrates in the flot included some aquatics, with abundant chironomids, *Lophopus crystallinus*, *Helophorus*, but the assemblage was dominated by terrestrial forms. Subjectively, this group is synanthropic ('archaeological'), with one *Cryptolestes* elytron and *Ptinus ?fur*. There were quite a lot of insects from semi-natural habitats, mostly herbaceous plants and the ground beneath them. *?Leperisinus varius* probably indicates ash (*Fraxinus*). This is an interesting group, with interpretative potential from a large subsample.
			Pollen preservation for the top sample (0.72m) was assessed as poor and with a low pollen count, this sample should probably be regarded with some circumspection. Preservation was also assessed as poor for the basal sample (1.03m), but as good for the middle sample (0.94m). Pollen concentrations of 36 $x10^3$ grains cm^{-3} (top), 35 $x10^3$ grains cm^{-3} (middle) and 28 $x10^3$ grains cm^{-3} (base) were recorded. The sequence is dominated by Poaceae (c.50-55%) with other herbs including *Plantago lanceolata*, *Rumex*, Ranunculaceae, Asteroideae (Lactuceae undiff.) also recorded at lower values. Cereal type is present in all three samples reaching a maximum of around 3% at 0.94m. Tree and shrub pollen is poorly represented. The sequence indicates an open, predominantly treeless grassland environment present around the sampling site. Both pastoral and arable habitats were probably in fairly close proximity to the sampling site.

3.2. Site 2, Lower Dove, Middle Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 2			Dating: Post-medieval (17^{th}-18^{th} C)
	21	0.85	This sample yielded a large residue of about 220 cm^3 of herbaceous detritus with some small willow (*Salix*) twigs. There were rather few identifiable macrofossils, the more frequent being water-plantain (*Alisma*) carpels, which were quite variable in preservational state. Both aquatic-marginal and terrestrial habitats were indicated. There was a small group of insects, some mites, Cladocera, and 'many' earthworm egg capsules in the flot. Aquatic deposition is indicated by cladocerans, caddis, and water beetles. There were also a few terrestrial species. A much larger subsample would be needed for more detailed interpretation.
	22	1.10	There was a large residue of about 340 cm^3 of herbaceous detritus including abundant ?pteridophyte root (probably from horsetails, *Equisetum*); there were few identifiable plant macrofossils, mainly *Alisma* (as in Sample 21) with some vegetative fragments of aerial parts of horsetail. Preservation was generally good. A small group of invertebrates was present, with abundant immature insects. Aquatic deposition may be inferred from various of the beetles and from the presence of chironomid larva. There were few terrestrial insects. Again, a much larger subsample would be required for detailed interpretation.
			Pollen preservation was assessed as poor for the basal sample and moderate for the middle and top samples. Pollen concentrations of $20x10^3$ grains cm^{-3} (top), 72 $x10^3$ grains cm^{-3} (middle) and $48x10^3$ grains cm^{-3} are recorded. Comparatively high (26%) percentages of pre-Quaternary spores for the basal sample indicate that this spectrum might include secondary/re-worked palynomorphs, although indeterminable grains form a relatively low 11%TLP+indet. The sample is dominated by herbaceous pollen consisting mainly of Cyperaceae (43%) and Poaceae (16%). Other herbs present include Asteroideae (Lactuceae undiff.) (3%) and Ranunculaceae (2%). Tree and shrub pollen is poorly represented, with *Alnus glutinosa* (11%) and *Calluna vulgaris* (8%) attaining the highest percentages. The middle sample (1.11m) is also distinguished by high a value for herbaceous pollen, but consisting predominantly of Poaceae (53%) whilst Cyperaceae is reduced to 3%. Percentages of other herbs are also enhanced, with relatively high values for *Plantago lanceolata* (7%), Ranunculaceae (5%), *Thalictrum* (meadowrue) (7%) and Asteroideae (Lactuceae undiff.) (5%). Spores in the form of *Equisetum*-type (horsetail ferns) (16%) are also well represented. The top sample sees an increase in *Alnus glutinosa* to 25% and *Calluna vulgaris* (heather) to 11%. This is accompanied by a general reduction in the range and percentage values for herbaceous taxa, with Poaceae falling to 4% but Cyperaceae recovering to 22%, whilst *Plantago lanceolata* remains at 7%. The sequence reflects a relatively open landscape with little tree or shrub cover, whilst the dominance of sedges in the basal sample presumably reflects the presence of species of this group on the sampling site itself. The increase in grasses in the middle sample probably illustrates the

			spread of grassland in the wider landscape around the sampling site as well as the possible presence of wetland grasses locally. Evidence for open pasture is provided by the relatively high percentages of ribwort plantain and dandelions, with buttercups and meadow-rue perhaps suggesting a damp meadow/open wetland vegetation typical of a riverside environment. The record of heather does suggest some drier soils/heathy vegetation within the pollen catchment, whilst the occurrence of *Equisetum* in the middle sample illustrates the presence of horsetail ferns in the wetland vegetation. The increase in alder evident in the top sample suggests some expansion in alder carr vegetation on the wetter soils around the site. Increasing local soil moisture probably as a result of rising local watertables is also implied by the recovery in sedges in the top sample. However, the maintenance of high values for grasses and ribwort plantain indicates that despite a general reduction in the range of herbs recorded, open grassland remained significant in the wider landscape.

3.3. Site 3, Old Trent Water, Middle Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 3			Dating: Post-medieval (17^{th}–20^{th} C)
	31	0.85	The very large residue of about 575 cm^3 of organic detritus included considerable quantities of woody debris (to 40 mm) amongst which were some twig fragments (the largest wood fragment was soft on the exterior but very firm, blackened, and 'toughened' inside; it appeared to be birch, *Betula*). Overall, plant remains were only moderately well preserved, usually rather worn and a little 'silted'. There was, however, a well preserved spine of gorse (*Ulex*) and buds of willow (*Salix*) were usually in quite a good state of preservation. The presence of a trace of charcoal (to 5 mm) may suggest some occupation material accumulated in this deposit, but the plant assemblage was otherwise of rather limited interpretative value other than to suggest deposition in a marshy environment close to land. Insects were quite numerous, and there were also some *Daphnia*; these, caddis larvae, *Cristatella*, and various aquatic beetles and bugs all indicate a waterlain deposit. Terrestrial insects were not abundant. A larger subsample would be required for more detailed interpretation.
	32	0.90	There was a small residue of about 50 cm^3 of woody detritus (including small willow twig fragments) and some sand. Deposition in standing water is indicated by the presence of well-preserved seeds of yellow water-lily (*Nuphar lutea* (L.) Sibth. & Sm.). The wood fragments (to 25 mm) were firm and well-preserved, and some very small percid fish scales were in 'mint' condition. Invertebrates were rather rare, apart from numerous ostracods, these and various others indicating aquatic deposition. There were few terrestrial insects. Again, a much larger subsample would be needed to reconstruct ecology.
			Pollen preservation was assessed as good for the top and middle samples and moderate for the basal sample. Pollen concentrations fall from a high $157x10^3$ grains cm^{-3} (top) to $37x10^3$ grains cm^{-3} (middle) and $21x10^3$ grains cm^{-3} (base). The sequence is dominated by herbs, with Poaceae increases from c.25% in the basal sample at 1.16m to 55-60% by the middle and top samples. Other herbs including Asteroideae (Lactuceae undiff.), Asteroideae, Ranunculaceae and *Achillea*-type are also present in all three samples, and Cereal-type is identified in the basal and middle samples. Total tree and shrub pollen percentages reach 30% in these samples, with the greater proportion of this accounted for by *Alnus glutinosa* and *Corylus avellana*-type. A predominantly treeless, anthropogenically modified open landscape is reflected, although some hazel scrub on the drier soils and alder on the wetter soils might be inferred. The herb spectra includes taxa typical of rich meadow/grassland habitats around the sampling site. The records of cereal type in the middle and basal samples might imply some arable plots within the pollen catchment, but local landuse must have been predominantly pastoral.

3.4. Site 4, Mill Plantation, Middle Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 4			Dating: Medieval (13th-14th C)
	41	0.45	This subsample yielded a very small residue of a few cm^3 of detritus containing a few small twig fragments With the exception of pondweed (*Potamogeton*) fruits all the remains were of terrestrial origin and preservation was rather variable. Only traces of insects were noted; there was no interpretative potential.
	42	0.65	Again, there was a very small residue of a few cm^3 of woody and herbaceous plant detritus and a trace of sand; a small range of identifiable remains was noted, together indicating deposition in a marshy habitat or the drying mud of an intermittently wet ditch. Only traces of insects were observed and they have no interpretative potential.
			Pollen preservation was assessed as good for all three samples. Pollen concentrations are 64x10^3 grains cm^{-3} (top), 30x10^3 grains cm^{-3} (middle) and a very high 195x10^3 grains cm^{-3} (base). This sequence is dominated by Poaceae (40-50%) and by relatively high percentages of cereal type, peaking at 13% in the middle sample. A range of other herbs are present in the samples including: *Achillea*-type (yarrows), *Centaurea nigra* (knapweed), *Plantago lanceolata*, Ranunculaceae, *Rumex*. Significant taxa recorded in the top sample (0.85m) include *Linum bienne*-type and *Centaurea cyanus* (corncockle), whilst a grain of *Cannabis*-type is present at 1.69m. Tree and shrub pollen values are low with the exception of *Alnus glutinosa* which increases across the sequence from 5% at the base to 14% at the top. These pollen spectra are very much representative of a cultural landscape. The high representation of cereal type pollen indicates arable agriculture was taking place very close to the sampling site, with such habitats also reflected in the top sample by *Centaurea cyanus*, a weed of arable fields. The range of herbs in the samples suggest a variety of other habitats including disturbed grassland, meadow or pasture include ribwort plantain, docks, yarrow and knapweed, as well as perhaps wetland vegetation communities near to the sampling site. The presence of *Linum bienne*-type, a group which includes the crop plant *Linum usitatissimum* (flax), in the top sample and a grain of *Cannabis*-type (hemp) in the basal sample, might also be taken to indicate local cultivation of these crops, although these are represented only by single grains and thus perhaps too much significance cannot be placed on these records. However, there is good evidence in pollen records from elsewhere in East Yorkshire for Cannabis/Hemp cultivation during the medieval period (Smith 1985). Other pollen records from sites in Yorkshire have been characterised by this taxa, including Askham Bog near York, a sequence from a pond adjacent to a former priory at Ellerton on the River Derwent (Lillie & Gearey 1999), a pool feature from a post-medieval site at Morton Lane, Beverley (Gearey *et al*., 2002) and a sequence obtained from the moat of a former royal hunting lodge near Cowick (Hayfield & Grieg 1989). The increase in *Alnus glutinosa* across the sequence probably reflects an expansion in alder vegetation on the damper, more marginal soils around the channel.

3.5. Site 5, Barton in Fabis south, Middle Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 5			Dating: Anglo-Saxon
	51	0.88	There was a very large residue of about 575 cm^3 of herbaceous detritus, the coarser fraction of monocotyledonous rhizome/culm fragments appearing somewhat decayed and with (?recent) rootlets running through it. There were modest numbers of well-preserved fruits of bulrush (*Scirpus lacustris sensu lato*) and rather variably preserved fruits of spike-rush (*Eleocharis palustris sensu lato*). The fragments of moss present were mostly in short lengths, their leaves mostly somewhat damaged, and rarely whole. Overall deposition in a marsh is most likely, perhaps with some inwash or reworking of terrestrial or semi-terrestrial material. The flot contained moderate numbers of insects and other invertebrates. The deposit was clearly waterlain, to judge from the numerous water beetles present, but there was an appreciable terrestrial component, including dung beetles, and a slight hint of a 'synanthropic' component from *?Ptinus* sp. A larger subsample should give an interpretatively useful group.
	52	1.4	Another large residue (of about 600 cm^3) of (mainly) fine herbaceous detritus, rich in fruits of bulrush and with a modest range of marsh/fen and terrestrial taxa, some perhaps weeds of disturbed soils. The flot yielded appreciable numbers of insects, but mites were very abundant. They perhaps suggest deposition in a marsh rather than open water, and there was a range of terrestrial insects. Again, a larger subsample would give an interpretatively useful group.
	53	1.0	There was a moderate-sized residue of about 215 cm^3 of herbaceous detritus, including a few cm^3 of sand. The more frequent 'seeds' were of bulrush and pondweed, the former mostly well-preserved (though with some pale and/or broken), the latter moderately to well preserved. Some marsh to terrestrial taxa were also present, with some well preserved remains of horsetail stem sheaths. Insects were fairly numerous. Aquatic deposition is indicated by caddis, *Donacia*, a corixid, etc., but there was an appreciable terrestrial component. A larger subsample would give an interpretatively useful group.
			Pollen preservation was assessed as good for all three samples and concentrations of $32x10^3$ grains cm^{-3} (top), $114x10^3$ grains cm^{-3} (middle) and $69x10^3$ grains cm^{-3} (base) are also relatively high. Cyperaceae increases to c. 70% by the top of the sequence at 0.74m, Poaceae is recorded at c.20% in the lower two samples but has fallen to c.3% by 0.74m. Other herbs recorded include Asteroideae (Lactuceae undiff.) which increases from 2 to 5%, whilst *Plantago lanceolata* is recorded at 8% at the base decreasing to 3% by the top of the diagram. Other herbs include Rubiaceae (bedstraw family), Ranunuculaceae, *Rumex* and Chenopodiaceae. Tree and shrub pollen is generally low, but increases slightly in the middle of the sequence to c.30% of total land pollen, mainly consisting of *Alnus glutinosa* (10%) and *Corylus avellana*-type (11%). The low peak in *Sparganium*-type at the base of the diagram must reflect open water communities with aquatic plants such as bur-reed.

			The high percentages of Cyperaceae suggests on-site wetland sedge communities, with the increase in this taxa at the top of the diagram probably connected to vegetation changes resulting from the rising local watertables which preceded the transition to predominantly inorganic sedimentation at this location. In the wider landscape, grassland communities with herbs including ribwort plantain, dandelions and buttercups suggest meadow-type vegetation, and the maintenance of open conditions probably through grazing/pastoral activities. Little significant woodland cover is attested in the basal or top samples. Given the relatively coarse sampling interval, it is unclear how much significance should be attached to the increases in alder and hazel in the middle of the sequence, but it is possible that this reflects some localised recovery in these trees.

3.6. Site 6, Barton in Fabis north, Middle Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 6			Dating: latest Roman to Anglo-Saxon
	61	1.2	The moderate-sized residue of about 180 cm^3 comprised herbaceous detritus and the merest trace of sand. The abundant bulrush fruits showed some silting, but there were also 'clusters' of these (held together by the barbed bristles whose presence indicates a good state of preservation). The nutlets of mare's-tail (*Hippuris*) were well-preserved and, together with the bulrush, indicate aquatic-marginal habitats. The presence of at least one achene of stinking mayweed, *Anthemis cotula* L., is consistent with deposition in the early historic period, perhaps indicating a source in occupation material. The flot was quite rich in insects, and there were also numerous mites. Aquatics were well represented, with a modest terrestrial component; a larger subsample would provide sufficient remains for landscape reconstruction.
	62	0.85	The small to modest-sized residue of about 100 cm^3 comprised snail-rich herbaceous detritus. The more prominent fruits and seeds were 'embryos' of arrow-head (*Sagittaria sagittifolia* L.) (with some whole carpels in a much better state of preservation) and there were well-preserved pyrenes of pondweed and spike-rush. 'Mint' condition percid fish-scales were noted. Clearly deposition was essentially aquatic, but there were some terrestrial taxa, some of which may indicate input from occupation nearby, not least a trace of capsule fragments of flax, probably linseed (*Linum usitatissimum* L.). Ostracods were very abundant in the flot, with a range of water beetles indicating aquatic deposition. There was an appreciable terrestrial component, including *Pterostichus madidus*(!). A larger subsample would have good interpretative potential. There was a fairly large assemblage of snails of freshwater and of waterside plants (the Succineidae) and, in addition, many freshwater *Pisidium* bivalves. There were also very many ostracod valves (additional to those noted from the flot). As a whole, the assemblage suggested a rather low energy environment of still (or at most slow moving), heavily weeded, hard water—perhaps a small pond or the margin of a larger body of water. Closer identification of some of the taxa present (in particular the bivalves) should be possible given additional time. Closer identification of the bivalve remains, though difficult, may provide some refinement of the interpretation of the depositional environments.
			Pollen preservation was assessed as good for all three samples in this sequence, whilst concentrations of $32x10^3$ grains cm^{-3} (top), $73x10^3$ grains cm^{-3} (middle) and 39 $x10^3$ grains cm^{-3} (base) are relatively high. The sequence is dominated by herbaceous taxa, with Poaceae (wild grasses) (up to 40%) recorded at the highest percentages in all three samples, whilst Cyperaceae (sedges) increases to 30% by the uppermost sample. *Plantago lanceolata* (ribwort plantain) peaks at 12% at 2.05m, Asteroideae (Lactuceae undiff.) (dandelions) at 2-3%, whilst other well represented herbs in the samples from 2.05 and 2.55m include *Polygonum aviculare*-type (knotgrass) is recorded at 1-2%, Chenopodiaceae (fat hen)

			1-3% and *Artemisia*-type (mugwort) at 1-2%. Total arboreal pollen forms a maximum of 25% of total land pollen in the top sample at 1.59m, with *Corylus avellana*-type (hazel) accounting for 17% of this. *Alnus* (alder) decreases from c.10% at the base to 2% at the top of the sequence. This sequence reflects a largely open landscape with grassland habitats dominant around the sampling site. The range of herbs including ribwort plantain, mugwort and fat hen and knotgrass are strongly suggestive of ruderal habitats and an anthropogenic presence in the landscape. At most, patchy oak-hazel scrub/woodland was present. Some alder, probably on the wetter soils, might be attested for the basal sample, but the reduction in this species suggests this has disappeared by the top of the sequence, probably as a result of anthropogenic activity.

3.7. Site 7, Bulcote Farm, Middle Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 7			Dating: Roman to early Anglo-Saxon
	71	0.65	The modest-sized residue of about 120 cm^3 consisted of herbaceous detritus and snails. There was a rather wide range of identifiable remains, though most were sparse. They included several aquatic-marginal/marsh taxa, of which arrow-head was the only one present in modest numbers. A single flax seed and one uncharred barley (*Hordeum*) rachis (ear-stalk) suggest some input from nearby habitation. Preservation was generally quite good (the barley rachis fragment bore marginal hairs!) but some specimens showed erosion or breakage, others some pyritisation. There was strong iron staining of the plastic container in which the residue had been stored (for only a few weeks) between processing and examination. The flot contained abundant insects and some ostracods. There were numerous aquatics, suggesting a rich ecology and good emergent vegetation. The material offers a clear potential for reconstructing *in situ* and surrounding environments. A relatively small and less well-preserved assemblage (in comparison with those from Context 73, below, and the larger assemblages from Sites 6 and 9) of freshwater snails and bivalves (including many unidentified snail shell fragments) was recovered from this sample. Closer identification of some of the taxa present (in particular the bivalves) should be possible given additional time. Closer identification of the bivalve remains, though difficult, may provide some refinement of the interpretation of the depositional environments.
	72	0.5	The very small residue of a few cm^3 of sand and grit included only a very few plant remains indicating aquatic and marsh habitats, but of rather limited value in such small numbers. There was a smallish group of insects and abundant *Daphnia*; these and other aquatics were indicative of deposition in water. A small terrestrial component was present, but a larger subsample would probably give useful reconstruction of local ecology.
	73	0.25	Though the subsample was very small, it yielded a large residue of about 100 cm^3 of snail-rich detritus. Iron sulphide blackening was quite strong but the small wood fragments present were soft; preservation of identifiable fruits and seeds was generally good, however. The plant remains pointed to deposition in a marshy habitat. The flot was rich in insect remains, and ostracods, mites and snails were all common. Deposition was clearly aquatic, but there was also a substantial terrestrial component from herbaceous vegetation and decaying matter. The assemblage has good interpretative potential. The large shell assemblage from this sample was similar to that recovered from Context 62 (Site 6) though with the addition of a small component of land snails (*Carychium* species) indicative of permanently damp terrestrial vegetation - at least long grass and perhaps the more substantial cover of hedgerow or woodland. Ostracod valves were again present though not in such large numbers as noted in from Context 62 (many will have been extracted by flotation, see above). The aquatic environment indicated was, again, of still (or at most slow-moving), heavily weeded, hard water.

			Given this evidence of a low-energy environment, it seems more likely that the terrestrial snails represent a local habitat at the edge of a body of water and that they were washed into the deposit from further afield. Closer identification of some of the taxa present (in particular the bivalves) should be possible given additional time. Closer identification of the bivalve remains, though difficult, may provide some refinement of the interpretation of the depositional environments.
			Pollen preservation was assessed as good for all three samples in this sequence and relatively high pollen concentrations of $56x10^3$ grains cm^{-3} (top), $57x10^3$ grains cm^{-3} (middle) and $166x10^3$ grains cm^{-3}(base) are recorded. High percentages of Poaceae (40-60%) are a feature of all three samples, alongside consistent values for *Plantago lanceolata* (7%) and a steady increase in Cyperaceae from 8% at the base of the diagram to 18% by the top of the diagram. Other herbs including Ranunculaceae, *Rumex* spp., Asteroideae (Lactuceae undiff.) and *Filipendula* are also recorded. Cereal-type grains are present in the samples from 2.87m and 3.12m. Arboreal pollen values are low, with a maximum of c.20% total tree and shrubs recorded in the middle sample at 3.12m. This sequence reflects open grassland around the sampling site with very little woody vegetation present in the vicinity. The range of herbs including ribwort plantain, docks and dandelions indicate meadow/pastoral vegetation communities and the maintenance of open conditions, most probably through through pastoral activity. The record of cereal type pollen also implies the presence of arable plots within the pollen catchment, but it is probable that any such landuse was not taking place in the immediate vicinity of the site.

3.8. Site 8, Seymour Drain, Lower Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 8			Dating: Bronze Age to early Iron Age
	81	1.0	This subsample yielded a modest-sized residue of about 180 cm^3 of granular woody detritus, including about 35 cm^3 of sand and grit. Preservation of fruits and seeds varied but there was a rather rich assemblage, at least in terms of numbers of taxa, though none was present in more than trace amounts. The oogonia of stoneworts (Characeae, freshwater green algae) lacked their calcium carbonate shells, which may indicate some leaching. Aquatic, waterside and terrestrial habitats were all indicated. with the presence of cone-axes and twig fragments of alder (*Alnus glutinosa* (L.) Gaertner) pointing to some woody vegetation in the vicinity - although the presence of grit and gravel (to 5 mm) in the sample indicates some deposition by higher energy flow and thus perhaps some inwash of material from elsewhere. There were modest numbers of insects, with some mites, in the flot. An appreciable aquatic component was noted, but terrestrial insects were common; there is a clear potential to reconstruct surroundings from a larger subsample.
	82	0.85	The moderate-sized residue of about 150 cm^3 was approximately equal volumes of woody detritus and mineral material (sand and a trace of gravel). Most of the identifiable remains were probably terrestrial in origin - they included twig fragments of alder, buds/bud-scales of oak (*Quercus*) and even a seed of wood sorrel, *Oxalis acetosella* L.), a species rather rarely encountered in natural deposits. These were evidently deposited into water, however. There were rather few insects, mainly aquatic, with a few terrestrial forms. A larger subsample (5 kg or more) would probably give useful numbers of remains.
	83	0.6	The moderate-sized to large residue of about 110 cm^3 was largely sand with a few cm^3 of organic debris, including small twig fragments. The few identifiable remains were really too sparse to be of much interpretative value on their own. There were few insects, and some cladocerans. There seemed to be only limited potential, even from a very large subsample.
			Pollen preservation was assessed as good for all three samples. Pollen concentrations are an exceptionally high $1719x10^3$ grains cm^{-3} in the top sample, falling to high values of $666x10^3$ grains cm^{-3} (middle) and $870x10^3$ grains cm^{-3} (base). This sequence is dominated by *Alnus glutinosa*, which attains c.70% in the basal sample before falling to c.45% in the middle and top samples. *Corylus avellana*-type is present at c.10% in all three samples, whilst *Quercus* (oak) reaches a maximum of 14% in the middle sample. *Tilia* is present at 2-3%. There is a general increase in herbaceous taxa up the profile, with Poaceae rising from 4% to 16% by the top of the sequence and herbs indicative of open habitats including Asteroideae (Lactuceae undiff.), Asteroideae and *Plantago lanceolata* recorded. The high percentages of *Alnus glutinosa* and probably also the presence of fragments of wood in the stratigraphy imply the presence of an alder fen carr community on and around the sampling site. The low values for

			Poaceae and the record of Pteropsida (ferns) in the basal sample indicates a shaded, fern rich under storey. *Corylus avellana*-type (probably mainly hazel) and *Quercus* (oak) scrub/woodland probably formed the main component of the dryland vegetation. *Tilia* (lime) tends to be very poorly represented palynologically and it is possible that the values of this taxon reflect the presence of lime as part of the local dryland woodland. The rise in Poaceae and increases in other herbs up the sequence indicates increased openness, although the concomitant reductions in tree and shrub pollen are relatively subdued, which might imply that the Poaceae curve reflects a localised spread of wetland grasses such as *Phragmites* (common reed) as a result of changes within the fen system itself, rather than disturbance by human agency to or beyond the fen. This may also be reflected by the slight increase in *Sparganium*-type (bur-reeds) in the top sample, indicating a spread of open water communities. The low values for *Plantago lanceolata*, however, probably do reflect some open, anthropogenically modified habitats in more distant locations on the dryland.

3.9. Site 9, Holme Pierrepont, Middle Trent Valley

Site	Sample	Weight (kg)	Notes on plant and invertebrate remains (together with an interpretation of the radiocarbon dates)
Site 9			Dating: Unknown at present
	911	3.7	This large subsample yielded a modest-sized residue of about 500 cm^3 of rather 'granular' organics and a little gravel. There were quite large concentrations of seeds, especially bulrush, and there were some large caddis fragments (often coated with seeds). There were also some rounded and rather decayed wood fragments (to 10 mm) and 'platy' fragments of (?reworked) herbaceous peat. All the material seemed rather eroded and silted (probably through deposition by inwash - the material being perhaps largely reworked if not far-transported). There was a wide range of taxa, the more frequent (apart from bulrush) being fool's watercress (*Apium nodiflorum* (L.) Lag.), mare's-tail and pondweeds. Altogether, an aquatic environment is indicated, with some waterside taxa from fen or marsh vegetation. There was a smallish group of insects, but it was notable for presence of indicators of a cool climate: *Olophrum ?fuscum* and *Pycnoglypta lurida*. There is clear potential for further analysis, though a very large subsample would be desirable.
	912	2.0	The small residue of about 160 cm^3 of herbaceous detritus showed the same kind of erosion and silting as in 911, with many of the same taxa present (though a much less diverse flora). Characeae oogonia were well preserved, with their calcareous coats remaining. There was a small invertebrate group but a large subsample would probably give a useful assemblage: indications are of aquatic deposition and of a cool climate (from *Arpedium brachypterum*). A few operculae, apparently all of the smaller *Bithynia* species, *B. leachi*, were noted in this sample. This species is indicative of hard, slow-moving, thickly weeded water.
	913	3.7	A moderate-sized residue of about 500 cm^3 of gravel and coarse plant detritus and abundant very fragmentary snails was obtained. There were many rather well preserved *Potamogeton* pyrenes, and one almost whole Compositae involucre. A single flax seed seemed much more likely to be wild *Linum* '*perenne'* than cultivated flax. Preservation of Characea oogonia varied, some retaining their coats, others not. The modest numbers of insects included aquatic and terrestrial forms. A cool climate is certainly indicated by the presence of a boreal *Olophrum* and by *Pycnoglypta lurida*. There is clear interpretative potential, though a very large subsample would be desirable. There were abundant unidentified snail shell fragments in this sample. Many operculae were noted, probably of both *Bithynia tentaculata* and the smaller *B. leachi*. Approximately 30 ml of the residue was also examined under the binocular microscope—a few *Valvata piscinalis* were seen, as were rather more *V. ?cristata* and many snail eggs. No bivalves, planorbids or *Lymnaea* species were recorded. A rather low-energy aquatic environment was indicated by the snails.
	914	2.55	There was a small residue of about 250 cm^3, of which about 120 cm^3 was sand, the rest fine herbaceous organic detritus, with some snails, mostly fragmentary. Rather abundant, well-preserved seeds and rather eroded

			herbaceous fragments were present, some pyritisation being noted; the Characeae oogonia showed mixed preservation, as in 913 (*q.v.*), with some coats remaining. The more abundant taxa represented standing or flowing water and waterside habitats. Modest numbers of insects were present, including some flowing-water indicators and 'cool' indicators (*Arpedium brachypterum*, several *Pycnoglypta lurida*). A much larger subsample desirable; the deposit deserves analysis. There were some shell remains present, mostly unidentified fragments. As with Context 913, the most readily identifiable remains were operculae of *Bithynia leachi* and possibly also of *B. tentaculata*. Approximately 30 ml of the residue was also examined under the binocular microscope revealing the presence of fragments of ?*Valvata* sp. shell and numerous snail eggs. No bivalves, planorbids or *Lymnaea* species were recorded. Once again, a low-energy aquatic environment was indicated.
	915	2.0	There was a rather large residue of about 450 cm^3, mostly sand and gravel. The organic component comprised small quantities of fine herbaceous detritus and a few rather eroded seeds, with some pyritisation evident. Much the same kinds of taxa seen in the layers above were present here, though the assemblage was very small. The Characeae oogonia here lacked their calcareous shells. Fairly small numbers of insects, mostly terrestrial, were present. Indicators of flowing water and a cool climate (the latter from *Pycnoglypta lurida*) were noted. A very large subsample would be needed, but the material again deserves full analysis.
	921	4.0	There was a small to moderate-sized residue of about 300 cm^3 of granular organics (mostly <1mm) and some sand and gravel (to 45 mm), the mineral component making up about 100 cm^3; overall the material seemed most like that from 911 in the other section from Site 9. A mixture of terrestrial and aquatic and waterside taxa was present, the only one with an abundance score above a trace level being bulrush (*Scirpus lacustris*). Insects were not abundant, but distinctive: the assemblage was waterlain, and with *Arpedium brachypterum* and *Pycnoglypta lurida* indicating cool conditions.
	922	4.0	A modest-sized residue of about 500 cm^3 of granular organics with a little sand and gravel (to 25 mm) was yielded by this subsample. There were abundant *Scirpus lacustris* fruits with modest numbers of Characeae oogonia (lacking calcareous coats) and fruits of common meadow-rue (*Thalictrum flavum* L.) the other taxa being a mixture of aquatic, waterside and terrestrial forms as seen in the other deposits from Site 9. Unique to this sample, however, were three of the distinctive pod fragments of woad (*Isatis tinctoria* L.), a species first thought to have been introduced to the British Isles in the later Iron Age (cf. van der Veen *et al.* 1993). If this is not late prehistoric or later material—and the cold-climate insects seem to indicate that it is not—then this represents the first fossil evidence for the plant from the later part of the last cold stage. Woad is quite likely to have been a member of the flora found on disturbed soils in late-glacial times at these latitudes, having become restricted to the south-eastern parts of Europe during expansion of temperate forest across northern areas in the Holocene (and only re-appearing in our flora through the activities of humans).

			Insect remains were abundant, probably deposited in marshy pools; there was certainly a cool climate, perhaps colder than the overlying deposit (921). Good interpretative potential.

4. DISCUSSION

4.1. Macroscopic Plant and Insect Remains

Plant remains were usually quite well preserved and often abundant, though in some cases the plant component was largely herbaceous detritus with very few identifiable propagules. Most assemblages showed substantial insect fragmentation, in contrast to often good chemical preservation: this is probably a result of crushing during coring, combined with the need for fairly rapid processing. Hence, it does not reflect the quality and/or preservation potential of these organic-rich sediments. Most samples showed interpretative potential and some appear to be significant. However, as predicted, in many cases the samples were too small to provide insect assemblages adequate for the level of interpretation that would be required beyond an initial stage of assessment like this and almost all would need subsamples of 4-5 kg (with 8-10 kg desirable for the series from Site 9). Therefore, any future environmental sampling of these sites should be undertaken from large, open sections.

The preservational condition of the insect (and other invertebrate) remains was mostly fairly good (Appendix 3), although most assemblages included some to many fossils which showed a substantial degree of fragmentation. This damage was probably the result of coring and laboratory extraction. The assemblages from Samples 72 (Site 7) and 83 (Site 8) included insects which showed considerable colour change which suggested an episode of oxidation. Observation of the fossils cannot tell us whether this is current or took place during deposition, although subjectively the former appears likely. However, long term monitoring of groundwater conditions in the sample areas would be needed to elucidate the actual causes of oxidation.

In terms of site specific observations, the material seen in the samples from Site 1 seems likely to contain modern material and the potential for further study is questionable. The sediments from Site 2 yielded rather limited plant and insect remains, much larger subsamples being required to provide sufficient invertebrates for detailed interpretation. Material from Site 3 gave good evidence for aquatic deposition with excellent potential for further investigation using larger samples. The two samples from Site 4 gave rather limited preservation of plants and very few insects and do not appear to be of high potential for further analysis. Preservation at Site 5 was generally good and seemed to indicate a change in deposition from aquatic to telmatic (marsh), perhaps with some evidence for human activity nearby in the middle and upper parts. Large subsamples would yield useful invertebrate assemblages. The deposits from Site 6 also seemed to hint at the presence of material from human occupation or of human activity in the vicinity. Large subsamples would certainly provide useful plant and invertebrate assemblages. The molluscs from the lower part of the sequence would be useful in refining interpretation of local environments. Samples from Site 7 generally yielded rather rich assemblages, some having mainly snails and other molluscs. The uppermost sample offered some hints of human activity. Overall, the prospects for palaeoecological reconstruction seem good. At Site 8, the upper sample offered good potential for further study, with the middle one indicating some deposition in water of terrestrial plant taxa, though perhaps material washed in from some distance away. The basal sample had too little organic material to be useful.

Finally, the sediments examined from Site 9 were, to judge from the insects at least, clearly laid down in a cool climate, though not a glacial one. (The rather restricted range of mollusc taxa may also be consistent with this). Moreover, in each of the three samples containing molluscs, the identifiable remains were of operculate snails whose current range certainly extends into climatically colder and/or more extreme regions today - *Valvata piscinalis* is found throughout Europe and into Asia Minor and Tibet, and the *Bithynia* species in western Siberia (*B. tentaculata*) and northern Asia (*B. leachi*). Possible dates are the last phases of the Devensian (not likely since no extreme cold indicators were present amongst the insects), a cool phase in the Windermere, the very end of the Windermere, or the last part of the Loch Lomond stadial. At present, the site is undated though radiocarbon age estimates are due imminently, and if as seems possible, this is a rapidly-deposited sequence, it may prove important in reconstructing rates of climatic change. The presence of remains of woad (*Isatis tinctoria*) in the basal sample from the second sequence at this site is intriguing. If not of late prehistoric or later date, it is the only non-archaeological record for this plant in the British fossil flora and indicates the plant was a native prior to habitat loss during the spread of forest during the post-glacial warming.

4.2. Pollen Remains

With the exception of the Lower Dove Valley and Great Haywood sequences, the state of preservation of all the samples assessed as part of this report are described as good or moderate, with percentages of indeterminable grains not exceeding much above 10%TLP+indet. Generally low percentages of pre-Quaternary spores suggest a minimum of re-working/re-deposition of sediment, despite the presence of clay/silt components in most of the sampled deposits. With the exception of three samples (Mill Plantation base, Old Trent Water base and Lower Dove, top), pollen concentrations consistently reach over $30x10^3$ grains cm^{-3}. The Seymour Drain samples are distinguished by exceptionally high (up to $1719x10^3$ grains cm^{-3} in the top sample) pollen concentrations.

The pollen records (except for Seymour Drain, see below) are all dominated by herbaceous taxa, especially grasses and sedges. This may in part reflect the presence of open wetland vegetation communities in/adjacent to the palaeochannels, but the generally low values for trees and shrubs and high representation of other herbs point to the presence of predominantly open, 'cultural' landscapes around the sampling sites. Indeed, the range of other herbs which are recorded in the sequences tend to be very similar, with *Plantago lanceolata* (ribwort plantain), *Rumex* spp. (docks), species of Lactuceae (dandelions) and Asteroideae (daisies), Ranunculaceae (buttercup) and Caryophyllaceae (pink) families. The relatively high values for Asteroideae (Lactuceae undiff.), a group of generally low growing herbs of the dandelion tribe and thus poorly represented palynologically, were particularly significant taxa whilst lower or more sporadic records of other herbs indicate that, amongst others, *Filipendula* (meadowsweet), *Thalictrum* (meadow rue), *Centaurea nigra* (black knapweed), *Artemisia*-type (mugwort) and Rubiaceae (bedstraw) were components of the vegetation around the sampling sites. Some of these herbs, such as species' of Ranunculaceae and Caryophyllaceae, may derive in whole or part from vegetation communities on the wetland areas itself as well as from damp meadow or pasture environments in the wider environment.

The impressions for the environments around the majority of the sequences are thus of herbaceous communities typical of well grazed pasture or damp meadow. Cereal type pollen grains are recorded at: Barton in Fabis south; Great Haywood; Bulcote Farm; Old Trent Water; Mill Plantation; and Lower Dove. However, the percentage values tend to be low for all but two of the sites. The crumpled state of some of these grains precluded specific identification but in many cases the morphological characteristics of the grains indicate the presence of *Avena-Triticum* Group as well as *Hordeum*-type which can include species of the wild grass *Glyceria* (floating sweet grass) as well as barley. The highest and most consistent percentages are found at Mill Plantation and Great Haywood, implying that arable land may have been proximal to these sampling sites. The very high percentages in the Mill Plantation diagram (13% in the middle sample) suggests that cereals may have been cultivated close to these sampling locations for much of the periods of sediment accumulation. The impression of proximity to arable land at both these sites may be reinforced by the presence of *Centaurea cyanus*, a weed strongly associated with cultivated areas. The record of cereal type pollen at Great Haywood is of little significance since radiocarbon dating has demonstrated that this site is essentially modern; however, the records from Mill Plantation (13-14th centuries), Barton in Fabis south, and Bulcote Farm (Late Roman-Anglo Saxon) are particularly significant and merit further detailed research.

The Seymour Drain sequence contrasts with the other sites in that it is the only one to be distinguished by high values for tree pollen, mainly consisting of *Alnus glutinosa* but with *Quercus* and *Corylus avellana-type* also recorded. This indicates the presence of an alder dominated fen carr vegetation community on and around the sampling site, although some mixed woodland including oak and hazel was probably also growing on the better drained soils. The presence of *Plantago lanceolata* in these samples does suggest that some open habitats were present beyond the alder carr, but overall the impression for this site is of a considerably less disturbed environment. Radiocarbon dating of the deposits to the Bronze Age confirmed this palynological interpretation.

4.3. Radiocarbon Dating

Samples from Sites 1-8, have all yielded radiocarbon dating evidence spanning the Bronze Age to the recent past (Appendix 4), and corroborates the age estimates determined from environmental assessment, in particular, the pollen record.

5. CONCLUSIONS and RECOMMENDATIONS

This study has demonstrated that organic deposits within palaeochannels not directly threatened by mineral extraction have the potential to yield high quality records of land-use and human activity. With the exception of locality 1, which was of relatively recent date (though not on 1st edition Ordnance Survey maps), they deserve protection as a palaeoecological resource and should be excavated, sampled, and researched (or samples, at least, kept in safe storage) if they are threatened. To provide sufficient material for analyses, samples should be taken from large trial trenches. Further, the preservation of pollen, macroscopic plant and insect remains was variable within samples (e.g. Mill Plantation), which emphasises the need for a multi-proxy approach to environmental reconstruction.

The cores provided evidence for human activity from a variety of time frames in a range of landscape settings, some wooded, and others intensively cleared and farmed. Radiocarbon dating has confirmed that some of these organic-rich sequences belong to periods for which there is little understanding of the environment and human activity in both the East Midlands, (particularly the Roman, early post-Roman and Medieval periods, Monckton, 2003) and eastern England more generally (Van de Noort & Ellis, 1998; 1999; 2000; Kirby & Gearey, 2001). Some of these sequences should be targeted therefore as research priorities.

Although with the exception of locality 8, the sequences appear to record landscapes which have already been cleared of their primary woodland cover and thus would not appear to have the potential for discerning timing and nature of initial anthropogenic disturbance to the vegetation of Trent Valley, further more detailed palaeoenvironmental study linked to a radiocarbon chronology and available archaeological data nevertheless has the potential to produce a comprehensive picture of human-environment relations in discrete areas of the Trent valley. Some oxidation has been noted in samples and this may reflect the fluctuation of groundwater through time.

Finally, this study focused on the coring of palaeochannels that are visible within the landscape today and usually identified through a number of characteristics (e.g. surface expression, hedge and Parish boundaries etc). However, analysis of borehole records by Challis (2004) has resulted in the provisional identification of a number of deeply buried organic bodies, particularly in the Lower Trent Valley. Therefore, any future geoarchaeological assessments of organic remains should include an attempt to sample and characterise such deposits.

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APPENDIX 1 – Interim Report

COMPONENT 11a.

EXTENDING AND PROTECTING PALAEOENVIRONMENTAL DATA : DEPOSIT SAMPLING

INTERIM REPORT

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TRENT VALLEY GEOARCHAEOLOGY
CONTENTS

1. INTRODUCTION

This component is part of the larger Trent Valley project being delivered by members of the Trent Valley Geoarchaeology group. It is administered by English Heritage and funded from the Aggregates Sustainability Levy Fund (ASLF).

Organic deposits preserved in palaeochannels on river valley floors are capable of providing high-resolution proxy records of climate and land-use change and are an important component of the archaeological record. This component of the overall project is concerned with a pilot programme of taking samples from palaeochannels that are not affected by proposals for mineral extraction or other development. This is because quarry extraction is usually concentrated into distinct zones within the valley floor, usually the wide lowland reaches, so that only a partial record of land-use and climate is obtainable from such sites. This pilot programme will enhance the palaeoenvironmental record derived from developer funded work, and will assess the feasibility and implications of extending such a programme to the whole of the Trent Valley.

The specific aim of this component is to understand the preservation potential and character of organic deposits in palaeochannels within a number of contrasting geomorphic settings throughout the Trent Valley. Once suitable sites have been identified, nine approximately one metre cores will be recovered. The age of individual cores will be determined through single standard radiocarbon dates and each will be assessed for its palaeoenvironmental potential (e.g. pollen, plant macro-fossil and insect analysis).

This interim report presents details of the location and stratigraphy of the first eight cores. The final core is to be recovered in August 2003, followed by completion of the palaeoenvironmental analysis and radiocarbon dating.

2. SITE SELECTION & CORE RECOVERY

2.1. Site selection

Potential palaeochannels were identified in the Trent valley by a combination of inspecting:

(i) LiDAR derived digital terrain models, viewed through ArcView GIS. This method gives very good resolution of floodplain topography. Approximately 50% of the Trent Valley has LiDAR coverage. (*See Component 2*.)

(ii) GIS palaeochannel map of the Middle and Lower Trent valley (north of Nottingham), derived from aerial photographs. This map is produced by digitising floodplain topographical features (such as palaeochannels) from a mosaic of rectified and georeferenced vertical aerial photographs. (*See Component 2*.)

(iii) Topographical 1:25000 O.S. maps. In areas with no LiDAR coverage, O.S. maps prove useful in locating potential paleochannels, as field boundaries, drainage ditches and occasionally contour lines often delineate old channels.

(iv) Walkover survey. All potential sites are investigated and validated in the field.

2.2. Core recovery

Palaeochannels that have been identified as suitable for the recovery of organic-rich sediment are investigated by hand augering and coring methods. Cores are recovered with either a 60mm or 35mm gouge, with multiple adjacent cores usually recovered to supply enough sample. To prevent sample oxidation and contamination, all cores are wrapped in cling film in the field, and later stored in a refrigerated cold-room.

3. CORE LOCATION AND DESCRIPTION

3.1. Core 1 Great Haywood (Upper Trent Valley)

3.1.1 Location

Core 1 is located in a grass field north-west of Great Haywood, Staffordshire, upstream of the Trent and Sow confluence. **SJ 99307 23248**

Fig. 1 Location of Core 1.

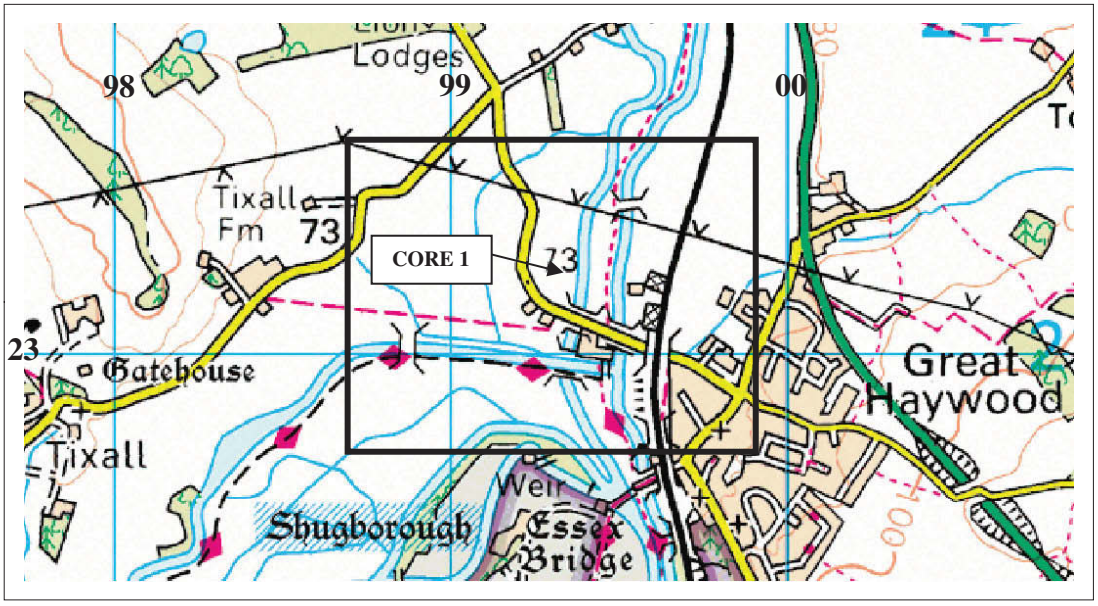
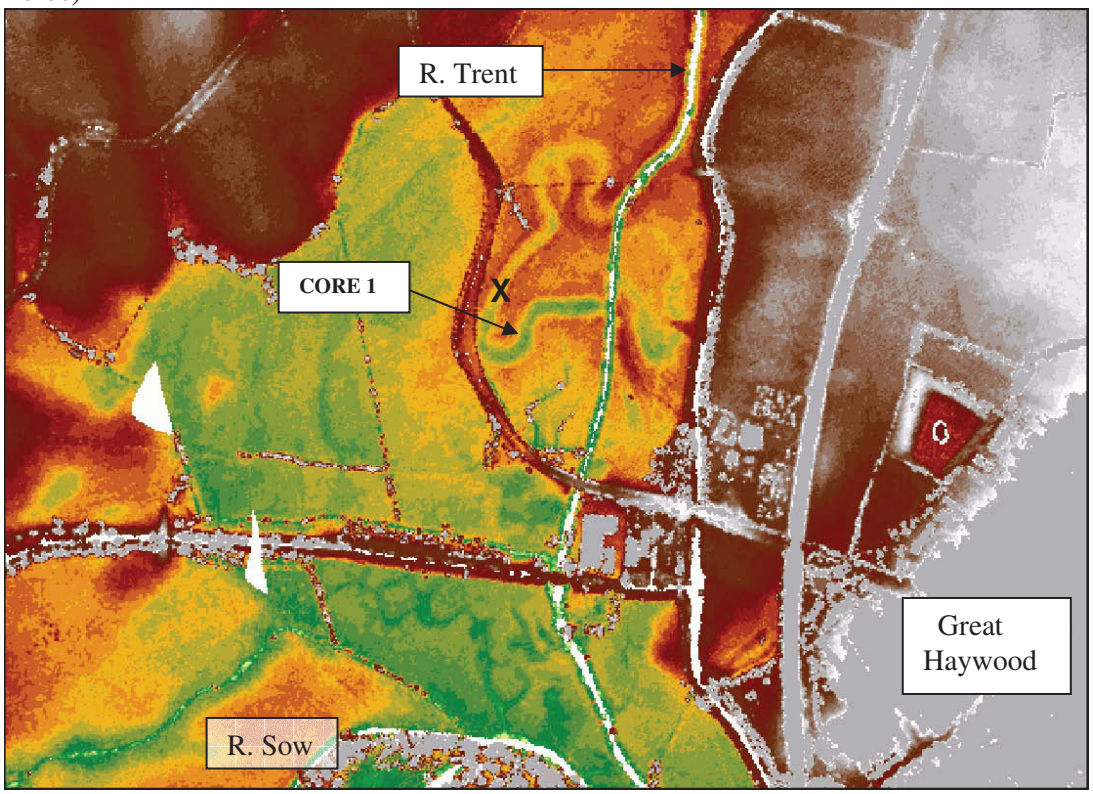


Fig. 2 LiDAR image of upper Trent valley showing Core 1 location. (**X** = other auger holes)



3.12. Stratigraphy

Core No.: 1			Date: 5 June 2003				
Location: Great Haywood			Coordinates: SJ 99307 23248 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Firm brown mottled grey clayey SILT		0.25 (70cm) 0.50					
Grey brown silty CLAY with black organic patches		0.75 (10cm)	0.70	0.70			
Soft dark grey organic silty sandy CLAY (sandier at 100-110cm). Wood fragments at 95-100cm.		(30cm) 1.00					
Black well sorted medium-course SAND		(10cm) 1.25	1.10	1.10			
		1.50 1.75 2.00					

3.2. Core 2 Lower Dove Valley (nr. Willington Quarry)

3.2.1. Location

Core 2 is located in a grass field on the east bank of the River Dove. This is near the Trent confluence north-east of Burton upon Trent. **SK 27285 26769**

Fig. 3 Location of Core 2.

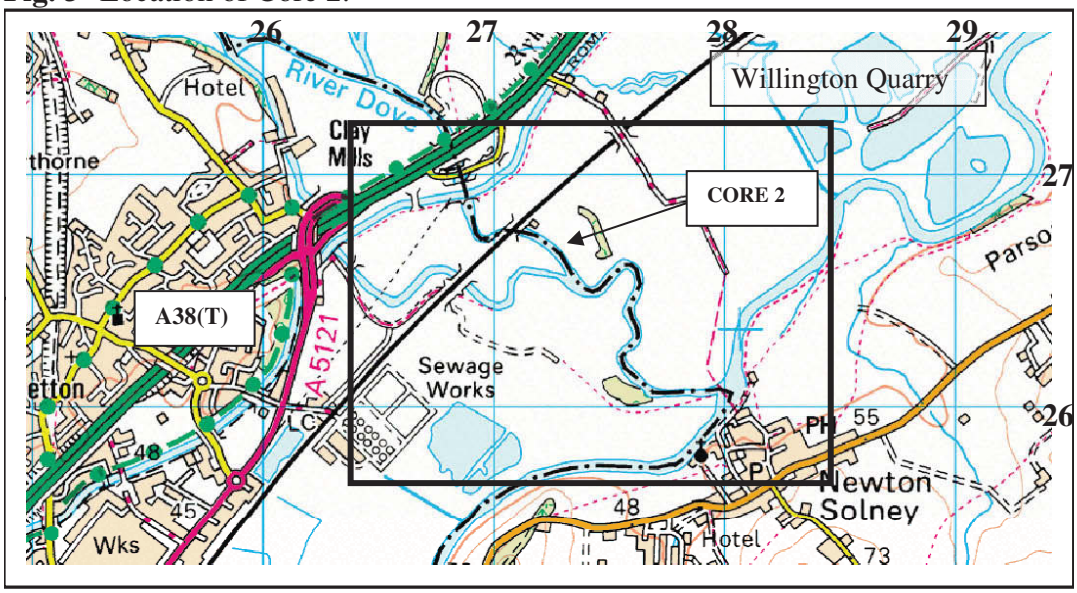
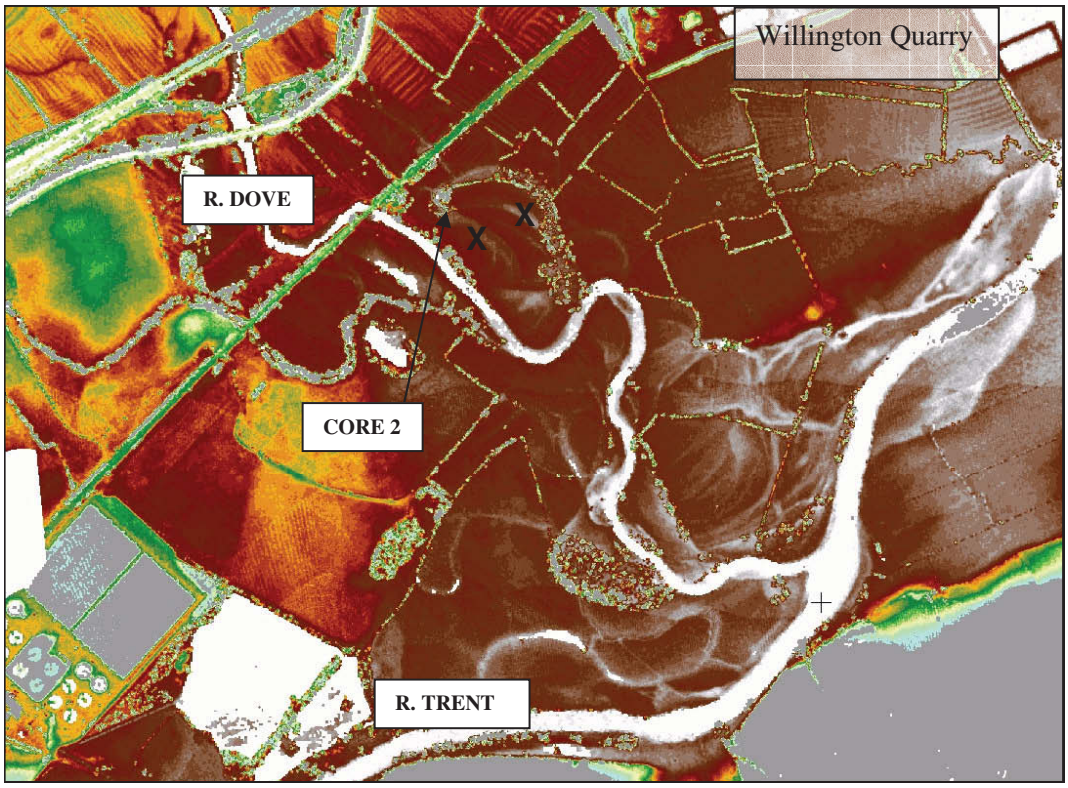


Fig. 4 LiDAR image of Trent and Dove confluence, showing Core 2 location. (**X** = other auger holes)



3.2.2. Stratigraphy

Core No.: 2			Date: 5 June 2003				
Location: Lower Dove Valley (nr. Willington Quarry)			Coordinates: SK 27285 26769 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Firm brown sandy (vf-f) clayey SILT		0.25 (85cm) 0.50 0.75					
Soft brown grey organic silty CLAY with numerous plant fragments		1.00 (50cm)	0.85	0.90			
As above but less plant fragments		1.25		1.30			
SAND/GRAVEL			1.35				
		1.50 1.75 2.00					

3.3. Core 3 Old Trent Water, nr. Repton (Middle Trent Valley)

3.3.1 Location

Core 3 is located in a grass field beside the "Old Trent Water" drainage channel, east of Repton. **SK 31157 27616.**

Fig. 5 Location of Core 3.

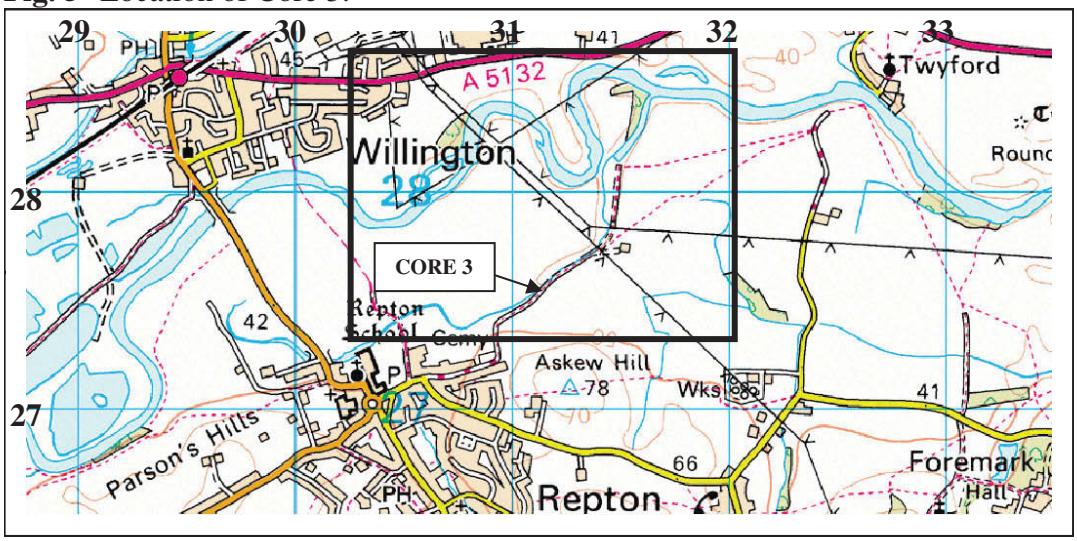


Fig. 6 LiDAR image of middle Trent valley, east of Repton. Core 3 is located within the "Old Trent Water" palaeochannel. (**X** = other auger holes)

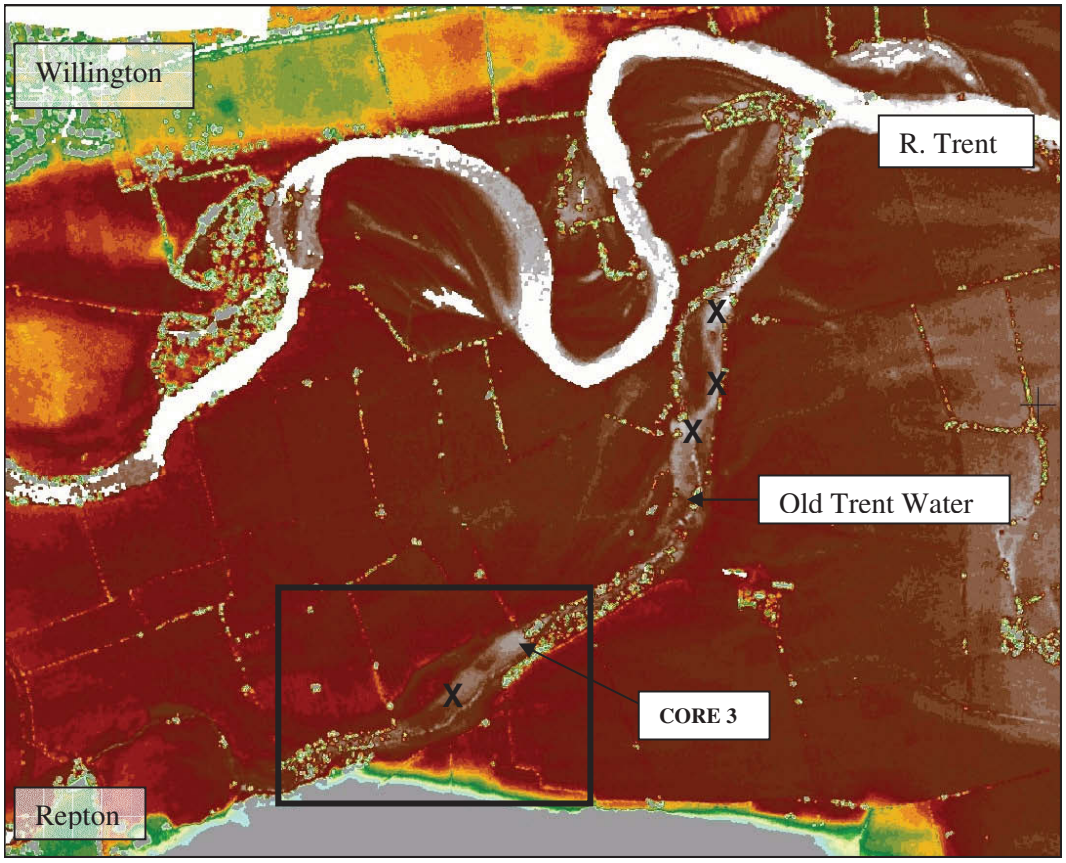
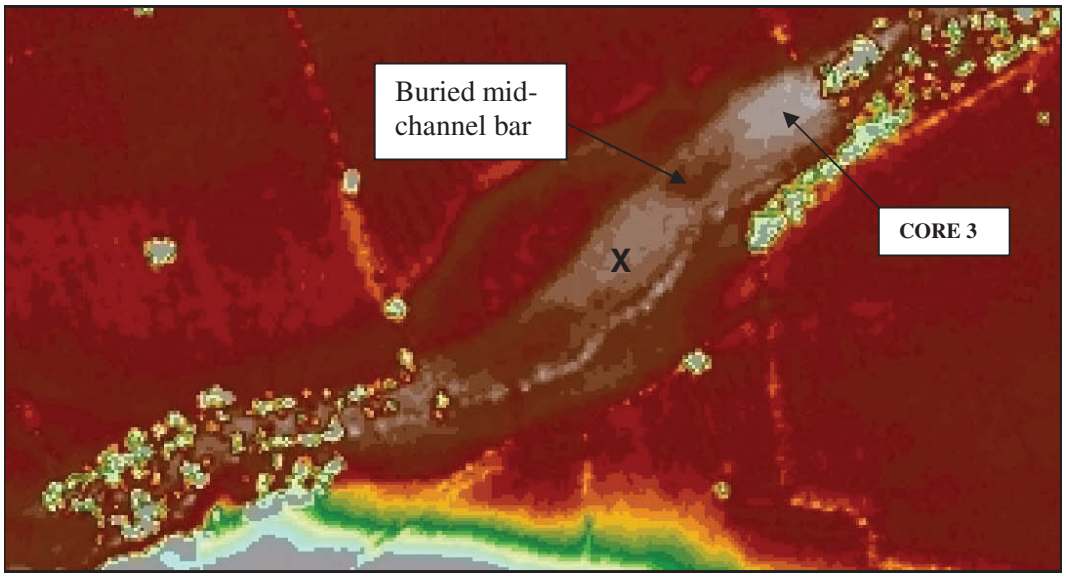


Fig. 7 Enlarged LiDAR image of "Old Trent Water" palaeochannel, showing location of Core 3. (**X** = other auger hole)



The other auger sites in the palaeochannel also reveal organic infill, but of less thickness and/or quality.

3.3.2. Stratigraphy

Core No.: 3			Date: 5 June 2003				
Location: Old Trent Water, nr. Repton			Coordinates: SK 31157 27616 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Firm grey mottled brown clayey SILT with numerous plant fragments and rootlets		(30cm) 0.25			0.20		
Grey brown peaty silty CLAY with many plant fragments		(20cm) 0.50	0.30	0.30			
Grey brown silty CLAY with many plant fragments		(20cm) 0.75					
Grey organic silty CLAY with occasional plant fragments		(50cm) 1.00					
SAND/GRAVEL		1.25	1.20	1.20	1.20		
		1.50					
		1.75					
		2.00					

3.4. Core 4, Mill Plantation (Middle Trent Valley)

3.4.1. Location

Core 4 is located in a corn field in the Middle Trent valley south of Twyford and the River Trent. Access is via a track from Mill Plantation to the south. **SK 32828 27680**

Fig. 8 Location of Core 4.

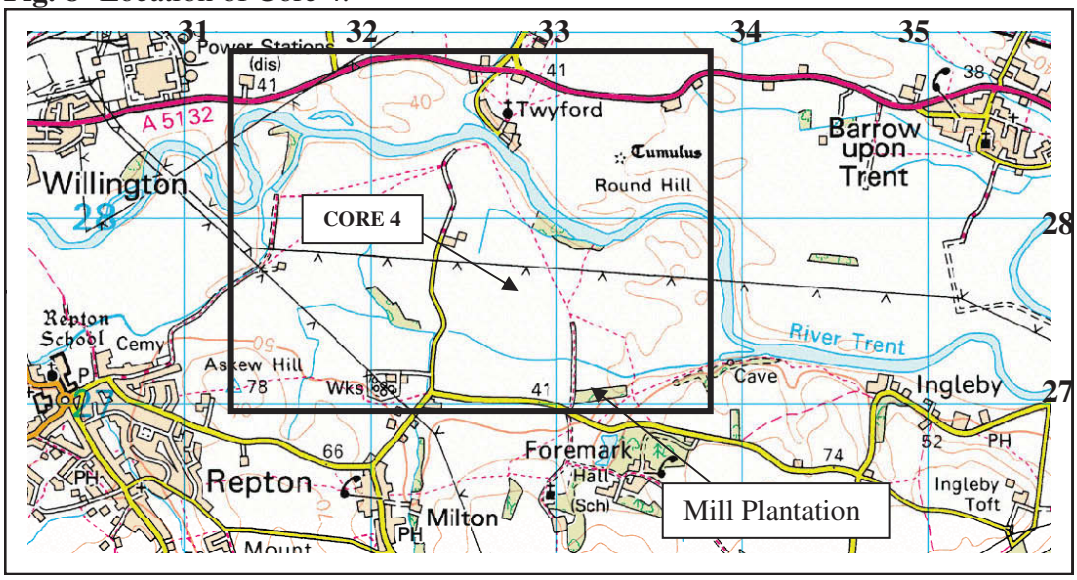
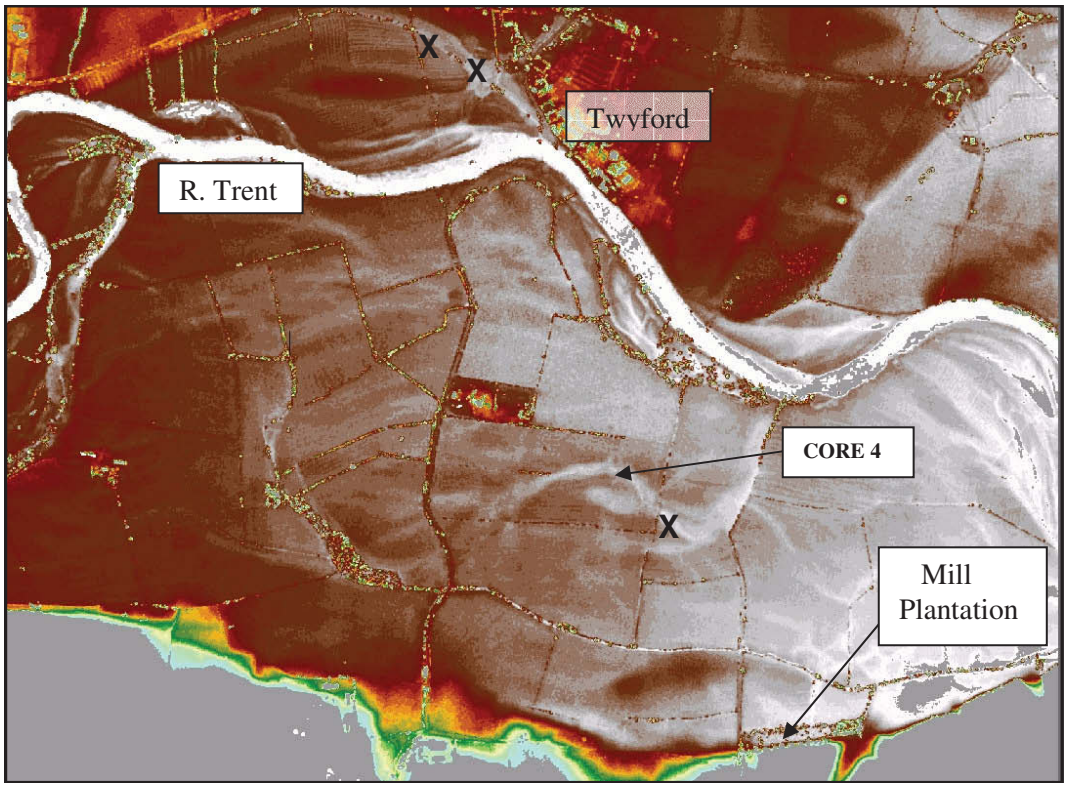


Fig. 9 LiDAR image of middle Trent valley, south of Twyford, showing location of Core 4. (**X** = other auger holes)



The palaeochannel to the north of the River Trent, which erodes into a Pleistocene terrace, was also investigated. Both auger holes revealed an inorganic infill.

3.4.2. Stratigraphy

Core No.: 4			Date: 5 June 2003				
Location: Mill Plantation, nr. Repton			Coordinates: SK 32828 27680 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Firm red brown sandy clayey SILT with occasional small pebbles		(35cm) 0.25					
Light grey gleyed silty CLAY		(55cm) 0.50 0.75			0.85		
Grey brown peaty silty CLAY with some plant fragments and occasional wood fragments		(90cm) 1.00 1.25 1.50 1.75	1.05	0.90 wood			
SAND/GRAVEL			1.70	1.70	1.70		

3.5. Core 5, Barton in Fabis, South (Middle Trent Valley)

3.5.1. Location

Core 5 is located near an arcuate drainage channel, in the grass headland of a corn field south of Barton in Fabis, Nottinghamshire. **SK 52152 32170.**

Fig. 10 Location of Cores 5 and 6.

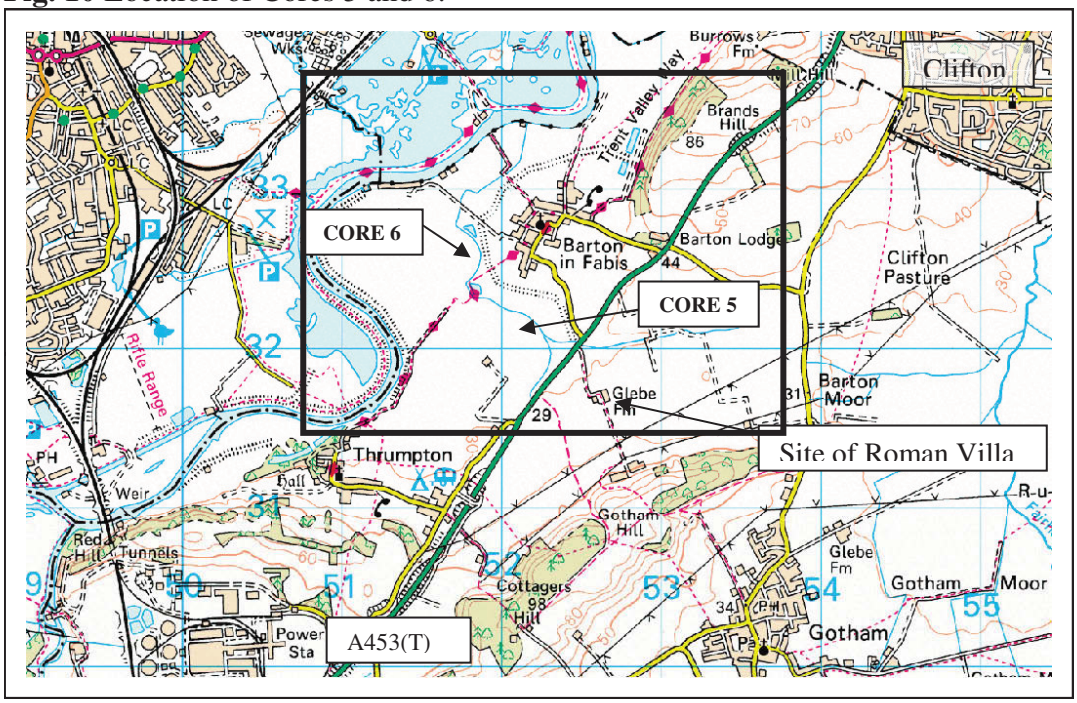
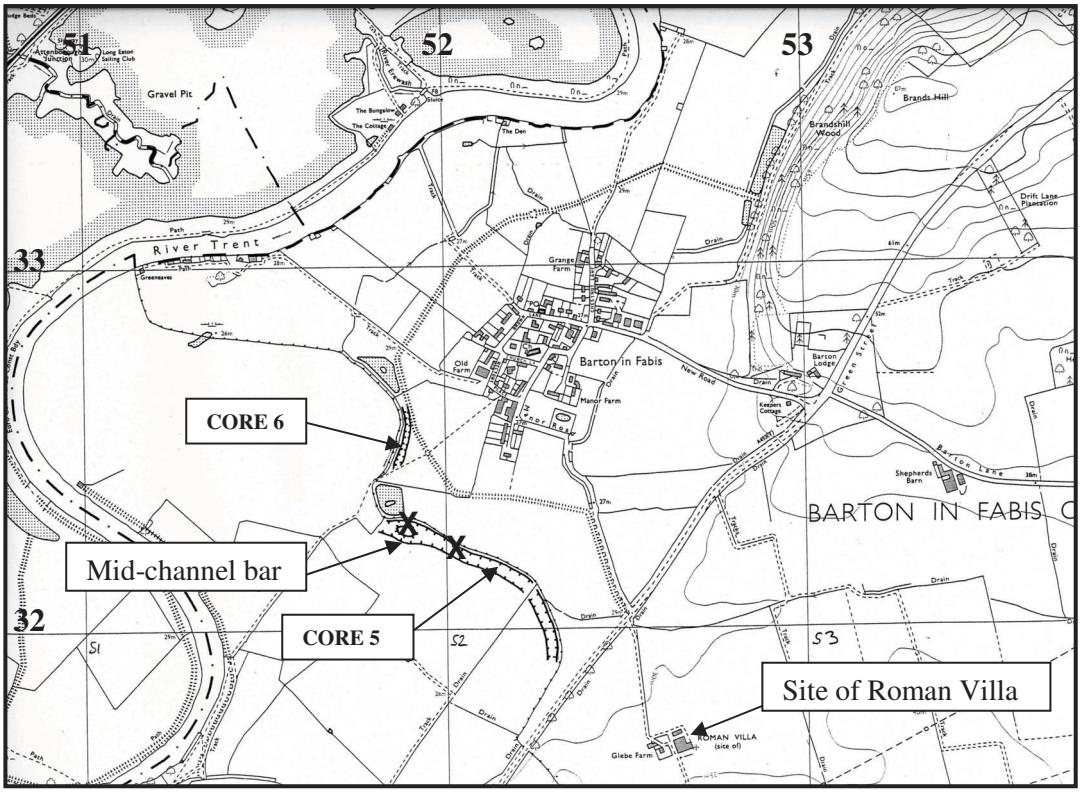


Fig. 11 Palaeochannels south of Barton in Fabis, with locations of Cores 5 and 6. (X = other auger holes)



This site is of particular interest because the floodplain is overlooked by the site of a Roman Villa at the present Glebe Farm.

Core 5 is located on the meander of a palaeochannel that dissects another channel to the north. Core 6 is taken from within this northern palaeochannel, and a chronology will be determined by dating the two deposits.

3.5.2. Stratigraphy

Core No.: 5			Date: 6 June 2003				
Location: Barton in Fabis, South			Coordinates: SK 52152 32170 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Firm/stiff brown clayey SILT with occasional charcoal flecks		0.25 (45cm)					
Light grey gleyed CLAY		0.50 (15cm)	0.55		0.50		
Brown silty clayey PEAT with numerous plant fragments		0.75 1.00 (80cm) 1.25	1.05	0.90	1.05	1.00	
Medium-course SAND		1.50		1.40		1.40	

3.6. Core 6, Barton in Fabis, North (Middle Trent Valley)

3.6.1. Location

Core 6 is also located near an arcuate drainage channel, west of Barton in Fabis. **SK 51858 32463** (*See fig.'s 10 and 11*).

3.6.2 Stratigraphy

Core No.: 6			Date: 6 June 2003				
Location: Barton in Fabis, North			Coordinates: SK 51858 32463 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Stiff brown clayey SILT with occasional charcoal flecks in top 30cm	-- -- -- -- --	0.25 (100cm) 0.50 0.75					
Light grey and brown thinly inter-laminated CLAY	-- -- -- -- -	1.00 (30cm) 1.25					
Light grey CLAY	-- -- -- -- -	(25cm) 1.50					
Brown grey clayey peaty SILT with many plant fragments and some gastropod shells	♠ @ ♠ -- ♠ -- -- ♠	(25cm) 1.75	1.55		1.55		
Grey clayey SILT with some plant fragments and many gastropod shells	@ ♠ @ ♠ -- -- @ -- @ @ ♠ ♠ @ -- -- -- -- @	2.00 (75cm) 2.25 2.50	2.05	2.05	2.05	2.05 2.45	
SAND/GRAVEL	O.O.O.O.O	2.75 3.00		2.55			

3.7. Core 7, Bulcote Farm (Middle Trent Valley)

3.7.1. Location

Core 7 is located on a field boundary near Trent Lane, 700m south of Bulcote Farm, Burton Joyce, Nottinghamshire. **SK 66341 43531.**

Fig. 12 Location of Core 7.

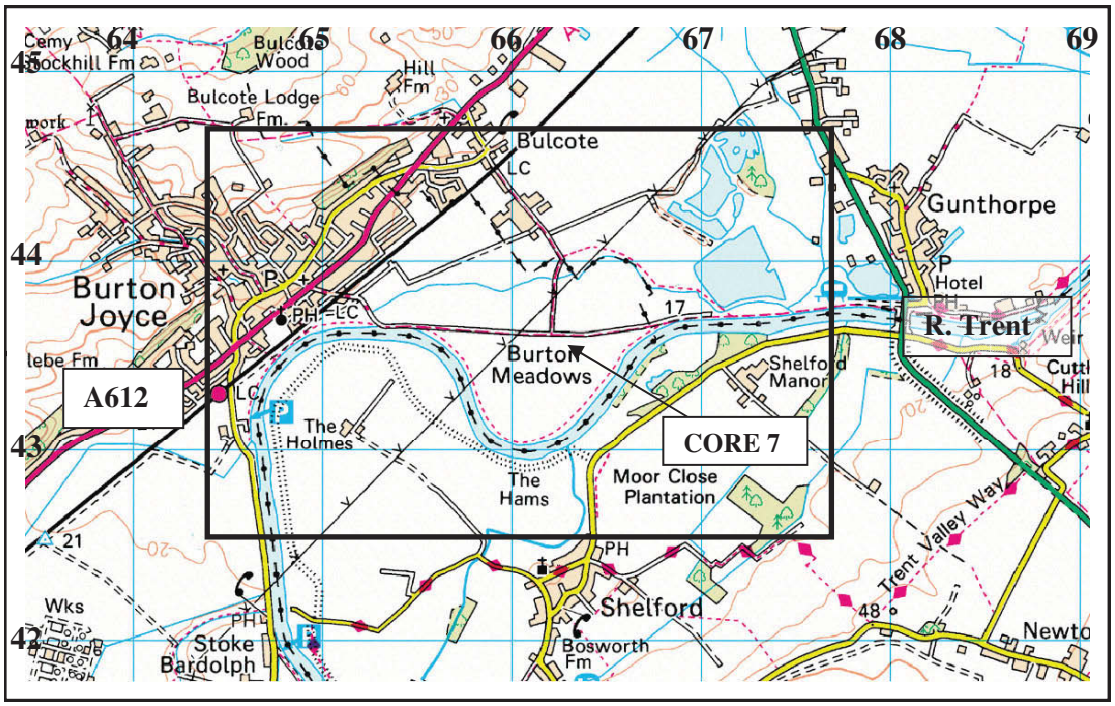
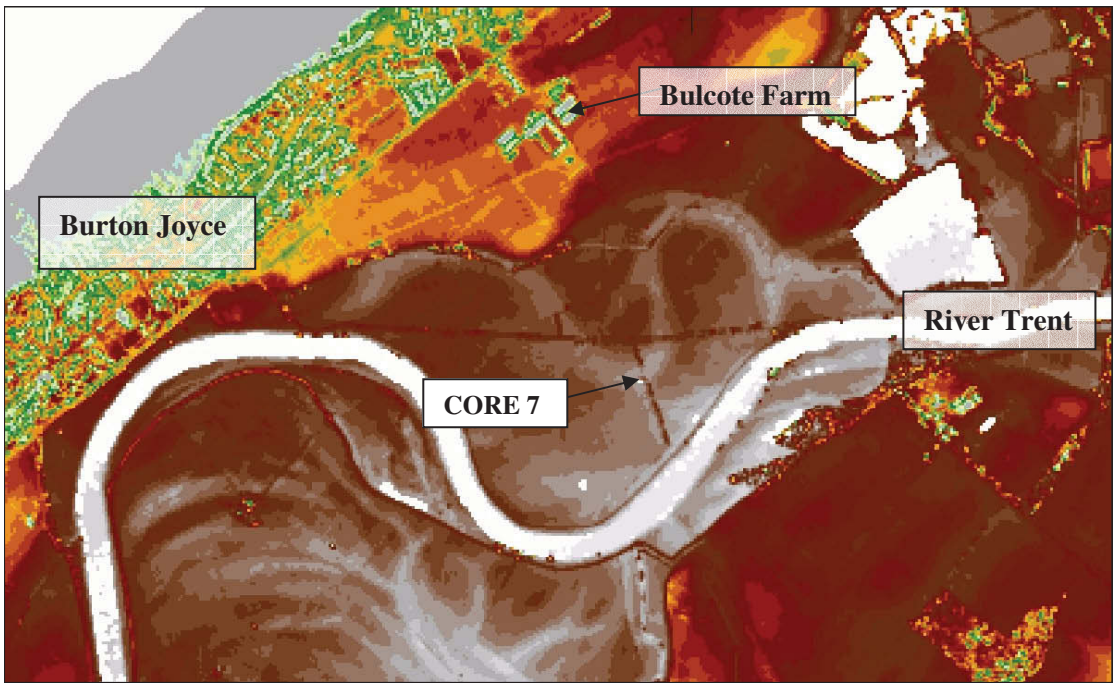


Fig. 13. LiDAR image of middle Trent valley near Burton Joyce, showing location of Core 7.



3.7.2. Stratigraphy

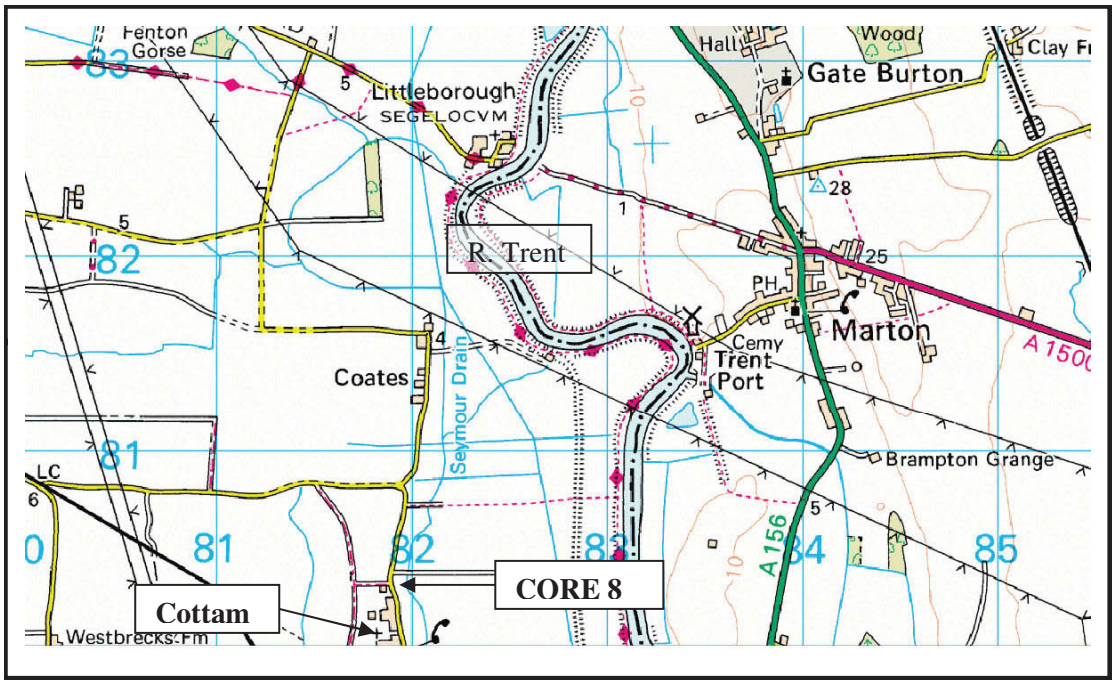
Core No.: 7			Date: 16 June 2003				
Location: Bulcote Farm, nr. Burton Joyce			Coordinates: SK 66341 43531 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Dark brown sandy SILT		0.25 (35cm)					
Brown sandy silty CLAY with occasional small Quartz pebbles		0.50 (15cm)					
Brown silty CLAY		1.00 (125cm)					
Grey organic CLAY		2.00 (60cm)					
Grey organic CLAY with some plant fragments		2.25 (20cm)					
Grey black organic peaty CLAY with some plant fragments and gastropod shells		2.50 (80cm)	2.55	2.95	2.55		
Brown peaty shelly CLAY with numerous gastropod and bivalve shells		3.25 (35cm)	3.17	3.70	3.40		
		3.50					
		3.75					
		4.00					

3.8. Core 8, Seymour Drain, Cottam (Lower Trent Valley)

3.8.1. Location

Core 8 is located beside the drainage channel of Seymour Drain, in a grass field on the edge of Cottam, Nottinghamshire. **SK 81953 80318.**

Fig. 14 Location of Core 8.



3.8.2. Stratigraphy

Core No.: 8			Date: 16 June 2003				
Location: Seymour Drain, Cotham			Coordinates: SK 81953 80318 (GPS ref.)				
Drilling method: Hand auger, using dutch head and gouge			Logged by: GMH				
Description	Legend	Depth (m) (thickness)	Sample core Depth (m)				
			a	**b**	**c**	**d**	**e**
Stiff red brown silty CLAY with rootlets		0.25 (60cm) 0.50					
Grey mottled brown thinly laminated CLAY		0.75 1.00 (70cm) 1.25 1.50					
Grey black organic silty CLAY with plant and mollusc shell fragments		1.75(15cm)	1.70		1.70		
Brown silty PEAT with many plant fragments and some mollusc shell fragments		2.00 (35cm)			2.03	2.10	
Grey brown sandy peaty SILT with many plant and some wood fragments (large piece at 230cm)		2.25 (30cm) 2.50 (20cm)	2.20	2.20			2.55
Grey sandy CLAY with occasional pebbles and occasional plant fragments		2.75		2.70			
SAND/GRAVEL		3.00 3.25 3.50 3.75 4.00					

4. Unsuccessful coring sites

During the recovery of the nine cores, several exploratory auger holes were usually made in the potential palaeochannel (and sometimes adjacent channels). These have been highlighted in the section 3 figures, for each of the coring sites. The borehole that produced the most organic sediment and/or the longest sequence of organic sediment, was chosen for deposit sampling.

In addition, several other unproductive palaeochannel sites were visited during exploration for organic palaeochannel infills in the Trent valley. These are briefly described below.

4.1. Barrow upon Trent

A potential early Holocene/Late Glacial palaeochannel was investigated near Barrow upon Trent. LiDAR data shows a distinct 200m wide palaeochannel eroding through the surrounding Pleistocene terrace to the north of the village. Cores were inspected at SK 355 286 and further up the channel at SK 351 289. Unfortunately, no suitable organic material was found above the underlying sand and gravel.

4.2. River Devon

Two sites were investigated on the River Devon, a tributary of the River Trent that has its confluence at Newark on Trent. The first site is near the village of Hawton at SK 793 502, where a potential palaeochannel has eroded into a higher terrace. The second site is at SK 788 478 near Cotham. The River Devon has been engineered straight in this part of the valley, and a sinuous drainage ditch and field boundary now highlight the old path of the river. No suitable organic material was found at either site.

4.3. South Clifton

Within the Lower Trent Valley, the meandering “Old Trent” palaeochannel south of South Clifton was investigated (SK 821 697). This area is of interest, as a Roman structure has been found on the adjacent Clifton Hill, and Roman coins are often discovered in the fields beside the channel. Unfortunately, no suitable organic material was found.

4.4. Littleborough

At Littleborough, in the Lower Trent Valley, there is a circular palaeochannel formed by meander cutoff. The village is of note as the site of a Roman Town. The palaeochannel was investigated near to where it crosses Marsh Lane at SK 81344 82199 (GPS ref.). Although no suitable organic sediment was recovered, a depth of 5.7m was reached before any sand and gravel was encountered. The bottom 4.0m contained a long sequence of homogenous light grey silt, with abundant gastropod and bivalve fragments. It appeared to be of estuarine origin.

4.5. Fledborough

A prominent palaeochannel, partly occupied by standing water, is present at Fledborough (SK 813 721) in the Lower Trent Valley. Several auger holes were made, but very little organic sediment was encountered above the sand and gravel.

APPENDIX 2 – Additional Radiocarbon Analyses

APPENDIX 3 – Insect, Molluscs and Sample Collation Data and Pollen Diagrams

Insect preservation record for samples from nine sites in the Trent Valley.

Sample	Weight (kg)	E top	E bottom	E mode	Strength of mode	F top	F bottom	F mode	Strength of mode	Colour change to	Colour change top	Colour change bottom	Colour change mode	Strength	Notes
11	1.25	2.0	5.0	3.5	w	2.0	5.5	3.5	w						
12	1.10	2.5	4.0	3.5	d	2.5	4.0	2.5	w	brown	0	2	1	w	
21	0.85	2.0	4.5	3.5	w	2.5	5.0	3.0	w						
22	1.10	1.0	3.0	2.0	w	1.0	3.0	2.5	w						
31	0.85	1.0	4.0	2.5	w	2.0	3.0	2.0	w						
32	0.90	1.5	2.5	2.0	w	1.5	3.0	2.5	w						
41	0.45			2.0		2.0	5.5	2.0	d						
42	0.65	2.0	2.0	2.0	s	1.5	5.5	1.5	w						
51	0.88	2.0	4.0	3.0	w	2.0	4.0	2.5	w						
52	1.40	1.5	2.5	2.0	w	2.0	4.0	3.0	w						
53	1.00	1.5	2.5	2.0	w	2.5	5.0	3.5	w						
61	1.20	1.5	3.0	2.0	w	1.5	5.0	2.5	w						
62	0.85	2.5	4.5	3.0	w	2.5	5.5	3.0	w						
71	0.60	1.5	2.5	2.5	w	1.5	5.0	3.5	w						
72	0.50	1.5	4.5	3.5	w	1.5	5.5	3.5	w	yellow/ pale	0	2	1	w	NB 2nd E mode 1.5

Sample	Weight (kg)	E top	E bottom	E mode	Strength of mode	F top	F bottom	F mode	Strength of mode	Colour change to	Colour change top	Colour change bottom	Colour change mode	Strength	Notes
73	0.25	1.5	2.5	2.0	w	1.5	3.5	2.5	w						
81	1.00	2.0	3.0	2.5	w	2.0	4.5	2.5	w						
82	0.80	2.0	2.5	2.0	w	2.0	3.0	2.5	w						
83	0.60	2.0	5.5	5.0	d					pale	0	3	1	w	
911	3.70	1.0	3.0	2.0	w	1.5	3.5	2.0	w						
912	2.00	1.5	3.0	2.0	w	2.0	3.5	2.5	w						
913	3.70	2.0	3.5	2.5	w	2.0	4.5	2.5	w						
914	2.55	2.0	4.0	3.0	w	2.0	4.0	2.5	w						
915	2.00	2.0	3.0	2.5	w	2.0	3.5	2.5	w						
921	4.00	2.5	4.5	3.5	w	2.0	4.0	2.5	w						
922	4.40	1.5	3.0	2.0	w	2.0	3.0	2.5	w						

Snails recovered from three of nine sites in the Trent Valley. **Key**: f = few (up to 3 individuals); s = some (4 to 20); m = many (21 to 50); v = very many (more than 50).

	Context					
	62	**71**	**73**	**912**	**913**	**914**
Sediment processed (kg)	0.85	0.65	0.25	2.0	3.7	2.55
Taxon						
FRESHWATER SNAILS						
Valvata ?*macrostoma* Mörch	m					
Valvata piscinalis (Müller)	m	s	m		f	
Valvata ?*cristata* Müller					s	
?*Valvata* sp.						s
Bithynia tentaculata (L.)	f		s		m[1]	m[1]
Bithynia leachi (Sheppard)	f	s		f[1]	m[1]	m[1]
Lymnaea ?*peregra* (Müller) forma *ovata* Draparnaud	f		f			
Lymnaea sp.			?f			
Planorbis planorbis (L.)	s	f	s			
Anisus leucostoma (Millet)	s					
Planorbidae sp. indet.	m	m				
Succinieidae sp. (probably *Oxyloma pfeifferi* (Rossmässler))	m		s			
FRESHWATER BIVALVES						
Pisidium spp. (bivalves)	m	m	m			
LAND SNAILS						
Carychium ?*tridentatum* (Risso)			f			
UNIDENTIFIED SHELL						
unidentified shell fragments	m	vm			vm	
mollusc eggs					m	m
OTHER ORDERS						
ostracods	vm		s			
insect cuticle fragments*					vm	

* – insect material that was not separated by paraffin flotation
[1] – the identified *Bithynia* species remains noted in these samples (from Site 9) were all of operculae.

Details of Sample Amalgamation

Upper Trent

Site 1 (Great Haywood): Sample 11 combined material from 0.7-0.9m from cores a and b, Sample 12 comprised the remaining sediment (0.9-1.1m).

Site 2 (Lower Dove): The upper parts of cores a and b formed Sample 21 (0.85-1.1m) and the lower, Sample 22 (1.1-1.35m).

Middle Trent

Site 3 (Old Trent Water): The uppermost parts of cores a-c (0.3-0.5m) were combined to form Sample 31, the lowermost (1.05-1.2m) to form Sample 32.

Site 4 (Mill Plantation): Sample 41 was formed from the uppermost parts of cores b and c (0.9-1.05m), Sample 42 from the basal parts of cores a-c (1.5-1.7m).

Site 5 (Barton in Fabis south): Four cores were available; Sample 51 was taken from 0.6-0.75m in cores a and c; 52 from 0.95-1.0 in cores a and c and from 0.95 –1.05 in cored b and d; and Sample 53 from 1.25-1.4m in cores b and d.

Site 6 (Barton in Fabis north): Again, four cores were available; Samples were taken as follows—61 from 1.55-1.1.8 in cores a and c, and 62 from 2.2.35-2.45/2.55 in cores b and d.

Site 7 (Bulcote Farm): Three cores were available. Sample 71 was derived from the sequences at 2.55-2.75 in cores a and c; 72 from 2.95-3.15 in all three cores; and 73 from 3.5-3.7m in core b.

Site 9 (Holme Pierrepont); Material from two parts of an open section were examined. For the first, numbered 91, five samples were processed (911-915); for the second, (92), two (921 and 922).

Lower Trent

Site 8 (Seymour Drain): Four cores were taken; material from 1.8-2.0 m was taken from cores and c for Sample 81, from 2.2-2.35 from cores b and d for Sample 82; and from 2.5-2.7 in core b for Sample 83.

APPENDIX 4 – Radiocarbon Dating

Analysis and Interpretation

Figure 1 shows the calibration of these results using the probability method (Stuiver and Reimer 1993), again INTCAL98. The calibrated dates given in Table 1 are accurate estimates of the dates of the samples, however, in archaeological terms they are not exactly what we want to know. Of much greater interest and potential importance are the dates of the archaeological events represented by those samples. Absolute dating information in the form of radiocarbon measurements on the organic remains can be combined with the relative information provided by stratigraphic relationships between samples to provide estimates of the dates of this activity.

These *posterior density estimates* are not absolute, they are interpretative estimates, that can and will change as further data becomes available and as other people choose to model the existing results from different perspectives.

The methodology used to combine these different sorts of information is a form of Markov Chain Monte Carlo sampling, and has been applied using the program OxCal v3.5 (http://units.ox.ac.uk/departments/rlaha/), which uses a mixture of the Metropolis-Hastings algorithim and Gibbs sampler (Gilks *et al* 1996; Gefland and Smith 1990). Details about the algorithims used by OxCal can be accessed from the on-line manual or in Bronk Ramsey (1995; 1998). The specific algorithims used in the models described below can be derived from the structures in Figure 2, or from the chronological query language files which are contained in the project archive.

Table 1 Trent Valley Survey Radiocarbon Results

Laboratory code	Sample	Material	$\delta^{13}C$ (‰)	Radiocarbon age BP	Calibrated date range (95% confidence)	Posterior density estimate (95% probability)
SEYMOUR DRAIN						
OxA-12775	TV-SD 8.81	alder twigs	-26.6	2476±29	790–400 cal BC	*790-500 cal BC*
OxA-12776	TV-SD 8.82	alder twigs	-26.4	2593±30	820–670 cal BC	*830-760 (94%) or 680-670 (1%) cal BC*
OxA-12777	TV-SD 8.83	twigs	-26.6	3434±30	1880–1640 cal BC	*1880-1630 cal BC*
BULCOTE FARM						
OxA-12778	TV-BUF 7.71	herbaceous stem	-25.1	1594±28	cal AD 400–540	*cal AD 400–540*
OxA-12779	TV-BUF 7.72	herbaceous stem	-24.5	1705±27	cal AD 250–420	*cal AD 250–420*
BARTON IN FABIS NORTH						
OxA-12780	TV-BFN 6.61	herbaceous stem	-24.5	1450±26	cal AD 540–660	*cal AD 540-660*
OxA-12781	TV-BFN 6.62	herbaceous stem	-27.6	1609±27	cal AD 390–540	*cal AD 400-540*
BARTON IN FABIS SOUTH						
awaited	TV-BFS 5.51	herbaceous stem				
OxA-12782	TV-BFS 5.52	plant remains	-27	1550±27	cal AD 420–600	-
OLD TRENT WATER, REPTON						
OxA-12783	TV-OTRW 3.31	willow twigs	-27.1	202±24	cal AD 1650–1950	*cal AD 1650-1690 (36%) or 1730-1810 (57%) or 1930-1950 (2%)*
OxA-12784	TV-OTRW 3.32	willow twigs	-27.9	192±24	cal AD 1650–1950	*cal AD 1660-1690 (18%) or (1730-1810 (72%) or 1930-1950 (5%)*
LOWER DOVE VALLEY						
OxA-12785	TV-LDV 2.21	willow twigs	-26.7	206±25	cal AD 1640–1950	*cal AD 1670-1680 (1%) or 1730-1810 (85%) or 1930-1950 (9%)*
OxA-12786	TV-LDV 2.22	horsetail	-24.8	165±24	cal AD 1660–1950	*cal AD 1660-1700 (15%) or 1720-1810 (75%) or 1920-1950 (5%*
GREAT HAYWOOD						
OxA-12787	TV-GH 1.11	twig fragments	-30.1	211±25	cal AD 1640–1950	*cal AD 1640-1680 (65%) or 1730-1810 (30%)*
OxA-12788	TV-GH 1.12	herbaceous stem	-27.9	330±25	cal AD 1470–1650	*cal AD 1490-1650*
MILL PLANTATION						
OxA-12789	TV-MP 4.41	twig fragments	-27.2	653±26	cal AD 1280–1400	*cal AD cal AD 1280–1400*
OxA-12790	TV-MP 4.42	twig fragments	-27.1	796±23	cal AD 1210–1290	*cal AD cal AD 1210–1290*

Figure 1: Probability distributions of radiocarbon results from the Trent Valley Survey. Each distribution represents the relative probability that an event occurred at a particular time. These distributions are the result of simple radiocarbon calibration (Stuiver and Reimer 1993).

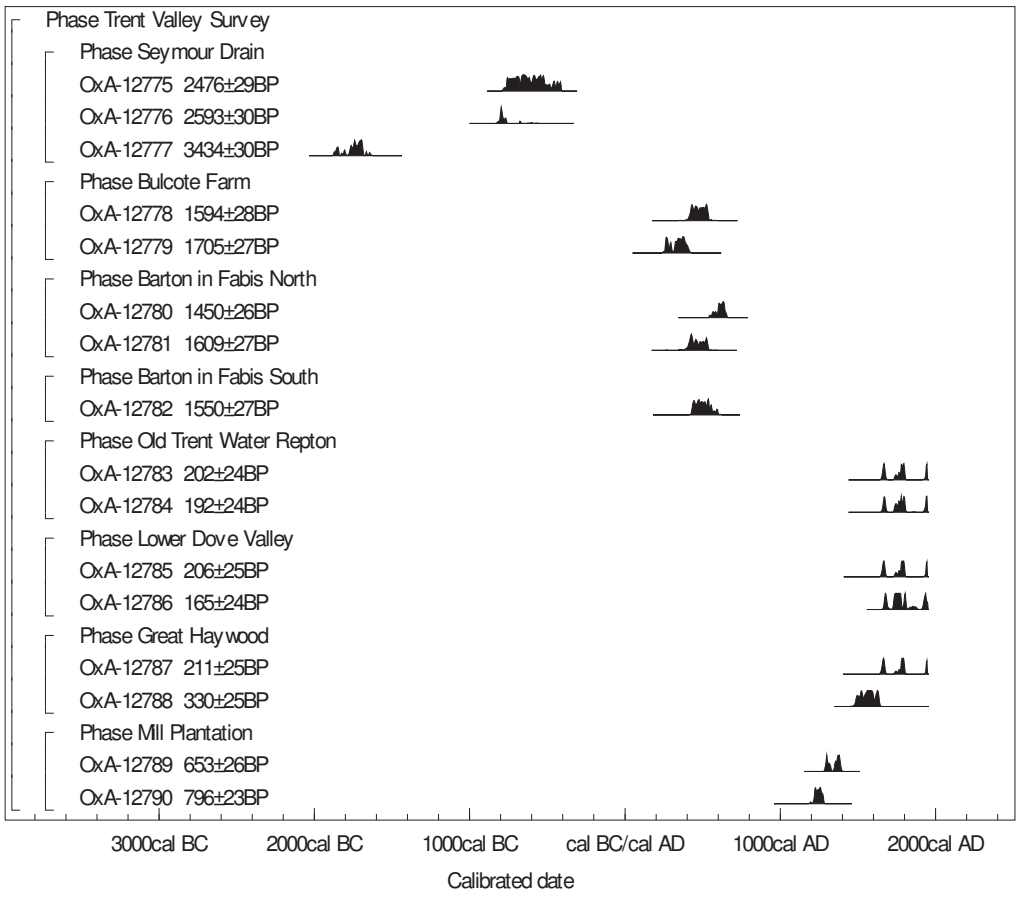


Figure 2. Probability distributions of dates from the Trent Valley Survey: each distribution represents the relative probability that an event occurs at a particular time. For each of the radiocarbon dates two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The large square brackets down the left hand side along with the OxCal keywords define the model exactly.