4 Results: Major Sites

Following the literature and grey literature review seventeen sites containing environmental information were identified. The site locations were entered into the GIS database of the Nene Valley and are presented in Figure 4.1.

Fig 4.1: Location of sites providing environmental data

Little Houghton

The Little Houghton site (SP 782 598) was located on the flood plain of the River Nene, about 2km downstream of Northampton. Another part of the site (*c* SP 79 60) had received some attention during aggregate excavation in the 1980s by Holyoak and Seddon (1984). They had noted organic silts from channel fills underlying the gravels at *c* 3m. The pollen and plant macrofossils from these deposits suggested a treeless arctic flora, comparable to the deposits at Great Billing (Morgan 1969). Animal remains were also recovered, including mammoth and woolly rhino, all suggesting a Mid Devensian age. Palaeolithic archaeological remains in the form of hand axes have been recorded from this site as discussed in Part I (Boismier) and Smith (1995).

Renewed gravel extraction in the late 1980s revealed a number of vertical exposures of unconsolidated deposits over wide areas of the floodplain. The extent of the workings and the two sections which have been logged in detail are shown on Figure 4.2.

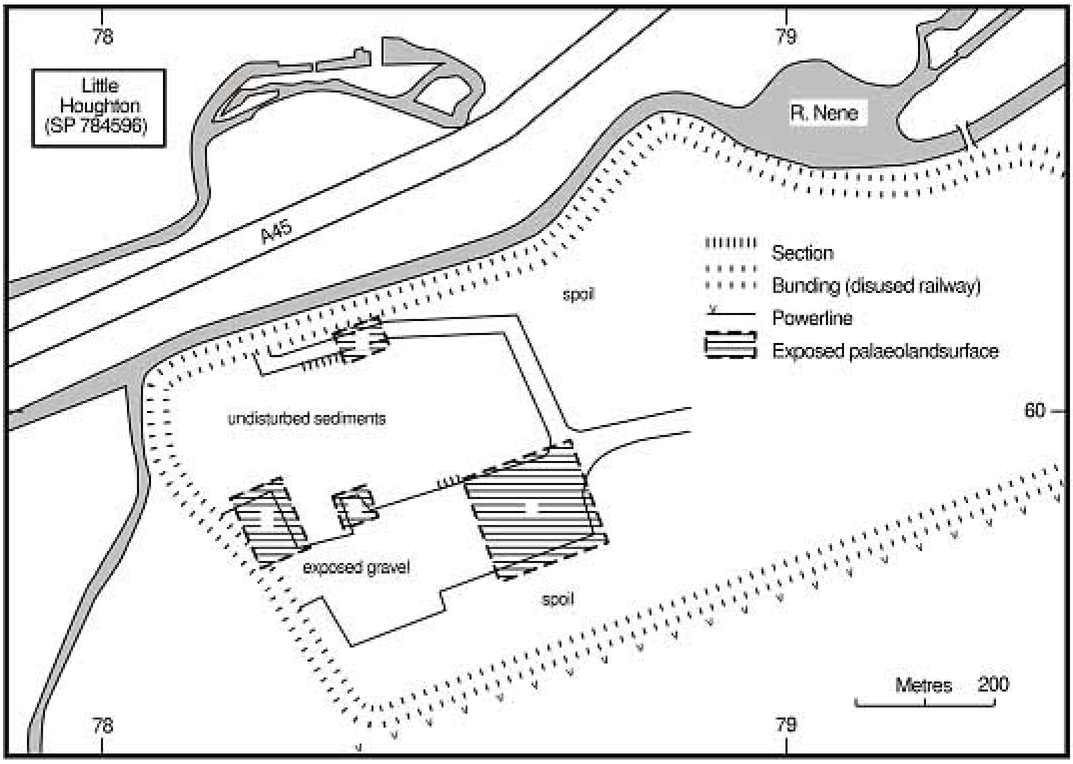

Fig 4.2: The Little Houghton site in plan.

Two sections were logged in detail and are known as the South and North sections and are shown in Figures 4.2 and 4.3 respectively.

The South Section

The South section (SS) was 25m long and 2.95m deep and was part of a 300m long exposure. The central area of the section was an accumulation of mainly sandy sediments that had a variety of structures and included some organic material. The stratigraphies have been placed into four distinct units as seen in Table 4.1.

Table 4.1: The sedimentary units of Little Houghton South Section

Depth (m)	Sediment Characteristics
Surface-0.20	Dark brown crumb ped structure
0.20 -1.40	Clayey silts with no apparent structure. Gradational boundary
1.40 - 1.55	Gravely loam. Sharp boundary
1.40 -2.90	Planar bedded sandy gravels. Gradational boundary

Organic material was preserved at three locations within the section, samples were collected for radiocarbon dating. The sampled organic material is described below.

Sample LH01 was a waterlogged *in situ* tree root (*Alnus glutinosa*). The samples were recovered from 2.75–2.25m below local datum, where it had penetrated through sandy gravels along with a large number of similar roots from the same tree. The bole of the tree was absent, but from the orientation and concentration of the roots it must have been less than 1m distant from the sample site. Microscopic examination showed that the wood tissue was in a site of exceptional preservation, with some cells showing slight discolouration. The LH01 sample was dated to 1880-1490 cal BC (3360±65 BP; SRR-3611).

Sample LH02 was undisturbed organic rich sediment that was collected from the base of an infilled erosional scar 1.68-1.78m below local datum. The gravel bed of the scar indicates that this was once a small fluvial channel, however, the palaeochannel was not extensive within the section, and further evidence of its course was not attainable. The organic sediment was grey to dark grey in colour (no Munsell values are available), very poorly stratified and only partly humified. The organic sediment contains fine sand and silts and small unidentified macrofossils. The sample has been logged using the Troels-Smith (1955) classifications: Nig 1, Strf 1, Elas 0, Sicc 3, humo 1, Gmin 1, Ag 2, As 1, Tl +, Dh +, Dg +. The loss on ignition of organics was 15%. The LH02 was fraction-dated (humic and humin) and gave the following radiocarbon ages for LH02(a) 3440± 50 years bp. LH02(b) 3215± 50 years bp. This date has been recently recalibrated using Calib 5 (Stuiver *et al* 2005) to 1890-1620 cal BC (LH02(a): HAR SRR-3612) and 1620-1400 cal BC (LH02(b): HAR SRR-3612). The two measurements are not statistically consistent (T'=10.1; ν=1; T'(5%)=3.8; Ward and Wilson 1978) indicating significant differences in the ages of organic components of this sediment.

Sample LH03 was a number of small well-preserved macrofossils in fine sediment from a small erosion hollow in the upper beds of the coarser sediment at a depth of 1.56-1.63m below local datum (Fig 4.3). The macrofossils were not identified, but may well have been *in situ Junipus* sp (Keough pers com). The LH03 sample returned as date of 4145± 60 years BP (HAR SRR-3613) or 2900-2490 cal BC. However, during the benzene preparation stage of the assay, chemical contamination of the samples occurred. When LH03 is compared with the other Little Houghton samples and the stratigraphic location of LH03, the contamination has made the date too old and rendering it of no value for site interpretation.

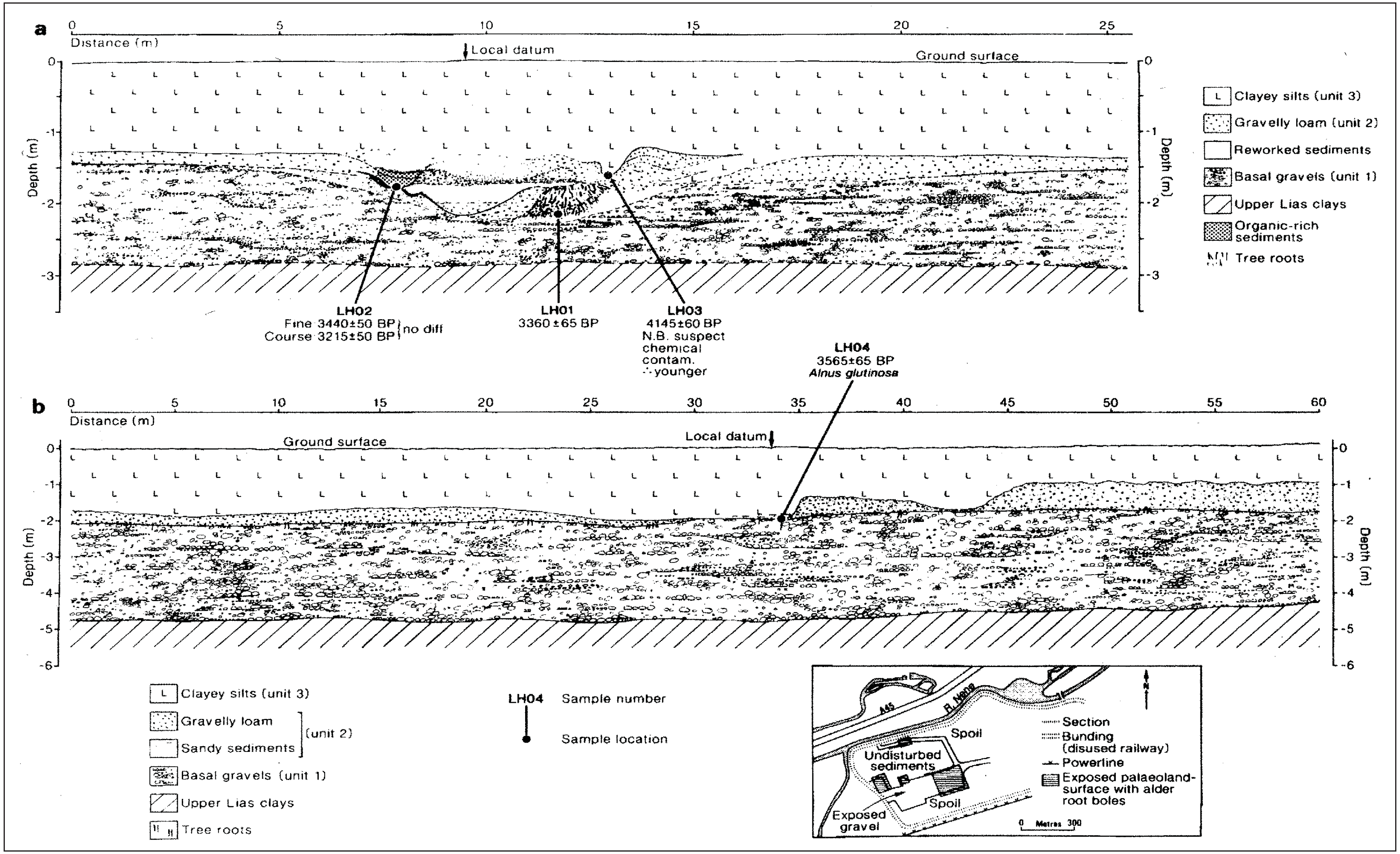

Fig 4.3: Little Houghton: South Section (top) and North Section (bottom)

The North Section

The North Section was 60m long and consisted of a 4.2–4.8m thick accumulation of unconsolidated sediment. The deposit ran parallel to the river, approximately 80m away, and the South Section 220m away. The stratigraphy of the North Section has been placed into three distinct units as seen in Table 4.2.

Table 4.2: The sedimentary units of Little Houghton North Section

Depth (m)	Sediment Characteristics
Surface -1.6	Clayey silts with no apparent structure. Laterally undulating and displaying variable thickness between 1 – 1.6m.
1.6-2.5 (Variable thickness)	Gravely loam composed of sub rounded gravel (35%) sand (38%) silt (16%) and clay (11%) forming minor but relatively sizable components. Lateral variation consisting of no apparent structure to coarse horizontal bedding. Sand lenses noted with clear bedding structures and discontinuous silty clay drapes. Abrupt boundary
2.5 – 2.8	Planar bedded sandy gravels. Consist of sub-rounded – well-rounded clasts; some of which were cobble-sized. Abrupt boundary

An interesting feature, and one which characterised the site, was the presence of *in situ* fossil tree roots that penetrate the upper 20-25cm of the basal sandy gravel unit. The roots were found in groups of two to five, but sometimes in isolation and always separated by distances of 2-5m. The tops of the roots were truncated in the lower 2-4cm of the gravely loam, a single specimen was collected for radiocarbon dating (Fig 4.3). The sample is described below.

Sample LH04 was an *in situ* waterlogged *Alnus glutinosa* (alder) tree root with intact bark was collected from 1.79–2.30m below local datum. Microscopic examination showed that the wood tissue was in a site of exceptional preservation, with no visible biogenic deterioration being observed. The sample was dated to 2130-1740 cal BC (3565 ± 65 BP;SRR-3565).

Wood identification

Several samples produced identifiable wood or other plant remains and microscopic wood identification of twigs and small timbers revealed the presence of a number of species (Table 4.3).

Table 4.3: Wood identifications at Little Houghton

Laboratory No.	Sample No.	Material dated	Date: years uncal BP	Notes
SRR-3611	LH01	*Alnus glutinosa*	3360±65	root
SRR3612	LH02	Organic sediment	3440±50 fine fraction 3215±50 coarse fraction	-
SRR-3613	LH03	*Juncus* sp.	4145±60	Probably contaminated
SRR-3565	LH04	*Alnus glutinosa*	3565±65	root

Interpretation of Little Houghton

The evolution of the floodplain recorded in the North and South sections is relatively recent, within the last 5000 years. This has been determined by the radiocarbon dates from the LH01-04 samples, although LH03 has been disregarded. The basal gravel unit accumulated prior to 2130-1740 cal BC, and the four samples that were radiocarbon dated, with the exception of the tree roots, were stratigraphcally above the basal gravel. However, the tree roots were recovered from within the upper sandy gravels and it was apparent that the roots had penetrated the bedding planes of the unit and disturbed the sediment, post deposition. Therefore, the roots are chronostratigraphically above (younger than) the sediments and the level with which they were associated. The tree roots were widespread across the floodplain, and all observed were truncated within the lowest 30-40mm of the gravely loam unit.

The root macrofossils were identified as *Alnus glutinosa*, and the relationship between the roots and sandy gravel unit indicates that the roots were *in situ*, and had not been reworked by a migrating river. The development and growth of the alder suggests a relatively stable land surface on the floodplain, and an expansive development of alder carr. The preservation of the roots indicates a dramatic change in the hydrological characteristics of the catchment, which resulted in a rise in the watertable level. This also explains why no other arboreal species had root preservation from an earlier period, as these roots would have decomposed naturally in the aerobic conditions above the watertable level.

Grendon

The Grendon site (SP 487 261) was located on the flood plain of the River Nene, about 12km downstream of Northampton (Fig 4.1). Gravel extraction revealed a number of vertical exposures of unconsolidated deposits over wide areas of the floodplain; the extent of the workings and the excavated areas are shown on Figure 4.4.

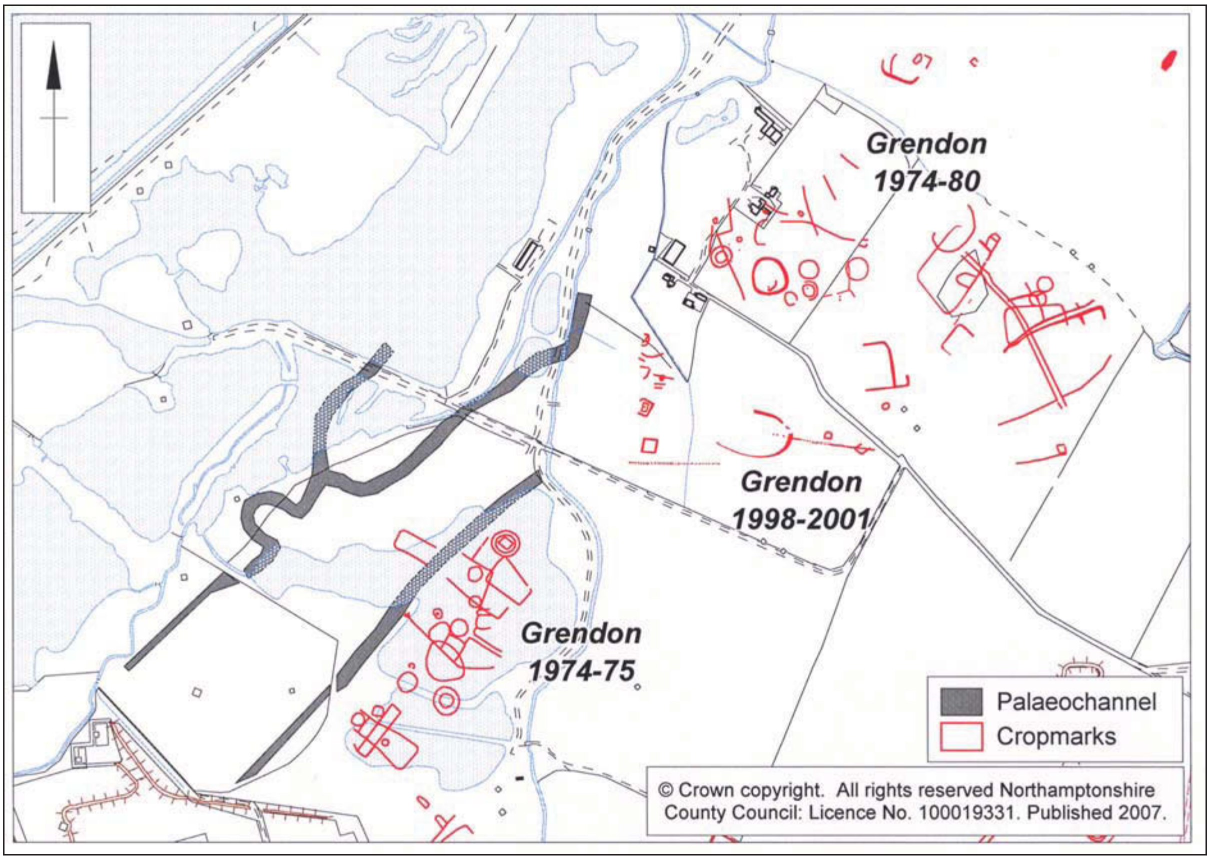

Fig 4.4: Grendon north in plan

The development of a prehistoric landscape by the River Nene at Grendon Lakes, partly revealed in the 1970s (Gibson and McCormick 1985), was further investigated in 1998 and 2001 by Hertfordshire Archaeological Trust (HAT). These excavations have recently been published by Last (2006) and described a rich assemblage of prehistoric remains in three principal areas of the site. Excavations at Grendon 1974-75 contained part of a cursus and several enclosures. Those at Grendon 1998-2001 contained three enclosures, two double-ditched and one with a central grave pit, whilst to the north-west there was a long enclosure (not illustrated), two sub-circular pits, a circular pit containing a polished stone axe and treethrow pits around the long enclosure. Two major phases of archaeological activity are evident, one interpreted as Neolithic to Early Bronze Age, the other as Iron Age. The gap between these is bridged by an environmental sequence reconstructed with the aid of two pollen cores from an adjacent palaeochannel, which shows that human activity continued in the intervening period.

The palaeochannel was sampled about 100m west of the main excavation area. Two monoliths (see Plate 4.1) were taken from the palaeochannel (see Fig 4.4). Both the size of the channel (approximately 20m in width where sampled) and its location on the floodplain are essential features in relation to the interpretation of the pollen diagram. The stratigraphy of the monoliths is given at cm depth below ground level as per communication with J Last (10/2/2000). Sediment codes follow the Troels-Smith system as modified in Aaby (1986).

Plate 4.1: Grendon Monoliths 1 and 2.

Monolith 1

198-164:	Dark brown organic rich silty-clay with abundant roots and wood (2cm max. diameter), sandy towards base, clay-rich up core: Tl 2+ Sh 2, H (humification) 4 (matrix) Nig 2-3, Strf 0, Elas 0, Sic 3.
198-204:	Silty clayey sandy grit, angular-rounded As +
204-212:	Thick grey clay with occasional small rounded stones As 3+ Gr1
212-214:	Brown-black sandy silty clay-rich peat: Sh 2, H 4 Nig 3, Strat 0, Elas 0, Sic 3

Monolith 2

201-210:	Missing
210-243:	Black sandy silty peat with clay, occasional small rounded stones: Sh 4, H 4, Nig 4, Strf 0, Elas 1, Sic 4
243-251:	Sandy, Fe rich fine gravel and sand. Small angular-sub-angular flints and grit (base of section monolith section). Small black peaty inclusions/aggregates at base: Gs2 +, Gg 2.

Results of the high resolution pollen analysis

Three pollen assemblage zones were identified, labelled Gr 2-Gr 4; these show that the infilling of the palaeochannel began in the early Holocene/pre-Boreal phase (*c* 9500-8000 ago). Following the initial analysis, radiocarbon dates were obtained and a more detailed diagram was produced for zones Gr 3 and Gr 4, which covers the Bronze Age (there is a hiatus covering the Neolithic period) (Fig 4.5).

The base of the monolith p.a.z. Gr 2 (2.15-2.04m, unchanged) is dominated by *Pinus sylvestris*, Poaceae and Cyperaceae. *Betula*, *Corylus*, *Quercus*, *Ulmus* and *Alnu*s are present but at low levels. Dwarf shrubs are absent indicating that they were not part of the *Pinus* woodland understory. The zone boundary with the overlying zone is a hiatus probably related to the stratigraphic discontinuity at 2.04m (clay to sandy grit). The additional levels do not alter these observations and the radiocarbon dates confirm the hiatus between Gr 2 and Gr 3. The pollen analysis shows some rather abrupt pollen fluctuations at the base of the zone (and the monolith). Given the stratigraphy there is clearly some possibility of disturbance of these levels making them difficult to interpret. The radiocarbon date (Gr 3) is also at variance with the pollen spectra and probably represents root penetration from a Neolithic level eroded from the fill and represented by H2.

p.a.z. Gr 3 (2.04-1.96m)

This zone was originally designated as a major zone separated by a hiatus from the zone above. The new counts and dates indicates that this zone is not separated from Gr 4 by a hiatus and the changes in pollen frequencies represent changes in pollen influx. The zone is dominated by *Alnus glutinosa*, *Quercus* and Poaceae. There is a strong representation of herbs and practically no shrubs. *Pteridium* rises at the beginning of the zone and *Polypodium* is the most abundant element of the spores and at the opening of the zone may have constituted a significant component of the vegetation. The difference between this zone and the succeeding zone is the high representation of *Quercus*. The fall in *Quercus,* and the simultaneous fall in *Ulmus,* indicate nearby slope deforestation, probably to the south-east.

The radiocarbon dates bracket the zone Gr 2/Gr 3 boundary and date it prior to 1430 cal BC and post 3990 cal BC (on the basis that it must have post-dated the Neolithic ground surface). However, at the boundary there is clearly a major hiatus and so the commencement of the zone cannot be directly dated. On the basis of extrapolation a date of 1470 cal BC is estimated, but this could be too young and using a slower upper accumulation rate would give a date of *c* 2000 BC. The real date almost certainly lies between 1500 and 2000 BC.

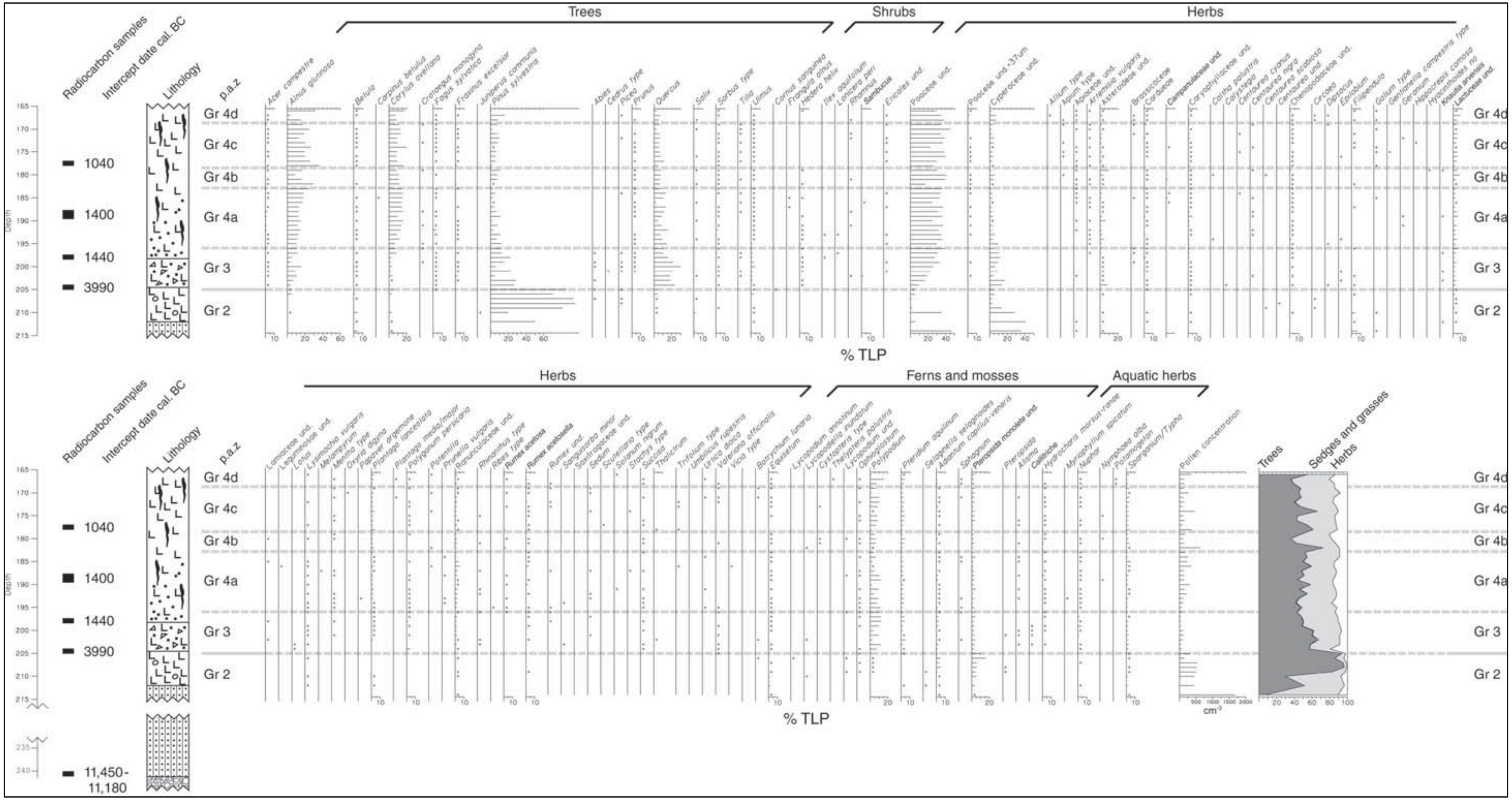

Fig 4.5: High resolution pollen diagram from Grendon (analyst J Hatton)

p.a.z. Gr 4

Due to the higher resolution analyses this zone can now be sub-divided into four sub-zones.

p.a.z. Gr 4a (1.96-1.83m)

The zone is dominated by *Alnus*, Poaceae, *Corylus* and *Quercus*. The following description is based upon 13 pollen levels at a vertical sampling interval of 0.02m and which, on the basis of the radiocarbon dating, represents a temporal resolution of 17 years per pollen level. *Alnus* and *Corylus* rise slowly throughout the sub-zone, *Pinus* falls and *Quercus* and Poaceae fluctuate.

s. p.a.z. Gr 4b (1.83-1.78m)

During this sub-zone there is a fall in *Alnus*, *Betula*, *Corylus* and *Quercus* but a small rise in *Pinus*. The most pronounced fall is in *Alnus* and *Corylus*. Unusually Poaceae also falls, with little change in Cyperaceae. There is, however, a rise in total herbs, contributions being made by Asteroideae und., Lactuceae, Chenopodiaceae, Ranunculaceae and *Rumex acetosa*. There is little effect on ferns or aquatic pollen and spore types. The tree and herb types involved suggest that the sub-zone represents a period of deforestation on the floodplain and most likely around the palaeochannel with wet woodland being replaced by pasture and some ground disturbance. The rise in *Pinus* is almost certainly an artefact of the opening up of the site allowing the influx of long-distance pollen.

s.p.a.z. Gr 4c (1.78-1.68m)

In this zone *Alnus*, *Corylus* and Poaceae have returned to former values and most other pollen and spore types fluctuate around a constant level. Poaceae is overwhelmingly dominant along with a large variety of herbs. In the early part of the zone there is a continuous presence of Cereal-type pollen.

s.p.a.z Gr 4d (1.68-1.65m)

In this sub-zone there is a gradual fall in *Alnus* and *Corylus*, although the uppermost level of the diagram has *Alnus* returned to former values. There is also an overall fall in tree pollen and a rise in herb pollen. There is a rise in Poaceae and a continuation of agricultural indicators especially those typical of grassland such as *Rumex* types, *Galium*, Apiaceae and Caryophyllaceae. The fall in *Alnus* probably represents the local deforestation of the wettest parts of the floodplain associated with the palaeochannel. The slight rise in Cyperaceae and aquatics in this zone probably represents the input of sediment-laden floodwater which is also responsible for the change to silt-clay deposition.

Discussion of pollen assemblage zone Gr 4

Comments on Selected Pollen and Spore Types

Acer campestre: there are significant quantities present throughout the zone (above 2.04m), at least as high as *Betula*. This suggests that field maple was part of the surrounding dryland flora. *Acer* is only found in significant quantities after the Neolithic and its continuous presence in pollen diagrams has been seen as the consequence of forest clearance or thinning (Godwin 1975) which is clearly in line with the record at Grendon.

Alnus: as would be expected from a palaeochannel *Alnus* is the dominant tree type throughout the zone, but with two periods of reduction, one at 1.8m the other just below the top of the diagram at 1.66m.

Table 4.4: Status of tree types present in Gr 4 (Pinus may be extra-local but was probably growing in the region as late as zone Gr 3)

Dominant trees	Locally present trees	Long distance transport	Status unclear
Alnus	*Acer*	*Abies*	*Carpinus*
Quercus	*Betula*	*Cedrus*	-
Corylus	*Crataegus*	*Picea*	-
(*Pinus*)	*Fagus*	-	-
-	*Fraxinus*	-	-
-	*Prunus*	-	-
-	*Salix Sorbus*	-	-
-	*Tilia*	-	-
-	*Ulmus*	-	-

Fagus: Given the poor pollen representation of *Fagus* in pollen diagrams the levels here which reach 5% TLP must represent beech trees growing on the slopes of the valley. It is also likely that the high pollen input is due to the trees being isolated in the landscape and not part of mixed woodland, possibly as isolated standards (eg parkland trees) or as hedgerow trees.

Pinus: The high levels with high pollen concentrations in zone Gr. 2 must represent the existence of pine woodland in the vicinity during the early Holocene (early Boreal/early Mesolithic). However, the continuation of relatively high *Pinus* into zone Gr 3 and even into zone Gr 4 (10-20%) is unlikely to all be attributable to long distance transport from Europe. Indeed, the decline or retreat of pine is known to have been extremely diachronous, with pine stands surviving on sandy soils in the Midlands well into the last millennium cal BC (Brown 1984) and it may have survived into the Bronze Age on the sandy well-drained soils of the Northamptonshire Ironstone.

Quercus: One of the most notable features of this diagram is the fall in *Quercus* in zone Gr 3 from 30 % TLP, which is unusually high for a floodplain pollen diagram, to 10-15% TLP. These high levels are probably due to *Quercus* growing both on the slopes surrounding the floodplain and on the drier islands within the floodplain, as is known during the Neolithic at Raunds (Macphail and Goldberg 1990). The relationship to the *Ulmus* curve suggests the first deforestation episode is of slope rather than floodplain origin.

Ulmus: Again, *Ulmus* is unusually well represented for a floodplain diagram in the region. A decline occurs in Gr 3 but it clearly remains in the landscape, probably as a hedge-row tree. Its presence in Gr 2 is difficult to interpret due to the high *Pinus* input which clearly drowns out other pollen types.

Crataegus/Prunus/Sorbus type: These types are all persistent throughout zones Gr 3 and Gr 4. They are also all typical of small copses (where pollen will not be drowned out by the major trees), scrub or hedgerows. Given other indications of the widespread clearance of trees within the Nene Valley by zone Gr 4, the most likely explanation is they were growing in hedges between agricultural fields with *Ulmus* and possibly *Fagus*.

Exotic Trees (*Abies/Cedrus/Picea*): The sporadic but significant discovery of these tree types, especially in zone Gr 3, is most probably due to the relatively open nature of the landscape and the location of the Nene Valley in eastern England where easterly airflows are not uncommon. The high representation of both dryland trees, *Pinus* and exotics is most probably due to the relative openness of the valley and particularly the partial clearance of the floodplain by the late Neolithic.

Shrubs: Of the shrubs in the diagram the most notable is *Hedera* which, rather surprisingly, is most common between H1 and 1.9m, in zones Gr 3 and Gr 4a. The flowering of *Hedera* is closely related to light levels and, being insect pollinated, it is a low pollen producer. For both reasons it is associated with the woodland edge and gaps, a continuous curve suggesting the persistence of isolated woodlands, copses or hedges in the vicinity. Shrubs from the surrounding slopes are poorly represented and ericaceous shrubs particularly rare as would be expected given the calcareous geology of the basin.

Herbs: From almost the base of the zone Poaceae is the dominant pollen type with 30-40 % TLP. At the base Cyperaceae is as high as 15% TLP, probably reflecting the early hydroseral status of the channel, but for the rest of the zone it is under 5 % TLP. The wide representation of herbs represents largely open land cover, but there are some indications of woodland or shade, such as the ferns *Adiantum capillus-veneris* and *Polypodium*. Wetland and wet grassland is well represented with indicators such as *Apium, Centaurea* spp, *Filipendula*, *Lysimachia, Mentha, Polygonum persicaria, Rumex acetosella, Valeriana* and *Equisetum.* The sub-zones Gr 4a-4d have a strong representation of herbs associated with disturbed or grazed grassland including *Plantago lanceolata, Rumex acetosella* and Lactuceae.

Aquatics: The strong representation of aquatics, both floating (eg *Nuphar*) and emergent (*Sparganium/Typha*) represents the wetland conditions of the palaeochannel.

Arable Cultivation: In addition to these typical floodplain land cover-types there is a strong representation of arable cultivation. The presence of cereal-type pollen is sporadic in sub-zone Gr 4a, but consistent to continuous in zones 4b-4e. The highest representation is 2% TLP in zone Gr 4e. The continuous presence across both zone Gr 4b-4c boundaries is curious. However, it is probably an artefact of the opening up of the site, with some clearance of the floodplain woodland, with the result being an increase in long-distance types such as *Pinus* which may have drowned-out the low cereal presence. It is therefore not likely that this break in cereal representation represents a break in the local cereal cultivation. This is supported by the presence of arable/disturbed ground indicators in this sub-zone such as *Artemisia,* Chenopodiaceae and *Thalictrum*. The arable indicators and cereal-type pollen suggests a continuous presence of cultivation, probably on the nearby slope from at least 1440 BC and probably 1500 BC or earlier. It is also possible that the cereal pollen has been transported as waterborne pollen from arable soils, a process which has been noted in studies of modern pollen transport (Brown *et al* 2008).

The Grendon diagram is more complex (multi-phased) than any other so far produced in the region. For this reason it is particularly valuable, but also difficult to interpret. The only dryland diagram from the region that is also the key-site for English region Gbj (*sensu* Greig 1996) is Sidling's Copse in Oxfordshire (Day 1991). In this diagram the pine peak occurs at 9,100-9,200 bp. This strongly supports the contention that the matrix of both zones Gr 1 and Gr 2 are early Holocene (early-Boreal/early Mesolithic) and that the date GR3 is anomalous and probably the result of root penetration. Obtaining a peat matrix date on Gr 3 could test this material. This situation is not unique and was described at Cossington in the Soar valley by Brown *et al* (1994).

Floodplain pollen diagram from the middle Nene include six from the Raunds Area Project (Brown in press), Turnell's Mill Lane near Wellingborough (Brown and Meadows 1996-97, Brown 2000), and a number of single levels from Wollaston I (Brown in prep). However, only two diagrams overlap the Grendon diagram. The only diagram that covers the equivalent of zone Gr 1 (early Mesolithic) is palaeochannel E from the Raunds Area Project. This single level diagram, radiocarbon dated to 9370 BP is dominated by Poaceae and herbs with some *Pinus* and *Corylus*. Several diagrams cover the Neolithic period, including the lower levels of Turnells Mill Lane, and palaeochannel C from Raunds (4300 +/-150 BP). At Redlands Farm (Wiltshire in press) the date of the barrow 4790+/-90 BP falls into the hiatus at Grendon. However, the Redlands Farm pollen spectra are very different to zone Gr 2 with low *Pinus*, high Poaceae and Cyperaceae. Indeed the spectra at Redlands Farm, which represent an open local landscape, are much more similar to Gr 3 - Gr 4a despite being a thousand years older.

Comparisons with Gr 3 – Gr 4 (Early – Middle Bronze Age) can only be made with one radiocarbon dated diagram: the upper levels of the palaeochannel at Turnells Mill Lane (TML; Meadows and Brown 1996-97). There is temporal overlap between Gr 3 and TML II (Early Bronze Age), both are dominated by *Alnus* and *Corylus,* however, there are major differences. Firstly *Quercus* and dryland trees values are lower at TML as is Poaceae and secondly cereal types are less frequent at TML although there is a peak 1600 BC, probably just predating the record at Grendon. Interestingly Grendon falls into a temporal gap in the records from the Raunds Area Project (Brown in press). Further afield both Narborough Bog on the floodplain of the Soar and Kirby Muxloe (Brown in prep) cover the Bronze Age. At Narborough both the valley slopes had largely been cleared by 4280±70 BP and a second clearance, largely of the floodplain occurred *c* 1000 BC. Interestingly this may be synchronous with the Middle-Late Bronze Age clearance event marked by Gr 4b. Pollen analyses from a number of Bronze-Iron Age palaeochannels in the Nene Valley were published by Holyoak and Seddon (1984), but due to a lack of radiocarbon dating comparisons cannot be usefully made with the Grendon diagram.

Conclusions and implications

The conclusions given here include both the first and second phases of analyses. As illustrated above the chronostratigraphy and palaeoenvironmental record from the channel fill is more complex than might have been assumed on the basis of field observations. The infilling of the palaeochannel begins in the early Holocene (pre-Boreal). This suggests that the palaeochannel is probably of Late-glacial origin. Palaeochannels of similar age are common in the East Midlands both in the Soar and Nene (Brown *et al* 1994). The base of monolith 2 (p.a.z. Gr 2) clearly formed during the early Boreal period (Mesolithic) with its termination and zone boundary being a stratigraphic hiatus (H2), although there is also an earlier hiatus (H1) which is undated. The second hiatus covers the Mesolithic to the Early Bronze Age, although the erosion that was responsible almost certainly occurred in the Early Bronze Age *c* 1500 BC. The radiocarbon dates suggests that zones Gr 3 and zone Gr 4 are conformable and they span a thousand years of deposition from the Early Bronze Age to the Middle/Late Bronze Age. The dry land mixed deciduous woodland on the surrounding slopes had been largely cleared by 1500 BC. There is a subtle but significant clearance episode of floodplain woodland between 1200 BC and 1,000 BC and another estimated as *c* 650 BC. A particularly notable feature of the diagram is the high representation of scrub or hedgerow tree types. The upper sub zones of Gr 4 reveal a largely open landscape cleared of dry land trees with pasture, arable cultivation and hedges.

The top of zone Gr 3 is dated to 1599-1315 cal BC (3190±60 BP; WK-8828), suggesting the start of the zone dates between 2000 and 1500 BC. The zone is dominated by *Alnus glutinosa*, *Quercus* and Poaceae; there are practically no shrubs. The main difference between this and the succeeding zone is the high representation of oak, which was probably growing both on the slopes surrounding the floodplain and on the drier islands within it, as is known during the Neolithic at Raunds (Macphail and Goldberg 1990). The subsequent fall in *Quercus* is accompanied by a decline in *Ulmus*, which suggests the first deforestation episode is of slope rather than floodplain origin. Ulmus nevertheless remained in the landscape, probably as a hedgerow tree.

Zone Gr 4 was divided into four sub-zones. The first of these (Gr 4a) is marked by a gradual rise in alder, which is the dominant tree-type throughout the zone, and *Corylus*. In the second sub-zone (Gr4b) both show a pronounced fall, along with grasses - although the total herb contribution rises. This suggests a period of deforestation on the floodplain, with wet woodland being replaced by pasture and some ground disturbance. The opening up of the site, allowing the influx of long-distance pollen transport, probably also accounts for a rise in pine, which may still have been growing on the sandy well-drained soils of the Northamptonshire Ironstone (Brown 1984). Sub-zones Gr 4a-4b appear to cover the second half of the second millennium BC; a sample from the middle of 4a is dated to 1513-1218 cal BC (3120±60 BP; WK-8826), while the top of Gr 4b is dated to 1262-909 cal BC (2900±60 BP; WK-8825).

In sub-zone Gr 4c alder, hazel and grasses return to former values, though further fluctuations in alder and hazel are seen in Gr 4d, which shows an overall fall in tree pollen and a rise in herb pollen, including grasses. The fall in *Alnus* probably represents local deforestation of the wettest parts of the floodplain associated with the palaeochannel. The top of zone Gr 4d has an estimated date of *c* 650 BC, perhaps slightly older than the start of the Iron Age activity described below.

Throughout zone Gr 4 there is a significant presence of *Acer campestre*, suggesting it was part of the surrounding dry land flora. Its continuous presence in pollen diagrams has been seen as the consequence of forest clearance or thinning (Godwin 1975), which is clearly in line with the record at Grendon. Similarly, relatively high levels of *Fagus* may represent isolated parkland or hedgerow trees growing on the valley slopes. The persistence of *Crataegus* and ecologically similar types (*Crataegus/Prunus/Sorbus* type) throughout zones Gr 3 and Gr 4 is probably also indicative of hedges between agricultural fields. The most notable shrub represented in the diagram is *Hedera,* which is most common in Gr 3 and Gr 4a. It is associated with woodland edges and gaps, a continuous curve suggesting the persistence of isolated woodlands, copses or hedges. Shrubs from the valley slopes, however, are poorly represented.

Throughout zone Gr 4 grasses are the dominant pollen type with 30-40% total land pollen (TLP). The wide representation of herbs indicates largely open land, but there are some indications of woodland or shade, such as the ferns *Adiantum capillus-veneris* and *Polypodium*. Wetland and wet grassland are well represented, as are herbs associated with disturbed or grazed grassland. Meanwhile the strong representation of aquatics reflects the wetland conditions of the palaeochannel.

In addition to these typical floodplain types there are strong indicators of arable cultivation. The presence of cereal-type pollen is sporadic in sub-zone Gr 4a but consistent thereafter, with the highest representation in Gr 4d. Overall, the presence of arable/disturbed ground indicators and cereal-type pollen suggest a continuous presence of cultivation, probably on the nearby slope, from around 1500 cal BC or before.

The pollen evidence suggests the mixed deciduous woodland on the surrounding slopes had been largely cleared by 1500 BC. There was then a subtle but significant clearance episode of floodplain woodland between 1200-1000 BC and another estimated as *c* 650 BC. A particularly notable feature of the diagram is the high representation of scrub or hedgerow tree types. By the end of the Bronze Age there was a largely open landscape, cleared of dry land trees, with pasture, arable cultivation and hedges. It is notable that these profound changes appear to have no correlates in terms of archaeological features and finds, at least not within the area investigated.

Direct comparisons can only be made with one other dated pollen diagram from the middle Nene: the upper levels of the palaeochannel at Turnells Mill Lane (TML: Meadows and Brown 1996-97). There is temporal overlap between Gr3 and TML II (Early Bronze Age) and alder and hazel dominate both, however, there are also major differences. Oak and dry land tree values are lower at TML, as are grasses, while cereal types are less frequent, although there is a peak *c* 1600 BC, probably just predating the record at Grendon.

Grendon falls into a temporal gap in the records from the Raunds Area Project (Brown in press) although Early Bronze Age clearance seems to have been more extensive at Raunds, leading to an open grassland environment that was relatively lightly grazed (Campbell and Robinson 2007). The earliest field system was probably laid out there in the Middle/Late Bronze Age and the presence of droveways suggests that stock raising remained the main activity; land-use probably changed less than the methods of land division (Healy *et al* 2007).

The small quantities of material present indicate a low-density scatter of refuse, which may not be directly related to on-site activity. Cereal grains, chaff or seeds of common weed species were noted at a low to moderate density in most samples from the enclosure but not from the pit alignment. The cereals are predominantly *Triticum* sp. grains, with *Avena*-type and *Hordeum*-type also present. *T. spelta* glume bases were noted in three of the enclosure samples. The cereals may derive from processing refuse dispersed into the features by the wind. Seeds/fruits of common weed species including *Chenopodium album*, indeterminate Poaceae, *Polygonum aviculare* and *Stellaria media* were noted in the enclosure while the pit alignment produced Poaceae, *Atriplex* sp. and *Rumex* sp. Seeds of wetland/aquatic plants were rare but included *Montia fontana* from both features, and *Alisma plantago-aquatica* from the pit alignment only.

Charcoal fragments were noted in nearly all samples. Fragments of charred and/or root, rhizome or stem, indeterminate seeds, inflorescence and leaf fragments and small pieces of wood were also found. Siliceous globules in six samples from the enclosure are probably residues from the burning of straw/grass at very high temperatures.

Waterlogged wood was identified from a field enclosure ditch (2285) and two pits in the alignment (2504, 2509). Two segments of roundwood from the ditch are either *Salix* or *Populus* (these closely related taxa are anatomically similar). Each bore an oblique cut mark across one end. The fast growth rate and morphology of these pieces suggest an origin from coppiced rods. Pit 2504 contained several pieces of roundwood identified as deriving from a member of the Pomoideae group, which includes the anatomically similar genera *Crataegus*, *Malus*, *Pyrus* and *Sorbus*. A possible toolmark was present on one of the narrower pieces, but in general the morphology and structure of the wood were not indicative of coppiced wood. Finally, the sample from pit 2509 consisted of a small, worn piece of *Quercus* heartwood.

Palaeoenvironmental change

Both the stratigraphy and the pollen suggest that the monoliths include three major hiatuses at 214/210cm, 204cm, and 198cm below ground surface, which fit into the overall sequence summarised below:

Time	*Event*	*Hiatus*	*p.a.z.*
T11	deposition of a silty/clay overbank unit (Layer 1)		
T10	deposition of a silty/clay rich peat		Gr 4
T9	**erosion**	**H3**	
T8	deposition of a clay/silt rich sandy grit		Gr 3
T7	**erosion**	**H2**	
T6	deposition of a silt-clay rich peat		Gr 2
T5	**erosion producing and erosional boundary**	**H1**	
T4	deposition of the basal peat (Layer 3)		Gr 1
T3	channel abandonment		
T2	deposition of basal gravels		
T1	incision/erosion of the channel		

It is also evident from the pollen data and lithology that the sedimentary records of monolith 1 and monolith 2 do not overlap. However, given the loss of the upper 10cm from monolith 2 and the vertical displacement across a dipping stratigraphic boundary this is not surprising.

Discussion

As illustrated above the chronostratigraphy and palaeaoenvironmental record from the channel fill is probably far more complex than might have been assumed on the basis of field observations. The infilling of the palaeochannel begins in the early Holocene pre-Boreal phase (*c* 9,500-9,200). This suggests that the palaeochannel is probably of Late-glacial origin. Palaeochannels of similar age are common in the East Midlands (Brown *et al* 1994).). The base of monolith 2 (p.a.z. Gr 2) clearly formed during the early Boreal period (early Mesolithic) with its termination and zone boundary being a stratigraphic hiatus (H2). In zone Gr 3 the presence of *Acer*, which can presumed to be *Acer campestre,* is particularly interesting as it suggests that this zone must post-date the early Neolithic and is likely to be Bronze Age or later. At first sight, its first appearance just above the rational limit of *Alnus* would suggest an early Mesolithic to early Neolithic date. However, the existence of H3 suggests that this is a stratigraphic artefact rather that the rational limit of *Alnus*. So a late Bronze Age to early Iron Age date for the zone is most likely. Palaeochannel deposits of this age are common in the Nene (Holyoak and Seddon 1984) including Wollaston (Brown 1996, in prep) and the Raunds area (Brown in press). The upper sub zone Gr 4 reveals an open landscape cleared of dry land trees with pasture, arable cultivation and hedges.

The interpretation of the pollen diagrams is complicated by three stratigraphic discontinuities. However, these features are of interest in their own right. Given the significant time losses associated with them, suggesting erosion of the channel fill, they probably resulted from periodic re-occupation of the palaeochannel by flowing water from flood overbank flows, rather than local erosion of the channel banks. These events seem to have occurred during the mid to later Mesolithic, the Neolithic or early Bronze Age and the late Bronze or early-middle Iron Age. Part of the pollen record here (Gr 4) is similar and probably overlaps with pollen samples from Iron Age contexts at the nearby site of Wollaston (Brown 1996, Brown in press) and the West Cotton palaeochannel at Raunds (Brown in press), but not the palaeochannel further downstream at Wellingborough (Meadows and Brown 1996-97).

Wollaston

The Wollaston sites (Wollaston I and HWR) were located on the floodplain of the River Nene, about 14km downstream of Northampton. Gravel extraction revealed a number of vertical exposures of unconsolidated deposits over wide areas of the floodplain; the extent of the workings and the two sections, which have been logged in detail, are shown on Figure 4.6. Wollaston is a multi-period site with archaeological evidence from the Mesolithic to Saxon period. The environmental data was generated from a series of monoliths and cores retrieved from numerous locations across the site.

Section S1013

A number of sections were excavated and cleaned for environmental analysis. Section S1013 was an exposed palaeochannel section, from which three monoliths were taken (Plate 4.2). The locations of these are shown in Figure 4.7.

Plate 4.2: Wollaston, section S1013

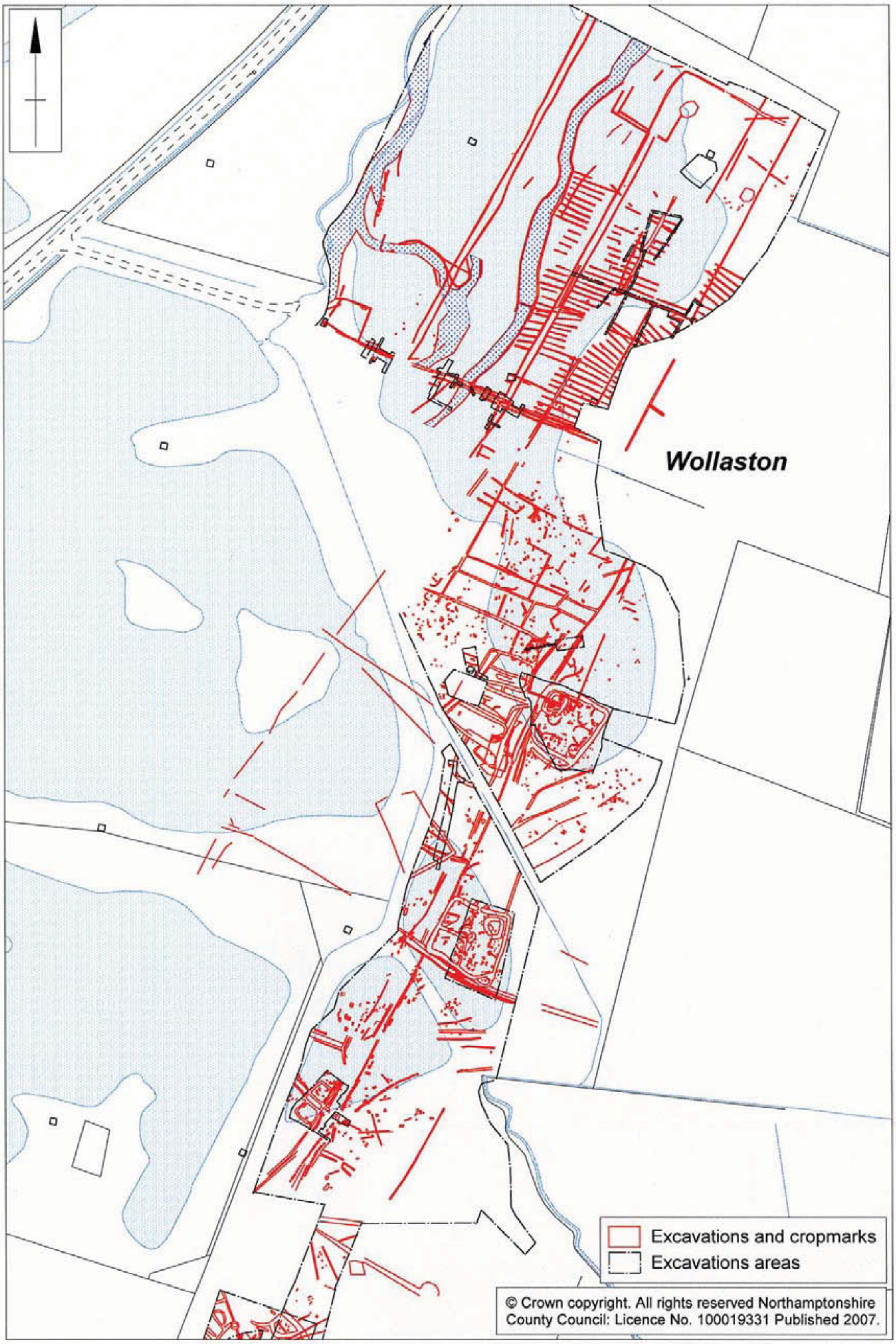

Fig 4.6: The Wollaston site

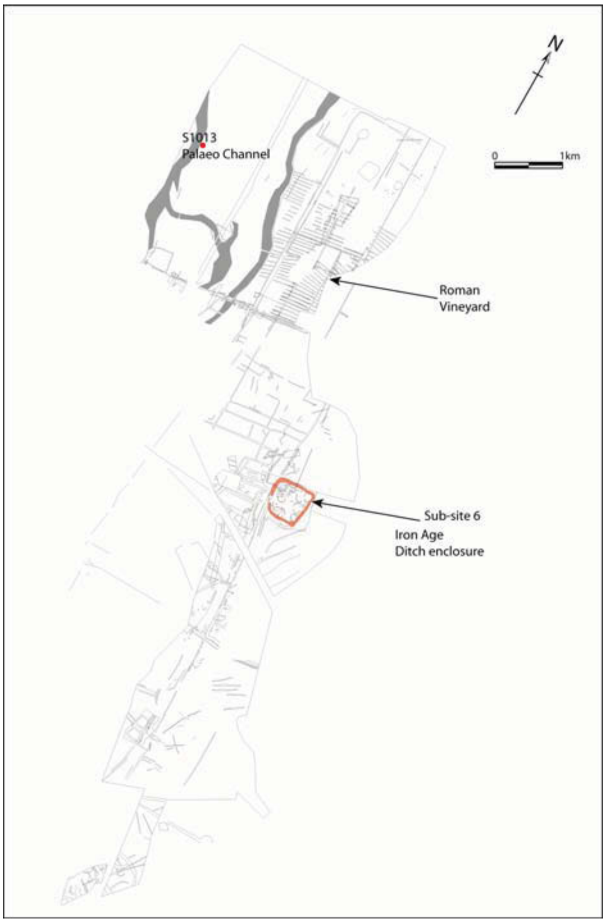

Fig 4.7: The location for S1013. This map also shows sub-site 6, which is Wollaston 94/95 Iron Age ditch

The stratigraphy of S1013 can be seen in Figure 4.8. It represents a remarkable section across a series of channel infills which date from the late Devensian into the late prehistoric period. The particular interest in this section is that it is one of few covering the Neolithic period. The monoliths shown on Figure 4.8 were all subjected to pollen analysis, but only the Holocene (Neolithic) diagram is show here as it is of archaeological significance.

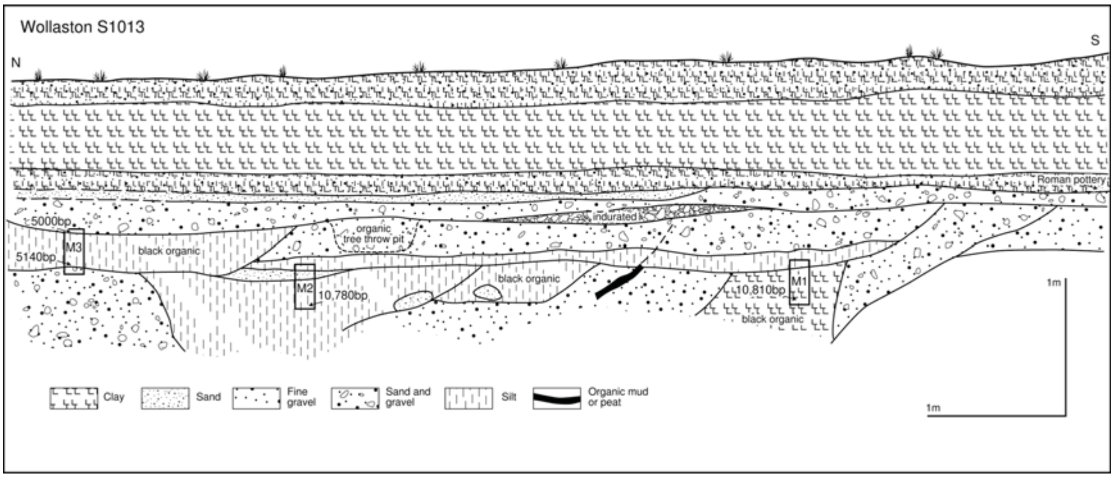

Fig 4.8: Wollaston, section S1013

Samples from a total of twelve levels were removed from monolith 3 and prepared for pollen analysis. The results were plotted in a percentage pollen diagram, which can be seen in Figure 4.9 and a description and interpretation of the local pollen assemblage zones (Z1-Z5) is given in Table 4.5.

Table 4.5: Pollen diagram interpretation of the high-resolution Wollaston S1013 diagram

Zone	Dominant types	Changes or events	Interpretation
Z1	*Alnus*, Poaceae, Corylus	Fall in *Alnus*, rise in *Corylus* & Poaceae	Mixed woodland with alder, oak and hazel but with increased open areas close by
Z2	Poaceae, *Corylus, Alnus*	Fall then rise in *Alnus*	Mixed woodland with alder, oak and hazel but with open areas close by & possible arable cultivation
Z3	Poaceae, *Corylus, Alnus*	Rise in *Quercus*	Mixed woodland with alder, oak and hazel but with open areas close by
Z4	Poaceae, *Corylus, Alnus*	Pronounced single level peak in *Betula*	Mixed woodland with alder, oak and hazel but with open areas close by & possible arable cultivation. Also some land abandonment causing birch colonisation
Z5	*Alnus, Corylus*, Poaceae	Initially high Lactuceae/*Taraxacum, Plantago lanceolata*	Mixed woodland with alder, oak and hazel but with open areas close by & possible arable cultivation

More information can be gained from the non-pollen microfossils counted at this site and listed in Table 4.6 below.

Table 4.6: Non-pollen microfossils from S1013 (Identifications and interpretation from van Hoeve and Hendrikse 1998)

Type number	Description - type	Typical ecological conditions
t 65	Fungal spore	West, mesotrophic conditions
t114	Scalariform perforation plate of Betula, *Alnus*, *Corylus* or *Myrica*	Indicative of these trees or shrub in the area
t115	Micrhystridium	Lake/open water indicator
t128	Globose microfossil	Shallow water, eutrophic conditions
T165	*Riccia* cf. *sorocarpa*	Arable land or open sites along open water
t215	*Meesia triquetra* spore	-
t519	Globose macofossil	-

As can be seen from the additional information in Table 4.6, the site was near shallow, mesotrophic to eutrophic water. Samples were also taken from the west side of Field 3 (S1014) which had a channel which was probably a continuation of the channel at the southern end of S1013 and was also of Late-glacial to early Holocene age (Table 4.6).

Dating S1013 and S1014 monoliths

The Site and Stratigraphy
Dating
In total eight radiocarbon dates were obtained from these two sections and the results are listed below in Table 4.7.

Table 4.7: Original dating of monoliths S1013 and S1014

Laboratory Number	Sample No	Radiocarbon Age (BP)	Calibrated date (95% confidence
GU5526	NM B1	8,880±150	8,300-7,570 BC
GU5527	NMB2	4,280±70	3,090-2,670 BC
Beta-87442	S1013M3a	5,000±70	4,230-3,710 BC
Beta-87443	S1013M3B	5,140±80	3,970-3,640 BC
Beta-87441	S1013M2	10,870±80	11,022- 10,809 BC
Beta-87440	S1013M1	10.810±80	10,967- 10,748 BC
GU5528	NMB3	3,680±50	2,210-1,920 cal BC
GU5529	NMBD	1,550±40	AD 400-620

The dating reveals that the fill of the palaeochannel is highly time transgressive with probably short periods of deposition separated by hiatuses. The snapshots presented include the Early Mesolithic (NMB1), the late Neolithic (M3a and M3b), the Middle Bronze Age (NMB3) and the early medieval (NMB4).

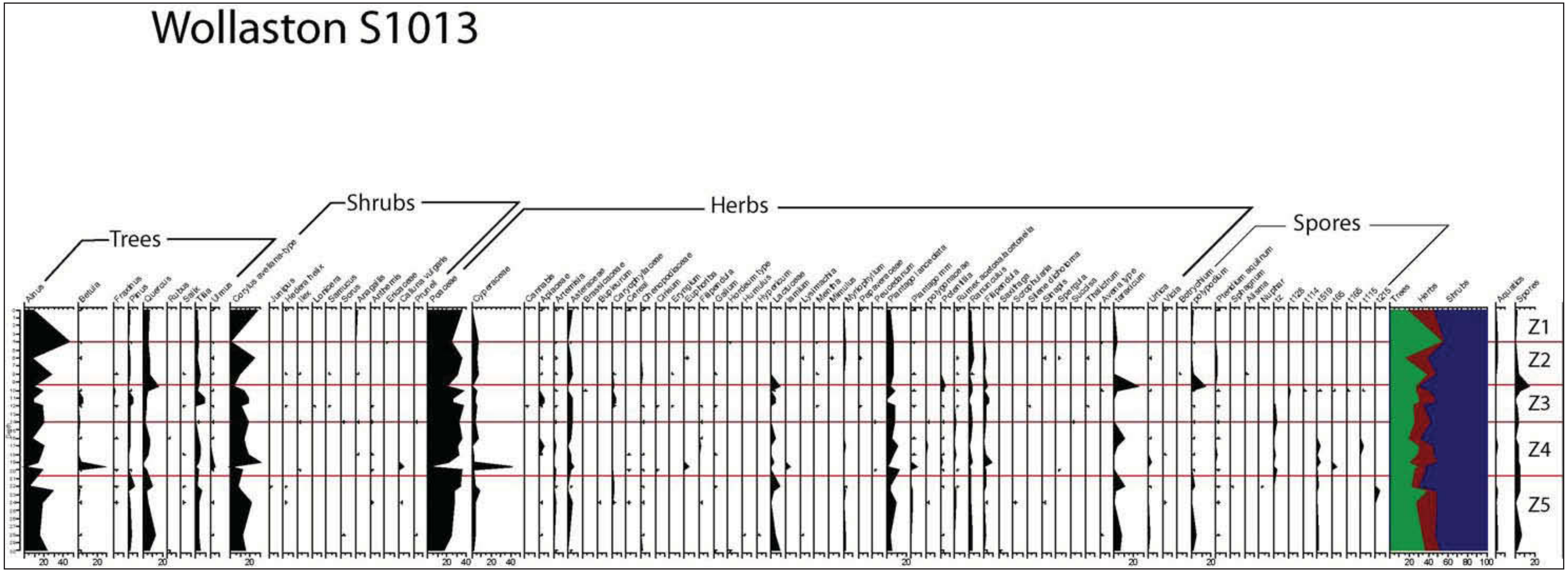

Fig 4.9: Pollen diagram for S1013. Five local pollen assemblage zones were identified (Z1-Z5) (analyst P Allen)

Wollaston Field 3 (WF3)

Wollaston Field 3 samples were taken from an early Iron Age pit alignment-junction cut by later Roman gullies (Fig 4.10). Four monoliths were taken from WF3, and their locations can be seen in Figure 4.10.

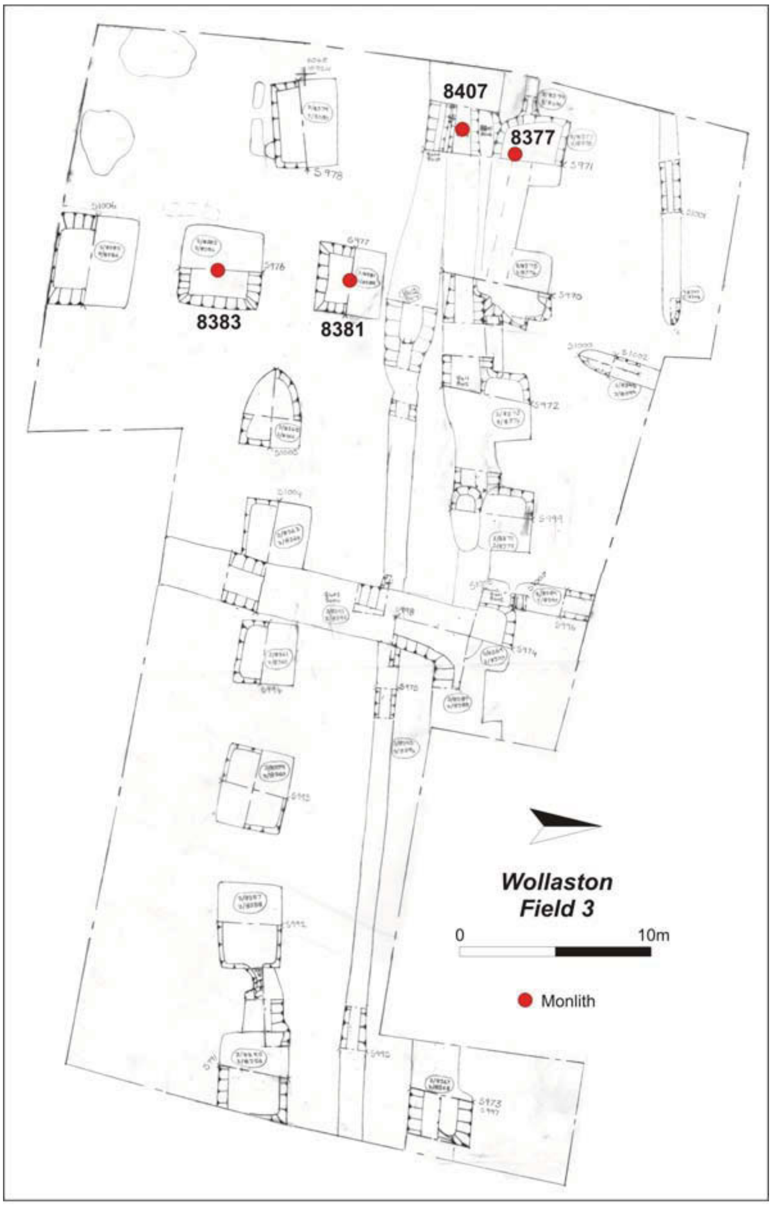

Fig 4.10: Plan of Wollaston Field 3 excavations (Locations sampled in May 1995)

The monoliths taken in 1995 are listed below;

AGB monolith 1 was taken from black organic fill, organic sand and black peat lenses with root penetration

AGB 1 top of monolith 1-30cm above gravel base (oldest sample with well developed stratigraphy)

AGBW1 wood – root adjacent to monolith 1, top 53cm above gravels along edge of monolith vertically

AGB 2 monolith 2 from laminated organic silty clay and grey clayey sand below a gravel lens. Immediately above monolith 2 a tree-throw pit was observed orientated to the left of the face and a cut feature containing charcoal.

Table 4.8: Sampled stratigraphy from trench 1, May 1995

Depth (cm)	Stratigraphy
0 -16	organic bands above gravel
16 – 26	medium angular flint gravel
26 – 43	grey organic clayey sand
43 – bas	yellow stoney sandy silt clay

Trench 2
In trench 2 a laterally extensive shallow organic-rich soil (Ah) was observed with an abrupt boundary with the underlying gravels. Also visible were cut features on the eastern side of the face, and features at the end of the trench included a ditch and a trunk/post *in situ*. At the base of the ditch down to the gravel layer was a stony brown organic soil (ploughed), and monolith 4 was taken from the ditch infill.

Full pollen analysis was undertaken on selected levels from the Field 3 site and the results are presented in Table 4.9.

Table 4.9: High-sum levels from Wollaston Field 3 samples (analyst P Allen), continued below

Palynomorph	Level					
	8383.1	8383.2	8407.1	8407.2	8377.1	8381.1
Betula	-	9	1	1	3	1
Pinus	1	2	1	1	-	3
Ulmus	-	5	4	1	1	-
Quercus	3	23	-	5	3	2
Tilia	1	3	-	-	-	-
Alnus	5	24	-	7	3	3
Carpinus	-	-	-	-	1	-
Populus	-	1	-	-	-	-
Corylus avellana-type	12	116	4	7	15	10
Salix	-	-	2	1	-	-
Ilex	-	-	1		1	-
Poaceae	31	494	36	122	14	14
Cereals	1	2	1	4	1	-
Cyperaceae	23	50	6	14	85	14
Asteraceae	-	-	-	-	50	18
Lactucaceae	11	29	24	18	-	-
Artemisia	-	6		4	-	-
Centaurea nigra	5	12	1	1	-	-
Centaurea scabiosa	3	-	-	-	-	-

Table 4.9: High-sum levels from Wollaston Field 3 samples (analyst P Allen), continued

Palynomorph	Level				
	8383.1	8383.2	8407.1	8407.2	8377.1	8381.1
Centaurea cyanus	-	-	-	2	-	-
Caryophyllaceae	1	10	2	3	6	2
Chenopodiaceae	2	4	4	6	2	-
Potentilla-type	-	1	-	-	-	-
Lychnis-type	1	-	-	-	-	-
Filipendula	4	1	2	5	-	-
Peucedanum palustre	-	-	-	1	-	-
Anthemis-type	-	2	5	10	3	-
Adonis-type	-	-	-	1	-	-
Prunella-type	-	1	-	-	-	-
Serratula-type	-	1	-	-	-	-
Gypsophila	1		-	-	-	-
Myriophyllum-type	-	1	-	-	-	-
Scheuchzeria palustris	-	1	-	-	-	-
Nuphar	20		-	-	-	-
Typha latifolia	-	4	-	-	-	-
Potamogeton	-	1	-	-	-	-
Sparganium	6	-	-	-	-	-
Plantago lanceolata	11	119	3	19	13	-
Plantago coronopus	-	-	-	-	1	-
Galium-type	-	-	-	1	1	-
Caltha	1	-	-	-	-	-
Polygonum avic	-	1	1	8	-	-
Sinapis-type	-	4	3	3	1	1
Hypericum perforatum	-	-	-	1	-	-
Astragalus-type	-	1	-	-	-	-
Ranunculaceae type	1	26	1	4	6	1
Rumex acetosa/acetosella	-	4	1	4	-	-
Apiaceae	-	1	1	3	-	-
Pinguicula	1	-	1	-	-	-
Thalictrum	-	1	-	-	-	-
Vicia-type	-	1	-	-	-	-
Scabiosa-type	-	3	-	-	-	-
Polypodium	2	6	1	1	4	3
Pteridium	15	38	2	6	1	-
Filicales	-	-	-	-	1	2
Spike (Lycopodium)	35	151	42	119	110	80

Iron Age Ditch [6335] [6351]

This part of the Wollaston site contained several Roman wells and an Iron Age enclosure ditch, a middle to late Iron Age linear arrangement and farmstead (Fig 4.7). The farmstead aligned with the edge of the limit of seasonal flooding. Features were disused by the Roman period and some sealed by alluvium. The Iron Age enclosure ditch for sub-site 6 contained plant macrofossils that included *Crataegus monogyna,* and snails. It is estimated that the ditch, which was *c* 0.30m deep, was open for a period of approximately 300 years and the pottery indicates that it was infilling in the middle to late Iron Age. Although most of levels were low in pollen, Table 4.10 shows that the surrounding area was cleared of trees, predominantly grassland with both arable and grassland indicators.

Table 4.10: Pollen assessment (selected types only) of levels at Wollaston 93/94 Iron Age

	Wollaston 93/94									
Depth (cm)	40.92	40.96	41.00	41.04	41.08	41.12	41.16	41.20	41.24	41.26
Trees										
Alnus	1	-	-	-	-	-	-	2	-	-
Betula	1	-	-	-	-	-	-	-	1	-
Fraxinus	-	-	-	1	-	-	-	-	-	-
Pinus	1	1	-	1	1	1	-	-	1	-
Quercus	-	1	2	-	-	-	-	-	1	-
Ulmus	-	-	-	2	-	-	-	-	-	1
Corylus avellana t.	3	-	-	-	-	-	-	2	-	-
Shrubs										
Salix	-	-	-	-	1	-	-	4	1	-
Ilex	1	-	-	1	-	-	-	-	-	-
Herbs										
Poaceae	-	11	-	62	37	4	1	59	9	-
Cyperaceae	-	1	-	3	2	-	-	2	-	-
Cannabis t.	-	-	-	1	-	-	-	-	-	-
Adonis aestivalis	-	-	-	1	-	-	-	1	-	-
Apiaceae	-	-	-	-	-	-	-	1	-	-
Artemisia	-	-	1	3	1	-	-	1	-	-
Anthemis t.	-	2	-	2	3	1	-	13	1	-
Asteraceae	-	2	-	14	-	-	-	9	-	-
Campanulaceae	-	-	-	1	-	-	-	-	-	-
Caryophyllaceae und.	4	-	-	2	3	-	-	2	1	-
Cariophyllaceae *dianthus* t.	-	-	-	-	-	-	-	2	-	-
Centaurea cyanus	-	1	-	2	-	1	1	-	-	-
Cheneopodiaceae	3	1	-	3	3	1	-	5	-	-
Cicuta virosa	-	-	-	1	-	-	-	-	-	-
Cultivars										
Cereal t.	-	-	-	3	1	-	-	4	1	-
Total Counted	14	20	3	104	53	8	2	107	23	1

Hardwater Road (HWR)

HWR Roman well

The well had a sloping ramp going down one side to a platform with a stone stage at the base (*c* 1.5 m) with lobes for buckets to be lowered into. It is of a similar design as others known in the area (Meadows pers comm).

The well lay within a small Romano-British farmstead. Excavation of the farmstead was preceded by both magnetometry survey and also the examination of trace elements in the soils. The farm comprised elements of two timber buildings, of which the base of shallow beam slots survived, but additional timber structures may once have been present that had been erased by recent cultivation. The farmstead comprised a rectilinear group of small, shallow ditched enclosures covering an area of 70m x 80m. The enclosures forming the northern half appeared to be entirely agricultural in use with one possibly containing a small orchard (tree root-balls were present only in this enclosure). The area to the south included the large open well.

The well produced a range of pottery of later Roman date, which has not yet been closely studied. A single human burial and a separate dog burial occurred within the farm. Generally the finds from the enclosure were poor suggesting a low social status for its inhabitants. The trace element analysis produced indications of high phosphate levels 20m to the east with a secondary lesser peak to the immediate south-west of the well. This latter peak possibly reflects a midden, whereas the others more directly relate to enclosures and their entrances suggesting close-penned stock.

Samples from a number of levels were removed for pollen analysis. The sediment from the base of the well (context 1064) produced a pollen spectrum dominated by herbs including Poaceae, Asteraceae, *Plantago lanceolata, Ranunculus* type, *Filipendula* and, most interestingly, *Vitis*-type (Table 4.11). This has been correlated with the existence of a substantial Roman vineyard complex which surrounded the well in the 3rd and 4th centuries AD (Brown *et al* 2001). Also present were the flower buds of *Populus* sp. and typical ruderal species such as *Urtica dioica* and *Conium maculatum* and the Coleoptera comprised a diverse open-country fauna (Robinson pers com). Due to the uniformity of the pollen data, the homogeneous stratigraphy of the unit and its context it can be assumed that the deposit accumulated over a short period of time – some years or at the most a few decades.

Table 4.11: Pollen analysis of context 1064 the Roman well (analysts A G Brown and J Hatton). Both Prunus and Corylus have been included in the tree pollen taxa category due to their likely occurrence as components of the woodland and hedges in the area (continued below)

	Total	Percentage abundance	Conc. Grains cm^{-2}
Tree pollen taxa			
Betula	9	0.89	314.42
Pinus	6	0.59	209.62
Ulmus	3	0.30	104.81
Quercus	10	0.99	349.36
Alnus	20	1.98	698.72
Fraxinus	29	2.87	1013.14
Acer	3	0.30	104.81
Sorbus type	3	0.30	104.81
Prunus	1	0.10	34.94
Corylus	16	1.58	558.97
Total Tree	100	9.89	3493.59
Shrub pollen taxa			
Salix	1	0.10	34.94
Hedera	1	0.10	34.94
Vitis vinifera	4	0.40	139.74
Total Shrub	6	0.6	209.62
Herb pollen taxa			
Apiaceae	17	1.68	593.91
Asteraceae subg. Asteroideae	27	2.67	943.27
subg. Cardueae	10	0.99	349.36
Artemisia	5	0.49	174.68
Centaurea nigra	1	0.10	34.94
Asteraceae subg. Lactuceae	130	12.86	4541.67
Brassicaceae	16	1.58	558.97
Caryophyllaceae	5	0.49	174.68
Chenopodiaceae	12	1.19	419.23
Cyperaceae	2	0.20	69.87
Gentianella campestris	3	0.30	104.81
Gentiana pneumonanthe	1	0.10	34.94
Lamiaceae	3	0.30	104.81
Lotus	1	0.10	34.94
Trifolium type	6	0.59	209.62
Malva sylvestris	2	0.20	69.87
Plantago lanceolata	83	8.21	2899.68
Poaceae	518	51.24	18096.81
Poaceae > 37 um	2	0.20	69.87
Polygonum aviculare	1	0.10	34.94
Rumex acetosa	1	0.10	34.94
Rumex acetosella	1	0.10	34.94
Rumex obtusifolius	5	0.49	174.68
Anagallis tenella	4	0.40	139.74
Lysimachia type	1	0.10	34.94
Ranunculus undiff.	24	2.37	838.46
Fillipendula	16	1.58	558.97
Potentilla type	2	0.20	69.87

Table 4.11: Pollen analysis of context 1064 the Roman well (analysts A G Brown and J Hatton). Both Prunus and Corylus have been included in the tree pollen taxa category due to their likely occurrence as components of the woodland and hedges in the area (continued)

	Total	Percentage abundance	Conc. Grains cm^{-2}
Sedum type	1	0.10	34.94
Solanum type	5	0.49	174.68
Total Herb	905	89.52	31617.02
Unidentified	22	2.18	768.59
Total Pollen	1011	100.00	35320.23
Added *Lycopodium*	359	-	-
% sample counted			
Typha latifolia	1	0.10	17.47
Lycopodium	4	0.40	69.87
Pteridium	8	0.79	139.74
Microthyrium	1	0.10	17.47

Additionally this site was used for exploratory work using Chironomid remains (non-biting midges). For a full discussion of this work see (Ruiz *et al* 2006) but in summary, sub-samples of sediment 2cm thick were taken at approximately regular intervals (~5 cm) from the monolith. Head capsule concentrations in the well sediments were low, necessitating the addition of the paraffin floatation step to the standard method for these samples. At least 50 head capsules were examined for each sample and specimens were mounted and identified.

A percentage relative abundance diagram of the chironomid taxa recovered from the HWR deposit (Fig 4.11) is shown in Figure 4.12. The deposit yielded only 13 chironomid taxa, with the assemblage being dominated by *Chironomus* type *plumosus*. The assemblage showed no significant changes over the sequence and so has not been zoned. The assemblage contains species which are tolerant of organic pollution and associated low levels of dissolved oxygen. This suggests stagnant water with the presence of introduced organic detritus. Furthermore the elevated incidence of deformities indicates an environmentally-stressed population and possibly specific pollution. Other elements of the fauna are semi-terrestrial or are associated with macrophytes, indicating that elements within the well were washed or thrown in from above.

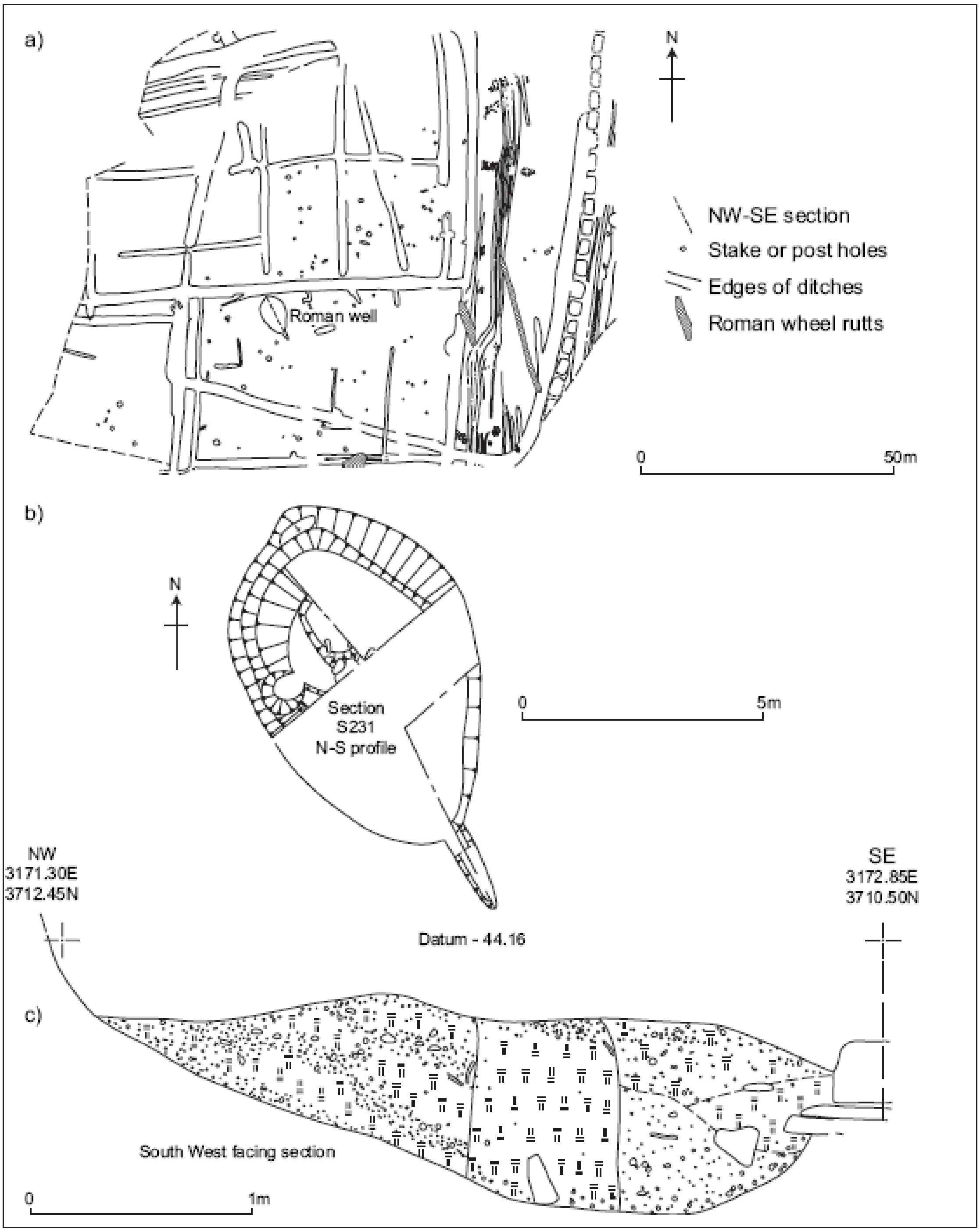

Fig 4.11: Hardwater Road Roman well

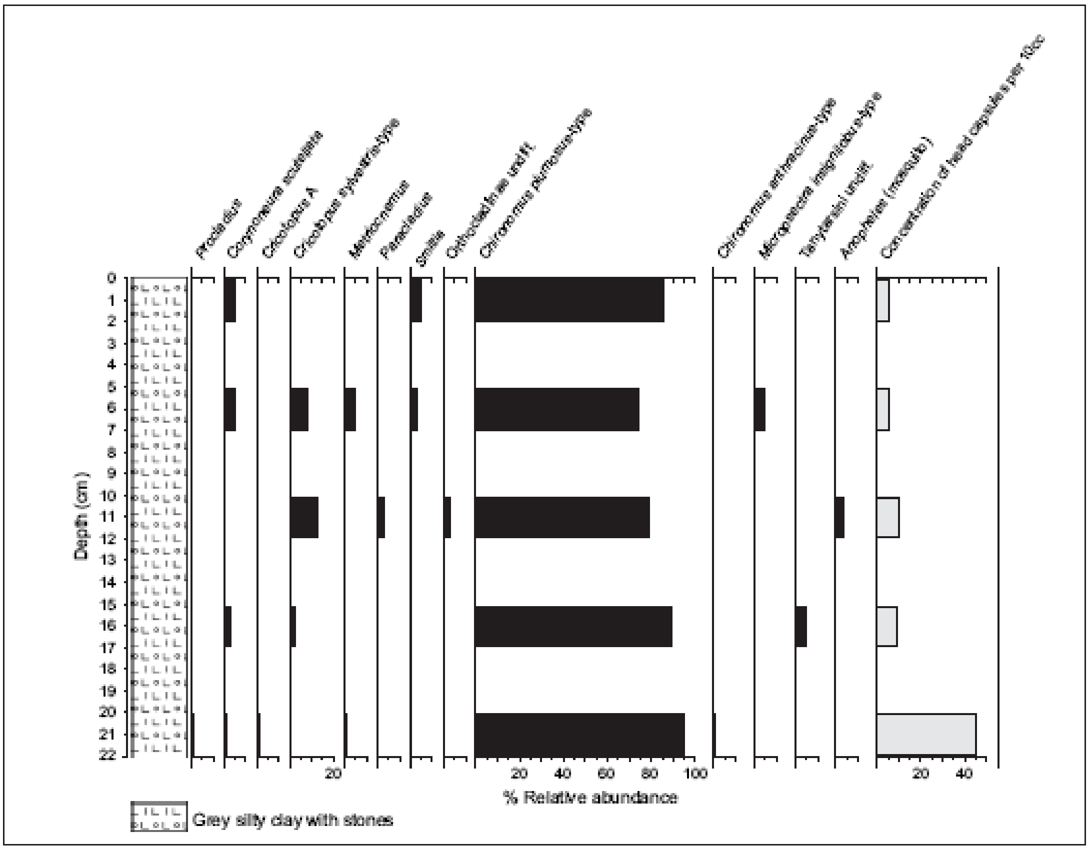

Fig 4.12: Chironomid diagram from Hardwater Road Roman well (analyst Z Ruiz)

The Roman Vineyard

This part of the excavation is well published (Meadows and Brown 1996-97, Brown *et al* 2001). However, the full list of percentage counts have not been published and are given in Table 4.12.

Table 4.12: The pollen data from the ditch (3/8532) close to the bedding trenches, the bedding trench (3/8530) and the upper two levels of a palaeochannel fill (HWR) 500m from the vineyard (analysts A G Brown and J Hatton) (continued below)

The values are % of the Total Land Pollen Sum (1000+) and values under 0.4% (4 grains) are entered as +. Herbs in bold are considered to be arable, disturbed or bare ground indicators

Pollen type	HWR 399.00	HWR 399.04
Trees and Shrubs	1.8	1.5
Alnus	0.4	0.4
Betula	+	-
Corylus	0.9	0.4
Fraxinus	-	+
Pinus	+	+
Prunus padus	-	+
Quercus	+	-
Salix	-	+
Sorbus t.	-	+
Ulmus	-	+
Calluna	+	-
Hedera	-	+

Table 4.12: The pollen data from the ditch (3/8532) close to the bedding trenches, the bedding trench (3/8530) and the upper two levels of a palaeochannel fill (HWR) 500m from the vineyard (analysts A G Brown and J Hatton) (continued)

Pollen type	HWR 399.00	HWR 399.04
Cultivars	***1.1***	***1.3***
Cereals tot.	1.0	0.9
Vitis	0.1	-
Vitis tot.	0.1	0.4
Herbs	***98.4***	***98.7***
Cyperaceae und.	0.5	2.1
Poaceae und.	42.1	42.9
Lactuceae und.	17.9	18.4
Adonis annua	1.4	1.4
Asteraceae t.	+	+
Calystegia	+	-
Caryophyllaceae und.	0.6	0.5
Centaurea cyanus	-	-
Centaurea nigra	1.3	0.7
Chenopodium album	2.0	1.9
Chenopodiaceae und.	0.4	-
Digitalis purpurea	-	+
Filipendula	+	+
Galium t.	+	+
Heracleum t.	-	-
Hypericum elodes	+	+
Hypericum perforatum	+	+
Lotus t.	+	-
Plantago lanceolata	10.7	9.6
Plantago media/major	0.4	+
Polygonum aviculare t.	5.0	5.3
Polygonum lapathifolium	+	+
Potentilla t.	+	+
Ranunulus t.	5.7	4.5
Rhinanthus t.	+	-
Rumex acetosa	0.4	0.4
Rumex acetosella	+	+
Rumex obtusifolius	-	+
Sagina t.	+	-
Solidago virgaurea	+	4.6
Trifolium dubium	-	0.1
Trifolium pratense	-	+
Trifolium repens	-	0.7
Trifolium t.	+	-
Typha angustifolia	-	+
Apium nodiflorum	+	+
Apiaceae und.	+	0.4
Urtica dioica	-	+
Pteropsida	***-***	***-***
Equisetum	+	-
Polypodium	+	-
Pteridium	+	0.8
Indeterminate	*1.0*	*0.8*

The values are % of the Total Land Pollen Sum (1000+) and values under 0.4% (4 grains) are entered as +. Herbs in bold are considered to be arable, disturbed or bare ground indicators

The unusually high levels of *Vitis* are the supporting microfossil evidence of the proposed vineyard. The pollen also reveals an almost totally deforested environment with high levels of herbs characteristic of disturbed arable ground. A particularly interesting occurrence is that of *Adonis annua*, a Roman introduction, which was a weed of arable fields but is now confined to a few localities in Eastern England.

Wellingborough, Turnell's Mill Lane

The site consisted of a sinuous palaeochannel close to the edge of the floodplain just upstream of Wellingborough on the River Nene (Fig 4.1) and is published in Meadows and Brown (1996-97). The sinuous palaeochannel could be followed downstream for approximately 500m and was sampled where it was cut approximately normal to its long axis. The site was sampled because of the presence of organic sediments including wood within the palaeochannel fill. The site was recorded, drawn and planned by Northamptonshire Archaeology.

The channel was cut into typical Nene valley gravels (lower gravels) which were moderately sorted and horizontally bedded. To the north the bedding was not related to the sampled palaeochannel, suggesting little or no reworking of the gravels. The strong iron staining of the gravels had developed into iron/manganese-cementation (of the gravels) adjacent to the north bank of the palaeochannel. At the base of the channel, root channels penetrated the gravels and these were filled with grey silty clay. Above the bed was the polleniferous organic-rich sandy silt (context 11). Above this unit the channel and gravel bank was buried by a silty clay which graded from a plastic gleyed clay up to a yellow brown mottled clay with some fine sand.

The base of context 11 was stiff black-brown organic silt with abundant wood (*Alnus* and *Corylus*) and macro-remains, including *Corylus* nuts. Between 42cm and 50cm above the base of the context was a sedimentary transition (graded) to an inorganic stiff red-yellow mottled sandy silt with occasional small stones. The boundary was depositional but iron staining showed that it had been modified by groundwater and REDOX conditions.

The pollen diagram (Meadows and Brown 1996-97) has been subdivided into local assemblage zones rather than traditional pollen zones for two reasons. Firstly, there are significant variations up the profile although the dominant pollen types are relatively constant and secondly, the thickness of the organic sediment (50cm). Analysis estimates that the sediment was deposited over 1020-1740 years (95% probability) and probably 1200-1580 years (68% probability). The diagram has been divided into two primary assemblage zones: TML I and TML II, and a further division of TML I into two sub-zones TML I(a) and TML I(b). A brief description of the local assemblage zones follows;

TML I 39.40-39.55m aOD
The main trees and shrubs are *Alnus*, *Corylus* and *Quercus* with a small amount of *Tilia*. *Alnus* falls during the zone and is replaced by *Corylus*. The zone has remarkably few herbs, the main types being Poaceae, Cyperaceae and Lactuceae type, *Filipendula* and *Plantago lanceolata*. Ferns are more abundant than all the herbs except Poaceae, and include *Polypodium*, *Pteridium* and an undifferentiated fern group. The division into sub-zone TLM I(a) and TML I(b) at 39.50 m OD is on the basis of a fall in *Alnus* (to its lowest percentage in the diagram) and a fall in *Corylus* with a corresponding rise in Poaceae, Cyperaceae, herbs and ferns. The herbs that increase are Chenopodiaceae, Lactuceae, *Plantago lanceolata* and, most significantly, *Pteridium* which rises to 20% TLP. The upper boundary of TML I is marked by a rise in *Alnus* and to a lesser extent *Corylus* and a relatively abrupt fall in all these herbs and ferns.

TML II 39.55-39.81m aOD
This zone is dominated by *Alnus* with less *Corylus* than TML I and relatively low percentages of Poaceae and Cyperaceae. Herbs are infrequent and low but there is a continuous curve for *Plantago*

lanceolata. At the top of the zone there are some minor changes including an increase in *Filipendula*, *Artemisia* and aquatics particularly *Myriophyllum verticillatum*.

Dating

Three samples were submitted for radiocarbon dating and the results are given below (Table 4.13, Fig 4.13).

Table 4.13: The radiocarbon dates for the organic rich silt/clay at Turnell's Mill Lane

Laboratory Number	Sample depth	Material	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date (95% confidence)
Beta-78585	TML1.2 0-7cm	Organic sediment	3170±60	-25.0	1610-1310 cal BC
Beta-78584	TML1b. 26-37cm	Organic sediment	3460±70	-25.0	1950-1610 cal BC
Beta-78583	TML1a. 37-41cm	Organic sediment	4280±100	-25.0	3310-2580 cal BC

No contamination was detected in the samples and all three were in the normal delta C^{13} ranges for terrestrial sediments and soils. The calibrated dates show that the pollen diagram spans the period from the early Neolithic to the early Bronze Age. This agrees with the low *Ulmus* values, which suggests that diagram post-dates the elm decline (which typically dates at *c* 3300-3000 cal BC) which, although not a marked feature in the area, can be discerned (Brown in prep). The calibrated dates give a low basal accumulation rate of 152 yrs cm^{-1} and a much higher upper accumulation rate of 12 yrs cm^{-1}. Using theses dates the deforestation event of Zone TML1b started at *c* 1826 BC (32cm) and it ended *c* 1661 BC (24cm) giving it an approximate duration of 160 years. The date for the start of the second decline of *Alnus* is *c* 1500 BC which would correlate with early-middle Bronze Age activity on the floodplain. However, the change in accumulation rate is very large at almost 13 times faster in the upper part of the section than the lower, even though no changes in the stratigraphy are recorded. Therefore an alternative explanation is a problem with the radiocarbon results. Thus the formal Bayesian model shown in Figure 4.13 has an overall index agreement of 0.3%, suggesting that the radiocarbon results and stratigraphy are not in agreement. Since there is no alternative way of assessing whether there was rapid change in the accumulation rate, which is possible due possibly to syn-depositional compaction, the estimates of the vegetation changes have to be accepted provisionally.

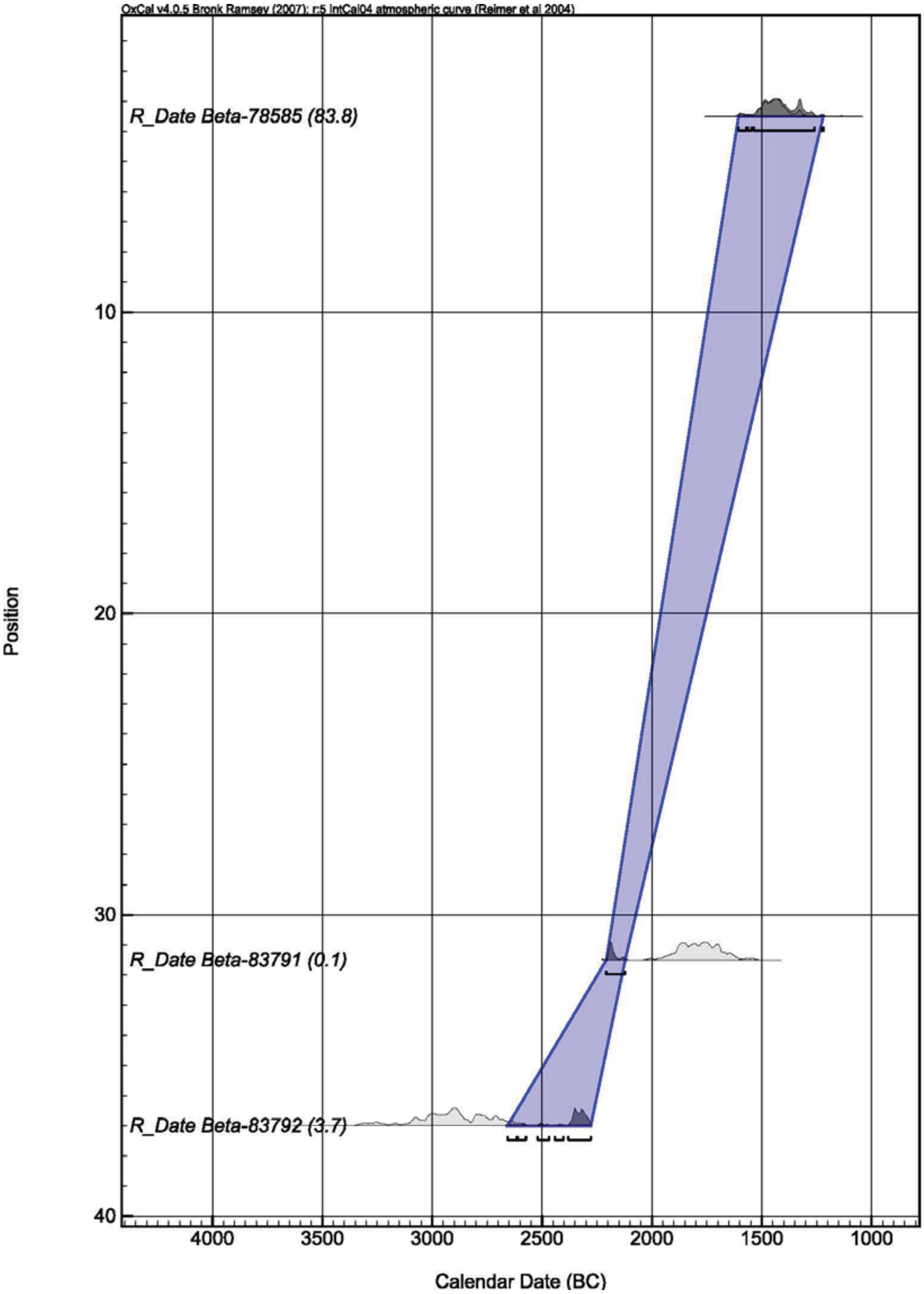

Fig 4.13: Bayesian modelling of the radiocarbon dates at Turnell's Mill Lane (English Heritage Dating Team)

The diagram indicates that this area of the floodplain was predominantly covered by woodland dominated by alder and hazel. Oak may have been growing on drier parts of the floodplain and the valley slopes. Lime was almost certainly growing on the valley side slopes. The diagram suggests that *c* 1800 BC the alder and hazel decreased and grasses and herbs increased. A climatic cause for this event would seem unlikely as this is not a known period of increased precipitation and, more importantly, the ecological requirement of alder and hazel are such that any climatic shift might have favoured one over the other rather than lead to a decline in both. Similarly there is no indication of a local hydrological cause from the stratigraphy or the pollen (no rise in aquatics). Sub-zone TML I(b) represents a brief period of *c* 200 years when some of the floodplain around Turnell's Mill Lane was opened up favouring an expansion of grasses, sedges and herbs. Many of these herbs, such as *Plantago lanceolata*, are associated with pastoral agriculture (Behre 1981) and would suggest that the nearby open parts of the floodplain were covered by wet pasture and/or hay meadow. The unusual but highly significant corresponding peak in *Pteridium* suggests that bracken also was growing on these open areas of floodplain. It is likely that these open areas (possibly fields) were close (ie adjacent) to the palaeochannel, otherwise due to the curtain effect of alder woodland (Janssen 1959) they would not have been registered here. Given that the clearance of the floodplain was not total (probably under 50%), then the most appropriate economic strategy would be some form of forest farming/plant husbandry as proposed by Zvelebil (1994). By the end of the sub-zone the area seems to be reverting back to *Alnus* dominated woodland, but with a lower hazel component than before.

The basal levels of TML II are dominated by *Alnus* (45% total land pollen) and *Corylus* (35% TLP) along with low percentages of *Quercus*, *Salix* and *Fraxinus* with some *Pinus* probably of long distance origin. There is very little Poaceae or Cyperaceae and only a very few herbs such as *Rumex acetosa* and *Hypericum* type. Aquatics and spores are also low. The counts indicate a forested local floodplain with no cleared land near to the palaeochannel. However, the upper counts are significantly different. Whilst *Alnus glutinosa* and *Corylus avellena* are still dominant there is more representation of other tree types including *Tilia*, *Ulmus*, *Betula* and *Fagus*. Thorny/scrub species are also present including *Prunus* type. Both Poaceae and Cyperaceae are much higher at *c* 10-20% TLP and there is a high representation of herbs of cleared ground such as *Artemisia*, *Anthemis* type, *Plantago lanceolata* and Ranunculaceae. Also present are *Linum* type and *Vicia* type. Although not taken fully to type/species, fairy flax (*Linum catharticum*), perennial flax (*Linum anglicum*) and pale flax (*Linum bienne*) are all native and occur on the dry calcareous or sandy soils which are common in the Nene basin. The pollen data represent a partially cleared floodplain (possible *c* 50%) with wet woodland remaining fragmented by clearings and/or fields. The increase in the diversity of trees is almost certainly caused by the curtain effect (the blocking of extra-local pollen by the high local pollen of the surrounding woodland) and this suggests that these trees types were present in the surrounding area, particularly the adjacent valley slope, throughout the period of deposition of the organic rich sediments.

The Turnell's Mill Lane palaeochannel gives a picture of changes in the local floodplain of the Nene for a period of approximately one and a half millennia. It suggests that some deforestation of the local slopes had already occurred by the mid/late Neolithic, probably as elsewhere as a result of a combination of natural factors such as Dutch elm disease and windthrow, with the human use and expansion of these natural clearings possibly as part of a forest farming system (Groenman-Van Waateringe 1983). The floodplain at this time was still covered by *Alnus*-*Corylus*-*Quercus* woodland. The deforestation event in the middle diagram is of local origin and would relate to the Neolithic/Bronze Age boundary. There is evidence of Neolithic clearance of *Quercus* on a segment of the Nene floodplain only 8km to the north, but this site could well be the result of natural, opportunistically exploited, windthrow events (Brown in prep). So although it indicated exploitation of the floodplain by Neolithic peoples (Macphail and Goldberg 1990), it does not suggest long-term sedentary use, and this is reinforced by a lack of any monuments or other Neolithic sites on the floodplain or surrounding terraces. There is, however, abundant evidence of clearance and utilisation of the Nene and other floodplains (Wiltshire and Edwards 1993) by Bronze Age peoples. The most obvious feature is the constructions of barrows, nearby at Irchester and a little farther downstream at Irthlingborough and Raunds. There is now little doubt that at least some of these monuments were constructed on what were then floodplain islands isolated by two channels of a bifurcating (anastomosing) pattern of the Nene. The pollen diagram also suggests that much of the floodplain was still wooded until the later Bronze Age or later. This is in agreement with pollen work from Wollaston (I), where samples from a variety of natural and artificial features indicates that deforestation of the floodplain took place in the late Bronze Age/early Iron Age and was maintained into the Roman period, when the Nene Valley had a dense pattern of settlement of all sizes (Taylor 1975).

The open sub-divided grassland floodplain of the middle Nene would appear to be established by the middle Iron Age. This is a pattern which is emerging from other river valleys in the Midlands, such as the Soar and its tributaries (Brown in prep), the upper Worcestershire Avon (Grieg 1996) and in Derbyshire where Wiltshire and Edwards (1993) have shown partial clearance of a floodplain during the Neolithic, but landscape-scale deforestation in the late Bronze Age/Iron Age.

One particularly interesting feature of the diagram is the pronounced peak of *Pteridium* during the clearance phase. The high quantity (20% TLP) and the calcareous nature of the surrounding soils suggests that it is a local/floodplain phenomenon, with *Pteridium* invading the newly cleared floodplain prior to substantial deposition of calcareous flood sediments, which resulted from agricultural activity in the catchment. Similar peaks in *Pteridium* pollen are recorded in Iron Age contexts from both the Nene at Titchmarsh and Orton Longueville (Holyoak and Seddon 1984), Wollaston and in the Soar valley at Kirby Muxloe (Brown in press). *Pteridium* macrofossils have been recorded from Iron Age ditch fills at Wollaston, suggesting that it was cut for bedding.

This site and others in the region are revealing a picture of fragmentary small-scale use and alteration of the environment in the Neolithic, probably part of a forest farming economy. This is replaced by more intensive ritual and agricultural use of the floodplain in the Bronze Age and an almost total woodland clearance for agriculture in the Iron Age. Turnell's Mill Lane also shows how coherent pollen spectra can be derived from palaeochannel infills and can document changing floodplain land use in prehistory.

Ditchford

The Ditchford site (SP 492 268) was located about 21km downstream of Northampton (Fig 4.14). Gravel extraction revealed a vertical exposure of unconsolidated deposits containing infilled palaeochannels over *c* 200m of the floodplain. The extent of the workings and the excavated areas are shown on Figure 4.14.

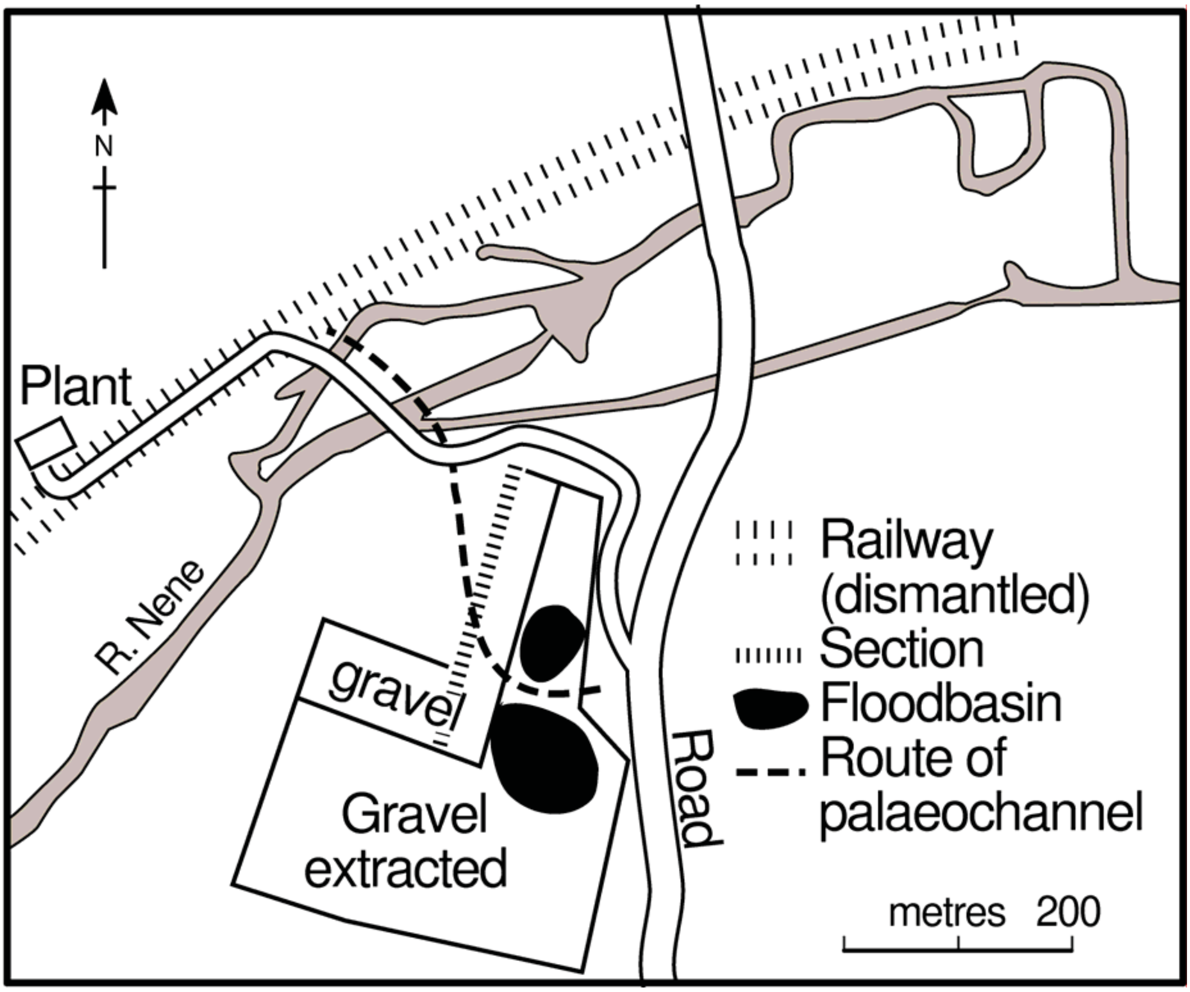

Fig 4.14: Ditchford site location

Several major phases of prehistoric archaeological activity are evident. The gap between these phases is bridged by an environmental sequence reconstructed with the aid of four pollen cores from an adjacent palaeochannel, which shows that human activity continued in the intervening period. The channel was observed and sampled rapidly during quarrying operations. From the exposed face the channel bearing was 40° crossing the site from south-west to north-east. Both the size of the channel (approximately 200m in length where sampled) and its location on the floodplain are essential features in relation to the interpretation of the pollen diagram. The approximate dimensions of the channel in exposure were 52m in total width with an inner channel of 3.3m and 3m in maximum depth. The stratigraphy of the monoliths is briefly described in Figure 4.15.

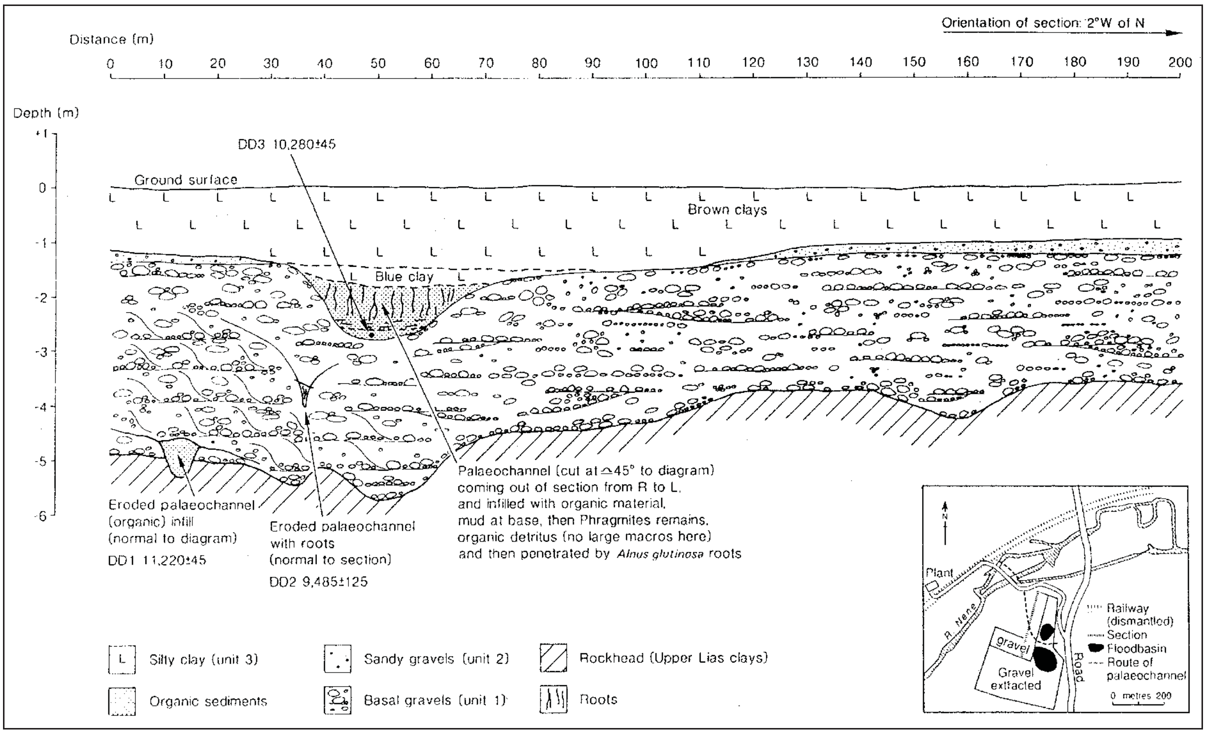

Fig 4.15: Ditchford, section diagram with brief sediment description

The palaeochannel was sampled and four monoliths (DD1 to DD4) were taken from the palaeochannel. From the four samples, two were counted (DD1 and DD4). Following examination it was found that DD2 and DD3 did not contain enough preserved pollen to facilitate counting. The results of DD1 and DD4 are presented in Figure 4.16. Details of the radiocarbon dates are given in Table 4.14.

Table 4.14: Ditchford, radiocarbon dates from the section illustrated in Figure 4.15

Lab ID	Sample Id	Depth below ground surface (m)	Material	$\delta^{13}C$ (‰)	Radiocarbon Age (BP)	Calibrated Date (95% confidence)
SRR-4643	DD1	5.05-5.35	Organic sediment	-28.5	11,220±45	11,230-11,135 BC
SRR-4642	DD2	3.85-4.05	Organic sediment	-28.1	9,485±125	9,124-8,634 BC
SRR-4642	DD3	2.45-2.60	Organic sediment	-30.4	10,280±45	10,188-10,029 BC

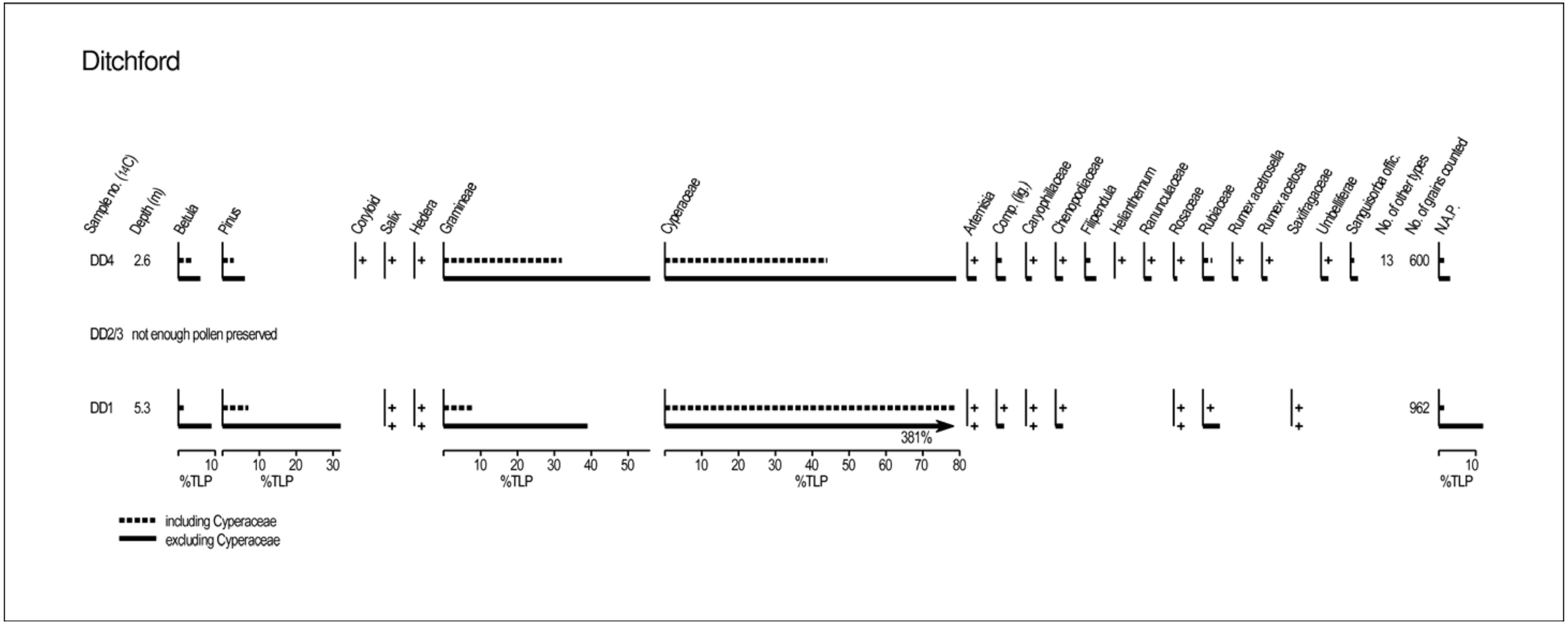

Fig 4.16: Ditchford, counted pollen from DD1 and DD4 (analyst A G Brown)

The preservation condition of the pollen from Ditchford was extremely low and as a result a very limited diagram has been produced. *Betula*, *Pinus* (both <10%TLP) and *Salix* (<1%TLP) were the only arboreal types represented. *Corylus avellana* type represented the shrubs (<1% TLP). The herbs were dominated by Cyperaceae (50-80%TLP) and Poaceae (10-40%TLP), other herbs were recorded but all recording low (<1%TLP) to trace presence only. Assuming that Cyperaceae is over-represented DD1 suggests a relatively open environment, but with *Pinus* and *Betula* in the area DD4 has a low arboreal content and a higher concentration of glacial indicators. DD1 and DD4 are both likely to be of late Devensian age.

In a different part of the Ditchford ARC pit was a Roman Road and a medieval causeway. An existing earthwork across the site was excavated by the Oxford Archaeological Unit in 1989 and reported in Keevil and Williams (1995). The earthwork was a metalled Roman road orientated to the east gate of the nearby Roman town of Irchester. A medieval causeway was also discovered. Faunal remains from the side ditches of the Roman road were entirely of cow, but Mollusca and Coleoptera were also preserved. The Mollusca and Coleoptera, analysed by M Robinson and listed in Table 4.15, indicate that the ditch held stagnant water which was probably seasonal (Robinson p 59, in Keevil and Williams 1995). The majority of the seeds (Table 4.16) are from dryland plants, mostly from annual weeds of disturbed ground followed by seeds of grassland herbs, indicating that the ditch was surrounded by very open conditions. The author states that this agrees with soil evidence for arable cultivation along one side of the road. Neither the invertebrates nor the plant remains contained any indications of woodland or scrub.

Table 4.15: Mollusca and Coleoptera remains from the Roman road excavation at Ditchford Pit (from Robinson, in Keevil and Williams 1995)

Mollusca	
Scientific name	Number
Carychium sp.	2
Lymnaea truncatula	1
Lymnaea palustris	1
Anisus leucostoma	3
Vallonia sp.	2
Coleoptera	
Notiophilus sp.	1
Amara sp.	1
Agabus bipustulatus	1
Agabus sp. (not *bipustulus*)	1
Helophorus aquaticus or *grandis*	1
Helophorus sp. (*brevipalpis* size)	2
Megasternum obsurum	1
Xantholinus linearis	1
Aphodius sp.	1
Phyllotreta nigripes	1
Longitarsus sp.	1
Apion sp.	1
Sitona sp.	1
Medinus circulatus	1

Table 4.16: Waterlogged seed and fruit remains from the Roman road excavation at Ditchford Pit (from Robinson, in Keevil and Williams 1995)

Latin name	Common name	Number
Ranunculus cf. *acris*	meadow buttercup	1
R. cf. *repens*	creeping buttercup	6
Barbarea vulgaris	yellow rocket	1
Cerastium sp.	mouse-ear chickweed	1
Stellaria media	chickweed	1
S. graminea	stitchwort	1
Montia fontana	blinks	1
Chenopodium polyspermum	all seed	5
Atriplex sp.	orache	17
Chenopodiaceae indet.	-	3
Filipendula ulmaria	meadowsweet	1
Potentilla anserina	silverweed	1
P. reptans	creeping cinquefoil	1
Rosaceae indet.	-	12
Aethusa cynapium	fool's parsley	1
Pastinaca sativa	wild parsnip	1
Polygonum aviculare agg.	knotgrass	24
P. persicaria	red shank	29
P. hydropiper	water-pepper	1
Polygonum sp.	-	3
Rumex conglomeratus	sharp dock	1
Rumex sp.	dock	5
Urtica urens	small nettle	1
U. dioica	stinging nettle	3
Plantago major	great plantain	1
Carduus or *Cirsium* sp.	thistle	2
Hypochoeris radicata	cat's ear	1
Leontodon sp.	hawkbit	16
Sonchus asper	sow-thistle	7
Juncus effusus gp.	rush	10
J. articulatus sp.	rush	10
Carex sp.	sedge	1
Cf. *Triticum* sp.	wheat	1
Poaceae indet.	grass	5
Total		175

Raunds Area Project sites

The Raunds Area Project officially lasted from 1985 to 1994 and covered *c* 40 km^2 of eastern Northamptonshire, including a 10km long reach of the River Nene floodplain between Higham Ferrers and Denford. The survey volume has been published (Parry 2006) and the volumes on excavation of the Saxon and medieval settlement in Raunds (Boddington 1996; Audouy and Chapman 2009), while the volume describing excavation of Saxon and medieval West Cotton is in press (Chapman in press). The landscape archaeology of the early prehistoric period is described in Harding and Healy (2007) and this volume contains the environmental evidence from studies by Robinson and Campbell. They suggest that the area has exceptional evidence from two archaeological features:

- The cairn over Barrow 1, which produced over 180 cattle skulls as well as some aurochs remains

- The waterlogged deposits in the ditches of the Long Barrow, from which a wealth of biological evidence was recovered (Robinson and Campbell in Harding and Healy 2007)

This evidence is discussed further below along with the pollen evidence not contained in Harding and Healy (2007).

Irthlingborough Barrows

The excavation of this area after initial topsoil stripping was undertaken by Oxford Archaeology Ltd. The site consists of a group of barrows (five in total) on a low terrace fragment or gravel island between two contemporary and post-medieval channels of the River Nene. Excavation revealed a number of tree-throw pits and of the treeholes that were sampled and their charcoal subjected to radiocarbon dating, one gave a Mesolithic date of 5310-4840 cal BC (6130±80 BP; OxA-3059) and another a date at the Mesolithic/Neolithic transition of 4360–3980 cal BC (5370±80 BP (OxA-3057). Both measurements were made on charcoal from *Corylus* or cf. *Corylus* (hazel), a short-lived species. Mesolithic flintwork was also recovered from some of the tree-throw holes (Campbell and Robinson 2007). Examination of the sub-barrow soils revealed no evidence of ploughing prior to barrow construction, but soils on the barrow revealed ploughing in the Iron Age and Romano-British period (Robinson pers com).

Redland Farm Long Barrow

Redlands Farm stands on the gravel low terrace on the south-east side of the floodplain between Irthlingborough and Stanwick. Environmental samples were taken during excavations from the long barrow ditch. The ditch contained organic deposits sealed by alluvium and were analysed for pollen and spores by P Wiltshire (Wiltshire undated) and plant macrofossils by M Robinson (Robinson pers comm). An oak plank from the revetment of the barrow at the base of the organic ditch fill was dated to 3760-3360 cal BC (4790±90 BP; OxA-3003). From the plant macrofossils Robinson (pers comm) suggested that the barrow had been constructed in an area cleared of woodland with a subsequent succession through open-habitat herb-dominated communities to scrub vegetation.

The pollen diagram was divided into four local assemblage zones which displayed variable preservation due to local physico-chemical effects (Wiltshire undated). The pollen, along with X-radiometry, allows Wiltshire (undated) to suggest an initial phase of rapid infilling with standing (eutrophic) water in the ditch. The rate declined and allowed a type rich pollen spectrum to accumulate. The surrounding area was dominated by herb-rich grassland with some mature trees still in the catchment (*c* 8% TLP). There was the presence of *Pteridium* but no convincing evidence of cereal growing around the site. At an unknown date later in the lifetime of the ditch there was scrub regeneration, particularly of *Corylus,* which may have been due to abandonment, reduced stocking densities or the cessation of coppicing.

Detailed evidence for an early Neolithic open area was provided by waterlogged remains from the ditches of the Long Barrow and this is reported on in detail in Campbell and Robinson (2007). The plant macrofossils and the beetles suggest that although the area had been thoroughly cleared and was covered by lightly grazed grassland, there were still some larger tree stumps which had been left to decay.

The pollen from the lower fills of the Long Barrow ditch (pollen zones RF1–RF2) suggested open conditions, with pollen from grasses and other herbaceous taxa predominating. There was good mutually supporting evidence from the pollen and the insects for the vegetation, for example *Plantago lanceolata* was indicated both by pollen and the host-specific weevil *Mecinus pyraster* (Campbell and Robinson 2007). Scarabaeoid dung beetles showed that the grassland was being grazed lightly. The soil beneath the barrow had possibly experienced trampling by stock and had its phosphorus level enhanced by animal droppings. Two of these dung beetles, *Caccobius schreberi* and *Onthophagus taurus*, are now extinct in

Britain, although the latter has been recorded from other Neolithic and Bronze Age sites (Campbell and Robinson 2007).

The Long Barrow was, however, set against a background of woodland. Oak leaves blew into the quarry ditches. The pollen, which would have been derived from a larger catchment than the insects, suggested a similar composition to the later Mesolithic woodland, with *Quercus* sp, *Tilia* sp, *Alnus glutinosa* and *Corylus avellana* the main trees and shrubs. There was also a low, but persistent, presence of *Pinus* sp pollen. *Pinus* is a prolific producer of pollen, which can be carried long distances on the wind. Therefore, there may have been small stands of *Pinus sylvestris* growing on the more acidic soils, for example on the Ironstone at some distance from the pollen site, rather than in the valley bottom.

Stanwick

The Stanwick-West Cotton area includes the Early Neolithic avenue (including tree-throw pits), turf mound, long barrow, long enclosure, causewayed ring ditch, southern enclosure (Harding and Healy 2007). Radiocarbon dates of 4770–4460 cal BC (5750±45 BP; OxA-7907) and 4460–4050 cal BC (5455±70 BP; OxA-7958) were obtained on tubers of *Arrhenatherum elatius* ssp *bulbosum* from the primary silt of the Segmented Ring Ditch (Campbell and Robinson 2007). The Segmented Ring Ditch was of early Bronze Age date, but these tubers are thought to have been derived from the Avenue, which contained much charred material, as this was cut by the Segmented Ring Ditch. An *Arrhenatherum* tuber which gave a date almost as early, 4330–3990 cal BC (5325±50 BP; OxA-7867), was recovered from the southern avenue ditch itself. *A elatius* is a grass which readily colonises disturbed ground, including abandoned arable land, and spreads in grassland provided little grazing is occurring. *Arrhenatherum* grassland represents a temporary stage in the succession to scrub and is now very common on roadside verges, but it is eventually shaded out unless scrub is cut. It is also eliminated by heavy grazing. Micromorphological examination of the body of the Long Mound showed it had indeed been constructed of turf, and charred roots of *Corylus* from two gullies cut into the top of the Neolithic part of the Turf Mound gave radiocarbon dates of 3950–3700 cal BC (5035±35 BP; OxA-7945) and 3910–3660 cal BC (4975±35 BP; OxA-7865) while the Long Mound was similarly early. The evidence of the *Arrhenatherum* tubers and the turf structures implies that areas of grassland were present in the valley bottom from almost the start of the Neolithic.

Palaeochannels C, D and E

As the quarry face moved from north to south along the Raunds floodplain, a series of palaeochannels were revealed and, where possible, sampled (Fig 4.17). As part of this project a series of assessments were done on the material archived at the University of Exeter and this forms the basis of this part of the report.

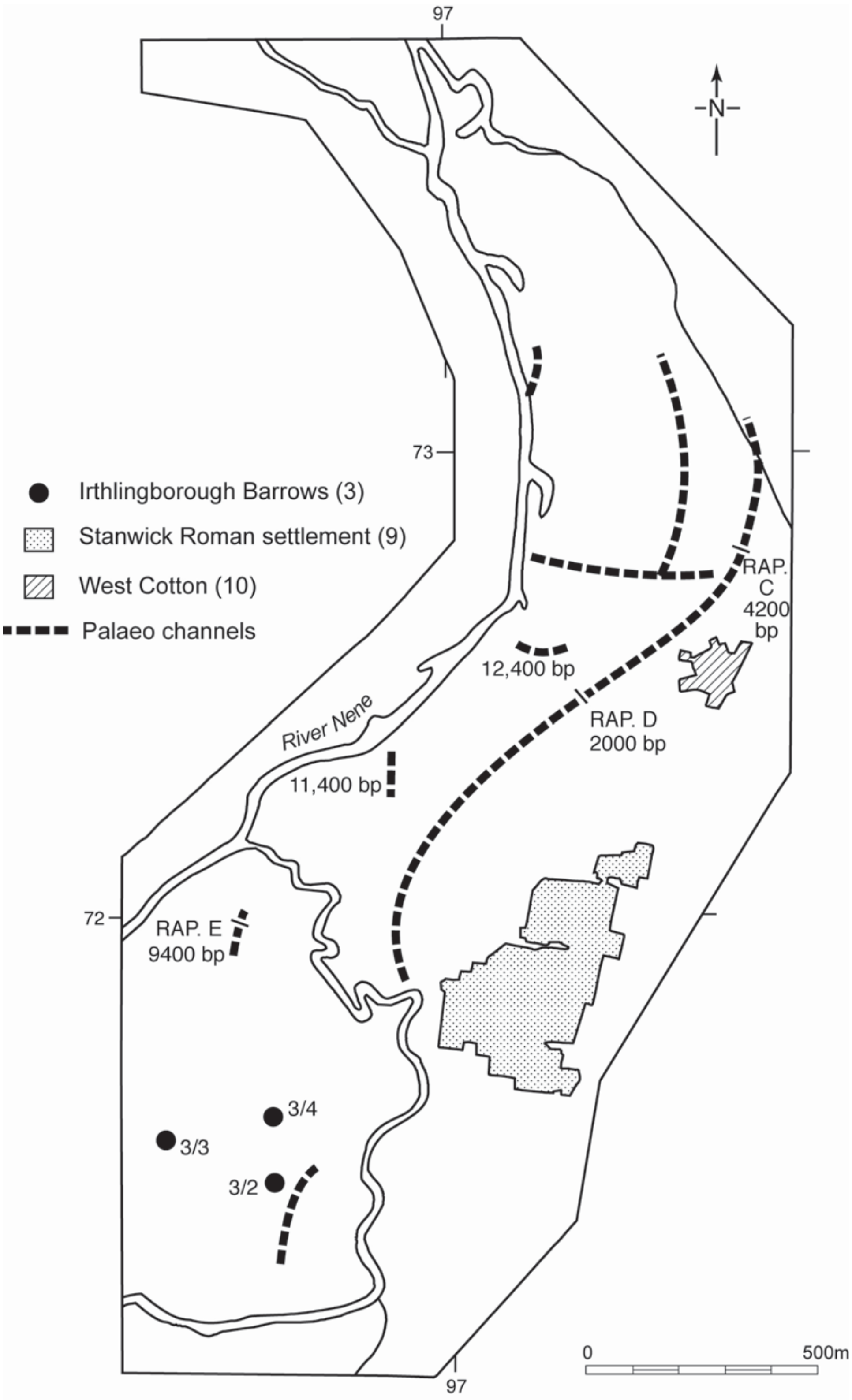

Fig 4.17: The Raunds Area floodplain palaeochannels and sites

Palaeochannel C

The stratigraphy of this site was re-described from the stored monolith (Fig 4.18).

RAP Palaeochannel C
Monolith length 53.5 cm.

0-5 cm Reddish brown clay 5 YR 4/3 with notable coarse sand - chips (1-2 mm) included. No apparent structure or dip. GB with fining downwards apparent. Non laterally extensive Wood macro present.
NIG 1.75 STRF 0 ELAS 0 SICC 3 HUMO 4 A Ga+

5-16 cm Reddish brown clay 5 YR 4/3 with notable coarse sand included. No apparent structure or dip GB.
NIG 1.75 STRF 0 ELAS 0 SICC 3 HUMO 4 A Ga+

16-20 cm Reddish brown clay 5 YR 3/3 with coarse sand. Organic matter present throughout unit. None laterally extensive sand lense present from 7.5 - 8 cm. Sharp boundary.
NIG 1.75 STRF 0 ELAS 0 SICC 3 HUMO 3.7 A Gg+

20-28 cm Clay 2.5 YR 2.5/3 with reduced coarse sand content. Organic macro fossils apparent with associated oxised (reddish orange) staining. Apparent structure with noticable dip and layers of organic material.Sparse occurences of shell fragments from 22 cm. SB
NIG 1.75 STRF 3 ELAS 0 SICC 3 HUMO 2 Sh 1 As Ga

28-34 cm Clay 5YR 3/1 with coarse sand. No apparent structure or dip. Occurences of snail shell (34 cm) and broken shell fragments throughout. Gradational coarsening downwards with more sand notaicable at 31.5-34 cm but intergrated within unit. SB.
NIG 2 STRF 0 ELAS 0 SICC 3 HUMO 0 As Ga

34-36 cm Black laterally extensive organic unit. Some occurences of oxidised reddish brown staining. No apparent structure or dip. SB
NIG 2.5 STRF 1 ELAS 0 SICC 3 HUMO 2 Lf D

36-40 cm Clay 5YR 3/1 with coarse sand. No apparent structure or dip. Occurences of snail shell (34 cm) and broken shell fragments throughout. Gradational coarsening downwards with more sand notaicable at 31.5-34 cm but intergrated within unit. SB.
NIG 2 STRF 0 ELAS 0 SICC 3 HUMO 0 As Ga

40-45 cm Clay 7.5 3/3 with notable coarse sand - chips (1-2 mm) included. No apparent structure or dip. Non lateral extensive organic macrofossils with associated reddish orange staining ca. 4 cm wide. GB.
NIG 1.75 STRF 0 ELAS 0 SICC 3 HUMO 0 As Ga

45-53.5 cm Clay 7.5 3/3 with notable coarse sand - chips (1-2 mm) included. No apparent structure or dip. Random occurences of plant macrofossils with associated reddish staining.
NIG 1.75 STRF 0 ELAS 0 SICC 3 HUMO 0 As Ga.

Fig 4.18: Photolog and description of the Raunds Area Project C monolith

This monolith is thought to contain material from the Late Bronze Age to the medieval period and the preservation within this monolith indicates the samples have the greatest potential. The monolith was taken from a trench which revealed the channel cross-sectional stratigraphy (Fig 4.19).

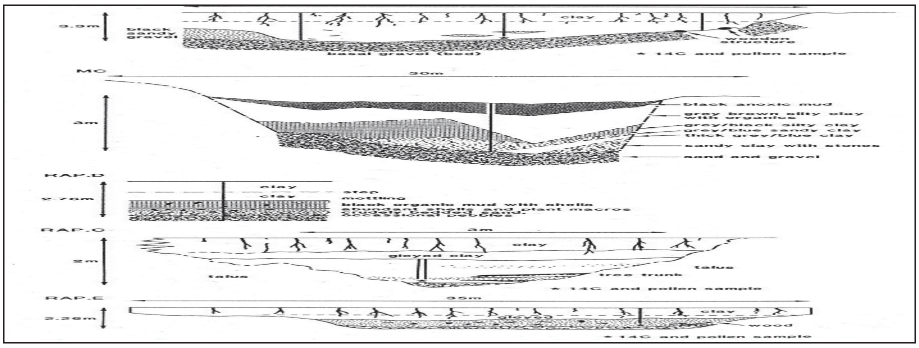

Fig 4.19: The cross-sectional stratigraphy of palaeochannel C

Originally, in the late 1980s, pollen analysis was undertaken on samples from the fill (Fig 4.20), but it was decided to resample the monolith as an assessment of the preservation potential of the archived sediments.

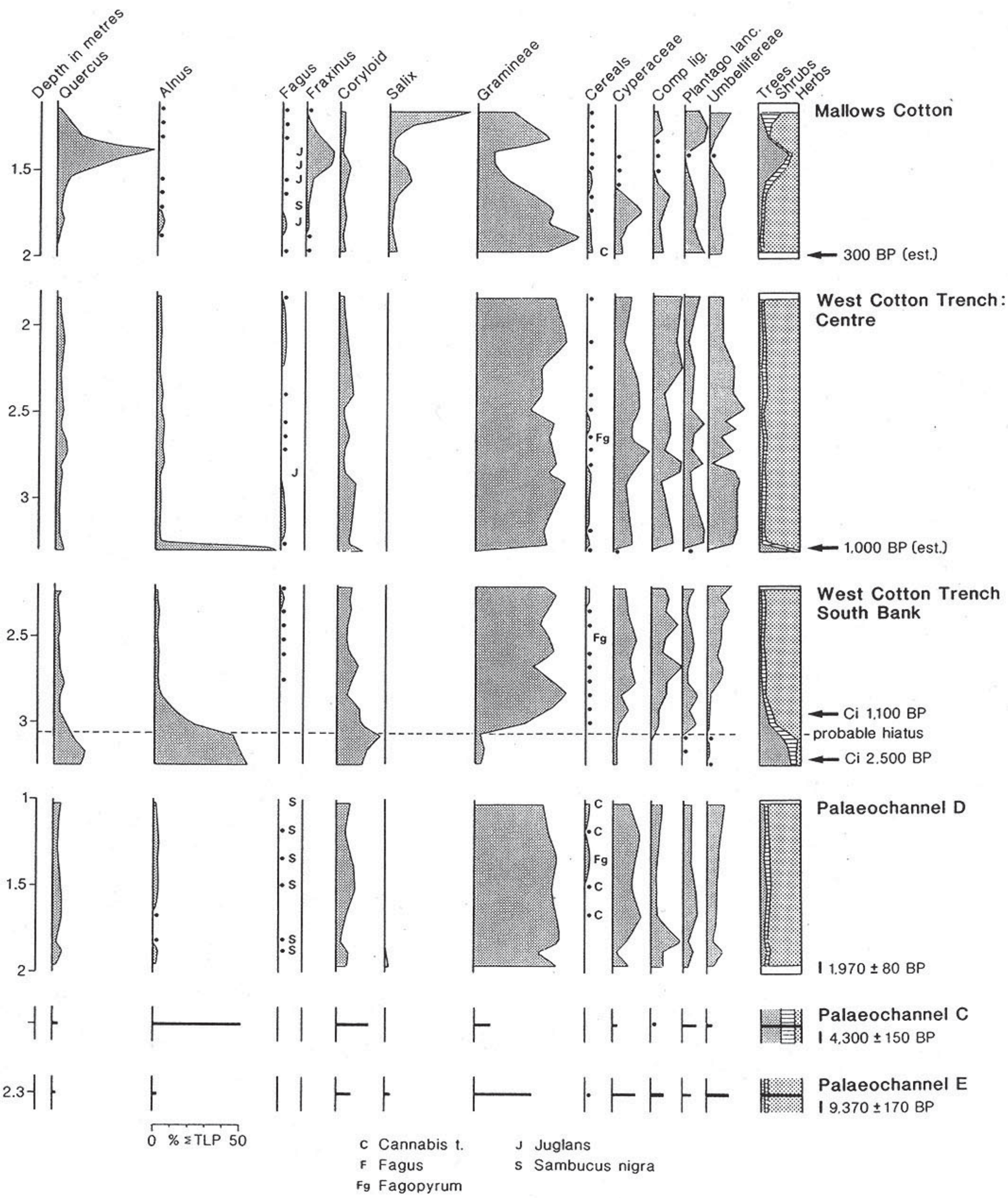

Fig 4.20: The low resolution pollen analyses of palaeochannels undertaken in the late 1980s, selected types only (analyst A G Brown)

The results of the new pollen assessment are given below with depths from the top of the monolith tins (analyst P Allen).

PAL C 48-48.5cm
Exceptionally sparse pollen levels.
Pollen identified: Poaceae, Roseaceae, Ranunculaceae.
Some additional non-pollen organic material present, but is very small and broken down.
Exotics were high almost 10:1 ratio, pollen in relatively good preservation condition.
Full count would generate a detailed vegetation history, interesting count due to such sparse concentrations. This level is countable.

PAL C 35-35.5cm
Sparse to moderate pollen levels.
Pollen identified: Poaceae, Ranunculaceae.
Some additional non-pollen organic material present, but is very small and broken down.
Exotics were high almost 5:1 ratio, pollen in relatively good preservation condition.
Full count would generate a detailed vegetation history, interesting count due to such sparse concentrations. This level is countable.

PAL C 14-14.5cm
Sparse to moderate pollen levels.
Pollen identified: Poaceae, Ranunculaceae.
Some additional non-pollen organic material present, but very small and broken down.
Polypodium was noted. However, slide is very clean, might be a very sparse context.
Exotics were high almost 5:1 ratio, pollen in relatively good preservation condition.
Full count would generate a detailed vegetation history, interesting count due to such sparse concentrations. This level is countable.

PAL C 5-5.5cm
Sparse to moderate pollen levels.
Pollen identified: Poaceae, Ranunculaceae.
Some additional non-pollen organic material present, but very small, and broken down.
Polypodium was noted. However, slide is very clean, might be a very sparse context.
Exotics were high almost 5:1 ratio, pollen in relatively good preservation condition.
Full count would generate a detailed vegetation history, interesting count due to such sparse concentrations. This level is countable.

Palaeochannel C contained a more typical assemblage of the Late Neolithic. The palaeochannel was surrounded by *Alnus* with *Quercus* and *Corylus,* but with some open areas. However, the lack of variation level to level suggested that it had accumulated very rapidly and probably would not repay the effort of high-resolution analyses. However, as Campbell and Robinson have noted and gone onto comment, 'Pollen analysis of organic sediments of Late Neolithic date from a palaeochannel of the River Nene at West Cotton (Brown and Keough 1992) gave a picture very different from that from the Early Neolithic Long Barrow.' The results were from RAP C, a little downstream from West Cotton, where macroscopic plant remains associated with a fallen *Quercus* trunk gave a radiocarbon date of 3370–2470 cal BC (4300±150 BP; HAR-9241), and from a short sequence associated with the Neolithic timber platform at West Cotton for which three radiocarbon measurements provide an estimated construction date of 2760–2470 cal BC at 82% probability (Campbell and Robinson 2007, 23). Tree pollen greatly outnumbered pollen of grasses and other herbaceous plants at both sites. Pollen of *Alnus* predominated, as might be expected given both the high p`ollen productivity of alder and the numerous macroscopic remains of alder recovered from these deposits, suggesting an alder-lined river bank. However, pollen of other trees and shrubs, particularly *Quercus* sp and *Corylus* sp, was still much more abundant than herb pollen. The macroscopic plant remains added *Tilia cordata* and *Fraxinus excelsior* to the woodland trees, while underwood or scrubby species included *Prunus* cf *spinosa*, *Cornus sanguinea* and *Rhamnus catharticus*. Seeds of an appropriate range of woodland herbs, including *Mercurialis perennis*, were also present.

Palaeochannel D

This monolith is potentially Roman period in date. There is evidence in this monolith for a significant human impact on this area, in particular to see the extent of agriculture and cereal production in competition with native populations. Again, a low-resolution pollen analysis was undertaken in the late 1980s (see Fig 4.20) and as part of this project archived samples were assessed (analyst P Allen).

PAL D 45-45.5cm
Pollen in very good condition, very good preservation.
The slide includes a large amount of non-pollen organic matter - spores, chironomids, and plant material.
The identified pollen biased towards Poaceae, *Rumex*, Lactuceae - *Taraxacum*, and Cyperaceae. Some *Alnus* noted, however, absence of other trees noted.
The pollen potentially indicates an open environment.
Full count would generate a detailed vegetation history.
Exotics were recorded almost 2:1 ratio, pollen in good quantities. Full count would generate a detailed vegetation history. This level is countable.

PAL D 31-31.5cm
Pollen in poor – good condition, equal amount of degraded grains to good grains. Less identifiable non-pollen organic matter. The organic matter is far smaller and more broken/degraded. Some evidence of charcoal.
Identified pollen were biased towards Poaceae, Rumex, Lactuceae - *Taraxacum*, and Cyperaceae, *Plantago* and Chenopodiaceae. *Quercus* was recorded, but exact quantities or significance remains to be determined.
Potentially indicating an open possibly worked environment, with small stands of woodland.
Exotics and pollen were recorded in a 1:1 ratio. This level is countable.

PAL D 18-18.5cm
Pollen in poor – good condition, equal amount of degraded grains to good grains, however, pollen concentrations appear to have decreased. There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small sizes (compared to 45-45.5).
The identified pollen was biased towards Poaceae, *Aster*-type, one *Quercus*. However, absence of additional trees noted.
More charcoal noted.
Exotics were recorded almost 2:1 ratio, pollen in good quantities. Full count would generate a detailed vegetation history. Potentially indicating an open environment. This level is countable.

PAL D 5-5.5cm
The pollen is in poor – good condition, equal amount of degraded grains to good grains. There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small (compared to 45-45.5) sizes.
The identified pollen was biased towards Poaceae (possible *Hordeum*), *Aster* type, *Artemisia*, Chenopodiaceae, Lactuceae. However, absence of additional trees noted.
Relatively high charcoal concentrations noted.
Full count would generate a detailed vegetation history.
Potentially indicating an open environment.
Exotics were recorded almost 3:1 ratio, pollen in good quantities. This level is countable.

Pollen concentrations and types change throughout monolith, increase in charcoal, and plantains indicate human impact on landscape.

Palaeochannel E(a)

This is a Late-glacial palaeochannel, again originally analysed at low resolution in the late 1980s. The stratigraphic cross-section (Fig 4.21) shows that it was a shallow gravel-bottomed channel with a sandy-infill containing wood fragments.

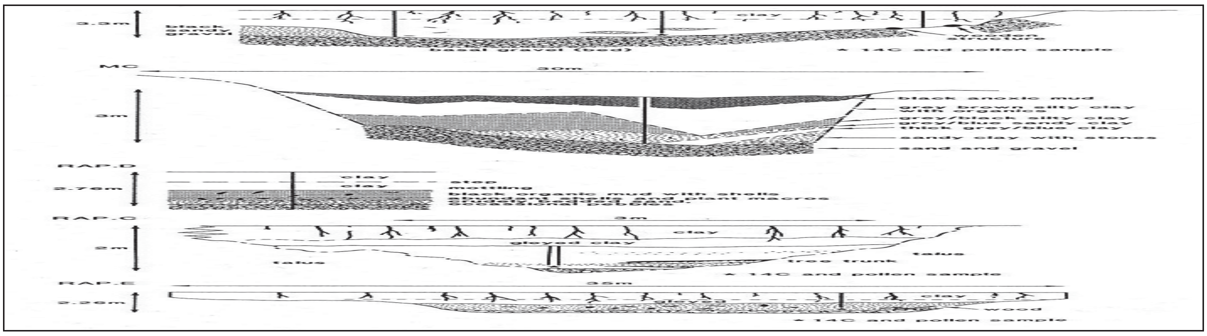

Fig 4.21 The cross-sectional stratigraphy of palaeochannel E

The two monoliths archived at Exeter were re-sampled for a pollen assessment as part of this project and the results are given below.

PAL E(a) 41.5-42cm
The monolith may date from the Late Glacial and would generate a base date for Nene vegetation history.

Moderate to good pollen levels.
Pollen in poor to good condition, equal amount of degraded grains to good grains. There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small sizes.
The identified pollen was biased towards Poaceae, Ranunculaceae. However, absence of trees noted.
No charcoal noted.
Full count would generate a detailed vegetation history. Potentially indicating an open environment.
Exotics were recorded almost 2:1 ratio. This level is countable.

PAL E(a) 31-31cm
Sparse to moderate pollen levels.
Pollen in poor to good condition, equal amount of degraded grains to good grains. There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small sizes.
The identified pollen was biased towards Poaceae, Ranunculaceae, Apiaceae, *Aster*, Rosaceae. However, absence of additional trees noted. Inorganic material noted, may need double HF for larger count.
No charcoal noted.
Full count would generate a detailed vegetation history. This level is countable.

PAL E(a) 20-20.5cm
Sparse to good pollen levels (higher concentrations than 31-31.5).
Pollen in poor to good condition, equal amount of degraded grains to good grains. There is additional non-pollen organic matter, but this material exhibits increased degradation and is broken into small sizes.
The identified pollen was biased towards Poaceae, Ranunculaceae, Apiaceae, *Aster*, Rosaceae. However, absence of additional trees noted.
No charcoal noted.
Full count would generate a detailed vegetation history. This level is countable.

PAL E(a) 7-7.5cm
Sparse to moderate pollen levels.
Pollen in poor to good condition, equal amount of degraded grains to good grains.
There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small sizes.
The identified pollen was biased towards Poaceae, Ranunculaceae, Apiaceae, *Aster*, Rosaceae. However, absence of additional trees noted.
No charcoal noted.
Full count would generate a detailed vegetation history. This level is countable.

RAP Palaeochannel E(b)

PAL E(b) 48-48.5cm
Sparse pollen to moderate pollen level.
Pollen in poor to good condition, equal amount of degraded grains to good grains. There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small sizes.
The identified pollen was biased towards Poaceae, Ranunculaceae, Apiaceae, *Aster*, Rosaceae. However, absence of additional trees noted.
No charcoal noted.
Full count would generate a detailed vegetation history. This level is countable.

PAL E(b) 31-31.5cm
Sparse pollen level.
Pollen in poor to good condition, equal amount of degraded grains to good grains. There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small sizes.
The identified pollen was biased towards Poaceae, Ranunculaceae, Apiaceae, *Aster*, Rosaceae. Pine noted in complete and broken conditions, however, absence of additional trees noted.
No charcoal noted.
Full count would generate a detailed vegetation history. This level is countable.

PAL E(b) 20-20.5cm
Sparse pollen level.
Pollen in poor to good condition, equal amount of degraded grains to good grains. There is additional non-pollen organic matter, but this material exhibits increased degradation, and is broken into small sizes, and far less than previous levels.
The identified pollen was biased towards Poaceae, Ranunculaceae, Apiaceae, *Aster*, Rosaceae. Absence of additional trees noted.
No charcoal noted.
Full count would generate a detailed vegetation history. This level is countable.

The site was not analysed further, despite all the archived material being countable, as it was out of the temporal scope of this project.

West Cotton

West Cotton palaeochannel
The samples from West Cotton were taken from monoliths collected in 1989 from the base of a palaeochannel, excavated by the Northamptonshire Archaeology Unit, which runs alongside the multi-period site (Neolithic, Bronze Age and medieval) of West Cotton (Windell *et al* 1990 and Chapman in press). The organic fill of the palaeochannel started to accumulate in *c* 2820 cal BC (*c* 4200 BP), but there is a basal hiatus at approximately 3m depth and the upper 2m accumulated post *c*

cal AD 850 (*c* 1100 BP, Fig 4.20). The Neolithic remains included a long mound 135m long, and a long enclosure, and in the palaeochannel was a brushwood and alder platform which, from a series of radiocarbon dates, was in use between *c* 2600 BC and *c* 1900 cal BC (Harding and Healy 2007). Late Neolithic to early Bronze Age funerary activity is represented by a triple-ditched round barrow over a beaker burial. During the Saxon period a village was constructed on the site.

Micromorphological examination of the body of the Long Mound showed it had been constructed of turf (Campbell and Robinson 2007). Charred roots of *Corylus* from two gullies cut into the top of the Neolithic part of the Turf Mound gave radiocarbon dates of 3950–3700 cal BC (5035±35 BP; OxA-7945) and 3910–3660 cal BC (4975±35 BP; OxA-7865) while the Long Mound was similarly early. The evidence of the *Arrhenatherum* tubers and the turf structures implies that areas of grassland were present in the valley bottom from almost the start of the Neolithic (Campbell and Robinson 2007).

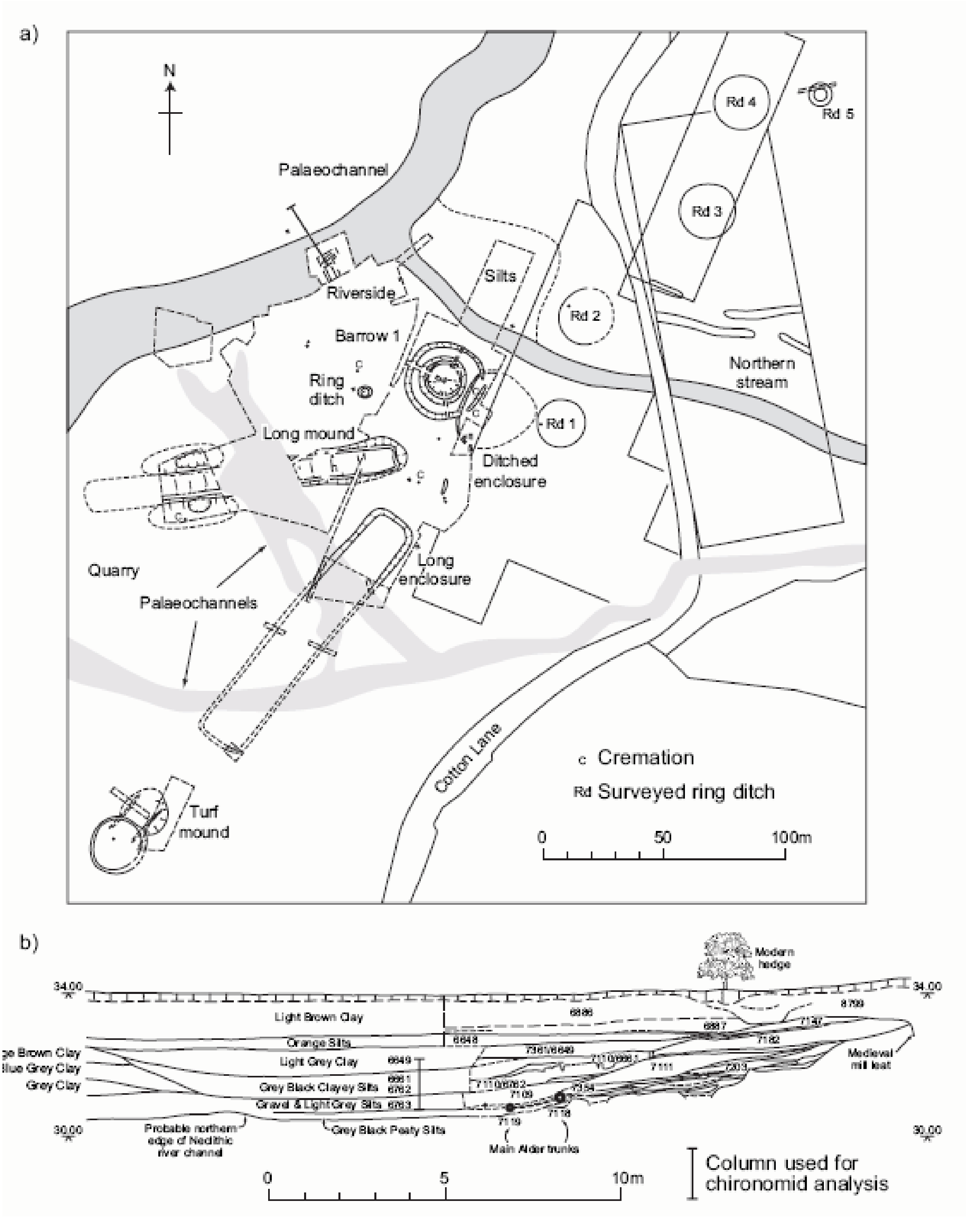

Fig 4.22: Location of sampling (a) and (b) stratigraphy of the West Cotton channel

Chironomid analyses was also applied to the deposits at West Cotton (Ruiz *et al* 2006). Sub-samples of sediment 2cm thick were taken at approximately regular intervals (~10 cm), available material permitting, from the WCP monoliths. Head capsule concentrations were relatively high in most of the deposit, thus the standard method of extraction described above (deflocculation in KOH, sieving and picking out) was used. At least 50 head capsules were examined for each sample and specimens were mounted and identified.

The chironomid-based chlorophyll-a and total phosphorus transfer functions were applied to the BC and WCP subfossil data in an attempt to generate quantitative reconstructions of these variables for the WCP site (Brooks *et al* 2001). A percentage relative abundance diagram of the chironomid taxa recovered from the WCP deposits is shown in Figure 4.23 with five zones defined by eye. A total of 47 chironomid taxa were identified from the core. The sequence has been divided into five zones which are interpreted below:

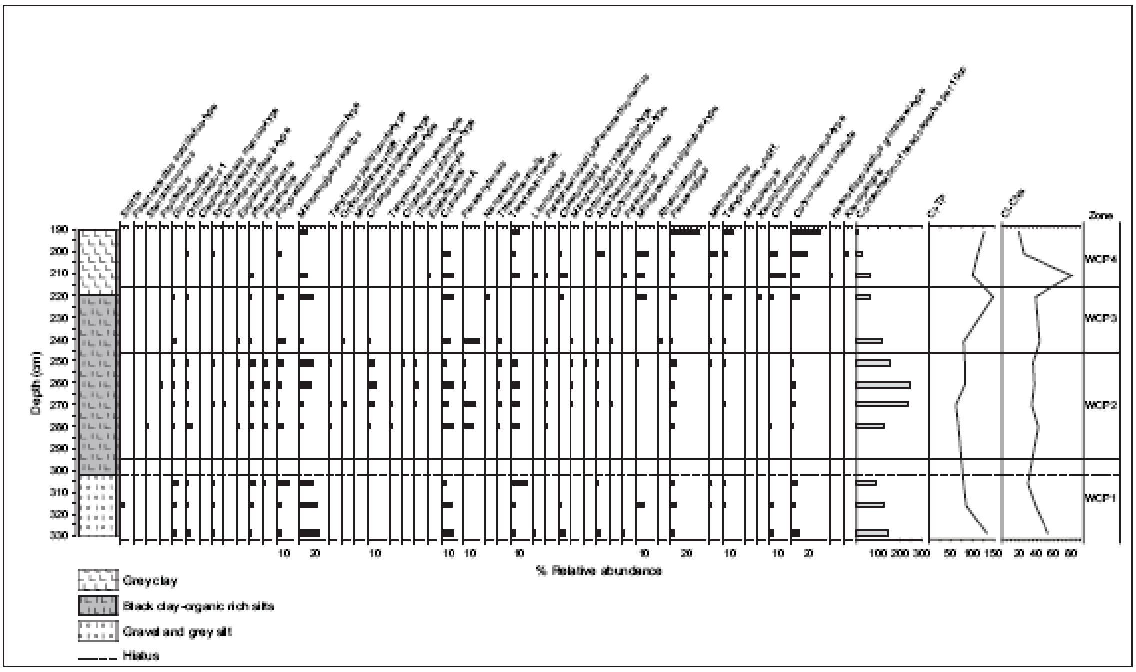

Fig 4.23: West Cotton, Palaeochannel Chironomid diagram (analyst Z Ruiz)

WCP1 – WCP3: indicate aquatic plant development on initially open, coarse sediment and clean/clear water, no human impact apparent.

WCP4: indicate an increase in more pollution-tolerant taxa and decrease in taxa intolerant of poor water quality indicating progressive nutrient enrichment, stagnation and the decomposition of organic matter during the Saxon period, probably associated with human activity (land use and settlement).

WCP5: indicate channel infilling at the top of the profile; several semi-terrestrial taxa present.

Pollen suggests the site was surrounded by *Alnus*-dominated woodland with *Quercus* and *Corylus,* but a rather local assemblage. The macroscopic plant remains reported by Campbell and Robinson (2007) added *Tilia cordata* and *Fraxinus excelsior* to the woodland trees, while underwood or scrubby species included *Prunus* cf *spinosa*, *Cornus sanguinea* and *Rhamnus catharticus*. Additionally seeds of an appropriate range of woodland herbs, including *Mercurialis perennis*, were also present.

Campbell and Robinson (2007) further note that,

> "The Coleoptera from the Late Neolithic palaeochannel deposits near West Cotton included major woodland faunal elements. There were species that feed on tree leaves, occur in different categories of dead and decaying wood, prey on caterpillars in the tree canopy and occur in woodland floor habitats either amongst leaf litter or feeding on woodland herbs. Some of the more host-specific Coleoptera suggested additional species of tree in the woodland, for example

> *Scolytus scolytus*, the elm bark beetle. As is typical for Neolithic woodland insect assemblages, Coleoptera that are now very rare or extinct in Britain were present, for example *Gastrallus immarginatus*, which is now restricted to Windsor Great Park".

The pollen and Coleopteran results showed that there was still much woodland in the catchment of the palaeochannel in the late fourth and early third millennium BC. The pollen was interpreted as reflecting woodland cover to the floodplain (Brown and Keough 1992, 188), while the value of 7% of the terrestrial Coleoptera belonging to the wood and tree-dependent species group was regarded as indicating between one-third and two-thirds tree cover (Robinson 2000). However, there were also at least some open areas. The pollen included *Plantago lanceolata* while the weevil *Mecinus pyraster*, which feeds on *P lanceolata*, was also present. There were other phytophagous Coleoptera of grassland plants and one, *Agrypnus murinus*, which has larvae that feed on the roots of grassland herbs, is characteristic of well-aerated soils. This would be consistent with other evidence that much of the floodplain had well-drained soils and did not experience seasonal inundation during the prehistoric period. Scarbaeiod dung beetles were not very abundant although there were sufficient of them to suggest the presence of some domestic animals in addition to any wild, medium to large-sized herbivores that lived in the area (Campbell and Robinson 2007).

Scalley Farm

The Scalley Farm excavations revealed a wealth of archaeological features: Roman structures (including a corn drier), medieval remains and early-middle Saxon pottery. A pronounced palaeosol was also seen on the mid-slopes of the valley side and a deep colluvial/alluvial sequence at the base of the slope which had accumulated against the field boundary associated with Cotton Lane (Fig 4.24). Pollen was not recovered from the sequence, but geomorphological and magnetic studies suggested that the main component of the accelerated erosion of the slope had occurred in mid-late medieval and post-medieval times (Brown 2006).

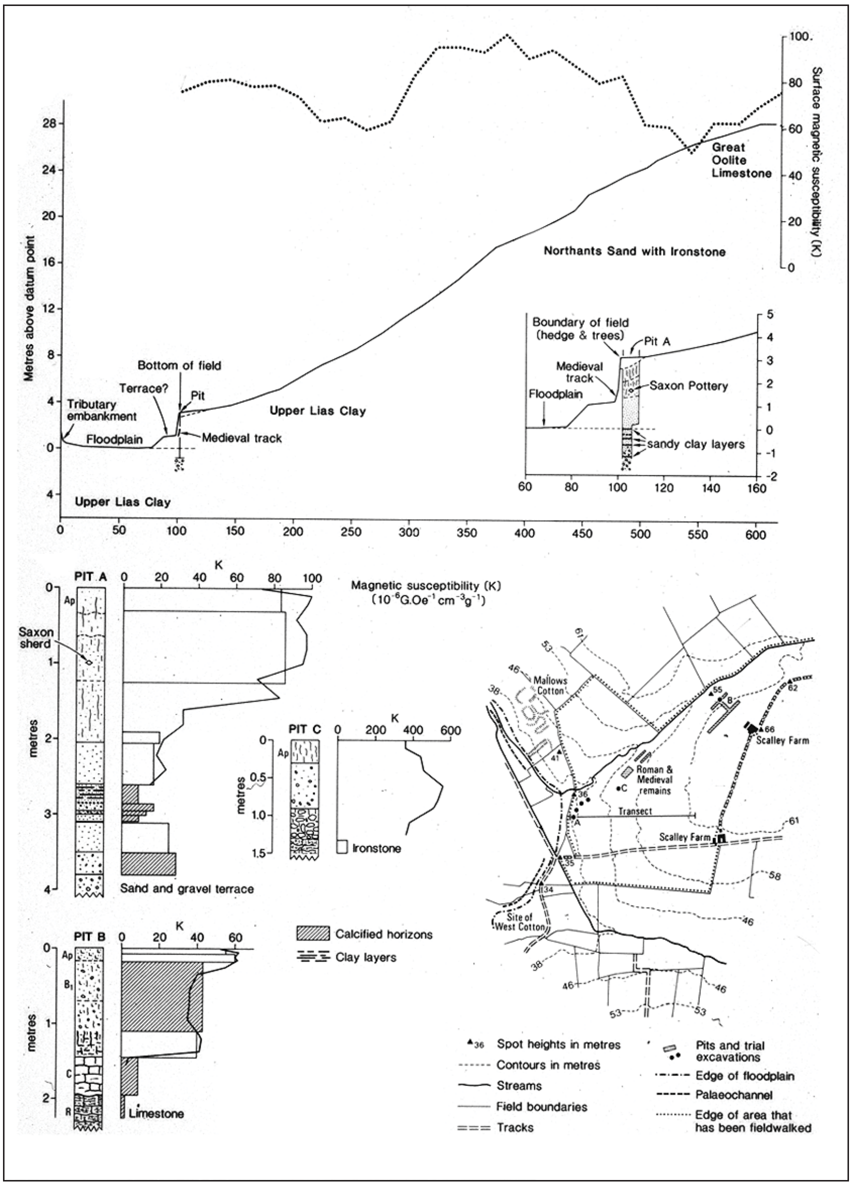

Fig 4.24: Scalley Farm, slope transect, core lithology and magnetic enhancement profiles from zone B

Mallows Cotton

Mallows Cotton is a deserted medieval village at the northern downstream end of the Raunds Area Project reach. The site lies on the lower slope at the southern edge of the floodplain. At its northern edge, along the southern edge of the floodplain a marsh-filled palaeochannel was observed. The palaeochannel was cored in order to produce a stratigraphic cross-section (Fig 4.25) and a central core taken and sampled.

Fig 4.25: Aerial photograph of the deserted village at Mallows Cotton with the transect location superimposed (Copyright Northamptonshire County Council)

The transect across the palaeochannel revealed a typical horizontally-layered stratigraphy (Fig 4.26). A central core was used for pollen analysis (Fig 4.20).

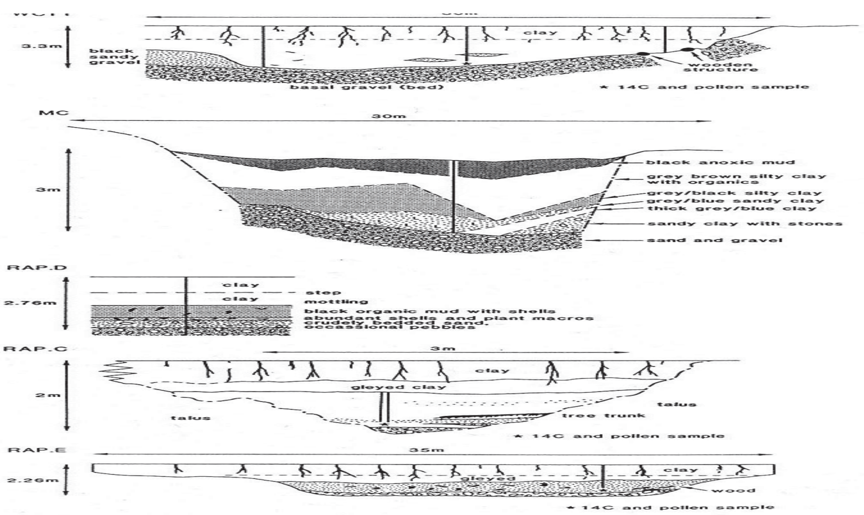

Fig 4.26: Stratigraphic cross-section of the palaeochannel at Mallows Cotton

The pollen diagram was not recounted at higher resolution due to its lack of dating and the strong suspicion that it is of post-medieval date. The reason for this conclusion is the almost continuous presence of *Juglans* from 1.8m to 1.4m and the location of a mature walnut tree on site. The high *Fraxinus* and the spike in *Quercus* are also unusual for late prehistoric-medieval pollen in the area. It is not suggested that the palaeochannel is post-medieval in date, but rather that the infill has been disturbed by the creation of a leat or ditches.