Minchery Farm, Littlemore, Oxford – Geoarchaeology and Palaeoenvironments

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Introduction

The geology of the Oxford Region is dominated by gently tilted limestones and clay strata (Parker and Goudie, 1998). The juxtaposition of these strata has given rise to numerous springs and seepages, which in some instances has led to the formation of peat. Such deposits provide important archives of environmental change. By analysing the physical, chemical and biological characteristics of the sediments preserved in these peat deposits change in the development of the landscape can be determined. Landscape change may be brought about via 'natural' or 'human' induced events.

The Minchery Farm area, between Littlemore and the Kassam Stadium, has been a major focus for archaeological investigation associated with developer funding archaeology. Infrastructure developments in the area include the Oxford Science Park, the Kassam Stadium and Hotel complexes, and the multiplex cinema site. Archaeological excavation sh0ws human occupation and impact on the landscape spanning from the Mesolithic period to the late Mediaeval period (approximately the last 10,000 years). Finds include Mesolithic flints, Neolithic pottery, early prehistoric post-holes, Bronze Age pottery, Roman pottery kilns and pottery amongst others (Moore, 2001).

The site is located on the southern boundary of the Northfield Brook, the source of which rises 5km to the north-west (Parker and Anderson, 1996). Extensive peat deposits exist along this shallow valley, which preserve waterlogged materials suitable for geoarchaeological and palaeoenvironmental reconstruction. The area of peat blankets the slope below springs which issue from the base of the Beckley Sand Member, which is comprised of fine to medium grained quartz sands (Horton, 1995). Excavations at the Oxford Science Park site revealed evidence for two beaver dams across the Northfield Brook. One of these was dated to the Iron Age (Moore, 2001).

Detailed pollen analysis from the Kassam Stadium site revealed a 175 cm deep section spanning the last 10,000 years which tracked changes in the vegetation, climate and human impact from the surrounding region (Parker and Anderson, 1996). Within the extensive peat deposits, Roman pottery from the 2nd and 3rd centuries AD was found t the site of the Multiplex Cinema complex (RPS. Unpubl.), a horses head with associated Roman Pottery was found at the Oxford Science Park site (Moore, 2001).

In 2012 Archaeox: The East Oxford Archaeology & History Project excavated trenches to the east of Minchery Farm and the also on the site of the Medieval priory at Minchery Farm Paddock. An evaluation trench was extended towards the Northfield Brook, which revealed peat buried underneath topsoil. 1.2 m of sediment was recovered using three overlapping monolith-sampling boxes.

Methods

The excavation trench profile revealed several units as shown in Table1. The monolith sections cut through all of the units except for the Topsoil/Turf unit 1000, which was not sampled.

Unit	**Description**
1000	Topsoil/turf - 100mm
1002	Firm/mid blue grey (with frequent mid orange veins)/Clay silt - 140mm
1008	Similar to 1002 above but with higher clay content -260mm
1001	Friable/dark brown black/clayey silt with very high organic component = Peat - 500mm
1003	Firm/light grey/silty clay – 220mm
1006	Firm/light grey/silty clay (60%)/ sub angular gravel (40%) 50mm+

Table 1: Sedimentary units described in the MP12 TR1 south facing trench

A 1.20 m long sediment sequence was collected in the field from an open trench section using three 50 cm long, over-lapping monolith tins. The depths are reported in m OD. The tops of each monolith tin were as follows:

Top of 1012 58.14m OD
Top of 1011 57.86m OD
Top of 1010 57.56m OD

Several techniques were employed to characterise the nature of the sediments and depositional history of the sequence. Bulk density (ρ) expresses the relationship of sediment mass to its volume (g/cm^3). Changes in bulk density may be related to a rise in the degree of organic decomposition, a change in the botanical composition of the sediment or due to an increase in the abiotic component of the sediment. This technique provides an indicator of changing sedimentary characteristics, which may help infer changes in the environmental history of the site (Bengtsen and Enell, 1996). Moisture content is associated with bulk density and will depend upon the volume and size of the pores in the sediment mass. As bulk density increases, the water holding capacity generally decreases. Bulk density measurements were made using calibrated brass pots (Parker, 1995a) and placed in a drying oven overnight at 105°C.

The organic content of the sediment was calculated as the percentage weight loss on ignition (LOI) at 550°C for 2 hours (Heiri et al., 2001). The carbonate content of the sediment was determined by heating the sediment to 925°C for 4 hours. The amount of carbon dioxide lost in the process, as carbonates are converted to oxides, can be used to determine the original carbonate content of the sediment by multiplying the weight lost by 1.36 (the difference between the molecular weights of CO_2 and CO_3) and expressed as a percentage (Bengtsen and Enell, 1996). The remaining residue is expressed as a percentage and reflects the inorganic sediment component.

Iron oxides form *ca* 2% of the constituents of the earth's crust, and are among the most sensitive indicators of environmental change conditions and processes (Oldfield, 1991). Different minerals exhibit distinct magnetic properties, allowing identification and differentiation of rock, and sediment types based purely on their magnetic characteristics (Walden *et al*., 1992). Such magnetic properties are often diagnostic of sources and of palaeoenvironmental processes including burning, slope instability and in wash of sediments. In washed material tends to have a greater magnetic signal than autochthonous, organically derived material generated *in situ*, providing that diagenetic processes are not prevalent. Increases in the magnetic signal from a sediment profile should reflect the extent of slope disturbance in response to human-induced phenomenon such as burning, clearance of vegetation and slope wash within the catchment. Sub-samples were dried overnight at 60°C and disaggregated using a rubber ended pestle and agate mortar. Samples were measured using a Bartington MS2 meter and 2b sensor.

Four pollen samples were examined in order to determine the vegetation characteristic of the site and surrounding region. 1cm 3 sub-samples were prepared using standard techniques (Moore et al, 1991). Samples were counted using a Nikon E400 light microscope with phase contrast. Three AMS ^{14}C samples were submitted for dating. The samples comprised terrestrial plant macrofossils samples that had been washed through a bank of sieves and picked under a low power binocular microscope.

Results:

Results from the core analyses are summarised in Figure 1. The diagram was divided into zones using stratigraphically-constrained multivariate cluster analysis using the programme CONISS in which transformations lead to different implicit dissimilarity coefficients (Grimm, 1987). The zones were labelled from the base upwards with zone MF prefix and described from oldest to youngest. The ages from the radiocarbon age determinations are shown in Table 2.

Lab Code	Depth m OD	^{14}C Age	1 SD	13C per mil	Age Cal. BC
SUERC-53914	57.94 – 57.96 (18-20 cm)	3572	35	-27.0	1972-1884
SUERC-53913	57.60 – 57.64 (50-54 cm)	10184	39	-25.0	10022-9825
SUERC-53119	57.32 – 57.29 (82-85 cm)	11597	33	-26.7	11521-11449

Table 2. Radiocarbon dates from Minchery Farm

MF1 (56.90 – 57.20 m OD)
The basal 5 cm of the sequence is characterised by inorganic-rich sediments (Unit 1006), which comprise firm, light grey, silty-clay (60%) and sub angular gravels (40%). No visible plant detritus was present. This was overlain by ~22 cm of firm/, light-grey, silty clay (Unit 1003). In this zone, bulk density figures are relatively high (1.5-1.0 g/cm^3). Moisture content is generally low at around 20%, inversely corresponding to the bulk density figures. Loss on ignition (LOI) 550^{o}C values are low (~15%) and increase to ~60% at the top of the zone. The LOI 950^{o}C values are ~5% for much of the unit and decrease to ~2.5% at the top of the zone. Magnetic susceptibility of the sediment is low with a small peak at 56.95 m OD (~0.35 units) but starts to rise at the top of the zone. At 57.05 m OD the pollen (Table 3) was reasonably well preserved but sparse and only a low count was possible (n=136). The sample was dominated by open ground taxa including Gramineae, Cyperaceae and some Chenopodiaceae. Single grains of *Helianthemum* and Compositae Liguliflorae were also present. Tree and shrub pollen levels were low and included *Pinus, Betula* and single grains *Corylus* and *Salix*. A single Nympheae grain was also present.

MF2 (57.20 – 57.45 m OD)
The sediment in this zone comprised ~50 cm of peat, which extended to the top of zone MF3 as well. This formed friable, dark-brown-black, clayey silt with very high organic component (Unit 1001). This zone is marked by a sharp increase in organic content and water content. This unit shows a large decrease in bulk density compared to the previous zone (values around 0.25 g/cm^3), indicating an increase in the organic composition of the sediment. A peak in bulk density (0.8 g/cm^3) occurs at 53.28 m OD. The moisture content in this zone is consistently high (relative to the previous zone) with values ranging from 50-70% - another indicator of an organic matter increase. LOI at 550°C values rise to around 60%. LOI at 950°C decreases to ~2.5%). Magnetic susceptibility values rise at the base of the zone to 0.4 x $10^{-6}m^3$ $kg^{-1}$and fall to lower values at the top of the zone ~ 0.1 x $10^{-6}m^3$ kg^{-1}. A pollen sample from MF2 was examined from 57.35 m OD. The sample contained well-preserved pollen. Tree and shrub pollen account for 57% of the total pollen sum. The level is dominated by *Betula* (37%) with *Pinus* (6%), *Corylus* (10%), *Ulmus* (2%) and *Salix* (1%) and *Alnus* (<1%). Non-arboreal herb pollen account for 30% of the pollen sum with Gramineae (17%) and Cyperaceae (11%) accounting for most of this component along with low frequencies of **Filipendula**, Umbelliferae, Compositae Liguliflorae and Chenopodiaceae. Filicales spores account for 12% of the total sum.

MF3 (57.45 – 57.80 m OD)
The zone was characterised by peat sediment (Unit 1001) with an increased clay and silt content towards the top of the unit. The sediment in this section shows some degree of humification with woody detritus and some minor iron staining. Some inclusions of sand and gravel were also present. Low BD (0.3-0.05 g/cm^3) and relatively high moisture content (75%) characterise the lower half of the zone. This falls to ~55% towards the top of the zone. Magnetic susceptibility values are the highest in this unit than compared to the rest of

the sequence. These values are variable with two major peaks observed at 57.55 m OD ($0.6x10^{-6}m^3\ kg^{-1}$) and at 57.70 m OD ($0.8x10^{-6}m^3\ kg^{-1}$). LOI 550°C values decline up zone from ~60% to 40%. LOI 990°C values increase to ~ 3%). Pollen from 57.66 m OD comprised 14% tree and shrubs with *Alnus* (9%) and *Corylus* the main types found. A single grain of *Tilia* was also found. Herbaceous pollen types were dominated by Gramineae (24%), Cyperaceae (46%) and Compositae Liguliflorae (9%). Caryophyllaceae, Chenopodiaceae, *Filipendula* and Umbelliferae were also observed in small amounts. A single cereal sized grain was also noted, however, several wild grasses e.g. *Glyceria maxima* may also fall into this size range.

The pollen from 57.76 m OD mainly comprised open ground taxa. Gramineae (30%) and Cyperaceae (42%) dominate the signal. Low frequencies of Chenopodiaceae, Caryophyllaceae, *Filpendula*, Composiate Liguliflorae and Umbelliferae were also present. Cereal pollen types comprised 2% of the pollen sum. Filicales spores account for 6% of the sum. Numerous microscopic particles of charcoal were observed on the pollen slide.

MF4 (57.80 – 57.88 m OD)
This zone is characterised by higher silt and clay content and a high degree of humification (Unit 1008). Some woody plant matter, fine detritus and charcoal were identified. The presence of some amounts iron oxide was also visible. The zone was characterised by little low values in BD (~0.2 g/cm^3), moisture content (about 60 – 70 %) and inorganic residue (about 20-40%). Magnetic susceptibility values fall compared with MF3 with values ~ $0.3x10^{-6}m^3\ kg^{-1}$. The LOI 550°C values are highly variable ranging from 10% to 60% and 950°C were almost the mirror images of each other, with high values of LOI 550°C (about 70-58%) and general low values of LOI 950°C (about 2.5-7.5%). The maximum values of LOI 950°C and inorganic residue correspond with the minimum values of LOI 550°C.

MF5 (57.88 – 58.14 m OD)
Unit 1008 extended into the lower half of zone MF5. This is overlain by 14 cm of firm, mid-blue-grey (with frequent mid orange veins) silt (75%-80%), clay and a minor sand component (Unit 1002). There was some reported presence of iron oxides, humus and fine detritus, but no charcoal or woody plant matter. This zone was characterised by a steady increase in BD (up to 0.65 g/cm^3 towards the surface), and inorganic residue (reaching 80%). LOI 950°C (about 6-5%) values are generally higher than in MF4. A steady decline was recorded for moisture content (40% at surface from an initial 65% at the base of the zone). LOI 550°C values fall to very low levels ~2% in this zone. Relatively stable and low magnetic susceptibility values were recorded in this zone ~$0.25x10^{-6}m^3\ kg^{-1}$.

Discussion:

Dimlington Stadial
The basal part of the sequence (Zone MF1, Units 1006,1003) comprised light to mid-grey minerogenic clays, slits and sands. Results from the BD and moisture contents from MF1 showed high values in mineral residue with low

quantities of organic matter. This may have been influenced by a period of sparse vegetation cover with in wash of sediment from the surrounding slopes into the stream channel with the deposition of clastic sand and sub-angular gravels along with finer grained silts and clays. Pollen in MF1 comprised open ground taxa dominated by grasses and sedges. Some tree pollen was present including low levels of Birch (*Betula*), Pine (*Pinus*), and trace levels of Hazel (*Corylus*) and Willow (*Salix*). Similar results were observed at Minchery Farm (Parker and Anderson, 1996) and the Oxford Science Park (Parker, 2001) from basal, grey, inorganic silt-rich sediments. These were undated but originally thought to relate to the Younger Dryas based on observations elsewhere e.g. Sidlings Copse and Cothill Fen (Day, 1991) where grey clays underlie Holocene dated tufa and peat. The radiocarbon dates from the overlying peat unit at Minchery Farm in this study (within Unit 1, MF2) place the grey inorganic-rich sediment within the Late Glacial Dimlington Stadial. It is probable that the grey inorganic sediments noted in the original Minchery Farm study (Parker and Anderson, 1996) and also at the Oxford Science Park (Moore, 2001) relate to the Dimlington Stadial.

Similar environmental conditions were noted at Thrupp, Abingdon where a Late Glacial Dimlington Stadial organic fill deposit in the sand and gravel of the Floodplain Terrace was radiocarbon dated to 16114-15764 cal BP (13 260±120 ^{14}C yr BP Hel-1092: 14615-13815 cal BC;) and 16552-16181 cal BP (13580±120 Q-2017: 14603-14232 cal BC) (Aalto et *al.,* 1984). The vegetation from the basal part of the Thrupp sequence contained a flora characterised by tundra with open vegetation and possibly scattered birch trees in sheltered places. Leaves of dwarf Birch (*Betula nana)*, Willow (*Salix* spp.) and Poplar (*Populus tremula)* were recovered. *Betula nana* is a circum-polar arctic-alpine plant, and apart from a relict population in Upper Teesdale, is now restricted in the British Isles to northern Scotland (Godwin 1975). Pollen of *Armeria* was also identified. This genus is at present restricted to coastal and mountainous localities but during the Devensian was common inland (Godwin 1975). In this harsh, cold environment, low ground scrub of *B. nana, Salix* and *Populus* may have been present in the more stable areas of the surrounding region. Grassland with a sparse flora of arctic-alpine plants is suggested. Dimlington Stadial age sediments were also found in the basal sediments at Spartum Fen, 11 km east of Minchery Farm, where a sparse, cold adapted flora was also noted (Parker, 1995a; Parker, 2000).

During the Dimlington Stadial (28000 to 15000 cal BP) cold surface polar waters occupied large areas of the North Atlantic with the oceanic polar front located around 40°N (Ruddiman and McIntyre (1981). This would have resulted in an extremely cold, continental climate with winter temperatures in the range of -20 to -25°C and summer temperatures below 10°C (Barber and Coope, 1987). Ice sheets extended as far south as South Wales, the Midlands and into North Norfolk. The Upper Thames region would have been under a periglacial regime with permafrost at this time.

Late Glacial (Windermere) Interstadial

At Minchery Farm Zone MF2 (Unit 1001) high values in LOI, moisture content and corresponding low values in BD reflect a change to organic-rich peats.

This unit represents the onset of the Late Glacial (Windermere) Interstadial. A radiocarbon date towards the base of this zone at 57.32 – 57.29 m OD was dated to 13583-13367 cal BP (11597±33 BP SUERC-53119; 11521-11449 cal BC). Pollen from the base of the Unit 1001 shows the development of Birch dominated woodland (37%) with smaller amounts of Pine (5%), Hazel (10%), Alder (0.79%) and Willow (1%). Tree birch macrofossils were also found in this unit. Open grassland and sedges (including Cyperaceae and *Carex* spp. macrofossils) were also present, most likely in the vicinity of the stream valley. The increase in magnetic susceptibility values may reflect burning within the landscape. This was corroborated by the presence of microscopic charcoal fragments on the pollen slide at 57.35 m OD. It is most likely that fire due to lightning caused this, however, the use fire by hunter-gatherers during the LGI cannot be over-ruled. No evidence for human presence at the site has been found. The only known Creswellian stage find from the region is a Cheddar point found at Mingies Ditch in the Windrush Valley by Barton (1993).

At Spartum Fen, 11 km east of Minchery Farm, a shallow, moderate sized, eutrophic lake, fringed by reedswamp, developed during the LGI. The transition between the Dimlington Stadial and the LGI was dated to 15012-14671 cal BP (12660±90 BP AA-11607; 13152-12721 cal BC). Pollen showed the presence of Birch (*Betula*) woodland (up to 25%) along with some Pine (*Pinus),* and Willow *(Salix).* Juniper *(Juniperus)* occurred at low frequencies (ca. 3%). Macrofossils of tree birch were also recovered from this zone. The presence of tree birch fruits at both Minchery Farm and Spartum Fen would be consistent with climatic warming during the LGI.

The rapid migration of the North Atlantic oceanic polar front has been recognised as the main cause of the rapid climatic warming in Britain at the end of the Dimlington Stadial. Thus, by 15250 cal BP (13000 ^{14}C yr BP) the oceanic polar front was well to the north of the British Isles, possibly at the same latitude as Iceland, which permitted warmer waters to spread northwards around the coastline of Britain (Bard et *al.,* 1989). During the Late Glacial Interstadial the Thames and its tributaries changed from braided channel to meandering channel form. There was also a change from gravel aggradation to incision and down cutting into gravel during this short interlude of temperate climate (Briggs *et al.,* 1985, Barber and Coope, 1987, Parker, 2000). The LGI displayed an extremely rapid climatic amelioration, which permitted thermophilous insect taxa to migrate into many parts of the British Isles. This did not last long enough to permit the migration of tree taxa except for *Betula* (birch) (Coope and Brophy, 1972, Parker 2000).

During the Late Glacial Interstadial ~14000 cal BP (12000 yr BP), the isopollen maps of Huntley and Birks (1983) show that the highest concentrations of *Betula* recorded in pollen diagrams come from sites in the north-east of England and north-east Ireland, with Lancashire to Cheshire and north-west Wales exhibiting significantly lower values. Few Late Glacial Interstadial records have been recorded in southern England with the exceptions of Church Moor, Hampshire (Clarke and Barber 1987), Woolhampton, Berkshire (Collins et al. 1996), Rissington, Gloucestershire (Wilkinson et al. 1993) and Spartum Fen, Oxfordshire (Parker 1995a). At

Church Moor the interstadial organic deposit was radiocarbon dated at 15924-13940 cal BP (12440±600 ^{14}C BP SRR-1921) yr BP and contained high birch pollen frequencies, (up to 70% TLP) along with both tree and dwarf birch macrofossils. At Spartum Fen, Woolhampton and Rissington the increase in the pollen frequency of birch is much less pronounced.

Younger Dryas (Loch Lomond Stadial)
The sedimentological analyses show evidence for increasing landscape instability in zone MF3 (upper part of Unit 1001). There is evidence for in wash of minerogenic sediment most likely associated with soil erosion as shown by the increase in bulk density, inorganic residue, decrease in sediment moisture content and the highest peaks in magnetic susceptibility within the record. Evidence for burning is corroborated by high levels of microscopic charcoal observed on the pollen slide at the top of the zone. Pollen from this level (57.66 m OD) revealed an open landscape with grasses and sedges dominating the signal. Plant macrofossils of Cyperaceae were present. Disturbed ground indicators included Compositae Liguliflorae, which suggest disturbed soils in close proximity to the site thus supporting the sedimentological indicators. The presence of *Alnus* and *Corylus* may suggest re-deposition of older, reworked material from inwashed soils rather than its presence at in the landscape at the time of deposition.

The percentage pollen indicates an open steppe-grassland landscape. The decrease in organics and the increase in disturbed ground indicators indicate an increase in landscape instability with sediment erosion and slope wash of reworked soils into the site. A radiocarbon date at 57.60 – 57.64 m OD yielded an age of 12002-11739 cal BP (10184±39 ^{14}C BP: SUERC-53913; 10022-9825 cal BC), which is close to the YD/LLS – Holocene transition.

The YD/LLS was characterised by a reversion to arctic temperatures and a tundra environment. Aggradation of the floodplain gravels of the Upper Thames re-occurred during the YD/LLS. Sites dating to this period include late Devensian palaeochannel cut-offs from the floodplain of the Upper Thames at Farmoor (Coope, 1976; Lambrick and Robinson, 1979), Northmoor (Sparks and West, in Sandford 1965), at Mingies Ditch (Allen and Robinson, 1979) and near Great Rissington both located in the Windrush Valley (Wilkinson *et al.,* 1994). These sites revealed floras indicative of cold, park tundra conditions dominated by grass, herbs, and sporadic trees cover including some Birch (*Betula* sp.) and Willow (*Salix* sp.). In addition, pollen from Goring (Parker 1995b) and Spartum Fen (Parker 1995a; 2000) support this evidence. Evidence for slope instability and the inwash of minerogenic material has also been noted at most of these sites aided by an incomplete vegetation cover across the landscape.

In the Lower Windrush Valley at MIngies Ditch (Allen and Robinson 1993), a sample from a channel in the floodplain gravel contained arctic fauna and flora. These included the presence of the arctic-alpine species of beetle (*Helophorus glacialis*) and fruit scales and leaves of dwarf birch (*Betula nana*). This deposit was dated to 12905-12668 cal BP (10860±130 BP: HAR-8356; 11,150 - 10,650 cal BC). No evidence for trees was present, although pollen analysis suggested that birch and pine grew beyond the edge of the floodplain terrace. At Farmoor the deposits contained Coleopteran assemblages with similar cold climate affinities to those from Mingies Ditch and dated to 12729-12108 cal BP (10600±250: Birm-590; 10780-10159 cal BC) (Coope, 1976).

The upper part of zone MF3 most likely represents the transition from the YD/LLS to the early Holocene. Pollen from a tree-throw pit, underlying the main peat bed, at the Oxford Science Park showed an open environment dominated by grasses and sedges with some birch and pine present. This deposit was dated to 9945±50 BP (11291-11531 cal. BP 1σ; 9461±60 cal. BC) and 9896±50 ^{14}C BP (11250-11376 cal BP 1σ; 9366±60 cal. BC) (Moore., 2001).

Similar environmental conditions have also been reported at Cothill Fen and Sidlings Copse (Day, 1991), Spartum Fen (Parker 2000), and Mingies Ditch (Allen and Robinson, 1993) at this time. Archaeological analysis of faunal assemblages at Mingies Ditch demonstrates that a transition to warmer climates occurred around 10744-10430 cal BP (9380±100 ^{14}C BP: Har-8366; 8795-8481cal BC) (Allen and Robinson, 1993). Botanical analysis suggested open woodland with *Populus* cf. *tremula, Salix* sp. (willow) and *Betula pendula* or *pubescens* (birch).

At Minchery Farm the increase in magnetic susceptibility values, with a major peak at ~57.70 m OD in the mid to upper part of zone MF3 may reflect the hypothesised use of fire by hunter-gatherers as a technique for hunting and browsing (*sensu* Edwards, 1988). A small quantity of Mesolithic debitage was found at Minchery Farm indicating the presence of humans in the landscape in the vicinity of the site (Beckley et al. 2012).

The chronology suggests that there is a break in sedimentation at the site or that very slow accumulation rates occurred during the early to late Holocene. There is no obvious stratigraphic break with a diffuse change in sediments from organic-rich peat to more minerogenic rich sediment from ~57.7 m OD.

The sediments in the upper zone of MF3 and MF 4 & 5 (Units 1008 and 1002) comprise clay and silt-rich gleyed sediments with iron mottling characteristic of overbank alluvium. Zone MF4 and the lower half of zone MF5 comprise sediment from unit 1008. Mid-blue-grey, mottled alluvial silts and sands (Unit 1002) overlie this unit. Charcoal from the base of MF5 at 57.94 – 57.96 m OD yielded an age of 3920-3832 cal BP (3572±35 ^{14}C BP: SUERC-53914; 1972-1884 cal BC) placing this in the early Bronze Age. The widespread removal of woodland cover in the Upper Thames valley occurred from the Bronze Age onwards with clearance for increased pasture and grazing, and cereal cropping. Intensified erosion, alluviation and a rise in the regional water table was enhanced especially during the Iron Age (Jones, 1988; Lambrick and Robinson, 1988). The rise in water table may have been a contributing factor for renewed sediment accumulation along the Northfield Brook, however, the presence of beaver dams noted earlier by Moore (2001) cannot be discounted for a rise in the water table.

Pollen from the upper part of MF3 at 57.76 m OD indicates a largely open landscape dominated by grasses and sedges existed around the site with some evidence for the presence of cereal grains. Alder, Hazel and very low levels of Lime and some Blackthorn provide evidence for some woodland cover in an otherwise open landscape. Environmental evidence from the Oxford Science Park indicates that the removal of lime woodland had commenced by the middle Bronze Age, whilst a pollen sequence from peat adjacent to Littlemore Brook recorded low levels of cereal pollen through most parts of the sequence correlating with the Bronze Age to Saxon periods (Moore, 2001; Parker and Anderson 1996). Pollen analysis from Sidlings Copse (Day, 1991) and Spartum Fen (Parker, 1995a) indicates that an open grassland landscape existed from the early Bronze Age with the near disappearance of Lime from the region by 3500 ^{14}C yr BP. Open ground conditions persisted through to the Roman period in the Upper Thames region with some woodland regeneration during Saxon and Mediaeval times.

Further evidence to support the opening up of the landscape comes from archaeological evidence in the vicinity of Minchery Farm. Excavations at Oxford Science Park provided some evidence for pastoralism with the occurrence of sheep, goat and cattle bones associated with Beaker pottery (Moore 2001: 167). Early-Middle Bronze Age features excavated at Blackbird Leys produced some evidence for charred cereals including wheat and possibly barley indicating (Campbell, 2003, 219). Mid to late Bronze Age settlement has also been suggested at Blackbird Leys where a number of pits producing pottery, burnt stone and a decorated cylindrical loom weight were found (Booth and Edgeley-Long, 2003).

Conclusions

The sediments from Minchery Farm provide an important environmental record from the Oxford region. The results enhance the previous studies undertaken along the Northfield Brook. The results document an extensive Late Glacial record, which extends into the early Holocene. There appears to be a break in the record until the Bronze Age when a rise in the water table, most likely due to regional woodland clearance for pasture with some cereal cultivation led to the deposition of alluvium at the site.

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Depth m OD	57.76		57.66		57.35		57.05	
Trees and shrubs	n	%	n	%	n	%	n	%
Betula	1	0.43	0	0.00	94	37.01	3	2.21
Pinus	0	0.00	0	0.00	15	5.91	7	5.15
Ulmus	0	0.00	0	0.00	5	1.97	0	0.00
Alnus	32	13.73	20	8.81	2	0.79	0	0.00
Tilia	1	0.43	1	0.44	0	0.00	0	0.00
Corylus	5	2.15	11	4.85	27	10.63	1	0.74
Salix	0	0.00	0	0.00	3	1.18	1	0.74
Crataegus	1	0.43	0	0.00	0	0.00	0	0.00
Herbs								
Gramineae	70	30.04	55	24.23	44	17.32	44	32.35
Cerealia	4	1.72	1	0.44	0	0.00	0	0.00
Cyperaceae	97	41.63	105	46.26	27	10.63	73	53.68
Chenopodiceae	1	0.43	1	0.44	1	0.39	4	2.94
Caryphyllaceae	7	3.00	4	1.76	0	0.00	0	0.00
Filipendula	2	0.86	1	0.44	2	0.79	0	0.00
Compositae Liguliflorae	4	1.72	21	9.25	2	0.79	1	0.74
Umbelliferae	2	0.86	2	0.88	1	0.39	0	0.00
Helianthemum	0	0.00	0	0.00	0	0.00	1	0.74
Spores								
Filicales	6	2.58	5	2.20	31	12.20	0	0.00
Aquatics								
Nympheae	0	0.00	0	0.00	0	0.00	1	0.74
Trees and Shrubs	40	17.17	32	14.10	146	57.48	12	8.82
Herbs	187	80.26	190	83.70	77	30.31	123	90.44
Spores	6	2.58	5	2.20	31	12.20	0	0.00
Aquatics	0	0.00	0	0.00	0	0.00	1	0.74
Total Sum	233	100.00	227	100.00	254	100.00	136	100.00

Table 3: Pollen data from Minchery Farm

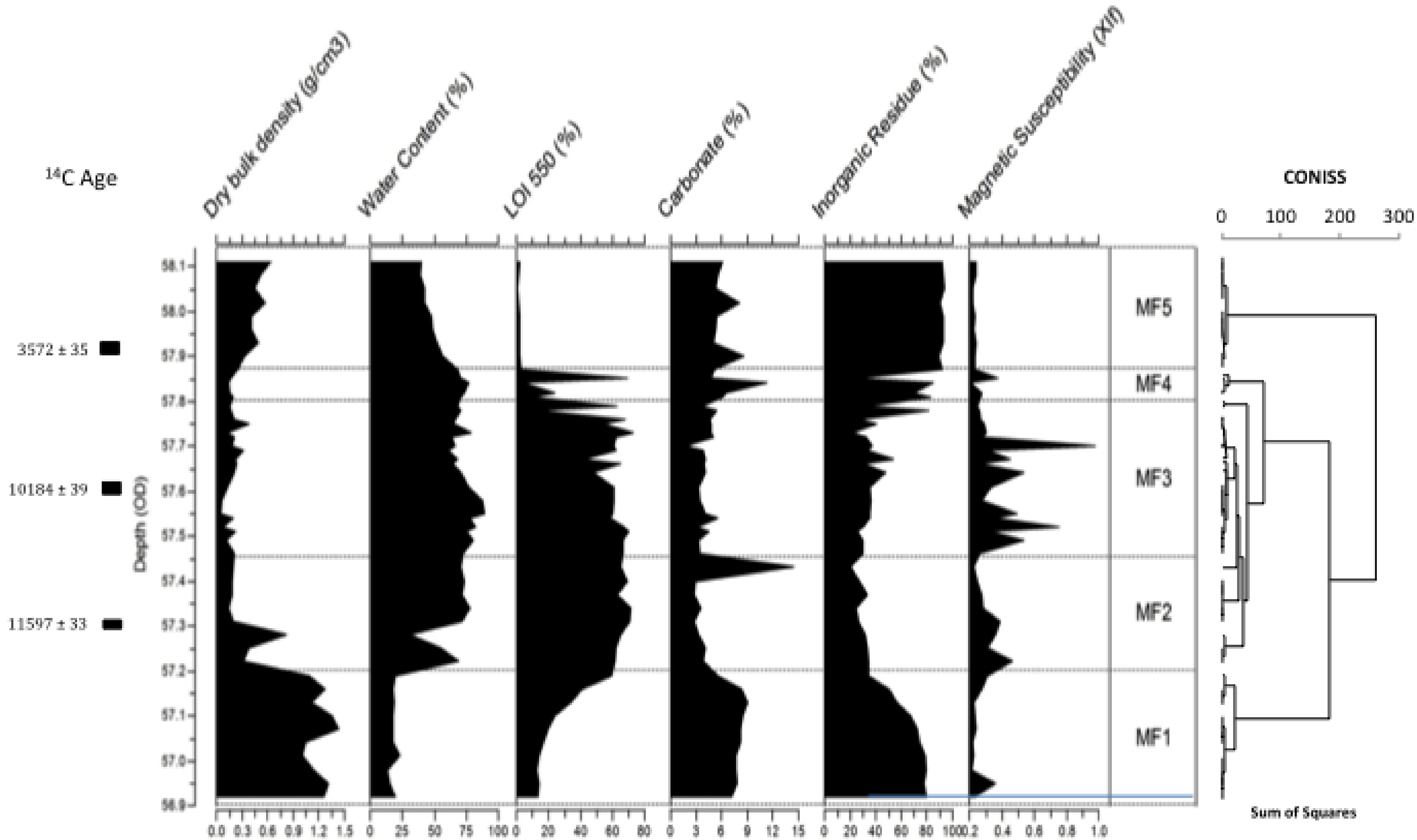

Figure 1: Stratigraphy and physical properties of a sediment sequence taken at Minchery Farm, Oxford (UK).