Thelnetham Fen, Suffolk

An Archaeological Evaluation and Palaeoenvironmental Investigation

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Abstract

In December 2008 an archaeological trench evaluation was undertaken at Thelnetham Fen, Suffolk in order to mitigate the impact resulting from the removal of up to 1m of degraded peat and peaty topsoil required for the fen restoration project being undertaken by the Little Ouse Headwaters Project (LOHP). Apart from possible drainage channels or linear peat cuttings no archaeology was found. However, environmental monolith samples were taken, and at the request of LOHP, the pollen was examined from an undisturbed section of the upper 1m of peat, and a section of the lower peat recovered from a testpit dug on a deeper section of the fen basin (1.85m deep) in June 2009. Radiocarbon dates obtained from this lower monolith show that fen mire development began here some 8000 years ago (7170 +/-50 BP), during which period peat accumulation was reasonably rapid. The pollen record is interesting in that it shows a number of increases in tree pollen (chiefly of oak and from 6000 BC of pine) with an expansion of wet meadow flora and persistence of fen aquatics in between. With the exception of one peak in Plantago lanceolata *and* Chenopodium *around 6000 BC suggesting possible human disturbance associated with clearance, there are few obvious indicators of anthropogenic activity.*

INTRODUCTION

An archaeological evaluation was undertaken by Cambridge Archaeological Unit (CAU) at Parkers Piece and Bleswycks Bank, part of the Blo Norton and Thelnetham Fens SSSI/SAC, on behalf of the Little Ouse Headwaters Project (LOHP). The work was carried out ahead of the proposed restoration of the area back to a fenland by LOHP. The site is centred on TM 0136 7894 and located immediately to the south of the River Little Ouse (also the Suffolk/Norfolk county boundary) *c.* 500m to the north of Thelnetham, Suffolk (Figure 1). The archaeological evaluation was undertaken in order to mitigate the impact resulting from the removal of up to 1m of degraded peat and peaty topsoil required for the fen restoration project. The evaluation was carried out in December 2008 and was supervised by Jonathan Tabor.

Additional environmental sampling was undertaken of the basal sediment sequence at Parker's Piece, Thelnetham Fen by the CAU (Simon Timberlake) in June 2009. This involved the machine digging of a 1.8m deep test pit through the upper fen peat and underlying white marly clay close to the southern end of Trench 1 excavated in 2008.

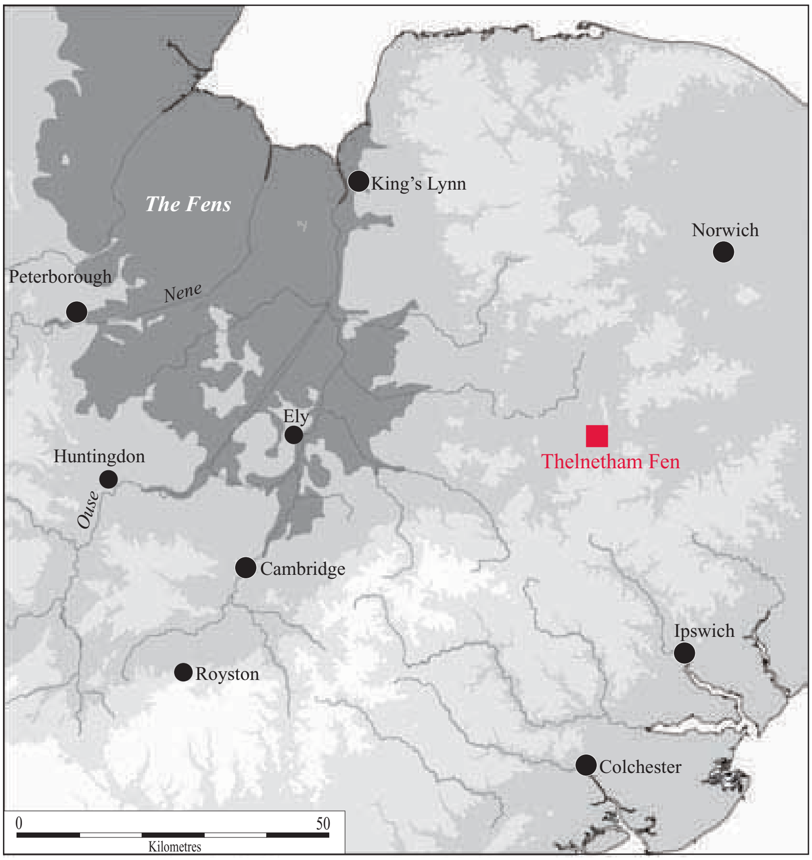
Geology, Drainage, Geomorphology and Land Use

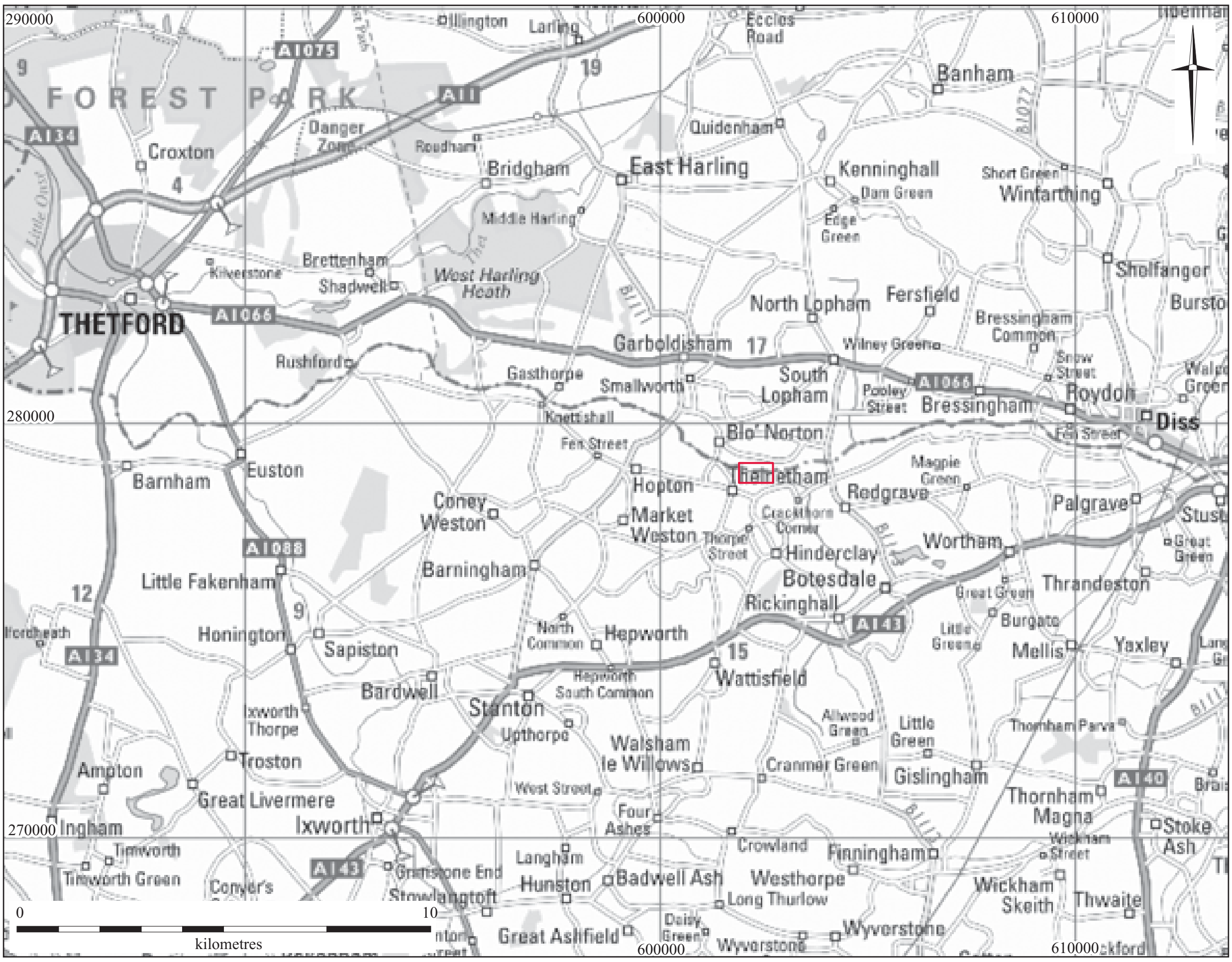
The site is situated at *c.* 22m OD and comprises approximately 5.36ha of flat grassland, open fen, woodland and scrub which was in the process of being cleared at the time of the evaluation. The majority of the site is former fen and is marked as such on early Ordnance Survey maps. However in recent years the land has been turned over to agriculture and has been cultivated as well as being used for pig farming. It seems likely that parts of the fen were also cut for peat, perhaps during the 19th century or before.

A soil auger survey undertaken by Ipswich-based consultants Ecology, Land and People (ELP), on behalf of the LOHP, revealed thick deposits of peat (between 50cm and 150cm deep), the latter containing intermittent lenses of silt, white clay and shelly marl over the entirety of the site. Where the base of the deep peat was encountered it was underlain by a uniform sandy gravel basal layer (ELP 2008).

Geology/ geomorphology of the Little Ouse – Waveney Rivers area

The solid geology underlying the recent peat, sands and gravels, and glacial till consists of Upper Chalk (Mathers *et al.* (Bristow 1990). However, within the area between Thelnetham Fen and Bungay this is overlain by the Boulder Clay of the Anglian glaciation; the chalk here lying considerably closer to surface much nearer to Lopham Ford (immediately to the east of Thelnetham Fen). To the east of this point the boulder clay is made up of thicker spreads of (chalky flinty) Lowestoft Till, whilst to the west this clay much is lighter and sandier (Bennet 1884). The east-west valley of the Little Ouse-Waveney rivers cuts through this boulder clay plateau at around 50-60m OD, the valley itself being occupied by low terraces of sand and gravel interrupted by areas of wetland either side of Hopton Ford. From west to east these wetland pockets include those of Hopton Fen, Buggs Hole, Blo' Norton and





Based on the Ordnance Survey 1:2500 map

Figure 1. Location map

Thelnetham Fens, Hinderclay Fen, Blo'Norton Little Fen, Lopham Little Fen, Redgrave and Lopham Fens, and Bressingham Fen.

The valley itself may owe its origin to the action of sub-glacial erosion which took place during the Anglian glaciation (West 2009). During the succeeding Hoxnian Temperate Period, deposits of fine waterlain material were deposited right across this area, much of which appears to be linked to the action of slow-flowing water associated with a re-established drainage system, most probably in the form of lakes. The subsequent Wolstonian glacial phase was characterised by a lowered sea level, thus the lowering of the base line of erosion, with down-cutting taking place either side of Lopham Ford where a barrier across the Waveney - Little Ouse Valley had been formed in the shape of the Lopham Terrace. The widening of the valley in the Lopham Ford area appears to have taken place before the Lopham Terrace sediments were in place, although the processes causing the depressions which contained the Redgrave, Lopham, Bressingham and Thelnetham Fens were clearly at work both before and after the deposition of the Terrace. As such these depressions were long-standing features which since the Hoxnian were further developed through hydrogeological and periglacial processes (West *ibid*.,7). What does seems certain though is the former existence of lakes beneath these localised fen mires; most of the latter being associated with the main valleys rather than with their tributaries.

West (*ibid*., 95) summarises the sequence of deposits and events within the Little Ouse and Waveney valleys: freshwater interglacial deposits form within the drainage catchments during the Hoxnian, then at the beginning of the Wolstonian stage we see downcutting in the Little Ouse Valley followed by solifluction and fluvial aggradation, then further downcutting and the formation of the Little Ouse Lake and the deposition of the Lopham Sands. This coincides with overflow into the Waveney Valley through the Lopham Terrace barrier, further downcutting, then capture of the Little Ouse headwaters by the fledgling River Waveney and further fluvial aggradation (the formation of low terraces). Within both of these areas we witness the formation of additional freshwater interglacial deposits during the Ipswichian, followed by further down-cutting and fluvial aggradation during the Devensian, and finally, the localised development of peat and the deposition of alluvium during the Flandrian.

The present drainage system is characterised by a narrow watershed (corresponding to Lopham Ford) that lies mid-way between the Little Ouse River, which flows westwards into the Wash, and the Waveney River which flows eastwards into the North Sea.

Geomorphology of Thelnetham and Blo' Norton Fens

Thelnetham Fen lies to the south of Blo' Norton Fen, and immediately to the south of the Little Ouse River, the basinal area of this being separated from Hinderclay Fen to the east by the flatter area of the Thelnetham Terrace, a deposit of sand with seams of fine gravel, and part of the Lopham Sands barrier dissected by a range of north-south abandoned channels. West (ibid. 22-25, 27 Figs 3.1 – 3.3) describes the formation of the Thelnetham/ Blo' Norton Fen basinal depression in terms of original solution and 'collapse' (possibly ice-related?) of areas on the surface of this 'flat' terrace. The formation of this depression encouraged the diversion of the original north-south course of the Thelnetham Brook north-westwards following the damming of the original channel within the area of Hinderclay Fen Wood. It is suggested this was caused by an ice blockage resulting from spring-line seeping and freezing into the path of the stream. The course of the resulting 'escape' channel (stream course 'C': Fig.3.1) underlies Thelnetham Fen. This is now peat-filled, being one of a number dissecting the north sloping Lopham Terrace, subsequently exposed as a result of later degradation of this surface. The Thelnetham Terrace may in fact be a younger, lower terrace than the Lopham Terrace, there being a surface at a similar height on the north side of the Little Ouse, just to the east of Blo' Norton Fen. Meanwhile, the presence of an original depression within this area is suggested by the detailed topographic mapping produced by LOHP; the latter shows a lowering of the surface from the sandy 'flat' (c.23.5m OD) north-west towards the deeper basin underlying Thelnetham and Blo' Norton Fens.

The valley of the Little Ouse widens to accommodate both of these fens. This takes the form of a rectangular-shaped area of fen encompassing almost the whole of the floodplain. At its western margin the fen suddenly constricts, the latter forming a restricted channel which marks the course of the Little Ouse through the more sandy terraced areas. Bellamy and Rose (1960) drew a section through the Thelnetham Fen sediments from its south-eastern corner through to the Little Ouse. This showed organic sediments thickening to the north and reaching a depth of almost 2.5m close to the Little Ouse River. The floating 'fen mat' marked as recent fen deposits overlay a 'watery marl' within a basin confined to the north by 'highly humified fen peat' (West *ibid.*,27). It was thought this stratigraphy might be interpreted as being regrowth of fen following flooding of old peat cuttings dissecting older humified peat. Tallantire (1969) made preliminary observations on the lake and organic sediments underlying these fens, proposing the existence of former meres, and providing relevant pollen records relating to this and to the nearby Lopham Fen (1953).

Historical and Archaeological Background

The project area lies within an area of known prehistoric activity much of which occurs along the course of the River Little Ouse. The villages of Thelnetham and Blo Norton, between which the project area is situated, date to the medieval period, thus medieval and post-medieval sites, buildings and find spots are relatively common in the vicinity. The historical and archaeological background of the project area and relevant sites listed on the Suffolk Sites and Monuments Record (SMR) are detailed below:

Prehistoric

Palaeolithic sites identifiable through the presence of rolled or fresh artefacts are not uncommon within the Little Ouse Valley between Theford and Brandon, and have been recorded and published from the time of Evans (1897) onwards, most recently by Wymer (1985). Assemblages including Levallois type flakes suggests the presence of communities located on the chalk along this western edge of the Fens during the

Wolstonian cold period, prior to the establishment of the Little Ouse Lake. However, there appears to be little evidence for Palaeolithic occupation between Barham Heath and Bungay.

Although no sites have been excavated in the vicinity, later prehistoric activity is indicated by a number of find spots along the upper reaches of the Little Ouse as well as by cropmark evidence. The most pertinent known site occurs within the project area, but outside immediate the area of archaeological impact on Parker's Piece. This site comprises an artefact scatter including pottery, flint and a quern stone fragment (Suffolk SMR No. THE 014). The artefacts were found in 1958 and provisionally identified as Iron Age although it is noted in the Suffolk SMR that the finds could equally date from the Bronze Age. Either way the finds clearly indicate activity, potentially settlement, on the sand ridge (?) adjacent to Thelnetham Fen. More recently burnt stone has been recovered from the ground surface at Thelentham Fen (W. Fletcher *pers comm*.). Although the origin of this material is unknown it may well be connected to the Bronze Age/Iron Age site.

A series of other prehistoric findspots along the Little Ouse river valley including worked flint were noted along a number of the 'fen edge' sandy ridges by members of the LOHP project team (H. Smith *pers comm*.). These finds suggest such prehistoric activity is more widespread. There can be little doubt that the areas of fen along the Little Ouse and Waveney valleys would have provided a rich resource for prehistoric communities and although only limited evidence is known at Thelenetham Fen, sites in the Cambridgeshire fens, and the Bronze Age to Roman causeway at Beccles in Suffolk, highlight the potential for exceptionally preserved waterlogged sites surviving within fenland environments.

Outside the planned conservation area, a ring ditch possibly representing a Bronze Age funerary monument is visible as a cropmark at Bridge Farm to the west of the project area (Suffolk SMR No. THE 013). In addition slightly to the north-west of this site a ploughed out mound/earthwork (Suffolk SMR No. THE 004) with associated flint artefacts was observed in the 1950s. Only limited information exists regarding the 'mound' and whether it represents a burnt stone or flint mound, or even a denuded Bronze Age barrow is unknown.

Roman

Only limited evidence for activity dating to the Roman period exists within the area. The evidence entirely comprises surface finds and includes coins and pottery, none within the immediate vicinity of the project area.

Medieval

Surface finds, particularly metal finds made by metal detectorists in the area around Thelnetham, indicate an early medieval presence in the area dating back to at least the middle Saxon period. The settlements of both Thelnetham and Blo Norton are also listed in the Domesday Survey of 1086 suggesting they have pre-conquest origins.

Later medieval remains are more widespread although only a few extant medieval buildings survive in the villages. The churches of St. Nicholas in Thelnetham and St. Andrew in Blo Norton both have surviving medieval elements in their architecture. In addition Church Farmhouse in Blo Norton dates from the late 15th century and is thought to have originally been a manor house.

Other medieval remains include the remains of a cross base and shaft in Thelnetham, two moated sites - one to the south of Thelnetham and one to the west of Blo Norton - which probably represent the sites of medieval manors, and the site of a deserted medieval village to the west of Blo Norton.

Post-medieval

A large number of post-medieval listed buildings dating from the 16th to 19th century survive in Thelnetham and Blo Norton. The majority of the listed buildings are timber framed cottages and farmhouses but also include a windmill dated to 1819, which is located immediately to the west of Parkers Piece, and a 19th century school house.

As a potential source of peat fuel, it is possible that this or neighbouring fen(s) were exploited for peat during the post-medieval and probably medieval periods. Intensive peat cutting is well documented in the Little Ouse and Waveney valleys, for example in Blo' Norton a "Fuel Allotment" for parishioners was included in the Enclosure Award of 1822 (White 1845). During similar conservation work at Blo' Norton Fen to the north of the project area substantial trenches indicative of relatively large scale peat cutting were noted (P. Frizzell *pers comm.*).

Methodology

The project was undertaken in accordance with a project specification (Standring 2008) produced in response to a brief for archaeological evaluation written by W. Fletcher (2008) of Suffolk County Council Archaeological Service. The work was carried out in full accordance with the IFA's *Standard Guidance for Archaeological Field Evaluation.*

The trial trenching programme was designed specifically to mitigate any archaeological impact caused by the clearance of degraded peat unsuitable for habitat regeneration. The clearance requires the removal of peat to a depth of 0.2m or 0.4m across the majority of the site and to a depth of 1m in the planned location of a 'fen pool'. Accordingly trenches were excavated to an arbitrary depth of 0.4m or 1m depending on their location.

A total of five 2m wide trial trenches plus an additional judgemental trial trench - 244m of trenching in total – were excavated (Figure 2). Trenches were excavated using a 360° tracked excavator fitted with a toothless bucket under direct archaeological supervision at all times.

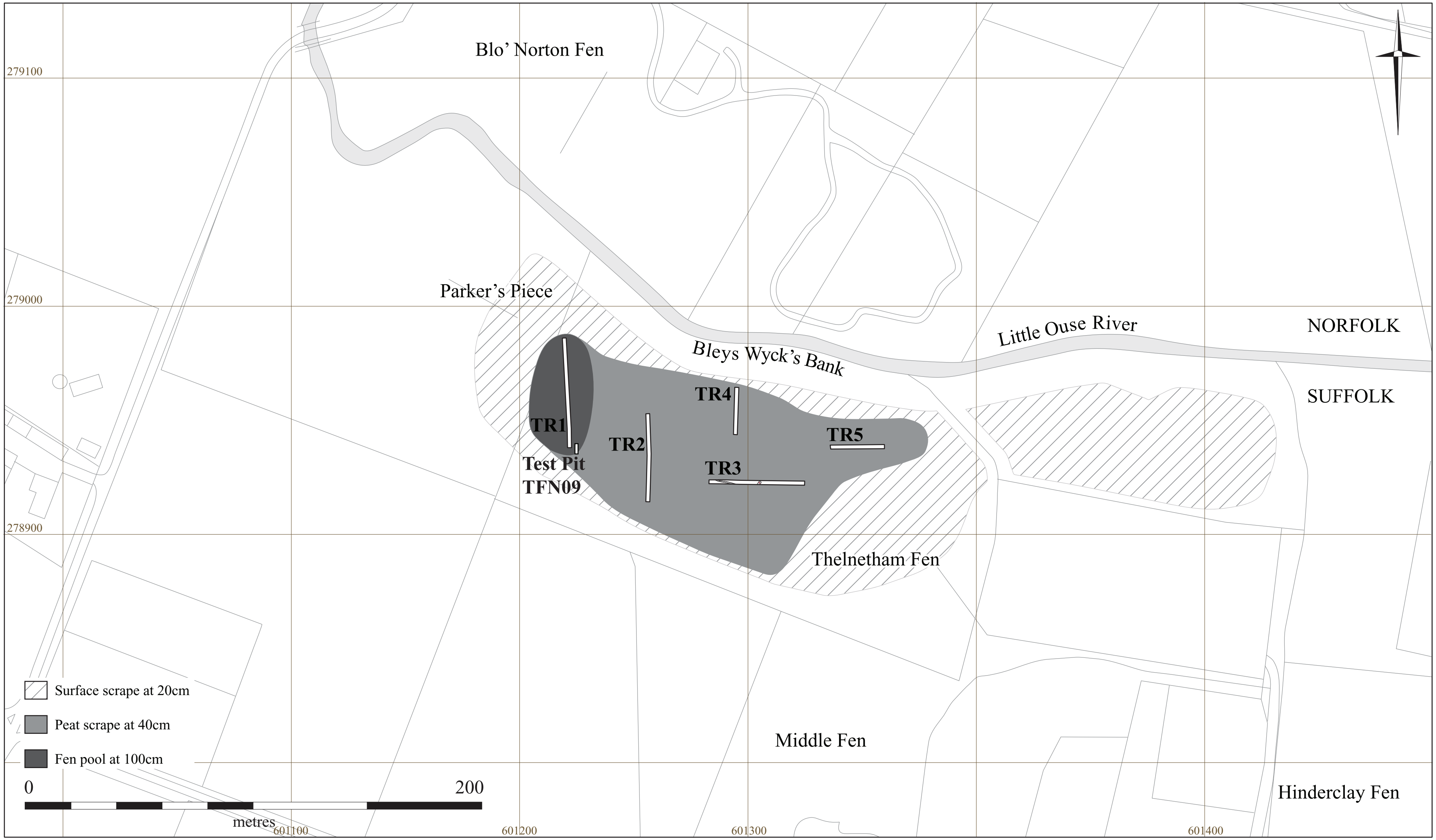


Figure 2. Trench location plan

The trenches were located using an advanced Global Positioning System (GPS) with Ordnance Datum (OD) heights obtained. Potential archaeological features, were planned at a scale of 1:50 and subsequently sample excavated. All potential features were hand excavated and archaeological finds retained. A written record of archaeological features and environmental sequences was created using the CAU recording system (a modification of the MoLAS system) and sections drawn at an appropriate scale.

The 1.8m deep (*c.* 4m^2) test pit dug in June 2009 consisted of a stepped pit in which the step corresponded to the level of the interleaved clay/sand and silt horizon located in between the upper and lower peat layers. To one side of this was dug a metre deep sump designed to keep this test pit relatively free of water whilst it was being recorded and sampled.

The site code was THE 031.

RESULTS

The depositional sequence observed in each trench was basically the same across the site and comprised a degraded peat topsoil overlying peat in various states of preservation. All of the trenches were excavated wholly within the area / depth of the peat (as required by the LOHP project design), with only Trench 1, the deepest of the six trenches, making contact with the interface between the peat and the underlying basal sands. This was also the case with the environmental testpit (TFN09 TP1).

Trench 1

Trench 1, aligned north to south, measured 2m wide by 50m in length and was excavated to an arbitrary depth of *c.*1m. The soil profile comprised 0.3 – 0.4m of degraded peat topsoil overlying peat which was recorded to a depth of 1m, at which point the interface between the peat and the underlying basal sands was encountered over the majority of the trench. Within the undisturbed peat deposit, and sealed by the surface degraded peat layer, were three square but slightly irregular cuts (**F.5, F.6, F.7**), each of these possessing rounded corners, and each containing both marl lenses and layers of peat in a slightly different sequence (SEE Figure 3). The features were approx. 2m to 3m wide and up to 1m deep, and each was about 4m apart; all of them aligned very approximately E-W, seemingly extending beyond the limits of excavation to the west. The infill lenses had irregular, diffuse edges with flattish bases and were filled by a mid brown silty clay with thin layers of light grey marl a maximum of 01.m thick, containing often dense deposits of snail shells. No artefacts or any evidence of modern intrusive material(s) were noted. The regularity of the arrangement of these implied that these could have been peat cuttings, though the fact that they were only encountered on the west side of the trench, and that they were irregularly shaped, places some element of doubt on this. If not anthropogenic, then these marl and peat-filled features could represent small pools infilling the hollows of old tree throws. One of these features (F.5), however, shows clear signs of having been re-cut (a 1m wide rounded cut) on its south side.

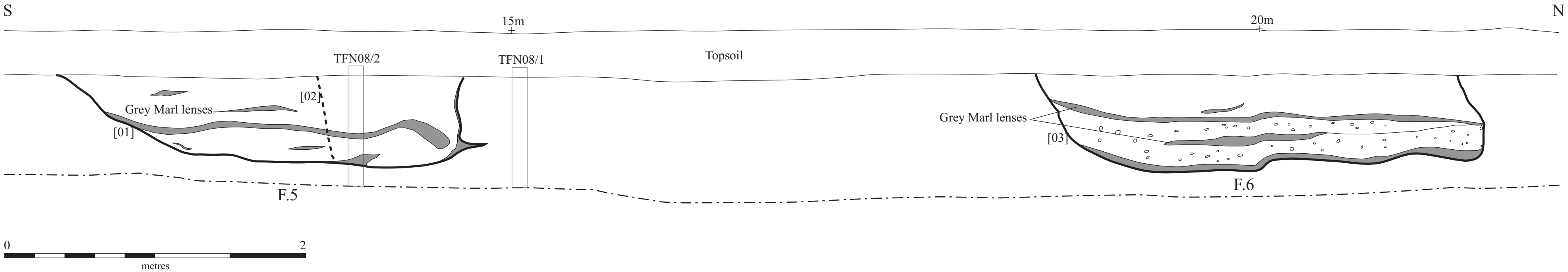


Figure 3. Plan and section of features in Trench 1 showing points of monolith samples

The peat stratigraphy of the undisturbed peat was recorded on the south side of F.5, and from this same section two peat monoliths (TFN08/1: c.80cms) were collected (Figure 3). The description of this section is as follows, the layering of which can also be correlated with the peat observed within the upper half of Test Pit 1 (Figure 4). This location of the latter test pit section was immediately to the south-east of the southern tip of Trench 1 (see Figure 2).

monolith samples

<TFN08/1>

	Layer A	Peaty topsoil	0-28 cm
UPPER PEAT	*Layer K*	Dark grey-black well humified peat	28-50 cm
	Layer L	A more compressed, black, humified peat with some wood fragments	50-60 cm
	Layer M	Brown, dense, humified peat	60-70 cm
	Layer I	Dark grey-black humified peat, loose and pasty consistency with light brown detrital wood inclusions	70-100 cm
	Layer J	Dark grey-black peaty silt and sand with flint gravel, roots and wood inclusions	85-103 cm

below this within **Test Pit 1** (TFN09):

<TFN09/1>

7110 +/-50 BP	UPPER PEAT	*Layer N*	Grey silt and sand with flint inclusions	103 – 120 cm
		Layer O	Lens of white clay	103 – 110 cm
		Layer P	Lens of humic silt with reed and roots (buried soil)	120 – 125 cm
		Layer Q	White clay gleyed horizon (sub-soil or lake mud	120 – 147 cm
		Layer R	Grey silty sand lens	147 – 155 cm
		Layer S	Humic clay horizon (buried soil?) lens	150 - 155 cm
7170 +/-50 BP	LOWER PEAT	*Layer T*	Dark black peaty laminae	155 – 157 cm
		Layer U	Woody peat and organic mud	158 – 165 cm
	water table…….	*Layer Y*	White clay + roots (eroded/wash out soil)	165 – 168 cm
		Layer W	Lens of peat	165 – 170 cm
		Layer X	Grey sand and flinty gravel	170–185 cm+

The recorded peat stratigraphy infilling **F.5** (TFN08) Trench 1 was as follows:

REDEPOSITED PEAT	*Layer A*	Peaty topsoil – medium grey pasty (bioturbated and/or plough truncated)	0-28 cm
	Layer B	Pale grey-cream pasty peat with thin whispy streaks of shell marl (gastropods)	28-30cm
	Layer C	A grey brown peat with silty humic laminae	30-42 cm
	Layer D	Pale grey marly peat with woody inclusions	42-45 cm
	Layer E	Brown peat with both marly and humified incl.	45-54 cm
	Layer F	A thicker lens of marly peat similar to D	54-62cm
	Layer G	Light brown coloured peaty silt with shell, reeds, and woody inclusions	62-80 cm
	Layer H	Thin, dark and streaky black peat inclusions	77-85 cm
	Layer G	as above	80-95 cm

Figure 4. Location of TFN09 Test pit 1 showing section of Upper Peat

Figure 5. Monolith TFN09/1 (85-185cm) prior to its removal. From the lower peat section within Test Pit 1

Trench 2

Trench 2, aligned north to south, measured 2m wide by 40m in length and was excavated to an arbitrary depth of *c.*0.4m. The soil profile comprised 0.2m to 0.3m of degraded peat topsoil overlying desiccated / humified peat, the depth of the trench was wholly within the depth of the peat and no underlying deposits were encountered. No archaeological features were encountered and a thin lenses of light grey marl sitting on the surface of the peat and sealed by the degraded peat topsoil is likely to be re-deposited material.

Trench 3

Trench 3, aligned east to west, measured 2m wide by 50m in length and was excavated to an arbitrary depth of *c.*0.4m. The soil profile comprised 0.3m to 0.4m of degraded peat topsoil overlying a desiccated / humified peat with silty clay lenses, the depth of the trench was wholly within the depth of the peat and no underlying deposits were encountered. Two features (**F. 3** and **F. 4**) were encountered in the trench. F. 03 was a shallow gully, recorded for a length of *c*. 8m, which measured 0.4m wide by 0.35m deep. It had vertical sides and a flat base and contained a silty clay topsoil-like fill. F. 04 was a regular, shallow rectangular feature which extended beyond the limit of excavation to the south. It measured 0.9m across by 0.2m deep with vertical sides and a flat base, once again, it was filled by a silty clay topsoil-like material. Neither feature yielded any finds and both were cut into the peat and sealed by the degraded peat topsoil. The regularity of the features and the nature of the fill suggests they are almost certainly modern features and are probably associated with agricultural drainage or the recent pig farming on site.

Trench 4

Trench 4, aligned north to south and measuring 2m by 22m (not excavated to its full length due to the presence of a tree stump), was excavated to an arbitrary depth of *c.*0.4m. Between 0.25m and 0.4m of degraded peat "topsoil" was removed to expose the desiccated / humified peat present across the site. With the exception of a lens of marl within the peat (part of **F.5**) measuring 0.75m across and of undetermined depth, no features were encountered in Trench 4. The only find comprised a horseshoe which was recovered from the degraded peat topsoil.

Trench 5

Trench 5 was aligned east to west and measured 2m wide by 25m in length. Once again it was excavated to an arbitrary depth of *c.*0.4m. The soil profile was consistent with the other trenches excavated and comprised 0.3 – 0.35m of topsoil overlying desiccated / humified peat. No archaeological features were exposed within Trench 5 although fragments of waterlogged, unworked wood were found 'floating' in the peat deposit. The fragments were identified in the field as probably oak (W. Fletcher *pers comm.*).

Trench 6

Due to the presence of small fragments of bog oak within Trench 5, following discussion with W. Fletcher of the Suffolk County Council Archaeology Service, one further trench was excavated 1.5m to the south of, and parallel to, Trench 5. Once again, the trench was excavated to an arbitrary depth of 0.4m and measured 2m wide by 0.12m in length. The soil profile comprised entirely degraded peat "topsoil", with the interface of the "topsoil" deposit and the underlying desiccated / humified peat only just exposed at a depth of 0.4m. No archaeological features were encountered and no further fragments of waterlogged wood were exposed. A series of shallow, clayey silt filled hollows within the peat are interpreted as a combination of root disturbance (one such hollow contained semi-waterlogged tree roots) and remnants of topsoil.

DISCUSSION

Archaeological evidence

The programme of evaluation at Parkers Piece and Bleswycks Bank has not revealed any significant archaeological remains. The only features identified were modern features cut into the peat deposits which are considered to be the result of agricultural practices. No features were found to be sealed by the peat and the only material encountered within the peat itself were natural silt and marl lenses and fragments of waterlogged, unworked wood.

To some extent this result is to be expected given the fact that over the majority of the trenches only the top 0.4m of degraded peat was removed. The highest potential for the survival of archaeological remains is likely to be below this level or on former land surfaces sealed by the peat, the latter remaining largely unaffected and preserved *in situ* over the majority of the site. The lack of any clear evidence for peat cutting is perhaps more significant, suggesting that this area of Thelnetham Fen was never intensively exploited. The E-W 'trench' features cut through the peat (F.5-F.7) seem too narrow and deep for peat cuttings, though caution must be exercised here given that the peat cuttings examined on air photos or from later diggings into these fens have often been described as 'lines of old peat trenches' (Tallantire 1953). Meanwhile, some of the circular features encountered (such as at Lopham Little Fen Lake) might have been pits dug to extract the marl lenses for the purposes of agricultural improvement (Tallantire 1969). The most likely explanation is that these represent examples of medieval or post-medieval channels dug to drain the fen and bring this into agricultural use. Certainly such cuts are very unlikely to be natural.

Palaeoenvironmental and dating evidence

The dating of this peat sequence and its palaeoenvironmental investigation has provided important new information on the Holocene history of this series of peat mires, none of which to my knowledge has previously been examined in this way. These radiocarbon dates are thus the only clear chronological markers for the date of these post-glacial meres and channels and the formation of the overlying peats.

The sequencing of the two fairly close radiocarbon dates as well as the pattern of pollen increase and decline confirms that what we are dealing with here is an undisturbed peat profile unaffected by peat cutting and/or re-growth. The two dates have also provided a lot more certainty as to the period of active peat formation taking place within this large post-glacial depression formed on the surface of the Thelnetham Terrace (as well as within the diverted channels of the Thelnetham Brook), whilst the average rate of peat formation calculated can help with suggesting a date for its beginning, though probably not its end.

The approximate date of active peat formation has turned out to be much earlier than expected at around **8000** years before present ((Beta-260685 **7170 +/-50 BP** [Cal BC 6070 to 5970 OR Cal BC 5950 to 5910]) at 160-155 cms and (Beta-260686 **7110 +/-50 BP** [Cal BC 6030 to 5850]) at 106-101 cms); the average rate of peat accumulation over this depth (160 – 101 cms) being about 0.75cm per year. Assuming some constancy in the early depositional environment, we might therefore be witnessing a date for the onset of peat growth somewhere around 6050 - 6000 BC. However, the presence of well humified layers within the peat at depths of less than a metre suggests that what we are looking at here from the dated section of peat upwards reflects a slower rate of accumulation than this, and perhaps therefore, a longer expanse of time.

Whilst it is possible that the upper layers of peat were still forming on the fen prior to its drainage and 'improvement' for agriculture which took place more than 150 years ago, it seems likely that the pollen record recorded up to the level of the topsoil disturbance is still entirely a record of the prehistoric vegetation history. However, the identification of a single cereal pollen grain within the uppermost level of sampled peat (at 36-35 cms depth) suggests that the very top of this must have been at least Neolithic or later in date. If, as originally identified, this is of oats (*Avena sativa*), then the presence of this cereal is likely to place the top of the sequence well within the Iron Age or even post-prehistoric period, something which seems unlikely on the basis of the peat accumulation rate recorded, and the shape and composition of the existing pollen diagram. It would be much safer to assume that in the absence of any further cereal pollen, or zonal pollen indicators, we should consider it rather unlikely that the sampled record extends beyond the Neolithic/ Early Bronze Age.

There are few local or directly relevant palynological studies with which the current pollen diagram and interpreted vegetation history can be compared. The now somewhat outdated work undertaken by Tallantire at Lopham Little Fen (1953), and on the deposits of the 'Bressingham-Langfen Lake' underlying the Blo' Norton – Thelnetham – Crackthorn Bridge fens (1969), exclusively examines lake sediments dating to the period of the Late Glacial to Post-glacial boundary (associated with the Allerod climatic oscillation).The pollen record from this thus bears very little resemblance to that recovered from the stratigraphically and chronologically more recent peats deposited within the overlying fen basins. Much more relevant is the work by Peglar et al. (1989) and Peglar (1993) on the vegetation and land-use history of the area around Diss Mere in Norfolk. The site of Diss Mere lies under the town of Diss which is located some 10km to the east of Thelnetham Fen. The cored pollen record covers some 7000 years from the Devensian Late Glacial up to the modern period. The post-glacial section of this pollen record charts the rise in *Betula* and its replacement by *Corylus* in the early Holocene (with *Pinus* absent but present locally elsewhere), and subsequent to that, the rise in mixed deciduous forests containing *Tilia*, *Ulmus*, *Quercus*, *Corylus*, *Fraxinus* and *Alnus*. Although the pollen record has no associated radiocarbon marker dates, it seems likely that the period of mixed deciduous forest growth referred to above is broadly equivalent to the 6000 – 5500 BC (Early-Middle Mesolithic) dated section of the Thelnetham Fen peat profile. Having said that, the differences between the two vegetation histories indicated are quite marked. The main growth in mixed deciduous woodland occurs after about 6000 BC at Thelnetham Fen, and is preceded by a peak in pine, moreover, there seems to be no significant elm present, and thus no evidence for elm decline which often characterises the beginning of the Neolithic. The pattern at Diss is followed by forest clearance and the cultivation of barley and other cereals in the Bronze Age. A more detailed comparison of the Thelnetham pollen record with this and other similar fen mires awaits a more detailed study of the vegetational and palaeoenvironmental history of the Thelnetham – Blo'Norton Fens.

One other important agricultural (cultivation) species indicator recorded within the peat fen basins of the Upper Waveney – Little Ouse River valleys is Cannabiaceae pollen; in particular that of *Cannabis sativa* or hemp which was grown alongside wheat and cereal crops nearby from Anglo-Saxon times onwards (Peglar et al. *ibid.*) In fact, cannabis appears so frequently as pollen within some of the upper parts of the peat profiles that it has been suggested that hemp retting ponds may have been dug on or close to some nearby fens such as those of Thompson's Common or Bugg's Hole (Bradshaw *et al.* 1981). On account of the dates of this activity the absence of *Cannabis* pollen within the Thelnetham Fen pollen record was completely expected. In fact, this only serves to confirm the pre-Medieval origin of this peat and the relative lack of disturbance of these deposits.

In summary, at around 6050 BC the base of the Thelnetham Fen pollen record shows just a small rise in oak and hazel, alongside a rise in the fen aquatics accompanied by a large wet meadow flora dominated by just a few taxa, predominantly docks and sorrels. Tree pollen then seems to disappear until the rise of oak and hazel around 6000 BC (at 155-160 cms) which is immediately followed by a significant peak in pine. Before this we see the maximum of the low diversity herbaceous wetland (at 130 cms) followed by a rise in the Ranunculaceae (buttercups) and plantains (Plantaginaceae), grasses, alongside an increase in the diversity of herb species. This period immediately preceding the rise in woodland is the only horizon where we see significant anthropogenic indicators appearing such as the ruderal genera *Chenopodium* sp (fat hen) and *Plantago lanceolata* (ribwort plantain) – the latter a typical indicator of waste ground disturbance; perhaps in this case associated with some form of human settlement or land clearance, the herding of animals, or else foraging. The small rise in tree pollen seems to equate with the occurrence of woodland ferns (common polypody) and rise in bracken and bryophytes. Meanwhile, the area of open water or mire associated with this and neighbouring fens may have been expanding, with the number of and diversity of aquatic plants increasing (see Appendix 1). The first increase in oak occurs at 95 cms, accompanying small rises in birch, elm, beech, alder and a more significant presence of hazel. This then declines at the same time as the pine peaks, the latter perhaps associated with stands of scots pine found growing on the sandy ridges in between the fen basins. A significant increase in the diversity of the herb flora perhaps reflects species rich swards developing within woodland clearings. This is followed by a major increase in oak between 65cms and the top of the peat at 35cms, followed by alder and lime. These tend to reflect relatively short-lived peaks, whilst the hazel pollen appears to be reduced. Thereafter the evidence for a stable percentage of hazel pollen might suggest some sort of controlled exploitation; either as removal of the understorey brushwood or as coppicing. If the latter, we might more typically be looking at Neolithic/ Bronze Age activity.

Overall the scale of human influence on this landscape seems small, although there are at least some indications of man's presence. What is not clear here is to what extent the appearance and disappearance of woodland taxa is being controlled by man (given the relatively small pollen signals we are dealing with), whilst we know little of the date of some of these events. Likewise, it remains difficult to judge how the vegetation succession and changes within the surrounding habitat are affecting the development of the fen, with or without man's interference. However, there does seem to be a relationship between the rise in tree pollen (thus the expansion of woodland) and the increase in diversity and abundance of the fen aquatics and sphagnum. Perhaps the encroachment of woodland may simply reflect a decrease in use of open land and clearance, and as a result an increase in the impeded drainage.

The poor preservation of plant seeds within the peat samples attests to the drying out of the peat, or perhaps the repeated hydration and dehydration affect on this accompanied by oxidation associated with the change in water table. The latter situation may be linked to land management or abandonment practices which have taken place over the last 150 years. Unfortunately, this study of the plant macrofossils adds little to that gained from the pollen. However, the survival of some of the more robust seeds such as bramble attests to past drier conditions on the surface of the fen. Though indifferently preserved elsewhere, some of these seeds have survived well enough to show at least some of the significant changes which have taken place during the early vegetational history of the site.

One can only assume that the bottom of the pollen record also reflects the origins of the fen some 8000 years ago; the latter appears to be linked to the growth of damp meadow vegetation containing some boggy areas associated with moss and *Equisetum*. These areas later developed into small pools of open water containing aquatic plants, reeds and sphagnum, parts of this eventually becoming a mire.

Future analysis of the molluscs, ostracods and charophytes associated with the peat and marl horizons, alongside the beetles from the peat, might add considerably to our knowledge of this former fen environment.

Acknowledgement

The archaeological trenching was supervised by Jonathan Tabor who also provided the archaeological sections and undertook the background archaeological research. Andy Hall and Brian Crossan produced the graphics for this report and Robin Standring (CAU) was project manager. Dr Tim Mighall (Department of Geography, Aberdeen University) undertook the preparation of the pollen samples and also the finished pollen diagram based on the data supplied by ST. The work was carried out at the request of the Little Ouse Headwaters Project (LOHP), the site management and liaison of which was undertaken by Helen Smith. The funding for the palaeoenvironmental work was provided through a grant given to LOHP from Natural England. The consultant for the restoration work on the Blo' Norton and Thelnetham Fens was Mike Harding of ELP, Ipswich. On site the machining and conservation work was managed by Peter Frizzel. Will Fletcher (Suffolk CC) monitored the archaeology.

APPENDIX 1

POLLEN ANALYSIS AND RADIOCARBON DATES

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CAU

Sampling locations

2008

During the 2008 trench evaluation two sections within Trench 1 were sampled (SEE section in Figure 2). The first was of the section of peat infill (or regrowth) within the cutting for F.5 (see section log above), this being sampled and recorded at 13.9m from the southern end of this trench and removed from the East-facing section (x2 monoliths of 50cm and 30 cm: sampling from 30cm to approx. 1m below the top of the peat topsoil). The second sample was of the undisturbed peat which lay just to the north of this feature (at 15m from the south end of the trench). Again this was sampled using two monolith tins of 30cm (top) and 50 cm (bottom). The section examined was from 25 cm to 106 cm below the top of the peat (i.e. from the base of Horizon A to the very bottom of Horizon J at the silty peat/ sand interface (base of the peat)).

Only the second section of undisturbed peat (sample TFN 08/1) was sub-sampled for the purposes of pollen analysis.

2009

Three 30cm monolith tins (Figure 5) were removed from the machine-cut stepped section of Test Pit 1 (2.85m x 1.8m x 1.85m deep) which lay just a short distance to the east of the southern end of Trench 1 (Figure 4). The latter was temporarily kept free of water by pumping. The top of this monolith sample sequence (at 95cm below the top of the peat/topsoil) coincided stratigraphically with the base of the upper peat previously sampled for pollen in Trench 1 (TP08/1). The 'Lower Peat' consisted of buried peaty soil(s) separated by marly clay intercalations and a woody peat/ organic mud horizon at its base. These monoliths (TFN09/1) were sampling the peat and clay from 95cm to 185cm below the top of the peat/ topsoil (i.e. Horizon J to Horizon X (the natural grey sand and gravel).

Other samples taken

Apart from the pollen monoliths, bulk samples were also taken from the recorded section within Test Pit 1. These were taken from 30-50cm and 60-80cm below the top of the peat to analyse for plant macrofossils/ seeds and molluscs, as well as for beetles. A shell marl lens visible within the upper peat at a depth of 20-45cm was sampled for the possible future analysis of ostracod and charophyte remains. Two other peat samples were removed from depths of 101-105cm and 155-160cm below the top of the peat for radiocarbon dating this environmental sequence (Figure 6)

Methodology

After logging and visually describing the stratigraphy of each of the sampled monoliths, one centimetre thick slices (between 10-28 gm) were carefully removed with a scalpel from the cleaned face at approx. 10cm intervals, the only other consideration on the sampling distance being to restrict this, wherever possible, to those defined horizons rich in organic material.

Some 8 pollen samples: 35-36cm, 45-46cm, 56-57cm, 65-66cm, 75-76cm, 85-86cm, 95-96cm, and 105-106 cm were sub-sampled from sub-sampled from monoliths TP08/1. Below this, another four sub-samples were removed from TP09/1: 126-127cm, 151-152cm, 156-157cm and 169-170cm. It was intended that this pollen study would form the basis of a reconstructed vegetation history of the site.

The twelve pollen samples were packed damp into small polygrip sample bags and were sent for processing (a pollen concentration) at the Department of Geography at the University of Aberdeen; the work there being supervised by Dr Tim Mighall.

Pollen preparation

Following standard practice for pollen preparation, exotic spores (in this case *Lycopodium clavellata*: 250 spores) were added to each of the weighed and further sub-sampled samples as a means to assess final pollen concentration (abundance) in the results. The preparation procedure followed was that of the standard acetolysis technique used on samples recovered from peat substrates with little or no silica present (Erdtman 1960). This involved the potassium hydroxide digestion (boiling) of samples in order to remove humic materials, followed by centrifuging and washing. The pollen-rich pellets were then subjected to acid hydrolysis (acetolysis) involving washing these in glacial acetic acid in order to dehydrate the organic content followed by the addition of acetic anhydride and concentrated sulphuric acid, then boiling this to remove cellulose Moore *et al.* 1991) The washed, centrifuged and rinsed pellets were then dried using alcohol and preserved in clear silicone fluid for mounting. The pollen samples were returned in small vials.

Pollen identification and counting

Glass microscope slides were made up and these were looked at using a light microscope with an illuminated field of view, the counting of spore and pollen grains being undertaken using a graticule eyepiece and a combination of the x10 and x40 objectives. Because of the relative paucity of pollen within some of the levels looked at it was decided to count only 150 pollen grains per slide. Spores of *L. clavellata* were counted separately from other lycopods. Bryophytes and ferns were recorded alongside pollen grains, and a range of palynomorphs, some of which included invertebrate exoskeleton parts and larvae, a variety of fungal spore types. On account of the indifferent preservation of some of the pollen, this was recorded just to generic level. An assessment of the degree of preservation and abrasion of the pollen grains was provided where relevant.

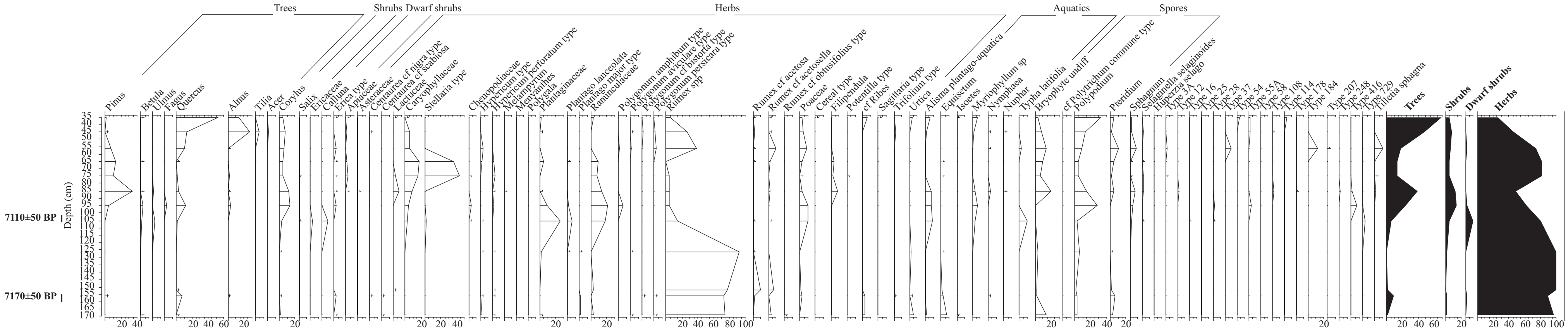

Figure 6. Telnetham Fen pollen diagram

Pollen diagram

The data is presented as a pollen diagram (Figure 6). This was compiled from sub-sampled peat horizons recovered from the southern end of Trench 1 *as well* as from Test Pit 1. The depth here was recorded at 10cm intervals on the vertical axis with pollen shown graphically as a percentage; the entries are divided up according to genus (sometimes to species), and are arranged in columns under the headings of trees, shrubs, dwarf shrubs, herbs, aquatics, spores and palynomorphs. An overall assessment (sum total) of trees, shrubs and herbs is also provided, along with a graph of the total land pollen (TLP).The two radiocarbon dates have been added.

Results (SEE Figure 6)

At the very base of the peat sequence between **170-165cm** (horizons W and Y) there is a low incidence of tree pollen with only birch, oak and a small amount of hazel recorded, though with a present but low incidence of ericaceous or heathland flora such as heather (*Calluna* sp.), some plantains, buttercups (Ranunculacea), nettle, *Polygonum* sp (knotgrass), followed by a much more significant peak (75 grains) of *Rumex* spp (docks and sorrel). There is also a minor presence of aquatics (including *Equisetum*) at this level. However, a clear indication of bracken and of bryophytes (mosses) suggesting that the site may be marginal to a number of different environments; for this instance this could be an area of wet meadow with pools, fringe heathland and wood, but without any developed grassland. The absence of clear anthropogenic indicators of disturbance such as *Plantago lanceolata*, or any evidence for cultivation, suggests there is little in the way of human activity nearby.

By the time we reach **160-155 cms** we see some small-scale but probably significant changes, chief amongst which is a small rise in the tree pollen, most of it oak, though with records of pine, alder and hazel. The low incidence of ericaceous shrub persists alongside a low, but slightly more diverse herb flora. Slight reductions in both the buttercups and docks and sorrels may also be significant, alongside a drop in *Equisetum*, bryophytes, common polypody fern and bracken. Considering the level of pollen present one should not infer too much from this, though the tree pollen data may represent a rise in deciduous forest, but probably not immediately local to the site, given the persistence of docks and sorrels and the lack of any typical woodland margin flora. The radiocarbon date obtained from the peat of this horizon (Beta-260685 ***7170 +/-50 BP*** [Cal BC 6070 to 5970 OR Cal BC 5950 to 5910]) suggests a date some 7900 to 8000 years before present, effectively during the Early to Mid Mesolithic.

Between **155-145 cms** we see a loss of tree pollen, and possibly also in the diversity of the grassland species (though pollen of the Lactucacea and *Hypericum perforatum*, a hedgebank or scrub weed, are recorded). Perhaps more significant though is a slight increase in the buttercups (Ranunculaceae), as well as the docks and sorrels, in particular *Rumex acetosa* and *R. acetellosa* (sheep’s sorrel) – the latter indicating a slight rise in a low diversity damp meadow flora. The absence of aquatics reflects the absence of open water, whilst the decline in ferns, bracken and the mosses probably reflects the loss of woodland margin.

There is no pollen data for the 20cm of peat above this, but that from **130-125cm** suggests a continuity in the low level, or near absence of woodland presence, though at this point we see the very beginning of a rise in hazel. Similarly, low diversity grassland herb species begin to increase, with fat hen (*Chenopodium* sp), plantains (including *P. lanceolata*) and the docks (*Polygonum* sp) being indicators both of damp meadow and disturbance (ruderal species). The latter coincides with the highest incidence of *Rumex* spp. (docks and sorrel) for the whole pollen sequence; most of this pollen being well preserved, though indeterminate to species level. Equisetum was recorded, whilst the slight rise in bryophytes, common polyplody and bracken suggests woodland margin, or at least damp shady conditions.

Above **125cm** there appears to be a very gradual rise in the tree pollen, some herbs (apart from the docks and sorrels) and aquatics. At **106cm** the increase in hazel, birch, and willow, which is then followed by oak, alder, elm and pine. Whilst these remain low, the consecutive increase does seem to reflect the rise in mixed woodland, though the absence of ferns, in particular common polyplody, implies that this woodland may not be immediately local. The presence of heather pollen alongside that of the aquatics such as water plantain (*Alisma plantago-aquatica*), water-milfoil (*Myriophyllum* sp) and reedmace (*Typha latifolia*), plus a rise in the sphagnum, suggests an interesting mix of freshwater pools forming (thus localised fen) with much drier tussocks and/or heathland fringe on the sandy ridges. The (relatively) high incidence of grasses attests to these more open conditions, though the absence of sedges (Cyperaceae) is perhaps a little confusing with respect to the gradual increase in wetter conditions. There may also be an issue of pollen preservation here (NB the poor survival of grasses). Particularly significant is the prominent peak at this point in the plantains and buttercups (Ranunculaceae) which replace the docks and sorrels (*Rumex* spp). A significant record for *Plantago lanceolata* suggests the presence of disturbed grassland nearby. Along with the rise in grass pollen this may indicate clearance and perhaps animal grazing. The radiocarbon date from this horizon (Beta-260686 ***7110 +/-50 BP*** [Cal BC 6030 to 5850]) not only helps to confirm the unbroken nature of this sequence, but also the very rapid rate of peat formation taking place during this period (up to 0.75cm accumulation per year).

At **95cm** we witness a small peak in the oak pollen which accompanies a similar rise in hazel, the latter presumably as a woodland understory species. Very low peaks in the other mixed woodland species such as birch, elm, alder and beech probably reflects the more distant location of this woodland which seems to be dominated by climax oak. Accompanying this is a peak for spores of the common woodland polypody fern. Meanwhile, the significant (beginning) to a rise in the pine pollen probably reflects a quite different location to this scots pine – the latter probably found growing as clumps upon the dry 'Breckland type' sandy ridges surrounding these fens. Statistically this rise in tree pollen corresponds to the main decline in the herbaceous pollen count, yet the diversity of meadow flora, if anything, increases. The sample horizon does not equate with many peaks in pollen, although the campions (Carophyllaceae) and daiseys (Lactucaceae) do seem to accompany a distinct peak in the Ranunculacaea, alongside a very significant drop in the docks and sorrels. The continuing presence of grass pollen attests to the persistence of meadow, whilst the drop in the Plantaginaceae (and much poorer condition of this pollen) suggests that the source of this disturbance may well have been removed. At this point the aquatics also appear to be high, with water milfoil and water plantain. At the same time we are witnessing a small but significant rise in sphagnum spores and palynomorphs. Despite the statistically low percentage of spores, there seems little doubt that these are indicators of the still-forming fen.

Behind the **90-80 cm** maximum in the tree pollen lies a substantial peak in pine (of up to 47 grains). In fact this rise accompanies a significant decrease in the oak and other mixed deciduous pollen, apart from hazel, which continues to remain high. In fact, the pine declines from this maximum level to the present. Decline in the pollen of the woodland fern common polypody probably reflects this change from a mixed deciduous dominated woodland habitat to more open coniferous woodland. The herbaceous flora at this level appears to be fairly diverse, reflecting the local development of meadow around the fen. This flora includes the daisies and campions, buttercups, St. John's Wort (*Hypericum* sp.), and either meadowsweet or dropwort (*Filipendula* sp) – all indicative of damp species-rich grassland. However, the development of the fen habitat continues. The presence of aquatic plants and small peaks in the bryophytes and in sphagnum reflect this, though the absence of sedge and reed pollen is difficult to explain.

At **75cm** the dominance of pine over deciduous pollen (though at a much reduced level) continues. Both hazel and oak remain low, though a record of willow and also of birch might reflect the development of scrub fen carr. The aquatics remain low and there also seems to be a drop in bryophytes, common polypody and bracken. Amongst the herbaceous species we find peaks in campion, but particularly in stitchwort (*Stellaria* sp) pollen, the latter being a genus common to fenland margins, perhaps even suggesting localised drying-out The continuing presence of St. John's Wort (*Hypericum* sp) and buttercups perhaps also reflects this damp meadow/ fenland edge, alongside the presence of *Filipendula* sp and Potentilla-type (tormentil).

Between **70-60 cms** pine already seems to be in decline and the total assemblage is once again dominated by herbaceous pollen. Interestingly though, we begin to see another rise in oak pollen; the persistence and now gradual rise in the accompanying hazel reflecting the very slow expansion of woodland. However, at this early level of increase, we see relatively little diversity in the pollen. Interestingly both bracken and common polypody fern also appear to show an increase. The presence of Ericaceae in small amounts may reflect some drying out, there being relatively little sign of the aquatics, although both the non specific bryophytes and sphagnum appear to be on the increase, perhaps linked to the long term continuance of fen and peat formation. In this respect the presence of peat mire palynomorphs (Types 37, 184 and *Tilletia sphagni*) could be of interest, though the significance of this remains to be elucidated.

Oak pollen continues to rise between **60-55 cms**, followed by a sharp increase in alder. The percentage of hazel pollen, by contrast, appears fairly stable; though it is not clear whether the small rise and fall in this reflects any sort of woodland management. The presence of woodland margin is suggested by the continuing rise in the common polypody fern and bracken. The herbaceous pollen meanwhile remains moderately diverse, the sudden drop in campion and stitchwort being replaced by a corresponding rise in the docks and sorrels (*Rumex* spp.). Another rise in the grass pollen accompanies small increases in the docks and knotweed, cow parsley and St. John's wort. Moreover, the increase in generalised damp conditions is suggested by the rise in bryophyte spores and sphagnum, and in the peat profile, mire palynomorphs.

Towards the top of this peat section (between **50-45 cms**) we can see a significant rise in tree pollen, most of this caused by the large peak in alder (40 grains). This may reflect the presence of a riverine wooded margin to the adjacent Little Ouse River, or alternatively the growth of alder around the edges of the fen. Oak also begins to rise very steeply at this point, and this is accompanied by a more gentle rise in hazel, followed by small increases in lime and maple pollen. The rise in the common polypody fern spores mimics the rise in oak pollen almost exactly, suggesting the presence of reasonably close naturalised woodland. However, the abundance of pine, perhaps a feature of the late prehistoric landscape, has now completely disappeared. Meanwhile, in terms of the herbaceous flora, traces of cow parsley and knotweed accompanies a much smaller percentage of campions, buttercups (Ranunculaceae), wild currant and grasses. The decrease in the docks and sorrels at this point probably also reflects the increase in woodland and the general reduction in open grassland/ wet meadow areas surrounding the fen. Within the fen, the decrease in mosses and sphagnum are perhaps countered by an increase in the aquatics, notably water plantain, milfoil, water lily (*Nuphar* sp) and sweet flag (*Acorus calamus*). However, there is no evidence at all to suggest that the area of fen was increasing. Most probably the opposite was true. The pollen towards the top of this peat sequence seems quite degraded, yet it is still identifiable and reasonably abundant.

The very top of the recorded sequence (**35-36 cms**) rests within the humified peat layer just beneath the topsoil. Whilst the preservation of pollen grains within this is poor, the pollen itself is reasonably abundant. The most notable feature is the abundance of tree pollen, in particular oak (78 grains), though alder is also high (21 grains), but is declining by this point. The rapid drop in the latter may reflect the removal of trees, or else the loss of alder habitat with the draining or drying out of the fen. The much smaller presence of hazel, pine and lime also shows a decline. This is in sharp contrast to the oak, the abundance of the latter suggests the presence of a moderately large area of mature oak woodland near by; this perhaps surviving to within the last 2-300 years. The low diversity of the herbaceous species is reflected by the reduction in the abundance of docks and sorrels, buttercups, and campions, although the pollen of wild currants may still reflect the presence of a woodland margin, alongside the occurrence of nettles (*Urtica* sp). A slight increase in the aquatics, and their diversity, is reflected by the occurrence of water plantain, water milfoil, and arrow-head (*Saggitaria saggitifolia*). Whilst grass pollen is negligible, or not preserved, a single pollen grain identified as oats (*Avena sativa)* from this horizon forms the only evidence for cereal recovered from the entire sequence. This might be thought of as confirming a post-prehistoric date, though it is probably unwise to try and date the top of the peat on this basis alone. There exists the possibility this represents a different cereal, or alternatively, the pollen of wild oats (*Avena* sp.). In summary, what it seems possible to say is that this horizon is most likely post-Mesolithic (Neolithic or later) in date. The increasing degee of humification of the peat above 85 cms depth suggests that the rate of accumulation of this was probably quite different between 100 cms and the topsoil boundary at 30 cms. The now missing truncated top to this peat, may well have been more modern.

APPENDIX 2

MACROFOSSIL PLANT REMAINS

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Two bulk samples from Test Pit 1 (2009) were part processed for their environmental remains.

Method

Up to 500ml of samples <5> (30-50 cm depth) and <6> (60-80 cm depth) were wet-sieved and scanned by A. de Vareilles to assess the quality and quantity of waterlogged plant macro-remains. Both the flots obtained were large, but these were predominantly composed of root and wood fragments, most of which may be intrusive.

Results

Any seeds these once contained appear to have almost completely disappeared. The few that were found have tough outer coats making them more resistant to decay. These include those of alder (*Alnus cf. glutinosa*), buttercups (*Ranunculus sp*.), common fumitory (*Fumaria officinalis*) and bramble (*Rubus sp.*). Unfortunately seeds have not survived in sufficient quantities to provide past environmental information.

NOTE

The remaining material within the two bulk samples <5> and <6> has been kept for purposes of examining the molluscs. This was not processed, but will be retained for investigation at a later stage in the project. The sample from the upper shell marl at 25-40cms has not yet been examined for charophytes or ostracods.

REFERENCES

Bellamy, D.J. & Rose, F. 1960 The Waveney-Ouse valley fens of the Suffolk-Norfolk border. *Transactions of the Suffolk Naturalists' Society, 11*: 367-385

Bennett, F.J. 1884 The geology of the country around Diss, Eye, Botesdale and Ixworth. *Memoirs of the Geological Survey* (England & Wales)

Bradshaw, R.H.W., Coxon, P., Greig, J.R.A. & Hall, A.R. 1981 New fossil evidence for the past cultivation and processing of hemp (Cannabis sativa) in Eastern England, *New Phytologist 89*: 503-510

Bristow, C.R. 1990 Geology of the country around Bury St Edmunds, *Memoirs of the British Geological Survey, Sheet 189* (England & Wales)

ELP 2008 *Habitat management work at Parkers Piece and Bleyswycks Bank supporting the restoration of Blo'Norton and Thelnetham Fens SSSI/SAC*, October 2008 (unpublished document)

Erdtman, G. 1960 The acetolysis method. *Svensk. Bot. Tidskr. 54*, 561-564

Evans, J. 1897 *Ancient Stone Implements, Weapons and Ornaments of Great Britain*. 2nd ed. revised. London, Longmans, Green

Moore, P.D., Webb, J.A. & Collinson, M.E. 1991 *Pollen Analysis*. 2nd edition. Blackwell Scientific, Oxford, 216pp

Peglar, S.M. 1992 The development of the cultural landscape around Diss Mere, Norfolk, during the past 7000 years, *Review of Palaebotany and Palynology 76*: 1-47

Peglar, S.M., Fritz, S.C., & Birks, H.J.B. 1989 Vegetation and land-use history at Diss, Norfolk, UK, *Journal of Ecology 77*, 203-222

Standring, R. 2008 *Thelnetham Fen, Little Ouse Headwaters Project: Project specification for archaeological evaluation*, December 2008

Tallantire, P.A. 1953 Studies in the Post-glacial history of British vegetation. XIII. Lopham Little Fen, a Late-glacial site in central East Anglia. *Journal of Ecology 41*: 361-373

Tallantire, P.A. 1969 Three more nameless meres from the Ouse-Waveney valley, *Transactions of the Norfolk and Norwich Naturalists' Society 21*: 262-268

West, R. 2009 *From Brandon to Bungay: An exploration of the landscape history and geology of the Little Ouse and Waveney Rivers*, published by Suffolk Naturalists' Society, Ipswich Museum , 136pp

White, W. 1845 *History, Gazetteer and Directory of Norfolk.*

Wymer, J. 1985 *Palaeolithic Sites of East Anglia*. Norwich, Geobooks.