# APPENDIX I

## LITERATURE REVIEW

## THE SUFFOLK RIVER VALLEYS PROJECT:
## A REVIEW OF PUBLISHED AND GREY ARCHAEOLOGICAL AND PALAEOENVIRONMENTAL LITERATURE

# The Suffolk Valleys River Project: a review of published and grey archaeological and palaeoenvironmental literature

**Tom Hill[1], William Fletcher[2] & Clare Good[3]**

[1] *Birmingham Archaeo-Environmental, University of Birmingham, Edgbaston, Birmingham, B15 2TT.*
[2] *Suffolk County Council Archaeological Service, Shire Hall, Bury St Edmunds, IP33 2AR..*
[3]*Suffolk County Council Archaeology Service, St Edmund House, Rope Walk, Ipswich, IP4 1LZ.*

## Geological Background

The regional solid geology of East Anglia is described in detail by Chatwin (1948) and is summarised here. The oldest bedrock crops out in the extreme northwest of the County and comprises Jurassic-age Kimmeridge Clay unconformably overlain by thin beds of Cretaceous Greensand and Gault Clay. These deposits, in turn, are overlain by Cretaceous Chalk, which is the dominant bedrock lithology within Suffolk. From an archaeological perspective, the Chalk is a very significant lithology, as although the fossil-rich Lower Chalk is devoid of flint, the Middle and especially the Upper Chalk has an abundance of flint nodules. These flint deposits, derived from Pleistocene glacial and fluvial erosion, and in later prehistory mined by Neolithic peoples, were the primary material used for stone tools (discussed further below). This type of flint has continued to be a significant commodity since that time.

During the Early Tertiary (Eocene), marine conditions initially returned to the region, depositing the clays of the Thanet Beds, before regional uplift resulted in the deposition of fluvial sands (Reading Beds). Both the sands and clays of the Thanet and Reading Beds are limited in their spatial extent to the extreme southwest of Suffolk, around the Brett, Gipping and Deben Valleys. Shallow marine and marginal marine conditions returned during the Late Tertiary (Pliocene), leading to the deposition of shelly sands (the Norwich Crag and Red Crag), which crop out along the entire East Anglian coastline. The deposits, overlying the Early Tertiary sands and clays to the south and Cretaceous Chalk to the north, were aggraded in response to repeated fluctuations in regional sea level within the North Sea basin. A hiatus in sedimentation then occurred in the Suffolk region until the glaciations of the Quaternary period (described below).

Over the majority of Suffolk, these bedrock lithologies do not crop out at the surface due to the extensive cover of both Pleistocene (glacial tills, fluvial and fluvioglacial sands and gravels and aeolian sands) and Holocene (riverine and estuarine alluvium and peats) superficial deposits that blanket the region.

## Quaternary Palaeoenvironments

The lowland landscape of the Suffolk region has undergone significant change during the last 2 million years of geological time, a period known as the Quaternary (further divided into the Pleistocene and Holocene Epochs). The Pleistocene is characterised by episodes of intense cold termed glacials separated by warmer periods termed interglacials. During glacials, prolonged low temperatures allowed the accumulation of snow and ice in the form of glaciers and more extensive icesheets. In the uplands, glacial erosion was significant and in lowland regions, such as East Anglia, deposition was dominant. This deposition took the form of sediments laid down directly by glacial action (termed tills or boulder clays) or indirectly by associated meltwaters (termed glaciofluvial deposits). In these sparsely vegetated polar deserts, the action of wind was also important and extensive coversands were deposited during the last glaciation and form the impressive landscape of the Breckland today (Bateman & Godby, 2004).

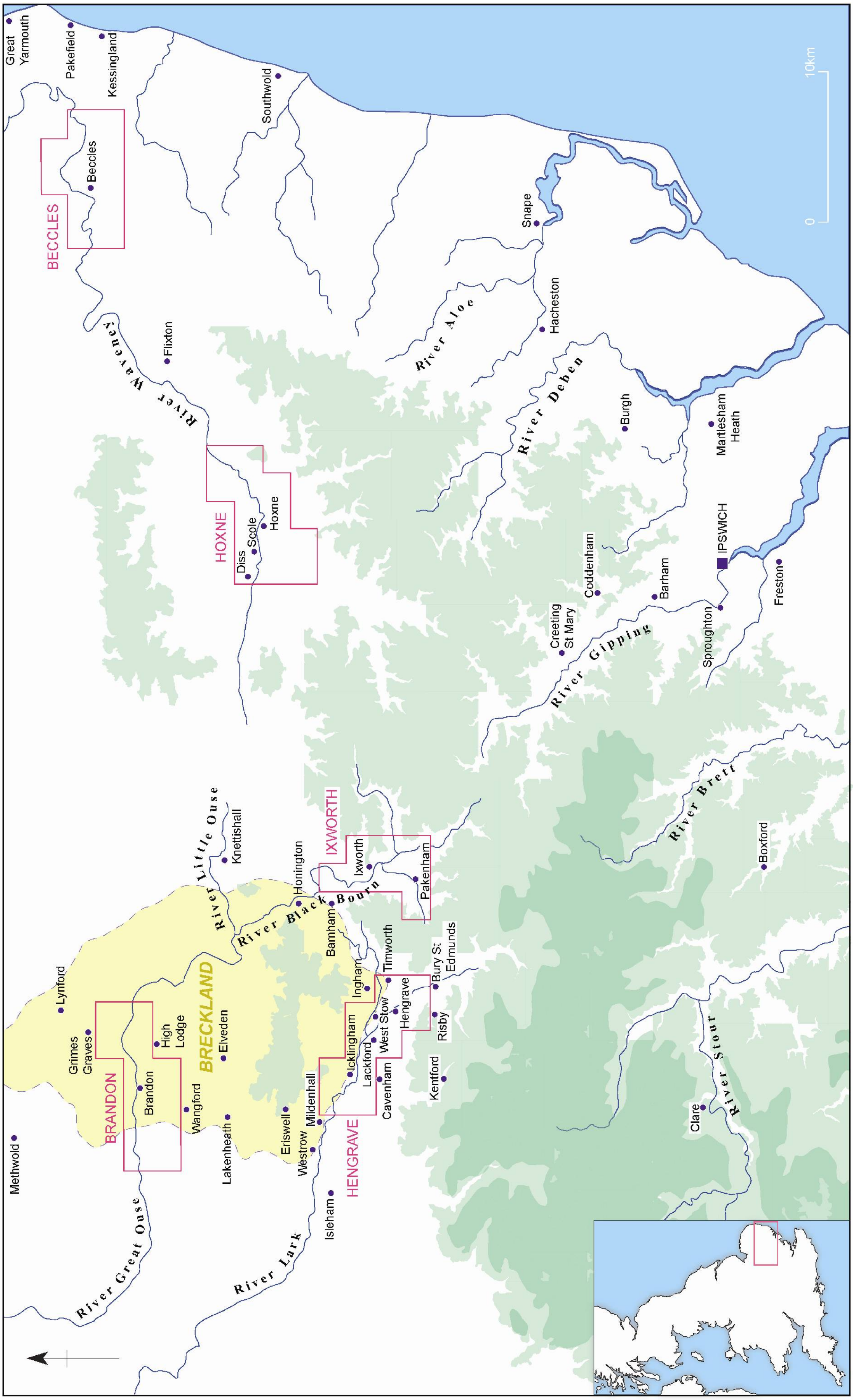



**Figure 1:** Map of Suffolk, identifying study areas of the Suffolk River Valleys Project as well as site locations of archaeological and palaeoenvironmental significance.

Fluctuations in sea level were also a significant factor when considering the evolution of the East Anglian coastal lowlands throughout the Quaternary. During periods of intense glacial activity much of the water from the world's oceans was stored in vast ice sheets, resulting in drastic reductions in global sea level and the development of a lowland landscape significantly different to that present today. During the Devensian Last Glacial Maximum (LGM; *c*. 22,000 yrs BP) for example, sea level was some 120m below present (Lambeck, 1995). As a consequence, much of the southern North Sea basin was no longer submerged by the sea, creating land bridges between south-east England and continental Europe. This would have enabled population migration to occur between the previously separated land masses. In contrast, interglacial periods experienced sea levels that were similar to, or above, the present day, flooding land bridges and restricting subsequent population movement.

The importance of East Anglia to the Quaternary history of Britain is indicated by the identification of a number of stratigraphic type sites for Pleistocene climatic stages within the region (e.g. Cromerian, Anglian, Hoxnian, Ipswichian; Wymer, 1999). As a consequence, much of the palaeoenvironmental and archaeological research that has been undertaken in Suffolk has been focused upon the Early and Middle Pleistocene palaeogeographies.

The oldest terrestrial sediments that have been studied are fluvial sands and gravels, which crop out beneath Anglian glacial sediments (the Lowestoft Till) at Ingham (TL 853 704) and Timworth (TL 861 693) in the Lark Valley, proximal to the River Little Ouse at Knettishall (TL 971 804) and also along the east coast at Pakefield (TM 536 906; Bridgland & Lewis, 1991; Lewis & Bridgland, 1991; Lewis & Rose, 1991; Stuart & Lister, 2000). These sediments are part of the Bytham River System (Rose 1994; Rose *et al*., 2001) and are dated on the basis of regional fluvial correlations and glacial stratigraphy; although not precisely dated, they are argued to have been deposited around the early Middle Pleistocene, during a series of both warm and cold stages possibly centred around the Cromerian Interglacial complex (680-750ky BP; Parfitt *et al*., 2005). At Pakefield these sediments have yielded the earliest known artefactual evidence for human occupation currently recorded in the UK (Parfitt *et al*., 2005). From archaeological finds further inland at High Lodge (TL 739 754; Cook *et al*., 1991) and Warren Hill, Mildenhall (TL 744 743; Wymer *et al*., 1991) and deep within the English Midlands at Waverlerley Wood (SP 367 722; Keen *et al*., 2006), it appears that this river system was an important migration path for the earliest hunter gatherers.

The subsequent Anglian glaciation destroyed this major drainage artery and the Suffolk area was covered by a large ice sheet, which further south diverted the River Thames into its present valley. Subsequent climatic amelioration at the end of the Anglian and associated downwasting and retreat of the ice front resulted in the deposition of glaciofluvial sands and gravels across the Suffolk lowlands. Fluvial incision through this newly created, freshly exposed landsurface (in response to continued low, but rising sea levels) resulted in the creation of a new drainage network, which formed the basis for that of the present today. Prior to the Anglian glaciation, palaeoflow data suggests the Bytham River flowed east across Suffolk towards the North Sea (Bridgland & Lewis, 1991). However, the extensive glacifluvial deposition within the region altered the drainage network entirely (Hunt *et al*., 1991).

Although Britain has experienced cold stages and periods of glaciation since the Anglian, unequivocal sedimentary evidence for glaciation following the Anglian is restricted to the Late Devensian Dimlington Stadial (Rose 1985). However, during the late Devensian, glacial ice did not advance further south than the north Norfolk coastline of East Anglia (Lambeck, 1995) and cold stage geomorphological activity has been restricted fluvial aggradation, coversand deposition and other periglacial processes (e.g. solifluction, development of pattern ground etc). In addition to this cold stage activity, fluvial aggradation and lacustrine deposition has continued during interglacials such as around Hoxne (TM 179 776) and High Lodge and has been an important focus of human activity.

Considering the timescale involved, very little research has been undertaken in relation to the palaeoenvironmental conditions present throughout much of the Suffolk region between the post-Anglian period and the Holocene. When palaeoenvironmental investigations have been undertaken on Palaeolithic archives, it has generally occurred to complement archaeological excavations. At Hoxne for example, the discovery of up to three separate flint industries led to the analysis of the environmental conditions present at the time of human occupation (Wymer 1985, Wymer & Singer 1993; Singer *et al*., 1993; Lewis *et al*., 2000). However, apart from site-specific investigations, little is known about the palaeoenvironmental potential of the stratigraphic archive in question. Subsequently, the spatial and temporal distribution of the post-Anglian sediments remains poorly understood.

Deposits of Devensian Late-glacial and Holocene age are likely to constitute the majority of the surface sedimentary deposits recorded within the Suffolk lowlands, although published research to date into post-glacial landscape evolution is limited. Late Devensian and Holocene river activity is evident between Lackford and West Stow in the Lark Valley (Hunt *et al*., 1991). Although undated, it is suggested that Early to Mid Holocene gravel aggradation was replaced by the deposition of organic muds and peat during the Late Holocene, reflecting a reduction in energy levels of the River Lark. At Sproughton, proximal to the River Gipping, Late Devensian periglacial slope deposits are overlain by lacustrine sediments dated to the Windermere Interstadial, c. 13,000-11,000 BP (*c*. 11,000-9,000 BC; Rose *et al*., 1980). Subsequent climatic deterioration during the Loch Lomond Stadial, *c*. 11,000-10,000 BP (*c*. 9,000-8,000 BC) encouraged enhanced fluvial activity, resulting in channel incision into the lake deposits and further sand and gravel aggradation. Holocene peat deposits, varying in thickness from 0.8 to 2.4m, overlie these Loch Lomond Stadial sands and gravels. Rose *et al*. (1980) believe that, at Sproughton at least, the position of the River Gipping has remained stable and fixed over the last 9,500 years. If such channel stability is a common feature of the post-glacial East Anglian landscape, this has important implications for the palaeoenvironmental and cultural archaeological potential of the Suffolk valleys and adjacent counties.

In the Breckland of central East Anglia, aeolian dune landforms developed within the coversand deposits during the Late Holocene period and have revealed alternating episodes of (dune) reactivation, migration and stability in response to changes in climate (aridity) and anthropogenic agricultural activity, resulting in the reduction in vegetation cover and lowering of regional water tables (Bateman & Godby, 2004). In addition, sea-level change may have been an important factor in such aeolian activity. Changes in relative sea level would influence local water tables and hence affect the landscape stability and sedimentary regime of a region (Waller, 1994). Irrespective of the mode by which dune stability and migration is controlled however, the potential for the burial and preservation of archaeological material renders such depositional archives of great palaeoenvironmental and archaeological value. An example of the potential of such dune activity is supported by a major 'sandflood' event in the Brecklands in the 1650's, which resulted in the burial of walls and destruction of houses (Wright, 1668). Whilst radiocarbon dating is the most popular method of providing a chronological understanding to sedimentary deposits, thermoluminescence dating has been proven to be a successful technique for non-organic material. Thermoluminescence dating for example was applied to coversand samples taken from Grimes Graves, East Anglia (TL 820 892), suggesting rapid wind-blown sand deposition *c*. 14,500 yrs BP (*c*. 12,500 BC; Bateman, 1995). Therefore accumulation occurred prior to the Younger Dryas period which does not correlate with most wind-blown sites in Britain. The structureless nature of the coversand is believed to be a consequence of post depositional periglacial activity on the deposits during the Younger Dryas.

Whilst there are extensive sedimentary sequences present within the valley floors of the Suffolk region, the coastal lowlands of East Anglia also preserve valuable palaeoenvironmental archives.

Interbedded estuarine alluvium and freshwater peat deposits have developed during the Holocene in response to the post-glacial rise in relative sea level. Such deposits are found in abundance along the East Anglian coastline (Coles & Funnell, 1981; Brew, 1990; Brew *et al*., 1992; Waller, 1994), and reflect the influence of variations in the rate of relative sea-level rise, as well as factors such as glacio-isostatic movements, sediment supply and human activity on coastal evolution (Long *et al*., 2000). Such interbedded deposits are present throughout the coastal lowlands of southern Britain and northwest Europe (Allen, 2000; Bell, 2000; Streif, 2004) and form important geoarchaeological archives.

## Palaeolithic Archaeology and Palaeoenvironments

Brief reviews of past human occupation in Suffolk are provided by Clarke (1971) and Carr (1991), but a summary of past research utilising the most recent literature is provided here. Past archaeological excavations have concentrated in the northwest, the Breckland area, and in the southeast of the County, chiefly along the main river valleys and on areas where lighter soil has provided ideal settlement conditions. The location and distribution of previous excavations however, does not necessarily imply that other areas of archaeological potential may not be present within Suffolk. In addition, the review is by no means a complete summary of all the archaeological discoveries made within the County, simply due to the vast archaeological archive present. It does attempt to identify important themes within the available literature regarding the development of human activities within the region, referring to key sites of archaeological and environmental significance. If radiocarbon dating has been undertaken during previous research, where applicable, the computer program OxCal 4.0 was used to convert dates to calibrated years BC (Cal. yrs BC) where necessary (Bronk Ramsey, 1995; 2001).

**Palaeolithic**
**I. Introduction**
The Palaeolithic period discussed within this section concentrates on the period *c*. 750,000 to 10,000 BP (*c*. 8,000 BC). When considering the amount of evidence available compared to the timescale covered, it is fair to state that most aspects of the period are relatively poorly understood (Austin, 2000). However, the evidence discovered from within East Anglia has provided some of the most important information of human occupation for Britain.

**II. Lower and Middle Palaeolithic**
**(*c*. 750,000-40,000 BP)**
**Summary of Archaeology**
The detailed archaeological assessment of *The English Rivers Palaeolithic Survey* (Wymer, 1999) has provided much information regarding the Lower and Middle Palaeolithic archaeological archive that survives as recorded finds of stone tools within East Anglia. The timing of the colonisation of northern Europe by early humans is still the focus of much debate, but the sizeable number of artefact finds from across the Suffolk lowlands has contributed to the developing story. Recent excavations in the pre-Anglian fluvial deposits around Pakefield identified worked flints and a quantity of debitage, which are believed to date from the early Cromerian interglacial. These deposits are dated on the basis of regional fluvial correlations and glacial stratigraphy and although not precisely dated, these finds are argued to represent the earliest evidence for human occupation north of the Alps (Parfitt *et al*., 2005).

Throughout the nineteenth and twentieth centuries, excavations identified Lower and Middle Palaeolithic flint bifaces, cores, flakes, and scrapers at a number of sites within Suffolk (Suckling, 1846; Clarke, 1913; Wymer, 1985; Cook *et al*., 1991; Wymer *et al*., 1991; Lewis *et al*., 2000; Ashton *et al*., 2000, 2005). The lithic assemblages and the associated palaeoenvironmental records make the sites and excavations at High Lodge (Cook *et al*., 1991), Elveden (TL 809 804; Ashton *et *al*., 2000), Bramford and Foxhall Roads, Ipswich (Wymer, 1985) and Hoxne (Singer *et al*., 1993; Lewis *et al*., 2000) of international importance (Carr, 1991). The majority of Lower and Middle Palaeolithic finds are concentrated around lowland valleys proximal to the Waveney, Little Ouse, Lark and Gipping rivers (Clarke, 1971). At Elveden and Hoxne for example, the finds were concentrated in fluvial- and lacustrine-derived sediments, with subsequent stratigraphic and biostratigraphic analysis enabling these artefacts to be dated to the late-Anglian 'Oxygen Isotope Stage' 12 (OIS 12, 474-427ky BP) and post-Anglian periods (OIS11, 427-364ky BP; Ashton *et al*., 2000; Schreve, 2000).

The archaeological excavations undertaken at Hoxne typify the geological context of Lower to Middle Palaeolithic records of the Suffolk region (Wymer 1985, Wymer & Singer 1993; Singer *et al*., 1993; Lewis *et al*., 2000). At Hoxne, Lowestoft Till was identified at the base of the excavations, and was overlain by lacustrine deposits, which were in turn overlain by thick units of fluvial sands and gravels. An unconformity was recorded between the lacustrine and riverine sediments, indicating a period of erosion and possible hiatus prior to fluvial sedimentation. The majority of the artefacts were recorded within the fluvial sediments that overlie the post-Anglian lacustrine-derived sediments. The artefactual evidence was divided into a Lower, Middle and Upper Industry, with the Lower Industry comprising a primary context biface assemblage with biface manufacturing flakes. The bifaces found were mainly of ovate and cordate form (Wymer & Singer 1993). In addition, cores and flakes were recovered with several flake tools (occasional scrapers, denticulates, notches and a large thick flake, interpreted as a wedge). Microwear on the flint artefacts indicated woodworking and carcass processing. The condition of these Lower Industry artefacts does suggest that some may have been reworked by fluvial processes, and hence may therefore pre-date the period of fluvial activity. The Upper Industry consisted primarily of a core and flake tool assemblage (including finely worked scrapers). The combined cultural and environmental evidence suggests that human activity at Hoxne was likely to have centred around a stream and lake edge, with evidence for hunting and gathering including butchery, plant gathering, hide preparation (Wymer & Singer, 1993).

Archaeological excavations at Lynford, Norfolk (TL 825 948) revealed a palaeochannel containing in-situ mammoth remains and associated Middle Pleistocene (Mousterian) stone tools buried under *c*. 3m of sands and gravels (Boismier *et al*., 2003). The site is one of very few Middle Pleistocene open-air sites in the whole of Europe, confirming the site's importance when reconstructing human activity during this period. Optically stimulated luminescence (OSL) dating of the channel infill revealed deposition occurred *c*. 67ky BP and 64ky BP. This indicates the faunal and artefactual material preserved within the palaeochannel dates to the early part of the Mousterian (OIS 3), with evidence for a mixture of butchering and scavenging Hominid activity.

## III. Upper Palaeolithic
## (*c*. 40,000-12,000 BP)
### Summary of Archaeology

After the Hoxnian (OIS 11), human activity in Suffolk is relatively sparely represented in the archaeological record. Models of human occupation developed from artefact assemblages from the Thames Valley in southern Britain to suggest that humans were present during OIS 9 (the Purfleet interglacial, *c*. 340-320ky BP; Schreve *et al*., 2002) and OIS 7 (the Aveley interglacial, *c*. 250-190ky BP; Bridgland, 1994) but abandoned Britain during OIS 6, probably due to the harsh climatic conditions present (Ashton & Lewis, 2002). Currently, there is no evidence for humans visiting the British mainland during the last interglacial OIS 5e (the Ipswichian, *c*. 130-80ky BP) and it is suggested this may be due to higher relative sea levels breaching of the Straits of Dover, thereby severing the land-bridge with continental Europe. Although there have only been a few isolated sites discovered throughout Europe (e.g. Lynford Quarry in Norfolk; Boismier *et al*., 2003), humans are believed to have then returned to Britain during OIS 3 (the British Mousterian).

One notable exception is two distinct flint assemblages discovered within river terrace gravels at Kentford (TL 707 668), located within the valley of the River Kennett (tributary to the River Lark). The stratigraphic relationship of the fluvial terrace gravels to known late Devensian glacial deposits, suggests human activity within the valley pre-dates the Dimlington Stadial, though the precise age of the artefacts is unclear (Lewis, 1998).

In summary, the Palaeolithic artefactual evidence suggests the initial human occupation of the Suffolk lowlands was during the Cromerian Interglacial and evidence from Pakefield provides the earliest record of human activity of the British mainland. The Anglian glaciation disrupted occupation, but upon climatic amelioration during the late- and post-Anglian periods, humans returned to Suffolk, as demonstrated by sites such as Hoxne. Although evidence for Middle to Upper Palaeolithic occupation of the Suffolk area is sparse, this does not necessarily suggest that humans were not present within the region during this period.

**IV. Palaeoenvironmental Evidence**

A considerable number of stratigraphic type sites for Pleistocene climatic stages are recorded in Suffolk and adjacent areas, hence the names e.g. Cromerian, Anglian, Hoxnian, and Ipswichian (Wymer, 1999), and reflects focus of much of the palaeoenvironmental research on the Early to Middle Pleistocene (incorporating the Lower and Middle Palaeolithic).

Along the coastline between Pakefield and Kessingland, Early Pleistocene marine sediments are overlain by a sequence of marine sands, glaciofluvial sediments and Lowestoft Till (Stuart & Lister, 2000; Parfitt *et al*., 2005). Through the analysis of vertebrate and molluscan faunas, the Cromer Forest bed Formation provided evidence for the occurrence of at least 6 temperate phases prior to the onset of the Anglian glaciation, between 780 – 450ky BP. Plant remains, beetle assemblages and the presence calcareous nodules within the sediments suggests a warm seasonally dry Mediterranean climate was present, with July temperatures estimated to have been 18-23 ºC. The sediments are primarily composed of organic detritus, muds and sands laid down within channels and on the floodplains of rivers which drained the East Midlands before the Anglian ice sheets advanced into the region *c*. 450ky BP. In addition, pre-Anglian fluvial sands and gravels are present in the Lark Valley at Ingham and Timworth, and also at proximal to the River Little Ouse at Knettishall (Bridgland & Lewis, 1991; Lewis & Bridgland, 1991; Lewis & Rose, 1991). Regional lithostratigraphic analyses of the fluvial sands and gravels of the 'Bytham River' indicate that the sedimentary sequences comprise quartz and quartzite-rich rocks derived from the Triassic 'Bunter Pebble Beds' of the English Midlands (Rose *et al*., 2001). Palaeocurrent measurements from a number of sites within the Bytham River sediments within the River Lark Valley (Lewis, 1998) confirms that this major river drained a large part of Midland Britain joining an ancestral Thames in the vicinity of Ipswich (this palaeoflow during the pre-Anglian from west to east is opposite to that of the modern drainage network). Fine-grained river sedimentation in channels and in backswamp areas of the Bytham floodplain is recorded from organic rich sediments at High Lodge, Mildenhall, during the Cromerian (Cook *et al*., 1991). Pollen analysis identified the presence of pine/spruce woodland together with juniper shrub, herbaceous and heathland plants, whilst coleoptera assemblages indicated cool temperate conditions similar to that present in East Anglia today.

Climatic deterioration and the onset of glaciation during OIS 12 (the Anglian) destroyed this earlier Bytham drainage network, infilling the valleys and coastal lowlands with glacial till. The extensive deposition of Lowestoft Till throughout East Anglia is considered one of the most important chronostratigraphic markers in the British Pleistocene. Prior to climatic deterioration and ice incursion, archaeological evidence from sites at Pakefield and High Lodge indicates that this region was populated by early human hunter gatherers during the Cromerian interglacial, foraging at the edges of lakes and rivers.

Subsequent climatic amelioration and recession/melting of the Anglian ice sheet allowed readjustment to local base levels and incision by rivers into the newly exposed land surface, creating the contemporary drainage network. At Barnham (TL 875 787), the transition from the Anglian glacial into the Hoxnian interglacial is recorded by the upward transition from (glacial) sands and gravels into fluvial silts and clays. Environmental evidence indicates that this temperate river environment was slow flowing and surrounded by mixed deciduous woodland with areas of open scrub and grassland with a climatic setting warmer than that present today (Ashton *et al*., 2000). Archaeological evidence suggests that human occupation of the Suffolk lowlands initially concentrated itself around lake margins during the late-Anglian. However, as drainage network developed across the newly exposed postglacial land-surface, exploitation is likely to have expanded along the river corridors, which would have provided attractive food resources and routes for migration (Ashton *et al*., 2005). In addition, the coarse gravels exposed within the riverbed would have provided a plentiful supply of flint for toolmaking (White, 1998, Lewis *et al*., 2000).

**V. Gaps in Knowledge**

- There is significant evidence for pre-Anglian occupation of the region, particularly associated with the Bytham River (i.e. prior to OIS 12). It is essential that every opportunity is taken to inspect new exposures within these deposits to allow the identification and recovery of artefacts. In addition, organic-rich sediments associated within the Bytham River should be sampled and analysed for biological remains (pollen, insects, mollusc, macroscopic plant remains etc) to provide an environmental setting (climate and vegetation) for this early human activity.
- In contrast, with the exception of a few sites (e.g. Hoxne), evidence for Palaeolithic activity after the Anglian glaciation until the Upper Palaeolithic is extremely sparse. The concentration of Palaeolithic research on the pre-Anglian and early post-Anglian deposits may partly explain the absence of finds, as do issues of archaeological visibility and geological filtering (subsequent erosion/burial of material). Although an alternative, it is extremely unlikely that human occupation ceased in these river valleys. Every effort should be made to prospect for post-Anglian sites associated with human activity, for OIS 11 (the Hoxnian); OIS 9 (Purfleet), OIS 7 (Aveley) and into OIS 3 (the British Mousterian). In addition, although it is generally assumed that Britian was not occupied by humans during the last interglacial (the Ipswichian, OIS 5e). Similarly there is a lack of evidence for the post-Anglian-Late Devensian palaeoenvironmental conditions. The Middle Pleistocene site of Lynford Quarry, immediately north of the Suffolk border, demonstrates the potential for suitable archaeological and palaeoenvironmental archives in East Anglia.
- The gravel resources dating to the Palaeolithic are of significant importance due to the threat posed by mineral extraction. Taking this into account, many of the areas proximal to the River Gipping, River Lark and along the River Waveney (east of Hoxne) within Suffolk are under threat. Subsequent gravel extraction would result in the destruction of any overlying or in-situ organic deposits of archaeological and palaeoenvironmental importance.
- Devensian ice during the Dimlington Stadial (26ky-13ky BP; Rose, 1985), advanced into the region as far south as the north Norfolk coast. This would have reworked sediments and associated archaeological remains in the southern North Sea Basin within its path. In addition, some artefacts may have been deposited within outwash sands and gravels within the periglacial zone of which present day Suffolk would have been a part. Associated fluvial incision in response to new local base levels may also have caused the rivers to incise and gully the surrounding slopes (e.g. Gipping at Sproughton). Again, there may be the possibility of reworked archaeology being associated with slope deposits and valley floor sands and gravels of this date.
- Due to the impact of fluctuations in relative sea level on the coastal lowlands during the Palaeolithic, there is significant archaeological and palaeoenvironmental potential preserved in the immediate offshore zone of the North Sea. Research into the submerged landscape may identify substantial depositional archives suitable for further analysis, whilst potential

- Aeolian activity during the Devensian Late-glacial period has received relatively little attention within the Suffolk lowlands. Considering the abundance of evidence suggesting a North Sea provenance for much of the wind blown deposits around the UK (Catt, 2001), a significant palaeoenvironmental archive may be present that has yet to be utilised. The inland coversands of the Brecklands have preserved valuable palaeoenvironmental and archaeological records relating to the late Holocene period (Bateman & Godby, 2004), but aeolian activity pre-dating this is poorly understood. In addition, Austin (2000) states that sealed valley deposits, sealed/waterlogged fen-edge deposits or estuarine deposits have the potential to contain Late-glacial/post-glacial archives.
- A number of meres, likely to be relict kettle holes dating back to the Devensian glacial, are present throughout Suffolk. It is likely that the meres contain significant sedimentary archives that may span the last *c*. 20,000 yrs. Such locations are therefore valuable palaeoenvironmental resources, which must be utilised to their full potential. Cavenham Mere (TL 762 705) on the Brecklands for example, yielded both archaeological and palaeoenvironmental evidence to indicate the potential of such locations for research purposes (Murphy, 1994a; Austin-Smith, 2000).

## Mesolithic (*c*. 12,000-6,000 BP; *c*. 10,000-4,000 BC)

### I. Summary of Archaeology

When compared to the Middle and Upper Palaeolithic period, archaeological evidence relating to Mesolithic hunter gatherers is relatively abundant throughout Suffolk. However, whilst there have been an abundance of Mesolithic surface artefact finds and flint scatters, very few 'primary' context sites have been excavated (Austin, 1997), and outside of excavated sites finds are only recorded as stray objects or finds from surface collection. Where systematic survey has taken place (e.g. Suffolk areas of the Fenland Survey), more a better understanding of Mesolithic exploitation has been forthcoming (Matins *Pers. comm.*).

Two barbed points and an associated long blade industry discovered in Devil's Wood Pit, Sproughton, provide evidence for early Mesolithic occupation (Wymer, 1975, 1976). The finds were in close proximity to one another, located within the gravel deposits of a palaeochannel of the River Gipping and suggest human activity at the wetland edge. Radiocarbon dating of a buried organic deposits associated with the artefacts indicate that the finds date to between 14,236-13,359 Cal. yrs BP (12,286-11,409 Cal. yrs BC; HAR260) and 11,955-10,876 Cal. yrs BP (10,005-8,926 Cal. yrs BC (HAR259); Rose, 1976).

Another Mesolithic site at Lackford Heath was located on a gravel ridge near the west bank of the River Lark. Significantly the site included an 'occupation floor', 10-15cm thick buried beneath blown sand deposits (Roberts *et al*., 1998). A large hearth was located proximal to the entrance of a hypothesized temporary shelter, with two subsidiary hearths located towards the rear. Over 5,000 flint artefacts were recorded. A sample of 'mastic' (a mixture of clay and beech residue, possibly used to fix microliths or barbed points into wooden or antler shafts) was radiocarbon dated, and this suggested that the site was occupied *c*. 10,550 – 9,950 Cal. yrs BP. (8,600-8,000 Cal. yrs BC; OxA-2342)

Across the Brecklands, the recovery of flint lithics suggests relatively frequent Mesolithic activity, with the most prolific sites being located around the edges of the Fen Basin (Sussams, 1996). At Lakenheath (TL 716 825), four 'islands of sand' within Joist Fen produced triangular microliths and a microlith core. Also near Lakenheath, a peat filled palaeochannel buried beneath wind blown sands contained large patinated blades, flakes and cores of probable early Mesolithic date (Tester, 2001a). At Hockham Mere (TL 933 937), a number of flint scatters were discovered, whilst microscopic charcoal found around the mere during coring was interpreted as evidence of small fires proximal to the lake edge; pollen analysis indicated burning of the vegetation (Wymer, 1991). At Cavenham Mere, a scatter of flint flakes, blades and cores were also recorded with the greatest concentrations found around the southern and eastern margins of the mere (Stimson, 1979). To the north of the mere, further flint scatters were recorded, overlain by possible Neolithic artefacts, demonstrating possible multi-phase occupation of these sites (Stimson, 1979).

References have also been made to the discovery of Mesolithic artefacts at sites including Wangford (TL 751 841), West Row (TL 678 751; Dymond & Martin, 1999) and at West Stow in the Lark Valley. Here Mesolithic tools, concentrations of flint waste and cores of Mesolithic character indicated the presence of working areas on the site (West, 1989).

**II. Palaeoenvironmental Evidence**

Pollen analysis was undertaken on a 17m lake sequence extracted from Diss Mere, located in southern Norfolk (Peglar *et al*., 1989). During the Devensian late glacial, dense *Betula* (birch) woodland typified the region's landscape, although the woodland cover was incomplete, indicated by the presence of shade-intolerant herbs. Palaeoenvironmental evidence for the Fenlands on the edge of northwest Suffolk, has been provided by palynological analyses undertaken by Waller (1994) and supports the palaeobotanical record from southern Norfolk. This work indicates that during the climatic amelioration of the early Holocene *Betula* (birch) and *Pinus* (pine) woodland initially colonised, only to be replaced by mixed woodland by Early-Mid Holocene.
The early Holocene experienced a significant shift to *Corylus*-dominated woodland, before the establishment of mixed deciduous forest of *Tilia* (lime), *Ulmus* (elm), *Quercus* (oak) and *Corylus* (hazel). At Methwold, also in Norfolk, pollen analysis of a basal peat suggested the post-glacial development of a sedge-dominated fen basin, prior to the onset of lacustrine marl accumulation and woodland expansion during the Early Holocene (Scaife, 1990). A heavily forested landscape is evident in Norwich during the Late Mesolithic, with evidence for pine-dominated woodland, supported by *Betula* (birch), *Quercus* (oak), *Salix* (willow) and *Corylus* (hazel) (Wiltshire & Emery, 2000).

Further west, evidence of anthropogenic activity during the Mesolithic was also identified, with pollen analysis suggesting potential woodland clearance occurring at this time at Peacock's Farm, Cambridgeshire (Smith *et al*., 1989) and at Borough and Newborough Fens (French & Pryor, 1993). At Eriswell, proximal to Mildenhall in the Brecklands, a peat filled channel overlain by aeolian sands and contained flint artefacts indicative of a Mesolithic origin. The peat deposit was likely to be a former drainage channel that flowed west towards the fens (Tester, 2001b).

In southern Suffolk, evidence for environmental change during the Mesolithic period has been identified in deposits from the Gipping Valley. The stratigraphic sequence present at Sproughton provides evidence for channel development over the last *c*. 13,000yrs (Rose, 1976; Rose *et al*., 1980). Insect and pollen evidence indicate the presence of a eutrophic and shallow pond setting during the late Devensian, with plant macrofossil analysis indicating an abundance of marsh vegetation surrounding the pool. In addition, the insect faunas that accumulated during lacustrine sedimentation, suggest mean July temperatures were in the order of 12-13 ºC. Deposition probably occurred within a backswamp environment behind a natural levee of the River Gipping. During the Younger Dryas Stadial, climatic deterioration resulted in enhanced fluvial activity and channel incision through the lacustrine deposits followed by deposition of sands and gravels. These, in turn, are overlain by Holocene peats, varying in thickness from 0.8 to 2.4m, reflecting the growth of topogeneous peats and the accumulation of fine-grained organic and inorganic detritus within backswamp environments of a frequently waterlogged and submerged floodplain. At Sproughton, Rose *et al.,* (1980) postulated that the channel position of the River Gipping had moved little over the last 9,500 years. Coring and stratigraphic analysis further north in the Waveney Valley, between Beccles and Great Yarmouth, also support the evidence for overall channel stability within the Suffolk lowlands (Alderton, 1983).

Coastal environmental change during the Mesolithic was also pronounced due to the influence of relative sea level on the coastal lowlands of East Anglia. Between c. 8,500 and 7,000 BP, Mean High Water (MHW) rose from -25.5m to -8.9m O.D (Devoy, 1979), submerging much of the coastal lowlands. This is supported by evidence obtained from boreholes proximal to Great Yarmouth, where a freshwater peat was recorded at a depth of *c*. -19.3m O.D. and was overlain by estuarine silts and clays; organic remains at this transgressive boundary was dated to 7,580 ± 90 BP (Coles, 1977). Along the north Norfolk coastline, a similar stratigraphic sequence has been observed with freshwater peat overlain by marine silts and clays and saltmarsh deposits (Andrews *et al*., 2000). Along the north Norfolk coast between Weybourne (TG 111 430) and Hunstanton (TF 674 408), the basal peat deposits present commonly developed *c*. 10,000-8,000 BP, but between 7,000-6,000 BP the influence of relative sea-level rise on the coastal lowlands resulted in marine inundation and the onset of estuarine sedimentation. In addition, lithostratigraphic analysis in the lower Blyth Estuary proximal to Southwold (TM 507 759) identified initial peat deposition around c. 6,750 yrs BP, after which, relative sea-level rise caused marine inundation and estuarine silt/clay deposition until 4,500 yrs BP (Brew *et al*., 1992). In the Yare Valley in Norfolk, initial peat deposition was replaced by estuarine sedimentation between *c*. 7,500 BP and 4,500 BP, with the tidal limit at Sarlingham, approximately 13km inland (Coles & Funnell, 1981). All these studies in East Anglia demonstrate a correlation between early Holocene transgressive and regressive phases. Significantly, this suggests that there is a significant potential for the preservation of Mesolithic palaeolandsurfaces, archaeology and environmental beneath these marine and estuarine silts and clays.

**III. Gaps in Knowledge**

- Although a considerable number of Mesolithic lithic scatters are known throughout the county, their distribution is concentrated at the fenland edge, where in places they are buried beneath wind-blown sands. There is a need to understand whether this distribution is a true reflection of the distribution of human activity or an artefact of land use, previous research or geomorphological processes.
- Interpretation of human activity is also based on an over reliance on isolated find spot finds with little excavation of primary contexts and foci of activity.
- Marine transgressive phases during the Early Holocene may have preserved archaeologically-rich palaeolandsurfaces at depth in the coastal lowlands of Suffolk. Every effort should be made to delimit these deposits and if exposed, assessed for both their cultural and environmental archaeological potential.
- Despite the identification of significant organic rich deposits, little palaeoenvironmental analysis has been undertaken on the deposits of this date. In addition, the lowland deposits associated with Mesolithic activity, in particular valley floor and fenland sediments, are likely to be under threat from mineral extraction (Austin, 1997).
- Agricultural activity and artificial drainage threatens to dewater and destroy artefactual and environmental evidence. In the Fenlands however, although extensive drainage has occurred since the 17$^{th}$ century, the best preserved sites are likely to date to the Mesolithic and Neolithic periods. This is due to burial of the palaeo-surfaces under peat and marine clays, resulting in much of the potential archaeology being permanently waterlogged (Hall & Chippindale, 1988). As the peat continue to waste however, new sites are likely to be exposed. It may be possible to develop a model of the likely distribution of evidence based on the potential for future exposal of palaeo landsurfaces in this area, after Middleton's (1999) work in the North West Wetlands.

**Neolithic (*c*. 6,000-4,000 BP; *c*. 4,000-2,000 BC)**

**I. Summary of Archaeology**

The development of trade over long distances becomes apparent within Suffolk during the Neolithic, demonstrated for example by the recognition of significant numbers of stone axes that originated from other parts of England (Dymond & Martin, 1999). Axe heads that originated from the Lake District are most common in north-west Suffolk, whilst in the south-east, axe heads from Cornwall are more prevalent. This spatial variation not only suggests that separate trade routes began to develop during the Neolithic, but also that tribal differentiation, more evident during the Bronze and Iron Ages, was beginning to become an important factor in the evolution of prehistoric human societies. Within Suffolk, the general spatial distribution of Neolithic material such as pottery and axes (*ibid*) shows a higher density in the north west of the county from the Lark valley and fen edge in the Brecklands, and in the south east around Ipswich and the rivers Gipping and Deben. There is however a small but representative distribution of Neolithic finds from across the county, seemingly limited to river valleys and tributaries. Whilst the known densities in the Ipswich and Breckland areas may reflect increased opportunities for the recovery of material (e.g. Sussams 1996), the heavily forested and dense clay of the high plateaus in the interior may have made settlement on the lighter lands more attractive. Activity elsewhere across these clays may have been restricted to these riverine locations.

Other known Neolithic sites may also indicate a tradition of ritual use of the valley floors. At Fornham, for example c. 3km south-east of West Stow, a Neolithic cursus, 1.9km in length has been recorded from aerial photographs aligned approximately parallel to the River Lark to the east (Oswald *et al*., 2001). The Forham cursus is part of a complex of structures that includes a causewayed enclosure and a henge. This is not an isolated river valley find, with another cursus known from the county at Stratford St Mary in the River Stour, and a causewayed enclosure at Freston in the Gipping valley.

At Sproughton, within the infilled palaeochannel in which the early Mesolithic barbed points were discovered (Wymer, 1975), a distinct Neolithic long blade industry was also recorded (Wymer, 1976; Rose, 1976), suggesting prolonged occupation of the Gipping floodplain. The absence of archaeological remains that post-date the Late Neolithic is suggested to reflect the waterlogging and abandonment of the lower parts of the floodplain in response to rising local water tables and marine transgression (Wymer, 1976). Evidence of Neolithic activity is also recorded at West Stow, where an individual crouched inhumation was positioned within a central pit, with some worked flint, blades and core pieces present (West, 1989). A ring ditch containing 49 cremations surrounded the burial, although no associated artefacts were found. Despite this evidence for burial and inhumation, there is no structured evidence for domestic activity at West Stow.

In central East Anglia, widespread evidence for Neolithic activity is found in the Brecklands. The increasing demand for high quality flint during the Late Neolithic saw a distinct shift in procurement strategies for raw tool making materials away from a reliance on surface flint finds to the development of local mining industries (Clarke, 1971; Barber *et al*., 1999). The most well known site in East Anglia is at Grimes Graves, located in southern Norfolk, close to the border with Suffolk. At Grimes Graves, flint extraction began around 4,700 BP (3,520-3,378 Cal. yrs BP) and reached a peak during the early Bronze Age, c. 4,000 BP (2,576-2,567 Cal. yrs BC). When open cast mining had exhausted near surface flint deposits, shafts were sank and linked underground by horizontal galleries. In addition to mining, once extracted, many of the flints were trimmed on site, before being distributed.

Settlement and farming appears to have been largely confined to the river valleys and calcareous soils on the slopes, with more limited exploitation of the poorer but lighter sandy soils (Sussams, 1996). At Hurst Fen, Mildenhall (TL 726 768) for example, numerous ditches and pits, together with pottery and worked flint were discovered, indicative of a potentially substantial settlement area (Clarke *et al*., 1960). Remnants of post holes and storage pits, combined with an abundance of pottery, arrowheads and flint, suggests the site was part of a community occupying the Breckland/Mildenhall region (other settlements identified at Peacock's Farm, Worlington and Upware). The evidence suggests that the inhabitants were farmers who cultivated emmer and barley, and possibly kept oxen, swine, sheep and goat. Intensive exploitation of the friable sandy deposits may have resulted in severe landscape degradation (wind blown), which is certainly recorded in later periods. Pollen evidence from Hockham Mere indicates a reduction in arboreal pollen to suggest widespread vegetation clearance during the Neolithic *c*. 5,800 BP, although initial phases of woodland clearance may date back into the Mesolithic (Murphy, 1994a). At Brandon (TL 783 864), on the western margin of the Brecklands, excavations at the Lignacite Works identified a fire-cracked flint flake within a pennular gully cut into wind-blown sands (Hall, 2006). The gully was probably used for drainage purposes, only to be abandoned, possibly in response to flooding. At Lakenheath, immediately south of Brandon, Neolithic tanged and leafed arrowheads and abundant flint scatters were discovered (Briscoe, 1964). In addition, at Cavenham Mere, large quantities of pottery, struck and burnt flint and other burnt features were found along a 150m excavation area to the north-east of the mere (Caruth, 1995). The Neolithic palaeolandsurface was subsequently buried beneath aeolian sands, which contributed to the preservation of the site (Bateman & Godby, 2004).

Excavations at Honington (TL 911 745) identified arable farming activities around huts, with evidence for grain storage pits, similar to those discovered at Creeting St. Mary, near Ipswich. However, the proximity of Creeting St Mary to the River Gipping, as well as that of Honington in relation to the River Black Bourn, suggests that rivers provided key economic resources for these communities, although farming was common practice people continued to rely on foraging for food. Other sites for which passing references to Neolithic archaeology are made include a site at Barham on the interfluve of the Gipping Valley (TM 144 518), where the presence of early prehistoric pottery at two proximal sites suggests occupation of the hillsides above the river at c. 5,000-4,500 BP (3,799-3,103 Cal yrs BC; Martin, 1993). Also, recent excavations on river terrace gravels at Flixton Quarry revealed a previously unknown Long Barrow burial mound, with vast numbers of Neolithic pits in close proximity, whose repetition in character, form and function suggests they were deliberately structured deposition rather than simple domestic disposal (Boulter, *Pers. Comm.*).

**II. Palaeoenvironmental Evidence**

There is a considerable lack of palaeoenvironmental data relating to landscape evolution during the Neolithic. Brown & Murphy (1997, p10) state that "targeted sedimentological, palynological and macrofossil analyses of sediment sequences in river valleys of lakes, adjacent to known archaeological sites, are needed to determine, scale, and geographical variation of (environmental) changes".

The first palynological evidence for cereal production in the East Anglian region comes from fine grained organic-rich sediments dated to 5,420 ± 100 BP (4,454-4,000 Cal. yrs BC) from the River Ouse at Haddenham, Cambridgeshire (Waller, 1994; Brown & Murphy, 1997). The recognition of cereal pollen is also associated with a reduction in arboreal pollen, suggesting a phase of woodland clearance related with agricultural expansion. The 'Elm Decline' recorded in British woodlands is generally dated to around 5,000BP, but spans 6,010-4,450BP (4,941-3,027 Cal. yrs BC) in East Anglia and it has been suggested that human impact on woodlands may have placed the trees under stress so that they were susceptible to disease (Peglar, 1993). In Norfolk, a reduction in arboreal pollen has been linked to Neolithic woodland clearance around Norwich, with expansion of herbaceous plants and *Ericaceae* (heather; Wiltshire & Emery, 2000).

At Brandon, wind-blown sands recorded within a ditch together with fire cracked flints are argued to have been redeposited during the Neolithic (Hall, 2006). The ditch, at the edge of the River Little Ouse floodplain, was subsequently infilled by possible riverine-derived fine sands and silts, which was in turn overlain by peat. The stratigraphy may indicate increasing surface wetness through time.

Lowland coastal sites indicate an absence of evidence for continued forest clearance during the Middle and Late Neolithic, which may suggest abandonment of agricultural activity within this zone. This may have been due to increased waterlogging associated with rising water tables, in response to rising sea levels. Evidence for relative sea-level rise and marine inundation in the Fenlands is also reflected in the coastal lowlands during the Neolithic, with periods of positive sea-level tendency occurring c. 5,400-4,500 BP (4,327-3,103 Cal. yrs BC) and 4,200-3,300 BP (2,884-1,530 Cal. yrs BC; Waller, 1994). A short-term negative sea-level tendency separated these periods, encouraging peat accumulation to return to the lowlands. In The Blyth Estuary, proximal to Southwold, a similar depositional sequence is evident during the Neolithic. Estuarine sedimentation typified the Early and Mid Neolithic, depositing clays along the coastal lowlands until *c*. 4,500 BP (3,337-3,103 Cal. yrs BC; Brew *et al*., 1992). Peat deposition then occurred until *c*. 4,250 BP (2,998-2,881 Cal. yrs BC), after which there was a return to estuarine sedimentation. In the Yare Valley in Norfolk, however, whilst a transition from estuarine to peat deposition occurred *c*. 4,500 BP, this negative sea-level tendency was maintained until *c*. 2,000 BP. Such spatial variations in coastal change are likely to have had considerable impact on the location of human activity along the coastal lowlands during the Neolithic.

**III. Gaps In Knowledge**

- Palaeoenvironmental evidence for the Suffolk region during the Neolithic, as stated by Brown & Murphy (1997), is very limited. The radiocarbon dating of organic deposits from this period has been primarily restricted to the Fenlands to the north, with occasional dating being applied to sedimentary sequences from the Suffolk coastal lowlands. This restricts the chronological understanding of the sedimentary archives available, many of which may date to at least the Neolithic. In addition, the onset of cereal production, agricultural expansion and associated deforestation, commonly recognised within national Neolithic palaeoenvironmental records, is poorly understood in Suffolk.
- Aeolian activity, whilst suggested to have occurred in the region proximal to Brandon during the Neolithic (Hall, 2006), remains poorly understood during this period. Analysis of the extensive Breckland aeolian deposits could substantially improve the understanding of this archive. This is further supported by optically stimulated luminescence (OSL) dating undertaken by Batemean & Godby (2004) to confirm that the wind-borne deposits were already accumulating by 6,530 ± 540 yrs (Shfd99108).
- Relative sea-level rise typifies the Neolithic period, with marine inundation and estuarine sedimentation dominant within the coastal lowlands. A short-term period of negative sea level is however recorded through much of the Fenlands to the north and the Blyth Estuary within Suffolk from *c*. 4,500-4,250 BP (*c*. 3,337-2,881 Cal. yrs BC), whilst organic sedimentation was maintained for *c*. 2,500 yrs within the Yare Valley. Such returns to terrestrial sedimentation, the deposits of which are commonly preserved by subsequent relative sea-level rise and estuarine sedimentation may contain valuable archives of palaeoenvironmental potential.

**Bronze Age (*c*. 4,000-2700 BP; *c*. 2,000-700 BC)**

**I. Summary of Archaeology**

The majority of Bronze Age activity in Suffolk is evidenced from three main types of remains; surviving earthworks such as round barrows; those sites identified from aerial photography particularly abundant ring ditches and barrow groups; and finds of metal work as single pieces, small groups and hoards. Excavated evidence is rarer but is beginning to make up an important part of the known record, with new finds and site being recovered every year. A rare jet lozenge (Good, *Pers. comm.*) is perhaps the most recent example, although evidence of Bronze Age landscapes are beginning to turn up underneath later period features (e.g. Abbot 1998). Recently, a number of previously unseen ring ditches have also been excavated, including four at Flixton Quarry in the Waveney Valley, one of which had a central feature of a square enclosure with three inverted biconical cremation urns within (Martin, 2006). Similarly from Lakenheath, on the fen edge, a ditch with a central grave containing four inhumations was excavated in 2005 (*ibid*). In the past, excavations, particularly at West Row Fen (Martin and Murphy 1988) have identified important Middle Bronze Age settlement evidence.

In general, however it is round barrows that are most commonly associated with the Bronze Age and Suffolk is no exception, where this group of monuments make up both the earliest surviving archaeological monuments of the period, and along with ring ditches one of the commonest groups of features. Over 800 barrows are known to have once existed in Suffolk (Dymond & Martin, 1999), with the majority of them thought to date from the Early Bronze Age. Agricultural activity and development has significantly reduced the number of barrows that survive today to a little over 100. It has also been suggested that the *c*.800 known barrows represented make up only 34% of the original number (Martin, 1981). The distribution pattern of barrows once again shows a predisposition for the lighter soils and in proximity to the river valleys. Consequently, there are four main concentrations: in the Brecklands of north west Suffolk; the Sandlings along the coastline of east Suffolk; the Stour, Box, Brett and Glenn Valleys of southern Suffolk; and the river valleys of central and south-east Suffolk such as the Gipping. There are few known barrows in high clay plateau of central and south west Suffolk, which may reflect similar to the Neolithic distribution both the poorly draining soils and the dense woodland which is though to still be covering the area during this period. Many barrows are grouped in close proximity to Bronze Age settlements, reserving the river terraces and valley slopes for arable and pastoral land. The location of some barrows also appears to coincide with boundaries (some of which may survive as parish boundaries), suggesting that the barrows may have been intentionally positioned to indicate the demarcation of territories and land 'ownership' (*ibid*). Evidence of further cultural variations are also visible in the archaeological record during the Bronze Age, with evidence pointing to predominantly cremation burials in the south, whilst both inhumation and cremation burials are present to the north, potentially recognising cultural groupings like those identified from the Neolithic.

Few barrows have been excavated in Suffolk, but four barrows without external ditches were identified on Martlesham Heath (TM 250 445) and described by Martin (1975; 1976a). Finds represented were flint scrapers, and arrowheads and early Bronze Age pottery. A similar site excavated at the aptly named Barrow Bottom in Risby (TL 795 664), west of Bury St Edmunds, yielded a female skeleton burial dated to the Bronze Age date by Radiocarbon dating (3,495 30 BP, 1900-1740 Cal. yrs BC; GrN-11358) (Martin, 1976b).

The abundance of Bronze Age burials in the Breckland has been used to argue that a deliberate and major barrow building phase took place in the region (Martin & Murphy, 1988). Their proximity to settlements on the edge of the Breckland would also suggest that these areas were in permanent use by the Bronze Age community. At West Row Fen for example, the settlement evidence consisted of traces of three round houses and numerous pits, whilst faunal remains indicated animal husbandry and seasonal cattle rearing. At Lakenheath, four sand islands within Joist Fen contained abundant Bronze Age beaker sherds with a variety of decorations and impressions, as well as arrowheads, scrapers and knives (Briscoe, 1964). Again at Barton Mere (TL 911 667), southwest of Pakenham in central Suffolk, Bronze Age spearheads, an abundance of flint flakes, cores, fragments and 'homemade' pottery suggest human activity and settlement along the margins of a former lake (Jones, 1869). In addition, animal bones including stag, pig, sheep, hare, goat and dog were discovered, as well as a wooden wattle structure towards the centre of the former mere, some of the earliest recorded and dated evidence for preserved structural remains from Suffolk.

The continued development of trading during the Bronze Age is supported by artefacts discovered at Mildenhall (Martin, 1988a). A stone axe-hammer with remains of the wooden handle in the shaft hole was discovered and petrological analysis identified the quartz dolerite stone as having originated from Whin Sill in northern England. Field walking in Mildenhall parish also resulted in the discovery of surface finds on a sandy ridge proximal to Cooks Drove and Haylands Drove (TL 656 771), which included beaker sherds, barbed and tanged arrowheads, plano-convex knives, worked and cut bone and a rubbing stone. Subsequent full scale excavations identified post-ring houses, a 'flax retting' pit, water holes and various working areas (Martin & Murphy, 1988).

Hoards and finds of Bronze Age metal work are also common, particularly from the middle bronze age onwards. For example, a Bronze Age metalwork hoard was discovered in 1959 as a result of ploughing near Isleham (Britton, 1960). The finds were located within a pit cut into the chalk bedrock and consisted of over 6500 pieces (200lb) of bronze, with the bulk of the finds consisting of fragments of weapons, tools, ornaments and an abundance of raw metal slab and the by-products of bronze-casting. Fragments of 'Wilburton' type swords were present within the hoard, which are typologically characteristic of the Late Bronze Age (*ibid*). This hoard is perhaps one of the most striking with a mixture of old and used objects juxtaposed with the raw materials with the potential to make new pieces. Hoards, however, are no longer uncommon. Many hoards have been noted in recent years (c.f. Dymond & Martin, 1999), but numbers are increasing as the effects of long term modern ploughing combined with metal detecting bring more and more finds to public attention. The reason for the deposition of objects in the Bronze Age is still much debated with functionalist and ritual arguments, yet a tendency to one side or the other does not truly illustrate the complexity of the case. The abundance of metal work found in and around the fen edges perhaps best illustrates that ritual offerings which modelled the sites at Flag Fen in the Cambridgeshire fens, were taking place. As Martin (2006) points out, much of the metal work found at West Row Fen is considerably later than the settlement. Other finds, particularly those from an important Breckland watering hole at Rymers Point, also seem to fit that category (*ibid*). The implication from the Iselham hoard however is that the material may have belonged to a metalworker, full of scrap bronze and the raw materials for new objects; however the location of the hoard and the reasons for its deposition and abandonment may be more meaningful.

**II. Palaeoenvironmental Evidence**

The majority of archaeological evidence within the Brecklands suggests Bronze Age human activity was concentrated on its calcareous soil slopes. Bronze Age barrow ditches at Risby contained land mollusc assemblages indicative of dry, open-country grassland habitats with broken and unstable soil surfaces (Murphy, 1994a); this suggests that not only was the landscape cleared of woodland, but was possibly intensively grazed (Sussams, 1996). Further north at Mildenhall, heat shattered flint and charcoal derived from *Alnus* (alder), *Corylus* (hazel), *Quercus* (oak) and *Crataegus* (hawthorn) were recorded overlying brown peaty loam on chalky drift (Murphy, 1994a). The peaty loam is interpreted as being a consequence of small-scale woodland clearance at the site. Radiocarbon dating of the charcoal deposits indicated anthropogenic activity on the site around 3,720 ± 70 BP (2,350-1,930 Cal yrs BC, HAR-1876; Murphy, 1994a). At West Row Fen, radiocarbon dating of a burnt oak tree revealed woodland clearance c. 3,650 ± 100 BP (2275-1830

Cal. yrs BC, HAR-5637; Martin & Murphy, 1988), the timing of clearance at West Row Fen and Mildenhall is similar and suggests a degree of synchronicity for woodland clearance. Evidence for the clearance and burning of valley floor alder carr is also present at Lackford, c. 10km southeast of West Row Fen. Charcoal of alder, with some hazel and oak overlies brushwood peat, with dating suggesting clearance *around* 3,940 ± 80 BP (2,835-2,151 Cal. yrs BC, HAR-2824; Martin, 1994a). Wetter and cooler environmental conditions are believed to have occurred from the middle Bronze Age (*c*. 3,450 BP; Barber, 1982) onwards and this is may have contributed to the abandonment of various occupation sites around the Brecklands, including West Row Fen and other regions around Mildenhall ).

The influence of relative sea-level change on the coastal lowlands was an important factor during the Bronze Age, although considerable spatial variation of the nature of change is evident between sites. The Fenlands experienced marine inundation and estuarine sedimentation from *c*. 4,100-3,700 BP, before fen peat development recommenced in the south-eastern fens (incorporating northwest Suffolk) throughout the middle to late Bronze Age (Waller 1994). However, stratigraphic analysis of coastal sediments in Suffolk's Blyth, Deben, Orwell and Stour estuaries indicate predominantly estuarine sedimentation throughout most of the Bronze Age (Brew *et al*., 1992).

At Barton Mere, located between the parish boundaries of Thurston, Pakenham and Great Barton, sediments provide evidence for a former Bronze Age lake. Chalk marl is overlain by a thin peaty clay, which in turn, is overlain by a blueish clay. The clay sequence varied in thickness from 0.3-1.5m and contained artefacts including a bronze spearhead, a basal looped spearhead, animal bones, flint flakes, handmade pottery and the remains of a wattle structure believed to be a basket (SMR BRG007 SF6874). The evidence suggests the presence of a Bronze Age settlement along the lake margins (Jones, 1869).

The *Tilia* decline is recorded in most pollen diagrams from Holme Fen and the south eastern Fens around 3,300-3,000 BP (Waller, 1994). The accompanying increases in *Plantago lanceolata* (ribwort plantain) and Poaceae (wild grasses) are used to support the hypothesis that enhanced forest clearance was occurring across comparatively large areas at this time. This deforestation is evident throughout much of the Suffolk region and beyond. Open landscapes are identified at Godmanchester by 3,240 ± 50 BP (GU-5213; 1671-1420 Cal. yrs BC), whilst at Fordham, a marked decline in *Alnus* and associated increase in minerogenic alluviation has also been associated with Bronze Age activity (Brown & Murphy, 2000). At Scole in the Waveney Valley (TM 147 784), a palaeochannel located proximal to a Roman town started infilling with organic-rich sediments during the Bronze Age (Wiltshire, *in prep*). Mixed woodland with an abundance of *Tilia* (lime) dominated the landscape *c*. 4,000yrs BP, after which pollen assemblages and increased charcoal levels suggests localised woodland clearance on sandy soils suitable for exploitation. Towards the end of the Bronze Age, the landscape had changed from dense woodland to open terrain, with pollen evidence supporting the hypothesis of preferential felling of *Tilia* woodland, being replaced by the expansion of grasslands and herbs species (Ashwin & Tester, *in prep*).

**III. Gaps in Knowledge**

- Brown & Murphy (1997) identify south east Suffolk as having significant potential for further research. The Stour Valley and estuary in particular, contains an abundance of cropmark field systems and ring ditches, which are indicative of an extensive Bronze Age landscape. However, limited archaeological and palaeoenvironmental investigations have been undertaken so far, with the exception of the aerial photo survey undertaken as part of the Suffolk Coastal project, which extensively mapped cropmarks within the tidal portion of the Stour. In addition, there is believed to be an abundance of sedimentary sequences within the Stour Valley, estuary and its numerous small tributaries in close proximity to such cropmarks. This area is therefore a priority for future research.

- Identifying sites that will shed light on the vegetation development in the high Suffolk Clays may help to shed light on the absence of evidence for these areas. Specifically the identification of evidence for or absence of abundant and dense woodland. The timing of deforestation is also a key temporal and spatial indicator which has not been fully explored in this region
- Ritualised elements of deposition have certainly been postulated for the abundance of metal work found in the fen edge and in other key location, further investigation of this phenomenon against a background of environmental change will help to develop and understanding of human eco-dynamics in this period.

**Iron Age (*c*. 2700-1900 BP; *c*. 700 BC-AD 43)**

**I. Summary of Archaeology**

The area which is now Suffolk was known to have been occupied by at least two British tribes during the Iron Age, commonly known as the Iceni and Trinovantes (Martin & Murphy, 1988). The Iceni settled in Norfolk and the north of Suffolk, whilst the Trinovantes populated southern Suffolk and Essex. Martin (*ibid*) and others, have attempted to reconstruct this tribal boundary, as a line that largely bisected the county from east to west. It is however less well known how or to what extent these territories developed through the Iron Age and how these tribes defined their territorial area. In common with evidence from earlier periods, the majority of Iron Age settlements are believed to have been located on areas of lighter soils, and along the main river valleys. There is a body of evidence beginning to exist however, for an expansion in the exploitation of the woodlands and an extension of settlement on to the boulder clays during this period.

The majority of known sites are open and undefended but hill forts, of the traditional model from elsewhere in England, are precluded from East Anglia due to absence of large hills. Large hill fort type earthworks are however present, with sites at Clare in the Stour Valley and the largest known fortification from the period at Burgh. This site is believed to date to the Late Iron Age, *c*. 1st century BC (Martin, 1988b), with evidence from the site indicating a phase of temporary destruction and/or abandonment, believed to have occurred prior to the Roman Conquest. Martin (1988b) suggests that such activities are possibly the result of conflict between local tribes. An Iron Age fort is also present at Barnham in north Suffolk, halfway between the Little Ouse River and Rymer Point on the Breckland plateau (Martin, 1993; Sussams, 1996). The rectilinear enclosure, believed to fall within the territory of the Iceni, is in close proximity to another major Iron Age site, which underlies Thetford Castle in Norfolk. The comparatively small number of Roman finds within the site suggests abandonment by the mid first century AD. At Lakenheath, *c*. 16km west of Barnham, further evidence for Iceni occupation is evident on the sand islands of Joist Fen. During a number of separate excavations, Iceni coins have been found in abundance across the site, along with a group of dark grey pottery sherds (SMR LKH067 SF9557; Briscoe, 1964).

A number of Iron Age sites have also been identified in the Flynn and Deben Valley's in southeast Suffolk. Described by Martin (1993), sites located at Great Bealings (TM 232 490), Little Bealings (TM 231 481) and Martlesham (TM 249 467), are spaced at regular (700m – 1km) intervals along the river valley and are presumed to represent individual farmsteads. They are also all situated on high ground at around 30m O.D., and are commonly positioned no further than 500m from the nearest water source. Comparisons can be made to the Iron Age sites located at Framlingham in the Ore Valley (TM 285 634), and with Barham near the Gipping, where the proximity to water supply and site altitudes are similar. In addition, scattered farmsteads in the Brecklands are also located along the river valley corridors at regular intervals of approximately 500m (e.g. River Lark), reflecting the dependence upon a principal water source (Sussams, 1996). The Iron Age settlement at Barham is known to date to *c*. 2,450 – 2,250BP (Cal. BC) (Martin, 1993) with occupation believed to have continued into the late Iron Age.

At West Stow, evidence for occupation throughout the Iron Age has been found, although activity was concentrated towards the middle and late Iron Age (West, 1989). Post holes suggestive of small huts were discovered, as well as a number of pits and curved and straight ditches. Pits and ditches of similar date commonly cut and overlap one another, indicative of a continually changing settlement layout. Field systems and pits of a probable Iron Age date were also identified in a re-evaluation of previously excavated material from Lackford Bridge adjacent to West Stow (Tipper *pers. comm.*), suggesting that a larger settled landscape existed in the Lark valley at this time. It is the Lark valley that is also home to Suffolk's other major Iron Age earthwork site, a long linear embankment, known as the Black Ditches. Although no totally reliable evidence is forthcoming, an Iron Age date is most likely (Dymond & Martin, 1999). The number of known field systems on the light soils continues to grow from interpretation of Aerial Photography, many of these sometimes extensive field systems are traditionally associated with a late prehistoric date. On the clay, these sites are less easy to identify, but a combination of evidence from field survey and study of surviving field systems (Martin and Satchel *forthcoming*), suggests that exploitation of the fringes of this landscape was becoming increasingly common, the evidence for which it is postulated may still survive in the modern landscape, as areas of small fields and long linear field boundaries.

In common with other areas in the south east, evidence for Belgic influence is also present in Suffolk from a period towards the end of the Iron Age. Two cemeteries at Boxford (TL 960 405), for example are known to contain Belgic influenced materials, one with at least 43 cremations in urns, some of which are accompanied with Bronze Age brooches suggesting possible artefact recycling (Clarke, 1971).

**II. Palaeoenvironmental Evidence**

One major difficulty encountered when attempting to apply palaeoenvironmental reconstructions to the Iron Age relates to dating. Due to the radiocarbon 'plateau effect' present during much of the Iron Age, there is a difficulty in dating samples to within 200-500 year accuracy (Bryant, 1997; Wiltshire & Murphy, 1999). As a consequence, distinguishing between early-, middle- and late Iron Age activity within the palaeoenvironmental record can often prove difficult if no securely dated artefactual evidence is available. One example of this issue can be found at Hockham Mere in the Breckland, where evidence of woodland clearance is present, which may have been initiated during the Iron Age (Bennett, 1983). However, calibrated radiocarbon dating indicates that such activity may have occurred at any time between the Late Bronze Age and Early Iron Age (2,870-2,730 BP) and the Early Roman period (2,060-1,839BP).

Despite these problems relating to radiocarbon dating chronologies, there is evidence for deforestation throughout the Brecklands at various stages during the Iron Age. At Hockham Mere for example, the overall reduction in arboreal pollen is mirrored by an increase in pollen from heathland plants, grasses and ruderals (Murphy, 1994a). In addition, an increase in the cereal pollen and a decline in pollen from grassland and forest taxa between 2750-1860 BP are interpreted as evidence for increased arable activity as part of a mixed agricultural economy. At Diss Mere, tree pollen assemblages decrease markedly during the Iron Age, only to be replaced by Poaceae (wild grasses), whilst *Cyperaceae* (sedge), *Artemisia* (mugwort), *Plantago* (plantain) and *Rumex* (dock) also contribute. The fall in tree pollen and major expansion of herbs suggests widespread and extensive forest clearance and conversion of cleared land to grassland (Peglar *et al.*, 1989). Woodland clearance around Diss Mere is suggested to have been for pastoral agriculture due to the relative absence of cereal pollen. In contrast, cereal cultivation is evident further south at West Stow, where excavation of a settlement on terrace gravels revealed charred grains and chaff of spelt, emmer and hulled barley.

Substantial woodland clearance occurred in the Breckland from 2,500 BP (Bennett, 1983), whilst open grassland and fen vegetation environments were developing in response to deforestation around Haddenham, Peterborough and Heybridge (Bryant, 2000). At Scole, the Early Iron Age landscape was similar to that of the Late Bronze Age (Wiltshire, *in prep*), with a pastoral economy initially dominating prior to the expansion of arable agriculture towards the middle Iron Age. After the middle Iron Age, there was a brief re-expansion of woodland, but it never achieved the level of land cover prevalent during the Bronze Age (Wiltshire & Murphy, 1999). A major phase of woodland clearance took place during the late Iron Age or early Roman period (*c*. 2,200-1,890yrs BP), with enhanced cereal production occurring whilst woody plants proximal to the palaeochannel of the River Waveney were being felled, coppiced or pollarded leading to the spread of weedy grassland.

During the archaeological work at Staunch Meadow, Brandon, valley floor deposits were assessed (Carr *et al*. 1988), which suggested initiation of peat development shortly after the end of the Iron Age. Radiocarbon dating of a basal peat sample suggested the onset of peat accumulation occurred around 1,950 ± 70 BP (120 Cal. yrs BC to 240 Cal. yrs AD, HAR-6475; Murphy & Fryer, 2005). Iron Age plough marks were recorded within basal sands underlying the peat and pollen, analysis of which identified an abundance of grassland and weed vegetation prior to peat accumulation (Wiltshire, 1990). Peat development was characterised by tall herb/swamp communities with a limited presence of tree and shrub species throughout much of the depositional archive.

A major marine transgressive phase is evident in the Fenlands between 2,500-1,800 BP, with estuarine silts being deposited as far inland as Redmere in northwest Suffolk (dated to 1,850 BP; Waller, 1994). Here, a regional rise in water table across the region is suggested *c*. 1,900 BP, in a Fenland landscape devoid of most trees by the late Iron Age. In the Yare Valley in Norfolk however, freshwater peat accumulation was maintained throughout the Iron Age, with evidence of localised channel incision into the peats (Coles & Funnell, 1981). A return to estuarine sedimentation only took place between *c*. 1,970-1,600 BP.

The widespread accumulation of peats in Norfolk during the Iron Age is argued to reflect rising water tables (Wiltshire & Murphy, 1999). Whether this is applicable to the valley systems of the Suffolk lowlands however is unclear, due to the relative lack of reliable Iron Age palaeoenvironmental records. Factors such as deforestation, increased precipitation and surface run-off (evident through channel incision in the Yare Valley) or rising base-levels (influenced by eustatic sea level) may have contributed to the changing water table. At the coastal margins at least, changes in eustatic sea level would have contributed to the landscape evolution during the Iron Age.

**III. Gaps in Knowledge**

- Bryant (1997, p14) states that a greater knowledge of the agricultural economy is needed in order to understand the social, economic and cultural processes which took place during the Iron Age. Therefore, this is directly translated into a need for further palaeoenvironmental research into the Iron Age of Suffolk, with particular reference made to palaeoecological analysis of dated sedimentary sequences such as overbank alluvium, peats and palaeochannel fills which are immediately adjacent to settlement sites.
- The archaeological excavations of Iron Age sites within Suffolk have suggested continued woodland clearance throughout this period. The limited palaeoenvironmental studies undertaken to date suggest deforestation was occurring to support the ever-increasing demand for land for agricultural purposes. Multiproxy palaeoenvironmental analyses of the sedimentary archives available would prove critical to fully understanding how the landscape was being exploited by Iron Age man. Pollen and beetle analysis would enhance the understanding of spatial and temporal variations in land use. In addition, such analyses, supported by testate amoebae analysis where applicable, would also contribute to our understanding of whether rising water tables were indeed occurring during this period.
- Due to the impact of ploughing on most Iron Age sites throughout East Anglia, the potential from such sites to provide reliable and complete palaeoenvironmental sequences is low. Well-preserved sites which have been buried by colluvium or alluvium can however be

- Developing a model of the Bronze Age to Iron Age rural agricultural economies and a characterisation of the landscape in this period is long overdue, particularly important should be to identify sequences that continue to identify and clarify changes in cultural and agricultural practice. This type of model could also be extremely important for the late Iron Age and early Roman period.
- Knowledge of water tables

**Romano-British (1,900-1,650 BP; AD 43-409**

**I. Summary of Archaeology**

The presence of the Roman Military in Suffolk is relatively sedate with only two 1st Century military forts known from Pakenham and Coddenham (Plouviez 1999). Individual farmsteads by far make up the largest proportion of the known Roman sites, (Plouviez 1999), and also the most excavated, with approximately twenty villas excavated or investigated to date (Carr, 1991). There is however, a considerable number of significant Romano-British “urban” centres known throughout the county (Icklingham, Pakenham, Long Melford, Coddenham, Stonham, Hacheston, Capel St. Mary and Wenhaston), each un-walled town dominating the area of the countryside around it (West & Plouviez, 1976). Of these, archaeological activity has concentrated on settlements at Coddenham (twelve excavations), Pakenham (fifteen excavations), Hacheston (seven excavations) and Icklingham (eleven excavations; Carr, 1991). The settlement at Icklingham, located near the River Lark, is dated to the late Romano-British period, with artefacts dating from the third century AD onwards. In addition, Icklingham was also an important Christian settlement during the latter part of the fourth century, identified through the discovery of lead tanks with Christian monograms and the presence of a large Christian cemetery (West & Plouviez, 1976). Much of the current evidence for Roman Suffolk continues to be developed from aerial photographs, surface and metal detected finds. It is interesting that new sites, particularly farmsteads and villas, have been identified within the last few years at places like Hitcham, south of Stowmarket, and a clearer picture relating to Roman exploitation of the landscape has begun to develop. The evidence seems to point to a spread of settlement across the county that was increasingly more pronounced than during the Iron Age, but still much of the central clay landscape was under utilised, and perhaps still densely forested in places.

From the published record an extensive settlement also existed at Hacheston (TM 308 590), possibly spanning up to 30 hectares, from the edge of the River Deben floodplain almost to the watershed between the Deben and the River Ore to the north (Blagg *et al*., 2004). Initial occupation is evident during the Late Iron Age, with a seemingly peaceful transition into the Roman occupation. Settlement developed gradually during the early Roman period, coinciding with improving road (and hence trade) networks. The site is believed to have been abandoned by around AD 370, possibly in response to the reduction in military presence at the coastal forts that occurred towards the end of the Roman Empire.

Industrial sites are now known to have existed at a number of locations across the county, particularly pottery manufacture. At West Stow, for example, proximal to the River Lark, an active pottery manufacturing site was present during the 1st and 2nd centuries (West, 1989). Developed on top of former Neolithic and Iron Age settlements, five pottery kilns and numerous associated pits were recorded, predominantly in the south and south-west of the site. Only limited evidence was found for domestic activity and settlement, with two possible buildings identified. This absence of evidence may be a consequence of medieval occupation destroying earlier remains and features.

In the Late Iron age and Romano- British period, coastal exploitation for salt making is well known along the east coast at Ingoldmels in Lincolnshire (e.g. Thomas and Fletcher 2001, Lane and Morris 2001) and the sites known as Red Hills in Essex (e.g. Wilkinson and Murphy 1995). Approximately nineteen salterns are also recorded in Suffolk from this period (Suffolk SMR). At Cavenham Mere, another published site (Stimson, 1979), evidence shows that multi-phase occupation is recorded, and scatters of Romano-British pottery and metalwork were found. The coins span the 1st to 3rd centuries whilst bracelets were also amongst the finds, the majority of which are from the western region of the mere (Stimson, 1979).

At West Row, located c. 10km down-valley from West Stow, an important hoard of fourth century silver dishes, goblets and spoons were discovered during ploughing in the early 1940's, known as the 'Mildenhall Treasure' (Painter, 1977). The silverware was discovered in close proximity to the site of a Roman building, located c. 20m to the east, and is suggested to indicate the hurried burial of a wealthy settler's possessions. A second buried hoard of about 500 coins at Little Bealings was dated to 379 – 395 AD, whilst a fourth century hoard containing 3,100 coins is recorded from Freston near Ipswich (Clarke, 1971). It is, however the Hoxne treasure of jewellery, coins and over 100 silver spoons (Plouviez, 1999) that is probably the most famous of the Roman period hoards from Suffolk. The burial of such valuable artefacts around this period may be in response to not only the gradual breakdown of the Roman Empire's monetary economy, but also the onset of Saxon attacks in the region as a consequence of the Empire's demise. A Saxon Shore fort of late Roman date, a feature commonly associated with the stresses and fears of this time is though to have existed on the end of the Felixstowe peninsular, although this has now been lost to the sea.

Evidence for Romano-British settlements is recorded along much of the coastal margin in and around Suffolk. At Hollesley Bay, post holes and an abundance of Roman pottery suggest continuous occupation through to the late Romano-British period, with some evidence for initial settlement during the Iron Age (Mowat, 1975). Further north, Roman settlement has long been known in the Cambridge Fenlands, proximal to the Suffolk border. Sites at Stonea, March and Grandford are recorded from this period with evidence for salt production and animal husbandry (Hall, 1988).

**II. Palaeoenvironmental Evidence**

The progressive, permanent woodland clearance in East Anglia that was initiated in the Bronze Age continued into the Roman period, with as little as 10% arboreal pollen present in early Roman sedimentary archives (Scaife, 1988). The clearance was primarily for agricultural purposes, with evidence for the production of spelt and emmer wheat throughout the region and barley, horse-bean, pea, oats, rye and linseed also found in rural locations (Going, 2000). At Scole, palynological evidence indicates maintained agricultural activity within the Waveney Valley, whilst it is suggested that social instability towards the end of the Romano-British period, combined with intensive cultivation, resulted in enhanced charcoal influx and the loss of *Ulmus* (elm), *Tilia* (lime) and *Fraxinus* (ash) from the pollen record respectively (Wiltshire, *in press*).

Investigations at Micklemere near Pakenham (TL 937 698) have identified basal peats that developed under mixed sedge fen and open grassland habitats during the late Iron Age (Murphy & Wiltshire, 1989). A shift in sedimentation then occurred during the Romano-British period, resulting in the accumulation of a sandy peat unit overlying the basal peat. Abundant microscopic charcoal remains and a peak in cereal and weed pollen suggest that the enhanced minerogenic input resulted from an increase in agricultural activity and associated soil erosion in the area.

The nature of coastal development in Suffolk during the Roman period is somewhat unclear due to the relative lack of research undertaken. However, in the Fenlands to the north, lithostratigraphic and chronostratigraphic evidence suggests maintained relative sea-level rise until *c*. 1,800 yrs BP, although regressive tendencies and peat development was also occurring at various locations along the coastal lowlands (Waller, 1994). During the Roman period, palaeosol development is recorded within the Breckland dunefields near Wangford Warren (Bateman & Godby, 2004), suggesting enhanced landscape stability due to the higher water tables resulting from relative sea-level rise. This is further supported by Murphy & Fryer (2005), who state that the expansion of intertidal environments that occurred as a result of such a positive sea-level tendency caused drainage to be impeded throughout many lowland river valleys. This would have encouraged valley floor waterlogging and peat development further inland from the coast, hence explaining the near-contemporaneous onset of freshwater peat growth around Brandon (Carr *et al*., 1998). Within the Yare Valley, a positive sea-level tendency is also suggested with a return to estuarine sedimentation occurring c. 2,000BP (Coles & Funnell, 1981). Lithostratigraphic assessment of the main Suffolk estuaries (the Blyth, Deben, Orwell and Stour) also supports maintained positive sea-level tendencies during the Roman period (Brew *et al*., 1992). Within the Waveney Valley, a temporary shift from peat to estuarine silt deposition occurred at Stanley Carr, north-east of Beccles *c.* 1985 ± 40 yrs BP (91 Cal. yrs BC to 139 Cal. yrs AD; Q-2184), before fen peat accumulation returned *c*. 1755 ± 40 yrs BP (139-390 Cal. yrs AD, Q-2183; Alderton, 1983). There is however considerable spatial and temporal variation in sedimentary stratigraphy throughout the lowlands of the Waveney Valley east of Beccles, suggesting that changes in relative sea level is not the only control on lowland evolution during the Romano-British period.

**III. Gaps in Knowledge**

- There is a lack of reliable palaeoenvironmental evidence relating to the Roman and post-Roman periods. Of the studies that have been undertaken within Suffolk and the surrounding regions, research has commonly concentrated on prehistoric sediments (the Late-glacial, and Early-Middle Holocene periods). The abundance of historic records for the last 2,000yrs may have previously reduced the value of such palaeoenvironmental research. This has commonly resulted in limited radiocarbon dating being applied to peat deposits that have accumulated during the last *c*. 2,000yrs. Palaeoenvironmental interpretations therefore commonly have to be inferred through accumulation rates to estimate the age of historic deposits. An absence of radiocarbon dating makes the interpretation of historic pollen sequences open to debate. Developing a model of the Roman rural agricultural economy, from the late I/A and R/B transition right up to the end of the Roman period, is long overdue. Particularly important is to develop a model to characterise the landscape in this period, and identify sequence's that continue into the post roman period to look at changes in cultural and agricultural practice as the Roman influence declined.
- An additional problem regarding palaeoenvironmental assessment relates to the availability of suitable deposits. The influence of factors such as agricultural activity, artificial drainage and (to a lesser extent) peat cutting have had a significant impact on organic deposits. Artificial drainage lowers water tables, leading to oxidation of the surface sediments and resulting biogenic decay. Ploughing commonly affects sediments to a depth of c. 0.5m, which results in the vertical mixing of the archive (disturbing the stratigraphic, pollen, plant, beetle records etc).
- Of the evidence that is available relating to the Romano-British period, questions continue to remain regarding how wooded the landscape was at the time, along with the spatial distribution of woodland. In addition, at the end of the Roman period, did substantial tracts of former agricultural land regenerate as woodland in response to settlement abandonment?

**The Medieval Landscape (400 AD – present)**

**I. Summary of Archaeology**

This period encompasses the period from the decline of the Roman empire and the emergence of a consolidated kingdom of East Anglia in the seventh century, through to the Norman invasion and into the later Medieval periods. This includes a vast range of history and archaeology for which Suffolk has a plentiful number of sites, particularly early Medieval (Carr, 1991). Williamson (2005) relates such an abundance of finds to the delayed development of 'nucleated villages' in East Anglia, unlike the 'Germanisation' of the Midlands during the same period. Suffolk therefore did not develop similar settlement types until between 1000 to 1200AD. As a consequence, poorly nucleated settlements developed, spread over considerable areas of agricultural land. Wade (1993) however argues that the framework of settlement that we now see was in fact laid out in the four centuries that preceded the Conquest. This suggests that whilst settlements may have shifted, the beginnings of urbanisation in Ipswich and the foundations of the major medieval towns and villages in Suffolk was already in place by the 7$^{th}$ Century, or certainly by the 9$^{th}$ (*ibid*). In wider landscape terms however, it appears that the number of settlements in the clay interior of the county declined from those in the Roman period, with the population preferring to work the lighter soils in the Brecks, the river valleys (West, 1999) and the coastal area. From the Middle through to the late Saxon period it appears that again settlement started to expand, particularly into the interior, with over 400 churches mentioned by the time of the Domesday survey. On this evidence, a widespread re-growth of woodland may be an expected consequence, however, the few palaeoenvironmental studies that have been completed appear to contradict this (see below), perhaps indicating a intensification of agriculture in some areas.

From the early medieval period finds are plentiful but fully excavated sites are not, and the excavations at West Stow represent one of the few. Here, an Anglo-Saxon settlement was identified that was occupied from c. 400AD to c. 650AD, coinciding with the end of the Roman occupation in Britain to abandonment around the beginning of the Middle Saxon period (West, 1999; Crabtree, 1989). The site, located on river terrace gravels of the River Lark, was preserved beneath wind-blown sand deposits. Seven small buildings, interpreted as halls, were each found to be surrounded by clusters of sunken-featured buildings (SFBs) used to suggest that a family group occupied each hall cluster.

A second Anglo-Saxon site was discovered at Snape in east Suffolk (TM 394 578), and has received considerable attention throughout the twentieth century (summarised by Filmer-Sankey & Pestell, 2001). Early excavations identified an Anglo-Saxon ship burial with associated urns within a barrow. Further work revealed an extensive cemetery approximately 50m west of the ship burial, containing both inhumations and cremations (24 and 12 respectively). Although preservation varied considerably between each grave site, a significant pagan Anglo-Saxon cemetery was uncovered. The complexity of burial rites is indicated by the various approaches reflected: inhumation, cremation, crouching or flat body positioning. Although the site is positioned over 1km away from the nearest villages (Snape and Friston), the choice of location is believed to relate to its possible visibility from the River Alde (2.5 km to the south) and the North Sea (7 km to the east). Whilst the ship burial at Snape site may not be well known, the evidence for this type of burial right is certainly familiar in the context of other sites such as Sutton Hoo. Some 15- 20 km to the South of Snape the mounds at Sutton Hoo are one of the counties most famous sites, and with Snape have been argued to demonstrate the power and wealth of the kings who ruled the area at this time (West 1988). Wood and wickerwork structures were recorded at an intertidal site proximal to Sutton Hoo, near the River Deben. These are thought to be related to fishing activity within the intertidal zone in the Anglo-Saxon period (Godwin, 2003). *Foraminifera* analysed from the surrounding sediments indicated that the tidal regime and the sedimentary environment present in the Anglo Saxon period, when the wickerwork was positioned, was the same as the present day. A very large wooden fishtrap from a similar location near Holbrook Bay has also recently been dated, with the primary sequence relating to the Middle Saxon period (Plouviez *pers comm)*, suggesting widespread economic activity can be associated with the coastal areas

At Cavenham Mere, metalwork dating to the early Saxon period was found concentrated around the western margins of a former mere. Decorated brooches and wrist-claps typified the finds, which suggest that the site may have been a former cemetery (Sussams, 1996). However, the relative abundance of plain ware pottery in close proximity to the artefacts may indicate a settlement site was also present (Stimson, 1979). An Anglo-Saxon cemetery was discovered in Westgarth Gardens, Bury St Edmunds, located proximal to a tributary of the River Lark (West, 1988). In total, 65 inhumations and four cremations were identified, all orientated due west and dating to between the mid-fifth and seventh centuries. Dress ornaments were common within the female burials: commonly shoulder brooches, larger centrally placed brooches, garment fasteners, beads, wrist clips, and knives. In contrast, swords, shield and spears were common within male graves. Such grave goods typify Anglo-Saxon burials (Filmer-Sankey & Pestell, 2001).

From the Middle to late Saxon periods considerable survey work as part of the South East Suffolk Survey (Newman 1988 *wf*) and many excavations in Ipswich have produced widespread evidence for settlement in these areas, as well as the growth of Ipswich as an urban centre. Few other sites have been excavated and there is a considerable lack of evidence for settlement in some areas such as the Waveney valley during this period (Wade *pers comm*). Recent excavations, at Flixton Quarry for example are beginning to change that perspective. Here, work ahead of gravel extraction has revealed as many as twenty-six early Saxon buildings, of varying construction methods such as posthole buildings and SFBs, roughly 500m from an inhumation cemetery, exposing one of the largest settlements of this date to be found in this area (Boulter, *Pers. Comm*.).

Into the later Medieval, excavations in Suffolk have commonly concentrated on rural sites, although a quarter of excavations relate to the urban environs of Ipswich and several at Bury St Edmunds, an indication of their importance during this period. By 1086 AD, a total of nine places in East Anglia are defined as being towns due to the presence of burgesses: Norwich, Thetford, Ipswich, Dunwich, Eye, Sudbury, Beccles, Clare and Yarmouth (Wade, 1993). Bury St Edmunds is also known to have had a population of over 3,000 suggesting its urban status. The majority of East Anglian urban settlements that existed by the 11$^{th}$ Century were therefore located within Suffolk.

The most ubiquitous monuments in Suffolk are moats, with nearly 1000 known references at the time of writing (*Suffolk SMR data*). The majority of these sites are square in shape and date to the period 1200 - 1325, with some circular and sub -square feature though to be earlier variants (Martin 1999 atlas reference) and later versions known. Many survive as earthworks but few excavations have been completed, and so the palaeoenvironmental potential of this resource may not have been fully realised. The other major area of study has been about understanding the historic landscape, from what survives through to the present day. Little of the structure of the landscape has changed in Suffolk since the medieval period. From the 1800's onwards land was enclosed, but only in the post war period have any substantial whole scale changes taken place. Whether it is possible to date the origins of this landscape and characterise the agricultural economy of the period through multi-proxy environmental work forms a major dialogue with the outcomes of this work.

**II. Palaeoenvironmental Evidence**

Due to the substantial lack of environmental evidence relating to the post Romano-British period, the nature of the Anglo-Saxon countryside is also poorly understood. Palaeoecological data relating to the Suffolk region is virtually non-existent and subsequently there is considerable variation regarding views on the character of the landscape (Murphy, 1994b). Whitelock (1952) suggested the early Anglo-Saxon landscape was heavily forested and any remaining cultivated land was surrounded by woodland and waste. In contrast, Rackham (1986) concluded that there was no large scale secondary woodland development at the end of the Roman period, with mainly farmland interspersed with restricted woodland.

An intensification of arable agriculture is evident shortly after the transition from the Romano-British period to the Saxon period at Scole (Wiltshire, *in press*), with the gradual removal of almost all woodland and scrub in the region by middle Saxon times. Hemp was being grown, viticulture had been established, and a mix of both arable and pastoral farming dominated the floor of the Waveney Valley.

Palaeoenvironmental work undertaken proximal to a Roman fort at Pakenham identified the presence of a possible former lake at Micklemere (Wiltshire, 1988; Murphy & Wiltshire, 1989). Peat formation took place prior to the onset of minerogenic sedimentation, with radiocarbon dating of the upper peat boundary indicating the change in the sedimentary regime occurred *c*. 1,290 ± 100 BP (*c*. AD660; HAR-5936). It is suggested that human activity relating to a renewed phase of arable farming occurred *c*. AD660, which resulted in enhanced soil erosion leading to the sudden shift to minerogenic deposition. Increased cereal pollen production is evident within the lake mud, which also correlates with elevated levels of microscopic charcoal. The expansion of agriculture onto the heavier soils on the 'Chalky Boulder Clays' during the Anglo-Saxon period may have been a contributing factor.

Palaeoenvironmental work undertaken at Staunch Meadow, near Brandon, has assisted in understanding the changes in land use since the Roman period. A natural sand ridge proximal to the River Little Ouse is surrounded by floodplain peat with evidence of human activity (Murphy, 1994b). Charcoal deposits and sand layers within the peat suggest heathland burning and subsequent slope erosion of the sand ridge *c*. 700-750AD (Murphy & Fryer, 2005). A middle Saxon occupation layer is evident, with associated plant macrofossil analyses identifying the growth of rye on impoverished sandy soils. Charred plant remains were also present along with evidence for possible flax production.

Ipswich was founded in the early 7$^{th}$ century on terrace gravels flanking the head of the Orwell Estuary, and soon grew to a *c*. 50 hectare occupation site by the 9$^{th}$ century AD (Murphy, 1993). As Ipswich was a major trading centre during the Saxon period onwards, environmental evidence for agricultural activity and crop processing is sparse. Heathland reclamation is however evident in the regions proximal to the original settlement. Areas of brackish grassland, salt-marsh and mudflat would have been exploited as pasture and for shell fish collection. Ipswich was seen as a 'consumer' settlement during the middle Saxon period, with the majority of crops being produced by farming settlements in relative proximity to the town (Murphy, 1984).

The Fenlands to the north experienced a gradual increase in water tables after the Roman period, which commonly resulted in the peat encroachment further inland. Such organic development is likely to have been encouraged by the development of sea defences whilst under monastic ownership during the Saxon era, although artificial drainage was also taking place (Hall, 1988)

**III. Gaps in Knowledge**

- As said previously there is a lack of reliable palaeoenvironmental evidence relating to the Roman and post-Roman periods. This is more so for the early medieval period, with virtually none present in the archaeological record. One of the most important aspects of this work is to look at the signature provided by multi proxy analysis of suitable sediment for post Roman abandonment of the clay lands, and changes in agriculture practice. What happens after the Roman economy and presence declines and can the environmental record tell us? Is there a re-growth of woodland, followed by a new period of settlement growth?
- Little or full multi proxy analysis of sediments has been completed from post Roman, Saxon or later medieval periods. The identification and interrogation of new sequences, which span these

- What is the nature of Saxon occupation, agriculture and economy?
- Are there evidence for agricultural expansion, and the environmental consequences of past activities?
- What is the impact of climate change and environmental change on the coastal zone, the coastal configuration, the fens and the river valley sediments?
- What is the impact of agriculture on the stability of the river valley sediments, particularly with reference to the differences between sandy and clay soils.

## REFERENCES

Abbot, C. (1998). *County Farm, Chilton, Archaeological Evaluation*. Suffolk County Council Archaeological Service unpublished report no. 98/43

Alderton, A.M. (1983). *Flandrian Vegetational History and Sea-Level Change in the Waveney Valley*. Unpublished PhD Thesis, University of Cambridge.

Allen, J.R.L. (2000). Morphodynamics of Holocene salt marshes: a review sketch from the Atlantic and Southern North Sea coasts of Europe. Quaternary Science Reviews, 19, 1155-1231.

Andrews, J.E., Funnell, B.M., Bailiff, I., Boomer, I., Bristow, C. & Chroston, P.N. (2000). The last 10,000 years on the north Norfolk coast – a message for the future? In: Dixon, R (ed), *Geological Society of Norfolk 50th Anniversary Jubilee Volume*, 76-85.

Ashton, N. & Lewis, S.G. (2002). Deserted Britain: declining populations in the British Late Middle Pleistocene. *Antiquity*, 76, 388-396.

Ashton, N., Lewis, S.G. & Parfitt, S.A. (2000). East Farm, Barnham, Suffolk. In: Lewis, S.G., Whiteman., C.A. & Preece, R.C. (eds), *The Quaternary of Norfolk & Suffolk Field Guide*. Quaternary Research Association, London.

Ashton, N., Lewis, S., Parfitt, S., Candy, I., Keen, D., Kemp, R., Penkman, K., Thomas, G., Whittaker, J. & White, M. (2005). Excavations at the Lower Palaeolithic site at Elveden, Suffolk, UK. *Proceedings of the Prehistoric Society* 71, 1-61.

Ashwin, T. & Tester, A. (in prep), A Romano-British Settlement in the Waveney Valley: Excavations at Scole, 1993-1994. East Anglian Archaeology.

Austin, L. (1997). Palaeolithic & Mesolithic. In: Glazebrook, J. (ed), *Research and Archaeology: a Framework for the Eastern Counties, 1. resource assessment*. East Anglian Archaeology Occasional Paper No. 3, 5-11.

Austin, L. (2000). Palaeolithic and Mesolithic. In: Brown, N. & Glazebrook, J. (eds), *Research and Archaeology: a Framework for the Eastern Counties, 2.research agenda and strategy*. East Anglian Archaeology Occasional Paper No. 8, 5-8.

Austin-Smith, R.J. (2000). The palaeoecology of Cavenham Mere, Suffolk. MSc, Cambridge University

Barber, K. E. (1982). Peat-bog stratigraphy as a proxy climate record. In: Harding, A. F. (eds), *Climate Change in Later Pre-History*. Edinburgh University Press, Edinburgh.

Barber, M., Field, D. & Topping, P. (1999). The Neolithic Flint Mines of England. English Heritage.

Bateman, M.D. (1995). Thermoluminescence dating of the British coversand deposits. *Quaternary Science Reviews*, 14, 791-798.

Bateman, M.D. & Godby, P. (2004). Late-Holocene inland dune activity in the UK: a case study from Breckland, East Anglia. *The Holocene*, 14, 4, 579-588.

Bell, M. (2000). Intertidal peats and archaeology of coastal change in the Severn Estuary, Bristol Channel and Pembrokeshire. In: Pye K. & Allen, J.R.L. (eds), *Coastal and Estuarine Environments: Sedimentology, Geomorphology and Geoarchaeology*. Geological Society Special Publication No. 175, 377-392.

Bennett, K.D. (1983) Devensian late glacial and Flandrian vegetational history at Hockham Mere, Norfolk, England, 1. Pollen assemblages and concentrations. *New phytologist* 95, 457-487.

Blagg, T., Plouviez, J. & Tester A. (2004). Excavations at a large Romano-British settlement at Hacheston, Suffolk in 1973-4. *East Anglian Archaeology Report No. 106*. Archaeological Service, Suffolk County Council.

Boismier, W.A., Schreve, D.C., White, M.J., Robertson, D.A., Stuart, A.J., Etienne, S., Andrews, J., Coope, G.R., Green, F.M.L., Keen, D.H., Lewis, S.G., French, C., Rhodes, E., Schwenninger, J.L., Tovey, K., Donahue, R.E., Richards, M.P., O'Connor, S. (2003). A Middle Palaeolithic Site at Lynford Quarry, Mundford, Norflk: Interim Statement. *Proceedings of the Prehistoric Society*, 69, 315-324.

Brew, D.S. (1990). Sedimentary Environments and Holocene Evolution of the Suffolk estuaries. PhD Thesis, university of East Anglia.

Brew, D.S., Funnell, B.M. & Kreiser, A. (1992). Sedimentary Environments and Holocene evolution of the lower Blyth estuary, Suffolk (England), and a comparison to other East Anglian coastal sequences. *Proceedings of the Geological Association*, 101, 1, 57-74.

Bridgland, D.R. (1994). Quaternary of the Thames. Geological Conservation Review Series 7. Chapman & Hall, London.

Bridgland, D.R & Lewis, S.G. (1991). Introduction to the Pleistocene Geology and Drainage History of the Lark Valley. In: Lewis, S.G, Whiteman, C.A. & Bridgland, D.R. (eds), *Central East Anglia and the Fen Basin Field Guide*. Quaternary Research Association, London.

Briscoe, G. (1964). Bronze Age pottery from Joist Fen, Lakenheath. *Proceedings of the Cambridge Antiquarian Society*, 56, 1964, 1-5.

Britton, D. (1960). The Isleham Hoard, Cambridgeshire. *Antiquity*, 34, 136, 279-282.

Bronk Ramsey, C. (1995). Radiocarbon calibration and analysis of stratigraphy: The OxCal program, *Radiocarbon*, 37, 2, 425-430.

Bronk Ramsey, C, 2001, Development of the radiocarbon calibration program OxCal, *Radiocarbon*, 43, 2A, 355-363

Brown, N. & Murphy, P. (1997). Neolithic and Bronze Age. In: Glazebrook, J. (ed), *Research and Archaeology: a Framework for the Eastern Counties, 1. resource assessment*. East Anglian Archaeology Occasional Paper No. 3, 5-11.

Brown, N. & Murphy, P. (2000). Neolithic & Bronze Age. In: Brown, N. & Glazebrook, J. (eds), *Research and Archaeology: a Framework for the Eastern Counties, 2. research agenda and strategy*. East Anglian Archaeology Occasional Paper No. 8, 12-22.

Bryant, S. (1997). Iron Age. In: Glazebrook, J. (ed), Research and Archaeology: a Framework for the Eastern Counties, 1. resource assessment. East Anglian Archaeology Occasional Paper No. 3, 14-18.

Bryant, S. (2000). Iron Age. In: Brown, N. & Glazebrook, J. (eds), *Research and Archaeology: a Framework for the Eastern Counties, 2. research agenda and strategy*. East Anglian Archaeology Occasional Paper No. 8, 23-34.

Carr, J. (1991). The Suffolk Excavation Index. *Proceedings of the Suffolk Institute of Archaeology and History* 37, 3, 179-185.

Carr, R.D., Tester, A. & Murphy, P. (1988). The Middle Saxon settlement at Staunch Meadow, Brandon. *Antiquity* 62, 371-7.

Catt, J. A. (2001). The agricultural importance of loess. *Earth Science Reviews*, 54, 213-229.

Caruth, J. (1995). Cavenham Excavation Report. Suffolk Archaeological Service, SCCAS Report 96/5

Chatwin, C.P. (1948). *East Anglia and adjoining areas*. British Regional Geology Series, London, HMSO.

Clarke, W.G. (1913). Some Barnham palaeoliths. P*roceedings of the Prehistoric Society of East Anglia*, 1, 300-303.

Clarke, H. (1971). Regional Archaeologies: *East Anglia*. Heinemann Educational Books Ltd, London.

Clarke, J.G.D., Higgs, E.S. & Longworth, I.H. (1960). Excavations at the Neolithic site at Hurst Fen, Mildenhall, Suffolk, 1954, 1957 and 1958. *Proceedings of the Prehistoric Society* 26, 202-245.

Coles, B.P.L. (1977). *The Holocene foraminifera and palaeogeography of Central Broadland*. Unpublished PhD Thesis, University of East Anglia.

Coles, B.P.L. & Funnell, B.M. (1981). Holocene palaeoenvironments of Broadland, England. *Special Publication of the International Association of Sedimentologists* 5, 121-131.

Cook, J., Ashton, N., Coope, G.R., Hunt, C.O., Lewis, S.G. & Rose, J. (1991). High Lodge, Mildenhall, Suffolk (TL 739574). In: Lewis, S.G, Whiteman, C.A. & Bridgland, D.R. (eds), *Central East Anglia and the Fen Basin Field Guide*. Quaternary Research Association, London.

Crabtree, P.J. (1989). West Stow, Suffolk: Early Anglo-Saxon Animal Husbandry. *East Anglian Archaeology Report No. 47*. Suffolk County Planning Department.

Devoy, R.J.N. (1979). Flandrian sea-level changes and vegetation history in the lower Thames Estuary. Philosophical Transactions of the Royal Society of London B285, 355-407.

Dymond, D. & Martin, E. (1999). An Historical Atlas of Suffolk: Revised and Enlarged Edition. Suffolk County Council, Environment & Transport. Ipswich.

Filmer-Sankey, W. & Pestell, T. (2001). Snape Anglo-Saxon Cemetery: Excavations and Surveys 1824-1992). *East Anglian Archaeology Report No. 95*. Suffolk County Council.

French, C.A.I. & Pryor, F.M.M. (1993). The South-west Fen Dyke Survey Project, 1982-1986. *East Anglian Archaeology No. 59*.

Frere, S. (1998). Britannia: A history of Roman Britain. Pimlico, London

Godwin, M. (2003). Palaeoenvironmental analysis of samples from an intertidal site at the River Deben near Sutton Hoo. Unpublished Grey Literature.

Going, C. (2000). Roman. In: Brown, N. & Glazebrook, J. (eds), *Research and Archaeology: a Framework for the Eastern Counties, 2. research agenda and strategy*. East Anglian Archaeology Occasional Paper No. 8, 23-34.

Hall, N. (2006). *Archaeological Monitoring of Ground Reduction at the Lignacite Works, Brandon, Suffolk*. Archaeological Project Services, Report 190/05.

Hall, D. (1988). 1 Survey: Survey results in the Cambridgeshire Fenland. *Antiquity*, 62, 235, 311-314.

Hall, D. & Chippindale, C. (1988). Special section: Survey, environmental an excavation in the English Fenland. *Antiquity*, 62, 235, 305-310.

Hunt, C.O., Lewis, S.G., Rose, J. & Wymer, J.J. (1991). Lackford, Suffolk (TL 815704). In: Lewis, S.G, Whiteman, C.A. & Bridgland, D.R. (eds), *Central East Anglia and the Fen Basin Field Guide*. Quaternary Research Association, London.

Jones, H. (1869). Bronze Barton

Keen, D.H., Hardaker, T. & Lang, A.T.O. (2006). A Lower Palaeolithic industry from the Cromerian (MIS 13) Baginton Formation of Waverley Wood and Wood Farm Pits, Bubbenhall, Warwickshire, UK. *Journal of Quaternary Science*, 21, 5, 457-470.

Lane, T. and Morris, E.L. Eds (2001) *A Millennium of Saltmaking: Prehistoric and Romano-British Salt Production in the Fenland*. Lincolnshire Archaeology and Heritage Report Series No. 4

Lambeck, K. (1995). Late Devensian and Holocene shorelines in the British Isles and North Sea from models of glacio-hydro-isostatic rebound. *Journal of the Geological Society*, 153, 853-872.

Lewis, S.G. (1998). Quaternary Stratigraphy and Lower Palaeolithic Archaeology of the Lark Valley, Suffolk. In: Ashton, N., Healy, F. & Pettitt, P. (eds), Stone Age Archaeology: Essays in honour of John Wymer. Oxbow Monograph 102. Lithic Studies Society Occasional Paper 6, 43-51.

Lewis, S.G. & Bridgland (1991). Ingham (TL 855715) and Timworth (TL 853692), Suffolk. In: Lewis, S.G, Whiteman, C.A. & Bridgland, D.R. (eds), *Central East Anglia and the Fen Basin Field Guide*. Quaternary Research Association, London.

Lewis, S.G. & Rose, J. (1991). Knettishall, Suffolk (TL 951798). In: Lewis, S.G, Whiteman, C.A. & Bridgland, D.R. (eds), *Central East Anglia and the Fen Basin Field Guide*. Quaternary Research Association, London.

Lewis, S.G., Ashton, N., Parfitt, S.A. & White, M. (2000). Hoxne, Suffolk (TM 176769). In:Lewis, S.G., Whiteman., C.A. & Preece, R.C. (eds), *The Quaternary of Norfolk & Suffolk Field Guide*. Quaternary Research Association, London.

Long. A.J., Scaife, R.G. & Edwards, R.J. (2000). Stratigraphic architecture, relative sea-level, and bodels of estuary development in Southern England: new data from Southampton Water. In: Pye, K. & Allen, J.R.L. (eds), *Coastal and Estuarine Environments: Sedimentology, Geomorphology and Geoarchaeology*. Geological Society Special Publication No. 175, 365-376.

Martin, E. A. (1975). The Excavation of Barrow I, Martlesham Heath. *East Anglian Archaeology Report No. 1: Suffolk*. Suffolk County planning Department.

Martin, E. A. (1976a). The excavation of Barrows II, III and IV, Martlesham Heath, 1974. *East Anglian Archaeology Report No. 3: Suffolk*. Suffolk County planning Department.

Martin, E. A. (1976b). The excavation of a tumulus at Barrow Bottom, Risby, 1875. *East Anglian Archaeology Report No. 3: Suffolk*. Suffolk County planning Department.

Martin, E.A. (1981). The Barrows of Suffolk. In: Lawson, A.J., Martin, E.A. & Priddy, D. (eds), *The Barrows of East Anglia*. East Anglian Archaeology Report No. 12. Norfolk Museums Service, Suffolk County Council & Essex County Council.

Martin, E.A. (1988a). 'Swales Fen', Suffolk: A Bronze Age Cooking Pit?, *Antiquity*, 62, 235, 358-359.

Martin, E.A. (1988b). Burgh: Iron Age and Roman Enclosure. *East Anglian Archaeology Report No. 40*. Suffolk County planing Department.

Martin, E.A. (1993). Settlements on Hill-Tops: Seven Prehistoric Sites in Suffolk. *East Anglian Archaeology Report No. 65*. Suffolk County Council Department.

Martin, E.A. (2006) (Ed.). Site Summaries, *Proceedings of the Suffolk Institute of Archaeology*, *XLI*

Martin, E.A. & Murphy, P. (1988). West Row Fen, Suffolk: a Bronze Age fen-edge settlement site. *Antiquity* 62, 235, 353-358.

Martin, E. & Satchell, M. (forthcoming). Wheare most Inclosures be: East Anglian Fields, History, Morphology and Management. EAA Monograph.

Middleton, R. (1999). Unleashing the Potential? Wetland Survey and Management in North West England, in Coles, B, Coles, J, and M, Schou Jorgensen (Eds) *Bog Bodies, Sacred Sites and Wetland* Archaeology, WARP, Exeter

Morris, M. & Wainwright, A. (1995). Iron Age and Romano-British Settlement, Agriculture and Industry in the Upper Bulbourne Valley, Hertfordshire: an Interim Interpretation. In: Holgate, R (ed). *Chiltern Archaeology: Recent Work*, 68-75.

Mowat, R.J. (1975). The Hollesley Bay Romano-British rural settlement. *East Anglian Archaeology Report No. 1: Suffolk*. Suffolk County planning Department.

Murphy, P. (1984). Plant macrofossils from the Middle Saxon and earlier contexts. Unpublished report, East Anglian Archaeology.

Murphy, P. (1993). The Environment and Agrarian Economy of Saxon and Medieval Ipswich. With contributions by Funnell, B., Keeley, H., Kenward, H., MacPhail, R., McLaren, F., Robinson, M. & Stenenson, R. Unpublished report, East Anglian Archaeology.

Murphy, P (1994a) Environmental archaeology in East Anglia 1977-1980: a review. UEA Centre of East Anglian Studies.

Murphy, P. (1994b). The Anglo-Saxon landscape and rural economy: some results from sites in Anglia and Essex. In: Rackham, J. (ed), *Environment and Economy in Anglo-Saxon England: A review of recent work on the environmental archaeology of rural an urban settlements in Anglo-Saxon England*. Council for British Archaeology, Research Report 89, 23-39.

Murphy, P. & Fryer, V. (2005). Valley sediments and plant macrofossils. In: Anderson S., Carr R. and Tester A. (eds), *A High Status Middle Saxon Settlement on the Fen Edge*: *Staunch Meadow, Brandon*. East Anglian Archaeology.

Murphy, P. & Wiltshire, P.E.J. (1989). *Pakenham, Suffolk (PKM 028): Environmental and Economic Studies*. Ancient Monument Laboratory report Series 99/89. London, HBMC.

Newman, J. (1988). *East Anglian Kingdom Survey:Interim Report on the South-East Suffolk Pilot Field Survey*. Sutton Hoo Research Committee Vol 5.

Oswald, A., Dyer, C. & Barber, M. (2001). The Creation of Monuments: Neolithic causewayed enclosures in the British Isles. English Heritage, Swindon.

Painter, K.S. (1977). The Mildenhall Treasure: Roman Silver from east Anglia. British Museum Publications limited.

Parfitt, S.A., Berendegt, R.W., Breda, M., Candy, I., Collins, M.J., Coope, G.R., Durbidge, P., Field, M.H., Lee, J.R., Lister, A.M., Mutch, R., Penkman, K.E.H., Preece, R.C., Rose, J., Stringer, C.B., Symmonds, R., Whittaker, J.E., Wymer, J.J. & Stuart, A.J. (2005). The earliest record of human activity in northern Europe. *Nature,* 438, 1008-1012.

Peglar, S.M. (1993). The mid-Holocene Ulmus decline at Diss Mere, Norfolk: a year by year pollen stratigraphy from annual laminations. *The Holocene* 3, 1, 203-222.

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.

Plouviez, J. (1999). 'The Romans'. In: Dymond, D. & Martin, E. (Eds), *An Historical Atlas of Suffolk: Revised and Enlarged Edition*. Suffolk County Council, Environment & Transport. Ipswich.

Rackham, O. (1986). *The history of the countryside.* London, Dent.

Roberts, A.J., Barton, R.N.E. & Evans, J. (1998). Early Mesolithic Mastic: Radiocarbon Dating and Analysis of Organic Residues from Thatcham III, Star Carr and Lackford Heath. In: Ashton, N., Healy, F & Pettitt, P. (eds), *Stone Age Archaeology: Essays in honour of John Wymer*. Oxbow Monograph 102, Lithic Studies Society Occasional Paper 6, 185-192.

Rose, J. (1976). The date of the buried channel deposits at Sproughton. *East Anglian Archaeology Report No. 3: Suffolk*. Suffolk County planning Department.

Rose, J. (1985). The Dimlington Stadial/Dimlington Chronozone: a proposal for naming the main glacial episode of the Late Devensian in Britain. *Boreas*, 14, 225-230.

Rose, J. (1994). Major River Systems of Central and Southern Britain during the Early and Middle Pleistocene. *Terra Nova*, 6, 435-443.

Rose, J., Turner, C., Coope, G.R. & Bryan., M.D. (1980). Channel Changes in a Lowland River Catchment Over the Last 13,000 years. In: Cullingford, R.A., Davidson, D.A., & Lewin, J. (eds), *Timescales in Geomorphology*. John Wiley & Sons Ltd.

Rose, J., Moorlock, B.S.P. & Hamblin, R.J.O. (2001). Pre-Anglian Fluvial and Coastal Deposits in Eastern England: Lithostratigraphy and Palaeoenvironments. *Quaternary International*, 79, 5-22.

Scaife, R. (1988). Pollen analysis of the Mar Dyke sediments. In: Wilkinson, T.J. (ed). *Archaeology and Environment in South Essex*. East Anglian Archaeology 42, 109-114.

Scaife, R. (1990). Pilot Pollen Analysis of Methwold. Unpublished report, Department of Geography, University of Southampton.

Schreve, D.C. (2000). The vertebrate assemblage from Hoxne, Suffolk. In: Lewis, S.G., Whiteman., C.A. & Preece, R.C. (eds), *The Quaternary of Norfolk & Suffolk Field Guide*. Quaternary Research Association, London.

Schreve, D.C., Bridgland, D.R., Allen, P., Blackford, J.J., Gleed-Owen, C.P., Griffiths, H.I. Keen, D.H., White, M.J. (2002). Sedimentology, palaeontology and archaeology of the late Middle Pleistocene River Thames terrace deposits at Purfleet, Essex, UK. *Quaternary Science Reviews*, 21, 1423-1464.

Singer, R., Gladfelter, B.G. & Wymer, J.J. (1993). The Lower Palaeolithic at Hoxne, England. University of Chicago Press.

Smith, A.G., Whittle, A., Cloutman, E.W. & Morgan. L.A. (1989). Mesolithic and Neolithic activity and environmental impact on the south-east fen edge in Cambridgeshire. *Proceedings of the Prehistoric Society* 55, 207, 249.

Stimson, D. (1979) Cavenham Mere

Stuart, A.J. & Lister, A.M. (2000). Pakefield, Suffolk. In: Lewis, S.G., Whiteman., C.A. & Preece, R.C. (eds), *The Quaternary of Norfolk & Suffolk Field Guide*. Quaternary Research Association, London.

Streif, H. (2004). Sedimentary record of Pleistocene and Holocene marine inundations along the North Sea coast of Lower Saxony, Germany. *Quaternary International*, 112, 3-28.

Suckling, A.I. (1846). The History and Antiquities of the County of Suffolk: with genealogical and archaeological notices of its several towns and villages. John Weale, London.

Sussams, K. (1996). *The Breckland Archaeological Survey 1994-1996: a characterisation of the Archaeology and Historic Landscape of the Breckland Environmental Sensitive Area*. Suffolk County Council.

Tester, A. (2001a). *Consolidated Support Compex RAF Lakenheath ERL116: A Report on the Archaeological Evaluation*. Suffolk County Council Archaeological Service 2001/56.

Tester, A. (2001b). Unpublished Report: Eriswell Evaluation Report, 2001/56a.

Thomas, G. and Fletcher, W. (2001) Prehistoric and Romano-British Saltmaking in the Lincolnshire Marsh. In Ellis, S. Fenwick, H. Lillie, M. and R. Van de Noort. (eds) *Wetland Heritage of the Lincolnshire Marsh.* Humber Wetlands Project, Hull

Wade, K. (1993). The Urbanisation of East Anglia: the Ipswich Perspective. In: Gardner, J. (ed), Flatlands and Wetlands: Current Themes in Anglian Archaeology. East Anglian Archaeology 50, 144-151.

Waller, M. (1994). The Fenland Project, Number 9: Flandrian Environmental Change in Fenland, Cambridge. *East Anglian Archaeology Report No. 70*. Cambridgeshire County Council.

Whitelock, D. (1952). *The Beginnings of English Society*. Penguin Books, Harmondsworth.

West. S.E. (1988). The Anglo-Saxon Cemetery at westgarth Gardens, Bury st Edmunds, Suffolk. *East Anglian Archaeology report No. 38*. Suffolk County Planning Department.

West, S.E. (1989). West Stow: The Prehistoric and Romano-British Occupations. *East Anglian Archaeology Report No. 48*. Suffolk County Planning Department.

West, S.E. (1999) The Early Anglo-Saxon Period. In: Dymond, D. & Martin, E. (Eds). *An Historical Atlas of Suffolk: Revised and Enlarged Edition*. Suffolk County Council, Environment & Transport. Ipswich.

West, S.E. & Plouviez, J. (1976). The Romano-British Site at Icklingham. *East Anglian Archaeology Report No. 3: Suffolk*. Suffolk County planning Department.

White, M. (1998). On the significance of Acheulian biface variability in southern England. *Proceedings of the Prehistoric Society*, 64, 15-44.

Wilikinson, T.J. and Murphy, P.L (1995). The Archaeology of the Essex Coast, Volume 1: The Hullbridge Survey. *East Anglian Archaeology Report No. 71: Essex County Council*

Williamson. T. (2005). Explaining Regional Landscapes: East Anglia and the Midlands in the Middle Ages. In: Harper-Bill (ed), *Medieval East Anglia*. The Boydell Press, Suffolk.

Wilson, D.R. (1975). 'Causewayed camps' and 'uninterrupted ditch systems'. *Antiquity* 44, 18-21.

Wiltshire, P.E.J. (1988). *Microscopic analysis of sediments taken from the edge of Micklemere, Pakenham, Suffolk*. Ancient Monuments Laboratory Report 209/88. London, HBMC.

Wiltshire, P.E.J. (in prep). Palynological assessment and analysis. In: Ashwin, T. & Tester, A. (eds) *A Romano-British Settlement in the Waveney Valley: Excavations at Scole, 1993-1994*. East Anglian Archaeology.

Wiltshire, P.E.J. (1990). *A palynological analysis of sediments from Staunch Meadow, Brandon, Suffolk*. Ancient Monuments Laboratory Report, 73/90.

Wiltshire, P.E.J. & Murphy, P.L. (1999) Current Knowledge of the Iron Age Environment and Agrarian Economy of Norfolk and Adjacent Areas. In: Davies, J. & Williamson, T. (eds) *Land of the Iceni: the Iron Age in northern East Anglia*. Centre of East Anglian Studies, Norfolk.

Wiltshire, P.E,J. & Emery, P.A. (2000). *Report on an Archaeological Watching Brief at Riverside, Norwich*. Norfolk Archaeological Unit, Report n. 354.

Wright, T. (1668). The curious and exact relation of a Sandfloud. *Philosophical Transactions of the Royal Society of London*, 3, 722-725.

Wymer, J.J. (1975). Two barbed points from Devil Wood's Pit, Sproughton. *East Anglian Archaeology Report No. 1: Suffolk*. Suffolk County planning Department.

Wymer, J.J. (1976). A long blade industry from Sproughton. *East Anglian Archaeology Report No. 3: Suffolk*. Suffolk County planning Department.

Wymer, J.J. (1985). The Palaeolithic Sites of East Anglia. Geobooks, Norwich.

Wymer, J.J. (1991). Mesolithic occupation around Hockham Mere. *Norfolk Archaeology* 41, 212-213.

Wymer, J.J. (1999). The Lower Palaeolithic Occupation of Britain. Volumes 1 & 2. Wessex Archaeology and English Heritage, Cromwell Press Ltd, England.

Wymer, J.J. & Singer, R. (1993). Flint Industries and Human Activity. In: Singer, R., Gladfelter, B.G. & Wymer, J.J. (eds), *The Lower Palaeolithic at Hoxne, England*. University of Chicago Press.

Wymer, J.J., Lewis, S.G. & Bridgland, D.R. (1991). Warren Hill, Mildenhall, Suffolk (TL 744743). In: Lewis, S.G, Whiteman, C.A. & Bridgland, D.R. (eds), *Central East Anglia and the Fen Basin Field Guide*. Quaternary Research Association, London.

# APPENDIX II

## BOREHOLE LOGS

## BECCLES

**Core 1 (-0.556m O.D.)**
0.00-2.40m Dark brown herbaceous woody slightly silty peat
2.40-4.05m Dark brown herbaceous woody peat
4.05-4.20m Dark brown well humified slightly silty peat
4.20-4.70m Dark brown herbaceous well humified peat
4.70-5.20m Red-brown herbaceous well-humified peat

**Core 2 (-0.486m O.D)**
0.00-0.95m Dark brown herbaceous well humified slightly silty peat
0.95-1.20m Grey-brown slightly sandy organic-rich silt
2.10-1.90m Red-brown herbaceous humified woody peat
1.90-3.90m Dark brown well humified woody slightly silty peat
3.90-5.15m Dark brown well humified slightly silty peat

**Core 3 (-0.515m O.D.)**
0.00-0.95m Dark brown slightly humified herbaceous peat
0.95-1.00m Grey-brown organic-rich silt
1.00-1.90m Red-brown herbaceous humified peat with occasional wood fragments
1.90-4.20m Red-brown herbaceous humified slightly silty peat
4.20-4.70m Dark brown-black very well humified slightly silty peat

**Core 4 (-0.540m O.D.)**
0.00-0.90m Dark brown herbaceous humified peat
0.90-1.00m Grey-brown organic-rich silt
1.00-1.90m Red-brown herbaceous woody peat
1.90-4.50m Red-brown well humified slightly silty peat

**Core 5 (-0.563m O.D.)**
0.00-0.90m Dark brown herbaceous slightly silty peat
0.90-1.00m Dark brown organic-rich silt
1.00-2.90m Red-brown herbaceous humified woody peat
2.90-3.90m Red-brow herbaceous humified slightly silty peat
3.90-4.40m dark brown-black herbaceous slightly silty peat

**Core 6 (-0.508m O.D.)**
0.00-0.90m Dark brown herbaceous well humified peat
0.90-1.00m Grey-brown organic-rich silt
1.00-2.40m Dark brown herbaceous well humified peat with occasional wood fragments
2.40-4.20m Dark brown herbaceous well humified slightly silty peat

**Core 7 (-0.626m O.D.)**
0.00-0.90m Dark brown herbaceous peat with occasional wood fragments
0.90-1.00m Grey-brown organic-rich silt
1.00-3.50m Red-brown herbaceous well humified peat with occasional wood fragments
3.50-4.05m Dark brown-black herbaceous well humified slightly silty peat

**Core 8 (-0.327m O.D.)**

| | |
|---|---|
| 0.00-1.00m | Dark brown herbaceous well humified slightly silty peat |
| 1.00-2.10m | Dark brown herbaceous well humified very silty peat with occasional wood fragments |
| 2.10-4.30m | Red-brown herbaceous well-humified peat with occasional wood fragments |
| 4.30-5.10m | Red-brown very well humified peat |
| 5.10-5.35m | Grey-brown herbaceous well-humified silty peat |

**Core 9 (-0.266m O.D.)**

| | |
|---|---|
| 0.00-0.80m | Dark brown herbaceous well-humified silty peat |
| 0.80-1.90m | Grey-brown very well humified slightly silty peat |
| 1.90-2.80m | Red-brown herbaceous humified peat with occasional wood remains |
| 2.80-4.00m | Red-brown herbaceous humified peat with abundant wood remains |
| 4.00-4.20m | Black herbaceous very well humified peat |
| 4.20-5.40m | Dark brown herbaceous humified peat |

**Core 10 (-0.269m .D.)**

| | |
|---|---|
| 0.00-1.30m | Red-brown herbaceous well humified slightly silty peat |
| 1.30-1.50m | Dark brown organic-rich silty peat |
| 1.50-2.05m | Grey-brown herbaceous well humified silty peat |
| 2.05-3.90m | Red-brown herbaceous well humified peat with occasional wood fragments |
| 3.90-4.60m | Dark brown herbaceous well humified peat |
| 4.60-5.50m | dark brown-black herbaceous very well humified peat |

**Core 11 (-0.265m O.D.)**

| | |
|---|---|
| 0.00-0.90m | Grey-brown herbaceous well humified silty peat |
| 0.90-1.00m | Light grey-brown organic-rich silt |
| 1.00-1.90m | Grey-brown herbaceous well humified silty peat |
| 1.90-5.25m | Red-brown herbaceous humified peat with occasional wood fragments |
| 5.25-6.05m | Dark brown-black very well humified peat |

**Core 12 (-0.374m O.D.)**

| | |
|---|---|
| 0.00-1.20m | Dark brown herbaceous humified slightly silty peat |
| 1.20-1.90m | Grey-brown herbaceous humified silty peat |
| 1.90-3.80m | Red-brown herbaceous very well humified peat |
| 3.80-4.10m | Black very well humified slightly silty peat |
| 4.10-5.00m | Red-brown herbaceous humified peat |
| 5.00-5.70m | Dark brown-black herbaceous well humified peat with occasional wood fragments |

**Core 13 (-0.350m O.D.)**

| | |
|---|---|
| 0.00-0.50m | Dark brown herbaceous well humified slightly silty peat |
| 0.50-0.80m | Grey-brown organic-rich silt |
| 0.80-4.10m | Red-brown very well humified silty peat with occasional wood fragments |
| 4.10-5.75m | Red-brown herbaceous well humified peat |

**Core 14 (-0.331m O.D.)**

| | |
|---|---|
| 0.00-0.35m | dark brown herbaceous slightly silty peat |
| 0.35-1.20m | Grey-brown organic-rich silt |
| 1.20-1.40m | Dark brown herbaceous silty peat |
| 1.20-1.95m | Grey-brown organic-rich silt |
| 1.95-4.00m | Red-brown very well humified slightly silty peat with occasional wood fragments |
| 4.00-5.70m | Red-brown to black herbaceous well humified peat |

**Core 15 (-0.261m O.D.)**

| | |
|---|---|
| 0.00-0.80m | Dark brown herbaceous silty peat |
| 0.80-1.00m | Grey-brown organic-rich silt |
| 1.00-1.80m | Grey-brown herbaceous well humified silty peat |
| 1.80-2.80m | Red-brown herbaceous humified peat with abundant wood fragments |
| 2.80-4.40m | Red-brown very well humified silty peat |
| 4.40-5.70m | Dark brown-black herbaceous very well humified peat |

**Core 16 (-0.361m O.D.)**

| | |
|---|---|
| 0.00-0.90m | Dark brown very well humified silty peat |
| 0.90-1.00m | Grey-brown organic-rich silt |
| 1.00-1.10m | Light grey organic silt |
| 1.10-1.80m | Grey-brown herbaceous silty peat |
| 1.80-4.30m | Red-brown herbaceous humified peat with occasional wood fragments |
| 4.30-5.70m | dark brown herbaceous very well humified peat |

**Core 17 (-0.321m O.D.)**

| | |
|---|---|
| 0.00-0.50m | Dark brown herbaceous silty peat |
| 0.50-0.80m | Grey-brown well humified silty peat with occasional flint |
| 0.80-1.10m | Light grey-brown organic-rich silt |
| 1.10-1.70m | Red-brown herbaceous well humified silty peat |
| 1.70-1.80m | Light grey organic-rich clay |
| 1.80-4.00m | Red-brown very well humified peat with occasional wood fragments |
| 4.00-4.80m | Black herbaceous very well humified peat |

**Core 18 (-0.309m O.D.)**

| | |
|---|---|
| 0.00-0.90m | Grey-brown herbaceous humified silty peat |
| 0.90-1.30m | Grey-brown organic-rich silt |
| 1.30-1.90m | Grey-brown herbaceous very well humified silty peat |
| 1.90-5.20m | Red-brown herbaceous humified peat with abundant wood fragments |
| 5.20-5.70m | Dark brown herbaceous very well humified peat |

**Core 19 (-0.246m O.D.)**

| | |
|---|---|
| 0.00-0.90m | Grey-brown herbaceous well humified silty peat |
| 0.90-1.00m | Light grey organic-rich silt |
| 1.00-1.90m | Grey-brown herbaceous well humified silty peat |
| 1.90-4.50m | Red-brown herbaceous well humified peat |
| 4.50-4.90m | dark brown-black herbaceous very well humified peat |

*Core abandoned at 4.90m due to hole collapse*

**Core 20 (-0.227m O.D.)**

| | |
|---|---|
| 0.00-0.20m | Dark brown herbaceous silty peat |
| 0.20-2.30m | Light grey organic rich silts and clays |
| 2.30-3.90m | Red-brown very well humified peat |

**Core 21 (-0.083m O.D)**
(***sampled for Suffolk River Valleys Project***)
0.00-0.16m Unsampled
0.16-0.89m Blue-grey clayey silt
0.89-0.96m Grey-brown organic-rich silt
0.96-1.35m Blue-grey clayey silt
1.35-1.56m Grey-brown organic-rich silt
1.56-1.74m Blue-grey clayey silt
1.74-2.23m Grey-brown organic-rich silt
2.23-2.51m Blue-grey clayey silt
2.51-2.55m Grey-brown organic-rich silt
2.55-2.58m Blue-grey clayey silt
2.58-2.76m Grey-brown organic-rich silt
2.76-2.84m Blue-grey clayey silt
2.84-3.74m Grey-brown herbaceous well humified peat

**Core 22 (-0.174m O.D.)**
0.00-1.70m Blue-grey silty clay
1.70-1.90m Grey-brown organic-rich silt
1.90-2.20m Black organic-rich silt
2.20-3.60m Blue-grey clayey silt
3.60-4.00m Red-brown herbaceous well humified peat

**Core 23 (-0.155m O.D.)**
0.00-1.40m Blue-grey clayey silts
1.40-1.90m Grey-brown organic-rich silt
1.90-2.10m Black organic rich silt
2.10-2.70m Blue-grey clayey silt
2.70-2.90m Grey-brown organic-rich silt
2.90-4.90m Thin interbedded layers of blue-grey clayey silts and organic-rich silts

**Core 24 (-0.571m O.D.)**
0.00-4.30m Thin interbedded layers of blue-grey clayey silts and organic-rich silts
4.30-5.00m Grey-brown herbaceous well humified silty peat

**Core 25 (-0.552m O.D.)**
0.00-0.80m Grey-brown organic-rich silt
0.80-1.00m Grey-brown clayey silt
1.00-3.00m Blue-grey clayey silt
3.00-3.35m Grey-brown organic-rich silt
3.35-4.00m Grey-brown herbaceous well humified silty peat

**Core 26 (-0.453m O.D.)**
0.00-0.80m Blue-grey silty clay
0.80-1.00m Grey-brown organic-rich silt
1.00-1.70m Blue-grey silty clay
1.70-1.80m Grey-brown organic-rich silt
1.80-1.90m Blue-grey silty clay
1.90-2.90m Red-brown herbaceous well humified peat with abundant wood fragments

**Core 27 (-0.517m O.D.)**
0.00-0.50m Grey-brown silty clay
0.50-0.80m Grey-brown organic-rich silt
0.80-1.10m Grey-brown herbaceous silty peat
1.10-1.90m Red-brown herbaceous well humified peat

**Core 28 (-0.717m O.D.)**
0.00-0.20m Grey-brown organic-rich silt
0.20-0.60m Grey-brown herbaceous silty peat
0.60-1.20m Grey-brown well humified peat
1.20-3.90m Red-brown very well humified peat
3.90-5.60m Dark brown-black very well humified peat

**Core 29 (-0.780m O.D.)**
0.00-0.70m Grey-brown well humified silty peat
0.70-0.90m Red-brown well humified peat
0.90-1.00m Grey-brown organic-rich silt
1.00-3.20m Red-brown herbaceous very well humified peat with occasional wood fragments
3.20-4.50m Black herbaceous well humified peat
4.50-5.40m Dark brown-black herbaceous well humified peat
5.40-5.60m Grey brown organic-rich sand

**Core 30 (-0.580m O.D.)**
0.00-0.80m Red-brown herbaceous well humified peat
0.80-1.00m Grey-brown organic-rich silt
1.00-1.60m Grey-brown herbaceous silty peat with occasional flint
1.60-3.50m Dark brown herbaceous well humified peat
3.50-4.70m Red-brown herbaceous humified peat with occasional wood fragments
4.70-5.50m Dark brown herbaceous well humified peat
5.50-5.60m Grey-brown humified sandy peat

**Core 31 (-0.721m O.D.)**
0.00-0.50m Grey-brown organic-rich silt
0.50-1.00m Grey-brown organic rich sand and gravel
1.00-2.70m Red-brown herbaceous well humified peat
2.70-3.60m Dark brown well humified peat
4.60-4.60m Black herbaceous well humified peat with occasional wood fragments
4.60-5.30m Dark brown-black very well humified peat
5.30-5.40m Dark grey-brown well humified sandy peat

**Core 32 (-0.616m O.D.)**
0.00-0.50m Grey-brown organic-rich silt
0.50-0.80m Light grey organic sand with occasional flint
0.80-3.70m Red-brown herbaceous well humified peat with occasional wood fragments
3.70-4.60m Black herbaceous well humified peat with occasional wood fragments
4.60-5.20m Red-brown very well humified peat
5.20-5.30m Dark brown well humified sandy peat

**Core 33 (-0.688m O.D.)**

| | |
|---|---|
| 0.00-0.50m | Grey-brown organic-rich silt |
| 0.50-0.70m | Grey organic-rich silt with occasional gravel |
| 0.70-1.90m | Red-brown herbaceous well humified peat |
| 1.90-3.40m | Red-brown herbaceous well humified peat with occasional wood fragments |
| 3.40-4.50m | Black herbaceous well humified peat with occasional wood fragments |
| 4.50-5.20m | Red-brown very well humified peat with sand towards base |

**Core 34 (-0.525m O.D.)**

| | |
|---|---|
| 0.00-0.80m | Blue-grey clayey silt |
| 0.80-1.00m | Grey-brown clayey silt |
| 1.00-2.20m | Blue grey clayey silt |
| 2.20-2.45m | Grey-brown organic-rich silt |
| 2.45-3.30m | Dark brown herbaceous well humified peat |

**Core 35 (-0.542m O.D.)**

| | |
|---|---|
| 0.00-0.80m | Blue-grey clayey silt |
| 0.80-1.00m | Grey-brown clayey silt |
| 1.00-1.50m | Blue-grey clayey silt |
| 1.50-1.70m | Grey-brown organic rich silt |
| 1.70-2.20m | Grey-brown herbaceous well humified slightly silty peat |
| 2.20-2.90m | Dark brown herbaceous very well humified peat |

**Core 36 (-0.543m O.D.)**

| | |
|---|---|
| 0.00-0.70m | Blue-grey clayey silt |
| 0.70-1.00m | Grey-brown organic-rich silt |
| 1.00-1.20m | Blue-grey clayey silt |
| 1.20-1.40m | Grey-brown organic-rich silt |
| 1.40-2.90m | Red-brown herbaceous very well humified peat with occasional wood fragments |

**Core 37 (-0.507m O.D.)**

| | |
|---|---|
| 0.00-0.70m | Grey-brown organic-rich silt |
| 0.70-0.90m | Blue-grey organic clayey silt |
| 0.90-1.30m | Black organic-rich silt |
| 1.30-2.90m | Red-brown herbaceous well humified peat with occasional wood fragments |

**Core 38 (-0.559m O.D.)**

| | |
|---|---|
| 0.00-0.90m | Grey-brown organic-rich silt |
| 0.90-1.20m | Grey-brown herbaceous humified slightly silty peat |
| 1.20-1.90m | Red-brown herbaceous humified peat |
| 1.90-3.80m | Dark brown very well humified peat |
| 3.80-5.25m | Black herbaceous well humified peat |
| 5.25-5.50m | Red-brown herbaceous humified peat |
| 5.50-5.65m | Grey-brown very well humified sandy peat |

**Core 39 (-0.558m O.D.)**

| | |
|---|---|
| 0.00-0.80m | Grey-brown herbaceous humified silty peat |
| 0.80-1.00m | Grey-brown organic-rich silt |
| 1.00-3.70m | Red-brown herbaceous well humified peat with occasional wood fragments |
| 3.70-5.15m | Black herbaceous well humified peat |
| 5.15-5.55m | Dark brown very well humified peat |

**Core 40 (-0.542m O.D.)**

| | |
|---|---|
| 0.00-0.10m | Grey-brown organic-rich silt |
| 0.10-0.80m | Dark brown herbaceous peat |
| 0.80-0.90m | Grey-brown organic-rich silt |
| 0.90-3.60m | Red-brown herbaceous very well humified peat |
| 3.60-4.70m | Black herbaceous well humified peat |
| 4.70-5.50m | Dark brown herbaceous very well humified peat with sand towards base |

**Core 41 (-0.645m O.D.)**

| | |
|---|---|
| 0.00-0.10m | Grey-brown organic-rich silt |
| 0.10-0.90m | Grey-brown herbaceous humified silty peat |
| 0.90-1.00m | Grey-brown organic-silt |
| 1.00-3.25m | Red-brown well humified peat with abundant wood fragments |
| 3.25-5.30m | Thin interbedded layers of black and red-brown herbaceous well humified peat |

**Core 42 (-0.607m O.D.)**

| | |
|---|---|
| 0.00-0.20m | Grey-brown organic-rich silt |
| 0.20-0.90m | dark brown herbaceous humified slightly silty peat |
| 0.90-1.00m | Grey-brow organic-rich silt |
| 1.00-3.70m | Red-brown herbaceous well humified peat |
| 3.70-5.10m | Black herbaceous well humified peat with occasional wood fragments |

**Core 43 (-0.659m O.D.)**

| | |
|---|---|
| 0.00-0.10m | Grey-brown organic-rich silt |
| 0.10-0.90m | Red-brown herbaceous humified peat |
| 0.90-1.00m | Grey-brown organic-rich silt |
| 1.00-3.70m | Red-brown herbaceous well humified peat |
| 3.70-4.50m | Black herbaceous well humified peat |
| 4.50-4.60m | Red-brown herbaceous well humified peat |
| 4.60-4.80m | Black herbaceous well humified peat |

**Core 44 (-1.694m O.D.)**
(within trackway excavation)

| | |
|---|---|
| 0.00-2.90m | Red-brown herbaceous well humified peat with occasional wood fragments |
| 2.90-3.10m | Black very well humified peat |
| 3.10-3.70m | Dark brown herbaceous well humified peat |
| 3.70-4.60m | Dark brown herbaceous very well humified peat |

**Core 45 (-1.376m O.D.)**
(within trackway excavation)

| | |
|---|---|
| 0.00-2.50m | Red-brown herbaceous well humified peat with occasional silt |
| 2.50-4.10m | Dark brown-black herbaceous humified peat |
| 4.10-4.40m | Red-brown herbaceous well humified peat |
| 4.40-4.60m | Dark brown-black well humified peat |

**Core 46 (-0.415m O.D.)**
(***sampled for Suffolk River Valleys Project***)

| | |
|---|---|
| 0.00-0.20m | Dark brown herbaceous well humified silty peat |
| 0.20-0.85m | Brown very well humified silty peat |
| 0.85-1.00m | Grey-brown organic-rich silt |
| 1.00-1.16m | Dark grey-brown well humified slightly silty peat |
| 1.16-2.00m | Red-brown very well humified peat with occasional wood fragments |
| 2.00-4.84m | Dark red-brown very well humified peat with abundant wood fragments |
| 4.84-5.00m | Dark brown herbaceous well humified peat |
| 5.00-5.25m | Red-brown herbaceous well humified peat |
| 5.25-5.35m | Dark brown herbaceous well humified peat |
| 5.35-5.45m | Dark grey-brown sandy silty peat |

## BRANDON

**Core 1 (3.969m O.D.)**
0.00-0.60m Light brown fine sand with occasional shell fragments
0.60-1.20m Orange-brown very fine sand
1.20-1.60m Yellow-brown medium sand with occasional flint fragments
1.60-2.20m Yellow-brown coarse sand with abundant shell fragments and occasional thin humic layers

**Core 2 (3.914m O.D.)**
0.00-0.60m Dark brown fine sand
0.60-1.60m Light yellow-brown medium sand with occasional shell fragments (pottery fragment present at c. 0.70m depth)
1.60-2.40m Yellow-brown medium sand with shell fragments

**Core 3 (3.876m O.D.)**
0.00-0.60m Dark brown fine sand with occasional flint fragments
0.60-1.00m Yellow-brown very fine sand with occasional flint fragments
1.00-1.80m Yellow-brown medium sand with occasional shell and flint fragments and humic remains
1.80-2.40m Yellow-brown coarse sands with flint gravel and abundant shall fragments

**Core 4 (3.828m O.D.)**
0.00-0.80m Dark brown fine sand
0.80-1.00m Light brown fine sand
1.00-1.50m Yellow brown sand with occasional shell fragments
1.50-2.20m Yellow-brown coarse sand with occasional shell fragments

**Core 5 (3.623m O.D.)**
0.00-0.60m Dark brown organic fine sand
0.60-0.90m Dark brown-black sandy peat
0.90-1.60m Yellow-brown medium sand
1.60-2.30m Orange-yellow coarse sand with occasional shell and flint fragments

**Core 6 (3.703m O.D.)**
0.00-0.55m Dark brown fine sand with occasional flint gravel
0.55-0.65m Dark brown slightly sandy silty peat with occasional thin sand laminations
0.65-0.90m Grey-brown medium sand
0.90-1.90m Yellow-brown slightly gravely sand with occasional shell fragments

**Core 7 (3.801m O.D.)**
0.00-0.20m Dark brown organic fine sand
0.20-1.20m Yellow-brown shelly sand with occasional gravel of flint

## HENGRAVE

**Core 1 (20.229m O.D.)**

0.00-0.70m Light brown organic sandy silt with occasional rootlets
0.70-1.00m Light blue-grey slightly calcareous clayey silt
1.00-1.25m Grey-brown sandy silt
1.25-1.27m Light grey-brown sand horizon
1.27-1.40m Grey-brown sandy silt
1.40-2.00m Dark grey-brown to black organic-rich silt with occasional shell (mollusc) fragments
2.00-2.85m Dark brown organic-rich silty peat, with occasional shell remains
2.85-2.90m Thin silty sand horizon (bone fragment preserved within sand)

**Core 2 (20.608m O.D.)**
***(Sampled for Suffolk River Valleys Project)***

0.00-0.24m Dark brown very well humified peat, occasional sand and silt
0.24-0.60m Grey-brown herbaceous very well humified silty peat
0.60-1.00m Dark brown/red-brown herbaceous humified peat with occasional wood
1.00-1.51m Dark brown/grey-brown herbaceous well humified silty peat
1.51-1.64m Dark grey-brown herbaceous very well humified slightly sandy peat
1.64-2.00m Dark grey-brown herbaceous well humified sandy peat with occasional sand horizons
2.00-3.00m Dark brown/grey-brown very herbaceous humified slightly silty peat with occasional wood fragments.
3.00-3.75m Grey-brown silty sand with organic mottling (*unsampled as Russian corer could not penetrate minerogenic sediments*)

**Core 3 (20.466m O.D.)**

0.00-0.50m Light grey sandy silt with abundant rootlets (topsoil)
0.50-0.70m Grey-brown slightly sandy silty peat
0.70-0.90m Dark brown/black slightly sandy silt
0.90-1.00m Grey-brown silty sand
1.00-2.00m Medium brown very well humified herbaceous peat
2.00-3.00m Grey-brown silty peat with occasional wood fragments, sand horizons and shell fragments
3.00-3.70m Grey-brown silty sands with abundant shell fragments and occasional organic remains

**Core 4 (20.849m O.D.)**

0.00-0.40m Light grey-brown silty sand with occasional rootlets (topsoil)
0.40-1.20m Dark brown very well humified silty peat
1.20-2.00m Interbedded layers of silty peat and grey-brown silty sand (<5cm in thickness)
2.00-2.80m Brown silty peat
2.80-3.70m Grey-brown silty sand with occasional thin (<2cm) brown peat horizons

**Core 5 (3.703m O.D.)**

0.00-0.80m Light grey-brown organic-rich silt with iron mottling
0.80-1.00m Brown silt with occasional organic remains
1.00-1.80m Dark brown/black silty peat with occasional well humified organic remains
1.80-2.20m Grey-brown silty sand
2.20-2.70m Brown silty peat with occasional sand horizons and shell fragments

**Core 6 (3.801m O.D.)**

| | |
|---|---|
| 0.00-0.30m | Grey brown sandy peat topsoil |
| 0.30-0.50m | Brown very well humified silty peat |
| 0.50-1.60m | Brown herbaceous peat with occasional silt lenses |
| 1.60-1.80m | Black herbaceous silty peat |
| 1.80-1.90m | Back silty peat |
| 1.90-2.20m | Light grey silty sand with occasional organic remains |

## HOXNE

**Core 1 (23.485m O.D.)**
0.00-0.45m Brown sand with occasional organic remains and flint gravel. Organic content reducing with depth

**Core 2 (23.285m O.D.)**
0.00-0.15m Dark brown organic sand with occasional gravel
0.15-0.50m Grey-brown slightly sandy silt
0.50-0.60m Orange-brown coarse sands

**Core 3 (23.105m O.D.)**
0.00-0.20m Dark brown organic sand
0.20-0.30m Grey-brown clayey silt
0.30-0.50m Orange-brown coarse sand

**Core 4 (22.995m O.D.)**
0.00-0.40m Brown slightly organic fine sand
0.40-0.70m Orange-brown coarse sands

**Core 5 (22.873m )**
0.00-0.35m Brown slightly organic sand
0.35-0.60m Orange-brown coarse sands

**Core 6 (22.761m O.D.)**
0.00-0.20m Brown slightly organic sand with occasional pebbles
0.20-0.35m Orange-brown fine sand
0.35-0.55m Orange-brown coarse sand

**Core 7 (22.697m O.D.)**
0.00-0.20m Brown slightly organic sand
0.20-0.40m Orange-brown fine sand
0.40-0.65m Orange-brown coarse sand

**Core 8 (22.604m O.D.)**
0.00-0.25m Brown slightly organic coarse sand with occasional pebbles
0.25-0.35m Orange-brown coarse sand

**Core 9 (22.591m O.D.)**
0.00-0.55m Orange-brown coarse sand

**Core 10 (22.121m O.D.)**
0.00-0.10m Brown slightly organic sand with occasional flint pebbles
0.10-0.40m Brown slightly organic pebbly sand with brick fragments
0.40-0.50m Brown to grey-brown silty sand
0.50-1.90m Dark grey-brown silty sand
1.90-3.50m Dark brown to black very well humified silty peat
3.50-3.70m Orange-brown coarse sand

**Core 11 (23.021m O.D.)**
0.00-0.40m Brown slightly organic sand with occasional flint pebbles
0.40-0.60m Yellow-brown sandy silt
0.60-0.70m Grey-brown silty sand with oocasional gravel

## IXWORTH

**Core 1 (27.487m O.D.)**
0.00-0.60m Grey-brown organic-rich silt with occasional iron mottling
0.60-1.00m Dark brown herbaceous very well humified silty peat
1.00-1.45m Dark brown herbaceous well humified peat
1.45-1.50m Grey-brown sand horizon
1.50-1.90m Dark brown herbaceous well humified peat
1.90-2.20m Light grey-brown sandy silt
2.20-2.50m Dark brown herbaceous well humified peat with occasional wood fragments
2.50-2.70m Grey-brown sandy silt

**Core 2 (27.268m O.D.)**
0.00-0.60m Grey-brown organic silt with iron mottling
0.60-0.90m Dark brown herbaceous well humified silty peat
0.90-0.95m Grey-brown silt with occasional shell fragments and iron mottling
0.95-1.05m Dark brown herbaceous well humified peat
1.05-2.10m Dark brown herbaceous slightly silty peat
2.10-2.20m Light grey silty sand with occasional wood fragments

**Core 3 (27.121m O.D.)**
0.00-0.10m Yellow-brown organic right sandy silt
0.10-0.45m Light grey clayey silt with iron mottling
0.45-0.80m Dark brown herbaceous very well humified peat
0.80-1.70m Dark brown well humified silty peat
1.70-1.85m Light grey fine sand horizon
1.85-1.90m Dark brown slightly silty peat
1.90-2.00m Grey-brown organic fine sand horizon
2.00-2.50m Dark brown humified herbaceous peat with occasional silt-rich horizons within
2.50-2.60m Grey sand

**Core 4 (27.126m O.D.)**
***(Sampled for Suffolk Rivers Valleys Project)***
0.00-0.50m Unsampled (light grey slightly gravely silt)
0.50-0.57m Same as above
0.57-0.87m Dark brown very well humified peat with occasional herbaceous remains
0.87-1.38m Dark brown/grey-brown herbaceous well humified silty peat.
1.38-1.41m Light grey-brown organic rich sand horizon
1.41-1.50m Dark brown very well humified slightly silty peat
1.50-2.50m Dark brown herbaceous very well humified peat, occasional wood fragments
2.50-2.64m Grey-brown slightly gravely organic silt.
2.64-3.45m Dark brown herbaceous well humified woody peat
3.45-3.50m Grey silty sand.

**Core 5 (27.151m O.D.)**
0.00-1.20m Light grey slightly organic clayey silt with iron mottling
1.20-2.20m Dark brown herbaceous well humified silty peat
2.20-2.70m Dark brown to red-brown herbaceous humified peat
2.70-2.90m Light yellow-brown silty peat
2.80-3.00m Dark brown to red-brown herbaceous humified peat

**Core 6 (27.476m O.D.)**

| | |
|---|---|
| 0.00-1.00m | Light grey slightly sandy clayey silt with iron mottling and occasional shell remains |
| 1.00-1.40m | Light grey-brown silty sands with organic fragments |
| 1.40-3.20m | Dark brown herbaceous well humified silty peat |
| 3.20-3.60m | Grey sand |

# APPENDIX III

# PALAEOENVIRONMENTAL TECHNIQUES

## Pollen Assessment

The sequences from Beccles Core 1, Hengrave and Ixworth were sub-sampled for pollen assessment at varying intervals, with 16 samples from each prepared using standard techniques including KOH digestion and acetylation (Moore *et al*., 1991). At least 125 total land pollen grains (TLP) excluding aquatics and spores were counted for each sample. However, where pollen preservation and concentration was found to be poor, then this was not always attained. In such instances, counting continued for one complete slide. Pollen nomenclature follows Moore *et al.* (1991), with the modifications suggested by Bennett *et al.* (1994). The pollen sum is based on TLP excluding obligate aquatics and spores. Percentages for these groups are calculated as percentage of the basic sum plus sum of the relevant group. The data are presented as skeleton pollen diagram produced using the computer programmes TILIA and TILIA*GRAPH. The diagrams have been divided into preliminary local pollen assemblage zones for the purposes of discussion.

**References**

Bennett, K.D., Whittington, G. & Edwards, K.J. (1994). Recent plant nomenclature changes and pollen morphology in the British Isles. *Quaternary Newsletter* 73, 1-6.

Moore, P.D., Webb, J.A. and Collinson, M.E. (1991) *Pollen Analysis*. London: Blackwell.

## Beetle Assessment

The samples were processed using the standard method of paraffin flotation outlined in Kenward *et al.* (1980) at the University of Birmingham. The insect remains were then sorted from the paraffin flot and the sclerites identified under a low power binocular microscope at x10 magnification. Where possible, the insect remains were identified by comparison with specimens in the Gorham and Girling collections housed at the University of Birmingham. The taxonomy used for the Coleoptera (beetles) follows that of Lucht (1987). When discussing the faunas recovered, two considerations were taken into account:

1) The identifications of the insects present were provisional. Many of the taxa present could be identified down to species level during a full analysis, producing more detailed information. As a result, the data presented should be regarded as preliminary.

2) The various proportions of insects are subjective assessments. Minimum numbers of individuals can be obtained through a full sample analysis.

**References**

Kenward, H.K., Hall, A.R., & Jones, A.K.G. (1980). A Tested Set of Techniques for the Extraction of Plant and Animal Macrofossils from Waterlogged Archaeological Deposits. Scientific Archaeology, 22, 3-15.

Lucht, W.H. (1987) *Die Käfer Mitteleuropas*. Katalog. Krefeld

**Diatom Assessment**

*Methodology*

Diatom samples were taken from the base of each stratigraphic unit within the minerogenic sequence, at the same depth from which samples had been processed for radiocarbon dating. 0.5$cm^3$ of sediment was sampled and prepared for diatoms following the standard procedure as described by Plater *et al*. (2000). Diatom samples were mounted on slides with naphrax and species were identified with reference to Hendy (1964) and van Der Werff & Huls (1958-1974). A minimum of 200 diatom valves were counted in each sample. Research has suggested that once a count of 200 diatoms has been achieved, a plateau effect occurs after which few new species are found. Those species present beyond a count of *c*. 200 valves would also not be significant in qualitative/quantitative environmental reconstructions due to their low abundance (Hill, 2006).

*Palaeoenvironmental Interpretation*

A diatom ecological classification scheme was developed by Vos & deWolf (1993) to assist in the reconstruction of past environmental conditions from archived fossil assemblages. The scheme classifies diatom species into ecological groups from which specific sedimentary environments can be obtained (Table 1). Although this method was based on diatom assemblages found in archived coastal deposits from the Netherlands, research by Hill (2006) into contemporary and archived coastal deposits from within the UK ensured the validity of such a reconstruction technique to UK coastal diatom assemblages. Species encountered were divided into groups according to salinity tolerances (freshwater, brackish water, marine or a mix) and lifeform. Planktonic and tychoplanktonic species live predominantly within the water column and commonly rely on wave motion and other water movements for locomotion. They are consequently easily transported into depositional settings, hence restricting their application into understanding changes in relative sea level. Other lifeforms are however more useful in diatom studies. Epipelic species attach themselves to muddy substrates, whilst epiphytic species live attached to plants. Finally, aerophilous species require periods of tidal submergence and emergence and are commonly found in abundance within the intertidal and supratidal zones.

**Refereces**

Hendy, N.I. (1964). An introductory account of the smaller algae of the British coastal waters. Part V: Bacillariophyceae (Diatoms). *Fisheries Investigation Series*, I, H.M.S.O., London.

Hill, T.C.B. (2006). *The Quaternary Evolution of the Gordano Valley, North Somerset, UK*. Unpublished Ph.D. Thesis, University of the West of England, 386pp.

Plater, A.J., Horton, B.P., Haworth, E.Y., Appleby, P.G., Zong, Y., Wright, M.R. & Rutherford, M.M. (2000). Holocene tidal levels and sedimentation using a diatom-based palaeoenvironmental reconstruction: the Tees estuary, northeastern England. *The Holocene*, 10 (4), 441-452.

van Der Werff & Huls (1958-1974). *Diatomeeënflora van Nederland*. Eight parts, published privately by van der Werff, De Hoef (U), The Netherlands.

Vos, P.C. & de Wolf, H. (1993). Diatoms as a tool for reconstructing sedimentary environments in coastal wetlands: methodological aspects. *Hydrobiologia,* 269/270, 285-96.

| Ecological groups | Macro- and mesotidal environments (%TDV) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Subtidal area | | Intertidal area | | Supratidal area | | |
| | open marine tidal channels | estuarine tidal conditions | sand-flats | mud-flats | salt-marshes, around MHW | salt-marshes, above MHW | pools in the salt-marshes |
| Marine plankton | 10-80 | 10-60 | 1-25 | 10-70 | 10-70 | 10-70 | 10-50 |
| Marine tychoplankton | 20-90 | 15-60 | 1-25 | 10-70 | 10-70 | 10-70 | 10-50 |
| Brackish plankton | 1-10 | 20-70 | 1-10 | 1-30 | 1-30 | 1-30 | 1-15 |
| Marine/brackish epipsammon | 1-40 | 1-45 | 50-95 | 1-45 | 0-15 | 0-15 | 0-15 |
| Marine/brackish epipelon | 0-5 | 0-5 | 1-30 | 15-50 | 1-40 | 0-5 | 5-30 |
| Marine/brackish aerophilous | 0-1 | 0-1 | 0-1 | 0-1 | 10-40 | 15-95 | 10-40 |
| Brackish/freshwater aerophilous | 0-1 | 0-1 | 0-1 | 0-1 | 10-40 | 15-95 | 10-40 |
| Marine/brackish epiphytes | 0-1 | 0-1 | 0-5 | 0-5 | 0-5 | 0-5 | 10-60 |
| Brackish/freshwater plankton | 0-1 | 0-25 | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 |
| Brackish/freshwater tychoplankton | 0-1 | 0-1 | 0-5 | 0-5 | 0-5 | 0-5 | 5-50 |
| Brackish/freshwater epiphytes | 0-1 | 0-1 | 0-5 | 0-5 | 0-5 | 0-5 | 1-50 |
| Freshwater epiphytes | 0-1 | 0-1 | 0-1 | 0-1 | 0-5 | 0-5 | 0-10 |
| Freshwater epipelon | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 | 0-10 |
| Freshwater plankton | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 | 0-1 | 0-5 |

**Table 1:** Relationship between the relative abundance (% total diatom valves; TDV) of the ecological groups and the sedimentary environments, modified from Vos & de Wolf (1993).

**Radiocarbon Dating**

## Introduction

A total of thirty six samples were submitted to English Heritage for radiocarbon dating. Of these samples, six were found to have insufficient carbon to enable dating to succeed. As a consequence, *thirty* radiocarbon age determinations were obtained on samples extracted from the four palaeoenvironmental cores (Beccles Core 1, Beccles Core 2, Hengrave, and Ixworth) taken as part of the Suffolk Rivers Project.

## Methods

The 13 samples submitted to the Scottish Universities Environmental Research Centre (SUERC), East Kilbride, were pre-treated following standard procedures, graphitised following the methods outlined in Slota *et al* (1987), and measured by Accelerator Mass Spectrometry (AMS) according to Xu *et al* (2004).

The 17 samples submitted to the Centre for Isotope Studies, The University of Groningen, The Netherlands (GrA) were processed and measured by Accelerator Mass Spectrometry as described by Aerts-Bijma *et al* (1997; 2001) and van der Plicht *et al* (2000).

Both laboratories maintain continual programmes of quality assurance procedures, in addition to participation in international inter-comparisons (Scott 2003). These tests indicate no laboratory offsets and demonstrate the validity of the precision quoted.

## Results

The radiocarbon results are presented within the report, and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

## Calibration

The calibrations of the results, relating the radiocarbon measurements directly to calendar dates, are given in Figures 18, 20, 22 and 24 within the report. They have been calculated using the calibration curves of Reimer *et al* (2004) and Keuppers *et al* (2004) and the computer program OxCal (v3.10) (Bronk Ramsey 1995; 1998, 2001). The calibrated date ranges cited in the text are those for 95% confidence. They are quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years if the error term is greater than or equal to 25 radiocarbon years. The ranges have been calculated according to the maximum intercept method (Stuiver and Reimer 1986). All other ranges are derived from the probability method (Stuiver and Reimer 1993).

## Sampling

The first stage in sample selection should be to identify short-lived material. This is because the taphonomic relationship between a sample and its context is the most hazardous link in this process, since the mechanisms by which a sample came to be in its context are a matter of interpretative decision rather than certain knowledge. Unfortunately not all the samples were identified as short-lived material (eg the unidentified wood fragments from Beccles Core 1 and Ixworth).

All samples consisted of single entities (Ashmore 1999), apart from a number where material had to be bulked together to provide enough carbon.

### References


Aerts-Bijma, A T, Meijer, H A J, and van der Plicht, J, 1997 AMS sample handling in Groningen, *Nuclear Instruments and Methods in Physics Research B*, **123**, 221–5

Aerts-Bijma, A T, van der Plicht, J, and Meijer, H A J, 2001 Automatic AMS sample combustion and $CO_2$ collection, *Radiocarbon*, **43(2A)**, 293–8

Ashmore, P, 1999 Radiocarbon dating: avoiding errors by avoiding mixed samples, *Antiquity*, 73, 124–30

Bronk Ramsey, C, 1995 Radiocarbon calibration and analysis of stratigraphy, *Radiocarbon*, **36**, 425-30

Bronk Ramsey, C, 1998 Probability and dating, *Radiocarbon*, **40**, 461-74

Bronk Ramsey, C, 2001 Development of the radiocarbon calibration program, *Radiocarbon*, **43**, 355-63

Kueppers, L M, Southon, Baer, J P and Harte, J, 2004 Dead wood biomass and turnover time, measured by radiocarbon, along a subalpine elevation gradient, *Oecologia* **141**, 641–51

Mook, W G, 1986 Business meeting: Recommendations/Resolutions adopted by the Twelfth International Radiocarbon Conference, *Radiocarbon*, **28**, 799

van der Plicht, J, Wijma, S, Aerts, A T, Pertuisot, M H, and Meijer, H A J, 2000
Status report: the Groningen AMS facility, *Nuclear Instruments and Methods in Physics Research B*, **172**, 58–65

Reimer, P J, Baillie, M G L, Bard, E, Bayliss, A, Beck, J W, Bertrand, C J H, Blackwell, P G, Buck, C E, Burr, G S, Cutler, K B, Damon, P E, Edwards, R L, Fairbanks, R G, Friedrich, M, Guilderson, T P, Hogg, A G, Hughen, K A, Kromer, B, McCormac, G, Manning, S, Bronk Ramsey, C, Reimer, R W, Remmele, S, Southon, J R, Stuiver, M, Talamo, S, Taylor, F W, van der Plicht, J, and Weyhenmeyer, C E, 2004 IntCal04 Terrestrial radiocarbon age calibration, 0–26 Cal Kyr BP, *Radiocarbon*, **46**, 1029–58

Scott, E M (ed), 2003 The Third International Radiocarbon Intercomparison (TIRI) and the Fourth International Radiocarbon Intercomparison (FIRI) 1990–2002: results, analysis, and conclusions, *Radiocarbon*, **45**, 135-408

Slota, Jr P J, Jull, A J T, Linick, T W, and Toolin, L J, 1987 Preparation of small samples for $^{14}C$ accelerator targets by catalytic reduction of CO, *Radiocarbon*, **29**, 303–6

Stuiver, M and Kra, R S 1986 Editorial comment, *Radiocarbon*, **28**(2B), ii

Stuiver, M, and Polach, H A, 1977 Reporting of $^{14}C$ data, *Radiocarbon*, **19**, 355-63

Stuiver, M, and Reimer, P J, 1986 A computer program for radiocarbon age calculation, *Radiocarbon*, **28**, 1022-30

Stuiver, M, and Reimer, P J, 1993 Extended $^{14}C$ data base and revised CALIB 3.0 $^{14}C$ age calibration program, *Radiocarbon*, **35**, 215-30

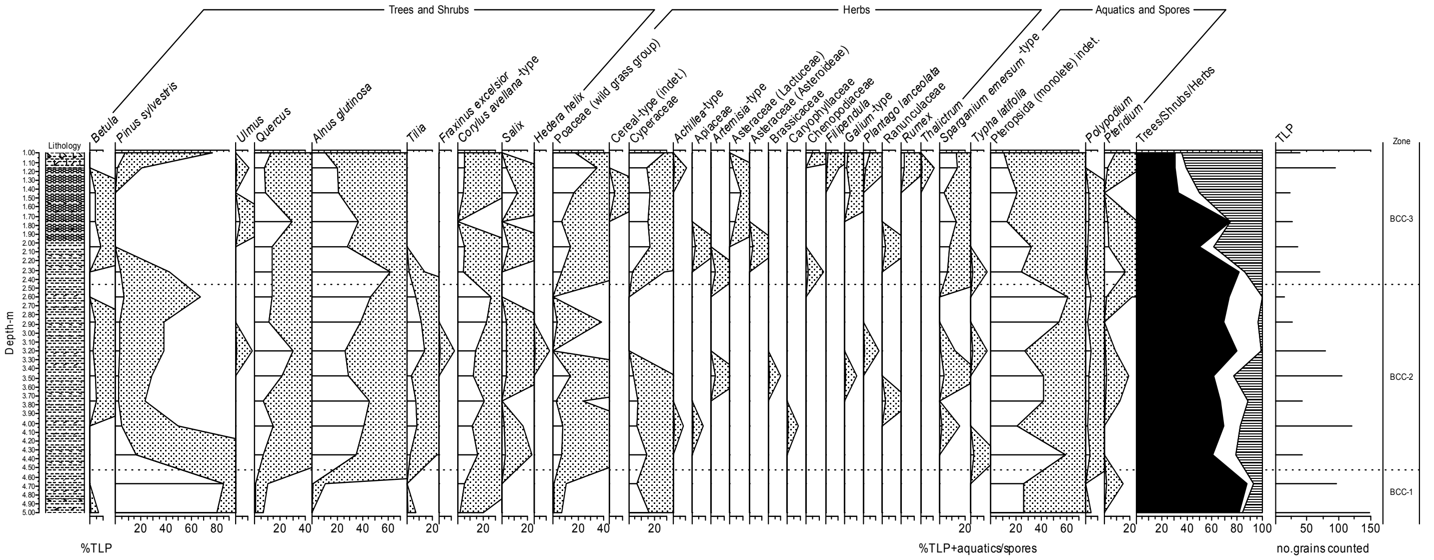
Xu, S, Anderson, R, Bryant, C, Cook, G T, Dougans, A, Freeman, S, Naysmith, P, Schnabel, C, and Scott, E M, 2004 Capabilities of the new SUERC 5MV AMS facility for $^{14}C$ dating, *Radiocarbon*, **46**, 59-64

# APPENDIX IV

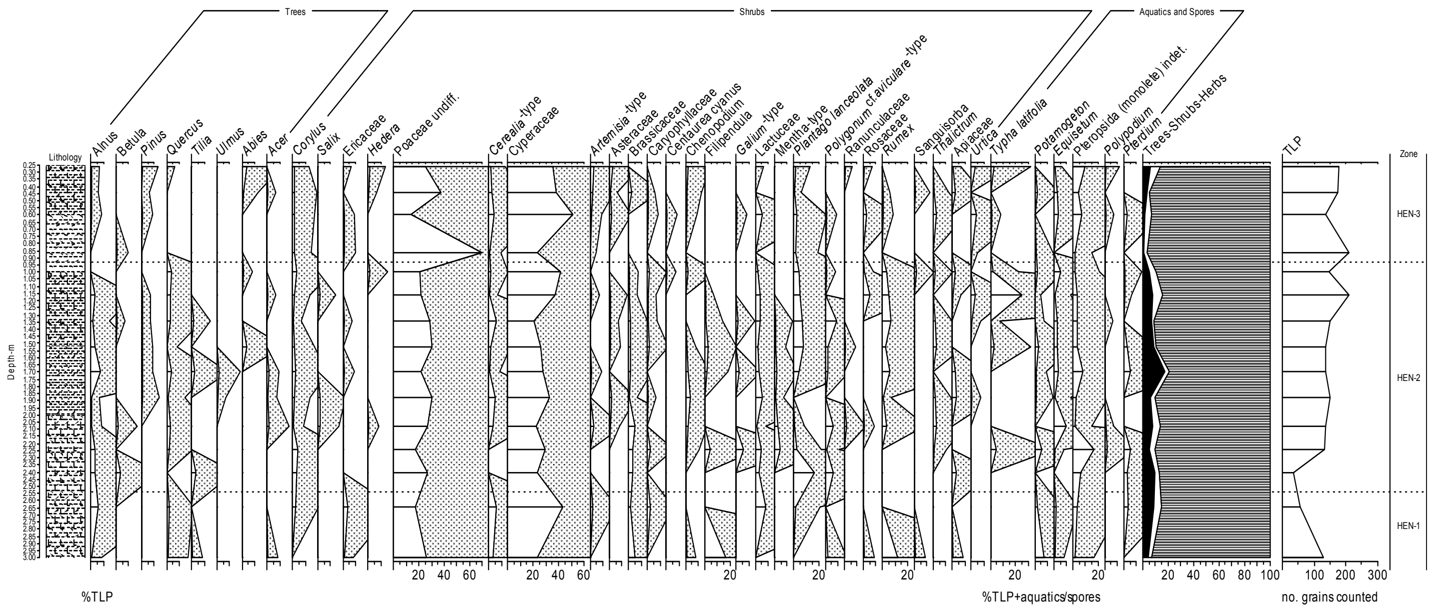
# PALAEOENVIRONMENTAL RESULTS

## Pollen Assessment

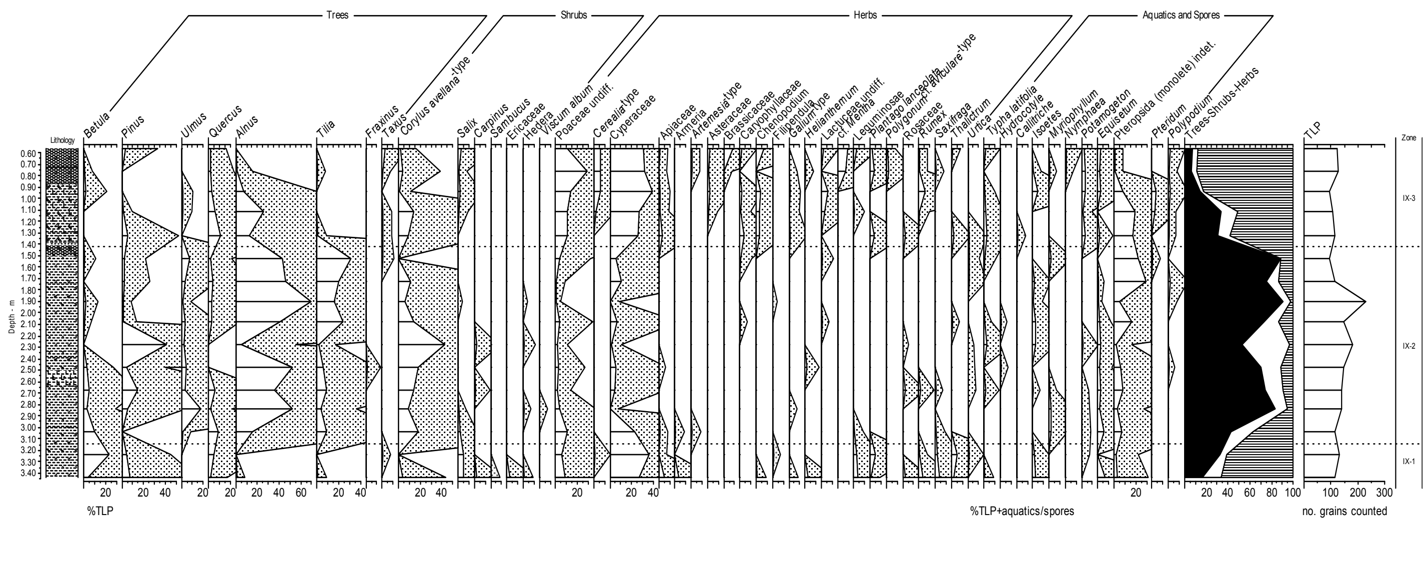
Beccles Skeleton Pollen Diagram (exagerration x10)



Hengrave Skeleton Pollen Diagram. Exagerration x10



Ixworth: Skeleton Pollen Diagram. Exagerration x10



## Beetle Assessment

| Context | Beccles I | | Beccles II | | Ixworth | | | Hengrave | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample | 400-540cm | 200-260cm | 320-380cm | 200-230cm | 270-310cm | 190-230cm | 50-90cm | 260-300cm | 140-180cm | 60-100cm | Ecology | Associated flora |
| Processed Volume | | | | | | | | | | | | |
| **COLEOPTERA** | | | | | | | | | | | | |
| **Carabidae** | | | | | | | | | | | | |
| *Elaphrus cupreus* Duft. | | | *** | | | | | | | | Amongst mud and reed in swamps and bogs | |
| *Pterostichus strenuus* (Panz.) | | * | | | | | | | | | Shaded places, moist woodland, swamps and bogs | |
| *Pterostichus* spp. | | * | * | | | | | | | | | |
| *Agonum* spp. | | | * | | | | | | | | | |
| | | | | | | | | | | | | |
| **Dytiscidae** | | | | | | | | | | | | |
| *Noterus* spp. | | | | | | | | | | * | Stagnant, standing water. | |
| | | | | | | | | | | | | |
| **Hydraenidae** | | | | | | | | | | | | |
| *Octhebius* spp. | | | | | | | | | ** | * | | |
| *Limnebius* spp. | | | | | | | | | * | * | | |
| *Helophorus* spp. | | | | * | | | | | * | | | |
| | | | | | | | | | | | | |
| **Hydrophilidae** | | | | | | | | | | | | Associated flora |
| *Cercyon haemorrhoidalis* (F.) | | | | | | | | * | | | Decaying organic material and dung | |
| Aquatic *Cercyon* spp. | | | *** | | | | | | | | | |
| *Hydrobius fuscipes* Leach | | | | | | | | * | | | Stagnant, standing water. | |
| *Cymbiodyta marginella* (F.) | | | | | | | * | | | * | Stagnant, standing water. | |
| *Chaetarthria seminulum* | | | | | | | | * | | | Stagnant, standing water and slow moving water | |
| | | | | | | | | | | | | |
| **Staphylinidae** | | | | | | | | | | | | |
| *Trogophloeus* spp. | | * | | | | | | | | | | |
| *Oxytelus* spp. | | | | | * | | * | | | | | |
| *Stenus spp.* | | | | * | | | | | | ** | | |
| *Stilicus* spp. | | | | | | | | * | | | | |
| *Lathrobium* spp. | | | | | | * | * | | | | | |
| *Philonthus spp.* | | * | * | | | | | | * | * | | |
| | | | | | | | | | | | | |
| **Staphylinidae** | | | | | | | | | | | | |
| *Quedius* spp. | | | * | | | | | | | | | |
| *Aleocharinae* gen. & spp. Indet. | | | | ** | | | | ** | | | | |
| | | | | | | | | | | | | |
| **Dryopidae** | | | | | | | | | | | | |
| *Dryops* spp. | | | * | | | | | | * | | | |
| | | | | | | | | | | | | |
| **Scarabaeidae** | | | | | | | | | | | | |
| *Geotrupes* spp. | | | | | | | | | * | | Dung | |
| *Aphodius* spp. | | * | | | | | | | | | Dung | |
| | | | | | | | | | | | | |
| **Chrysomelidae** | | | | | | | | | | | | |
| *Donacia* spp. | | | | | | | | | | * | | |
| *Plateumaris sericea* (L.) | | | | | | | | | | * | Swamps and bogs | Sedges, lilies, yellow flag |
| *Plateumaris braccata* (Scop.) | | | | | | | | * | ** | * | Fens, swamps and bogs | Common reed |
| *Donacia/Plateumaris* spp. | | | | | | | * | | | | | |
| *Hydrothassa glabra* (Hbst.) | | | * | | | | | | | | Damp places | Buttercups |
| | | | | | | | | | | | | |
| **Curculionidae** | | | | | | | | | | | | |
| *Apion* spp. | | | | | | | | * | | ** | | |
| *Thryogenes* spp. | | | | | | | | | | | | |
| *Baris* spp. | | | | | | | | | | * | | |
| *Ceutorhynchus* spp. | | | * | | | | | | | | | |
| *Gymnetron* spp. | | | | | | | | | ** | | | |

**Table 1:** Summary of coleopteran assemblages identified during assessment for the Suffolk River Valleys Project. The numbers of individuals present is estimated using the following scale: * = 1-2 individuals, ** = 2-5 individuals, *** = 5-10 individuals, **** = 10+ individuals.

# Diatom Assessment

| | | | Sample depth | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Diatom Species | Lifeform | salinity | 134cm | 155cm | 173cm | 222cm | 250cm | 254cm | 257cm | 275cm | 283cm |
| Actinoptychus senarius | planktonic | M | 16 | | 5 | 1 | | | | 1 | 4 |
| Cosconodiscus excentricus | planktonic | M | | 1 | 3 | 1 | | 2 | | | |
| Paralia sulcata | planktonic | M | 41 | 1 | 16 | 9 | 1 | 6 | 2 | 19 | 39 |
| Podosira stelligera | planktonic | M | 12 | | 1 | | | 1 | | | |
| Triceratium favus | planktonic | M | 2 | | | | | | | | |
| Auliscus sculptus | tycho | M | | | | | | | | | 2 |
| Melosira westii | tycho | M | 3 | | 1 | | | 2 | | | 1 |
| Rhaphoneis amphiceros | tycho | M | 6 | | | | 1 | 1 | | 1 | 3 |
| Rhaphoneis surirella | tycho | M | 2 | | | | | | | 2 | |
| Biddulpha subaquea | tycho | BM | 2 | | | | | | | | |
| Diploneis weissfloggi | epipelon | M | | | | 2 | | | | | |
| Trachyneis aspera | epipelon | M | 1 | | | | | | | | |
| Campylodiscus echeneis | epipelon | MB | 72 | 1 | 9 | 4 | | | | 1 | 4 |
| Diploneis bombus | epipelon | MB | 9 | 1 | 9 | | | 10 | | 10 | 10 |
| Diploneis didyma | epipelon | MB | 24 | | 1 | 2 | | 2 | | | |
| Navicula peregrina | epipelon | MB | | | | | | | | | |
| Nitzchia navicularis | epipelon | MB | 75 | 9 | 35 | 4 | 4 | 12 | | 27 | 60 |
| Nitzschia sigma | epipelon | MB | | | | 6 | | | | | 1 |
| Surirella ovata | epipelon | MB | | | | 1 | | | | | 2 |
| Diploneis aesturii | epipelon | BM | | | | | | | | 1 | |
| Nitzschia punctata | epipelon | BM | 35 | 2 | 15 | 4 | | 6 | | 14 | 26 |
| Surirella striatula | epipelon | B | 2 | | | | | | | 1 | |
| Cymatopleura elliptica | epipelon | FB | | | | 1 | | 2 | | 4 | |
| Cymbella affinis | epipelon | FB | | | | 4 | | | | 2 | 1 |
| Synedra capitata | epipelon | FB | | | | | | 3 | | 7 | 5 |
| Navicula oblonga | epipelon | F | | | | 2 | | | | 10 | 3 |
| Navicula viridula | epipelon | F | | | | | 3 | 5 | | 10 | |
| Achnanthes brevipes | epiphytic | MB | | 1 | | | | | | | 1 |
| Cocconeis placentula | epiphytic | BF | | | | 79 | 5 | 56 | 4 | 46 | 43 |
| Rhophalodia gibba | epiphytic | BF | | | | 4 | | 1 | | 1 | 3 |
| Achnanthes hungarica | epiphytic | FB | | 9 | | 8 | | 1 | | | |
| Anomoeoneis sphaerophora | epiphytic | FB | | | | | | 5 | | 5 | 6 |
| Gomphonema acuminatum | epiphytic | FB | | | | 9 | 1 | 19 | | 15 | 21 |
| Gomphonema constrictum | epiphytic | FB | | | | 10 | 2 | 25 | | 21 | 14 |
| Gomphonema gracile | epiphytic | FB | | | | | | 4 | | | |
| Gomphonema ovilaceum | epiphytic | FB | | 1 | | | 2 | 4 | | 14 | |
| Epithemia turgida | epiphytic | F | 12 | 4 | | 43 | 2 | 52 | 1 | 56 | 25 |
| Epithemia zebra | epiphytic | F | 7 | | 2 | 23 | | 9 | | 28 | 13 |
| Synedra unla | epiphytic | F | | | | | | 4 | 1 | | |
| Epithemia sorex | epiphytic | FB | | | | | 1 | 6 | 1 | 6 | |
| Diploneis interrupta | aerophil | MB | 18 | 8 | 8 | 2 | | 4 | | 7 | 18 |
| Diploneis ovalis | aerophil | MB | 36 | 8 | 17 | 2 | | 3 | | 11 | 24 |
| Hantzshia amphioxys | aerophil | BF | | 24 | 12 | | | | | 10 | 1 |
| Navicula pusilla | aerophil | BF | | 3 | 1 | | | 1 | | | |
| Pinnularia viridis | aerophil | BF | | 3 | | | | 4 | | | |
| Pinnularia gentilis | aerophil | FB | | | | 1 | | | | | |
| Pinnularia interrupta | aerophil | FB | | | | 1 | | | | | |
| Pinnularia microstauron | aerophil | FB | 1 | 29 | 19 | | 1 | 7 | | 15 | |
| Diploneis spp. | | | 25 | | | | | | | | |
| Pleurosigma spp. | | | | 4 | 8 | | | | | 4 | |
| | | | | | | | | | | | |
| Total Diatom Counts | | | 401 | 109 | 162 | 223 | 23 | 257 | 9 | 349 | 330 |

**Table 2:** Summary of raw diatom counts obtained from Beccles Core 2

| Sample Depth (m) | Altitude (m O.D) | Mar Plank | Mar Tych | MB Epipel | MB Epiphy | MB Aero | B Epipel | BF Epiphy | BF Aero | FB Epiphy | F Epiphy | F Epipel | Depositional Environment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.34 | -1.423 | 17.1 | 3.2 | 53.9 | 0 | 14 | 0.5 | 0 | 0.2 | 0 | 4.75 | 0 | **SM around MHW** |
| 1.55 | -1.633 | 2 | 0 | 12.2 | 1 | 14.5 | 0 | 0 | 57 | 9.2 | 4 | 0 | **Pools in SM** |
| 1.73 | -1.813 | 15.4 | 0.6 | 42.5 | 0 | 16 | 0 | 0 | 20 | 0 | 1.2 | 0 | **SM around MHW** |
| 2.22 | -2.303 | 5 | 0 | 7.3 | 0 | 1.8 | 0 | 37 | 0.9 | 12 | 30 | 3.2 | **Pools in SM** |
| 2.5 | -2.583 | Poor diatom preservation | | | | | | | | | | | |
| 2.54 | -2.623 | 3.5 | 1 | 11.3 | 0 | 2.7 | 0 | 22 | 4.7 | 24.5 | 25 | 4 | **Pools in SM** |
| 2.57 | -2.653 | Poor diatom preservation | | | | | | | | | | | |
| 2.75 | -2.833 | 5.7 | 0.8 | 15.3 | 0 | 5 | 0.3 | 13.5 | 7.1 | 17.6 | 24 | 9.3 | **Pools in SM** |
| 2.83 | -2.913 | 13 | 1.9 | 31.3 | 0.3 | 12.6 | 0 | 14 | 0 | 12.3 | 11.5 | 2.7 | **Pools in SM** |

**Ecological Groups**

Mar Plank = Marine planktonic
Mar Tych = Marine tychoplanktonic
MB Epipel = Marine/Brackish epipelon
MB Epiphy = Marine/Brackish epiphytic
MB Aero = Marine/Brackish aerophilous
B Epipel = Brackish epipelon
BF Epiphy = Brackish/Fresh epiphytic
BF Aero = Brackish/Fresh aerophilous
FB Epiphy = Fresh/Brackish epiphytic
F Epiphy = Fresh epiphytic
F Epipel = Fresh epipelon

**Depositional Environments**

SM around MHW = saltmarshes around Mean High Water
Pools in SM = Pools within saltmarshes

**Table 3:** Summary of diatom assemblages from selected sedimentary horizons in Beccles Core 2 (%TDV) according to the ecological classification scheme of Vos & deWolf (1993).