6. Palaeoenvironmental Investigation

6.1 Introduction

The NERCZA Phase 1 report highlighted four threatened sites that have been previously recorded as the location of inter-tidal peat deposits. These sites were identified at Hartlepool Bay, Whitburn, Cresswell and Low Hauxley. Each of these sites was surveyed during the course of the field survey and all visible inter-tidal peat deposits mapped using the same methodology as that adopted for the archaeological features (see Chapter 4). Investigation at Whitburn and Cresswell found no evidence of visible peats, which had been recorded in antiquarian records at Whitburn and in recent palaeoenvironmental studies by Ian Shennan beneath the active dunes at Cresswell. This is because the peat layers at these sites are currently covered by a substantial layer of sand. Exploratory coring was undertaken at these locations but no evidence of the previously recorded peats was found.

At Hartlepool, the area of exposed peat at the south end of the bay at Seaton Carew has been recorded, mapped and dated and a detailed report produced (Waughman *et al.* 2005). As a result of this further work on this peat was not undertaken in favour of attempting to map the northerly extent of what was described as a submerged forest by Trechmann (Trechmann 1936). Exploratory coring at the north end of Hartlepool Bay found an organic layer which could be the edge of a desiccated peat layer, located at the western edge of the Hartlepool headland to the east of the docks.

Fig. 6.1 A band o f exposed peat in the eroding cliff section at Low Hauxley, Northumberland, at low tide. Wave action is currently undercutting the soft cliff sediment (till) resulting in the collapse of the peat layers and dune sand above. Material is lost on most tides.

The peat beds exposed at Low Hauxley are some of the most exposed and best known on the North East coast. They have already been discussed in the context of the Mesolithic-Bronze Age archaeology associated with them in section 5.9. Although two separate 'peat' beds had been recognised before (e.g. Tipping 1994), this survey has established at least five separate peat beds at Low Hauxley (A-E below), one of which was previously unknown, and the visible bands that can be seen within the cliff section do not form one continuous sediment unit. These different units have been accurately mapped as part of this study and those peats that have not previously been subjected to radiocarbon dating have been dated. The new peat bed identified at low Hauxley has human and animal impressed footprints surviving on its surface and this thin organic horizon has been dated to the Late Mesolithic.

Samples were also taken from an organic deposit initially thought to represent a possible early land surface that was observed at Crimdon Dene, and which appeared spatially related to the position of the prolific flint scatter described Raistrick and Westoll (1933). However this surface ultimately proved to be a modern deposit (see radiocarbon results below).

Fig. 6.2 Excavation and recording of the test pit at Crimdon Dene.

6.1.1 Aims and Objectives

The aim of the palaeoenvironmental survey was to accurately survey areas of inter-tidal peats and organic sediments and to collect and submit material suitable for radiocarbon dating at those sites for which no dating evidence was available, as well as to assess the potential of each peat to contain palaeoecological remains suitable for understanding past environments.

At Hartlepool the aim of the investigation was to establish the depth, extent and date of the peat bed at the north end of Hartlepool Bay. This would help in

understanding the significance of the peat and whether it has the potential to contribute to palaeoenvironmental reconstructions.
At Low Hauxley some dates had already been obtained on peat exposures ~~top~~to the north of the Mesolithic-Bronze Age site but the other peats are of unknown age and so it is currently difficult to assess the relative significance and value of each peat bed and how, if at all, they relate to each other. Furthermore, the earlier dates are from samples with generally large age ranges. A targeted programme of accurate survey and dating was required to disentangle this complex suite of geomorphological deposits.

Crimdon Dene was not initially identified for sampling, however upon identification of the possible buried land surface during the field survey further investigation was deemed necessary. Although no worked flint was retrieved from the layer, if it proved to date from the Mesolithic period this would help not only in identifying Trechman's prolific lithic site but would also help establish the relative significance of this organic deposit. Further investigation to relocate and accurately map the position and extent of the lithic scatter could then be undertaken.

6.1.2 Methodology

At each site samples were collected using a sand auger with an open chamber, and samples were placed directly into plastic finds bags. These were then labelled, double bagged and kept in plastic tubs. Each sample was catalogued and refrigerated until sent for specialist pollen and macrofossil assessment and sub-samples taken for radiocarbon dating. Suitable samples from the targeted peat were selected for dating in a meeting with John Meadows from English Heritage's Scientific Dating Team and Jacqui Huntley, the English Heritage Regional Science Advisor.

The samples from Crimdon Dene were collected differently, being sampled by excavation of a test pit through the dune sand (Fig 6.2). The same collection and storage methodology was followed. This was also true of the sampling of the peat layer containing the footprints at Low Hauxley where a larger sample was taken in order to give the best chance for retrieval of datable material, as the peat had been re-covered in beach sand when the sampling took place.

6.2 Radio-Carbon Dating

By John Meadows and Clive Waddington

Each sample, other than OxA-22797 (Table 6.1, 6.2 and 6.3), consisted of a single waterlogged plant macrofossil, identified by Charlotte O'Brien of Durham University. Dana Challinor re-examined the Hartlepool Bay wood fragments to select those with minimal intrinsic age. The samples were dated by Accelerator Mass Spectrometry (AMS) radiocarbon dating at the Oxford Radiocarbon Accelerator Unit (technical procedures are described by Bronk Ramsey *et al.* (2002; 2004), and at the Scottish Universities Environmental Research Centre in East Kilbride (SUERC; technical procedures are described by Vandenputte *et al.* (1996), Slota *et al.* (1987), and Xu *et al.* (2004)). Internal quality assurance procedures at both laboratories and international inter-comparisons (Scott 2003) indicate no laboratory offsets, and validate the measurement precision given.

The BP results reported in Tables 6.1, 6.2 and 6.3 are conventional radiocarbon ages (Stuiver and Polach 1977), quoted according to the format known as the Trondheim convention (Stuiver and Kra 1986). Their calibrated date ranges have been calculated by the maximum intercept method (Stuiver and Reimer 1986), using the program OxCal v4.1 (Bronk Ramsey 1995; 1998; 2001; 2009) and the IntCal09 data set (Reimer *et al.* 2009), and are quoted in the form recommended by Mook (1986), rounded outwards to decadal endpoints. Fig 6.3 shows the calibration of these results by the probability method (Stuiver and Reimer 1993), again using OxCal 4.1 and the IntCal09 calibration data. The probability that a sample dates to a particular calendar date corresponds to the height of its probability distribution at that date.

Comparison of the radiocarbon results from each peat exposure sampled at Low Hauxley has been undertaken using Ward and Wilson's (1978) test of statistical consistency. This produces a test statistic, T', which should be less than 3.8 in 95% of cases where two samples are of the same radiocarbon age (which they will be, when they are of the same calendar age). Thus the two results from Low Hauxley A (711) are statistically consistent (T'=0.3), as are the two from Low Hauxley C (713) (T'=0.0). In these cases, we have no reason to believe that the two fragments dated are different in date, and we would tend to accept the results as indicative of the date of deposition of the sediment sampled and therefore the date after which peat accumulation commenced.

By contrast, neither the pair of results from Low Hauxley D, 7 (715) (T'=506.2), nor those from Low Hauxley E, 13 (750) (T'=7.8), are statistically consistent, and it is not clear which, if either, result is the better estimate of when the sediment sampled was deposited. Ordinarily we would use the later result as a *terminus post quem* for sedimentation. In the case of the peat with the human and animal footprints, Low Hauxley E, there is only a small difference in date between OxA-22735 and SUERC-30015 and this is probably due to the effects of compression in this thin peat lens, or the time taken for a few cm of sediment in this sample to accumulate. The Late Mesolithic date, in the last centuries of the 6th millennium cal BC, provides a significant new dimension for understanding human activity and natural coastal change at Low Hauxley in a period that did not appear to be encompassed by the previously dated peats. The dating of this peat bed is of further significance as it contains not only human and animal footprints but also worked timbers, one of which has shown evidence for having been worked with stone tools.

The difference between OxA-22734 and SUERC-30008 from Low Hauxley D, 7 (715), at the base of this sediment unit is considerable, perhaps as much as1500 years, and it is probably better to regard the latest of the two dates as a *terminus post quem* for the commencement of sediment accumulation until further dates are available. The stratigraphically later *Iris* seed from the top of the sediment unit (SUERC-30014) dates to the early Iron Age, indicating that peat formation ceased at this time before subsequent dune sand accumulation.

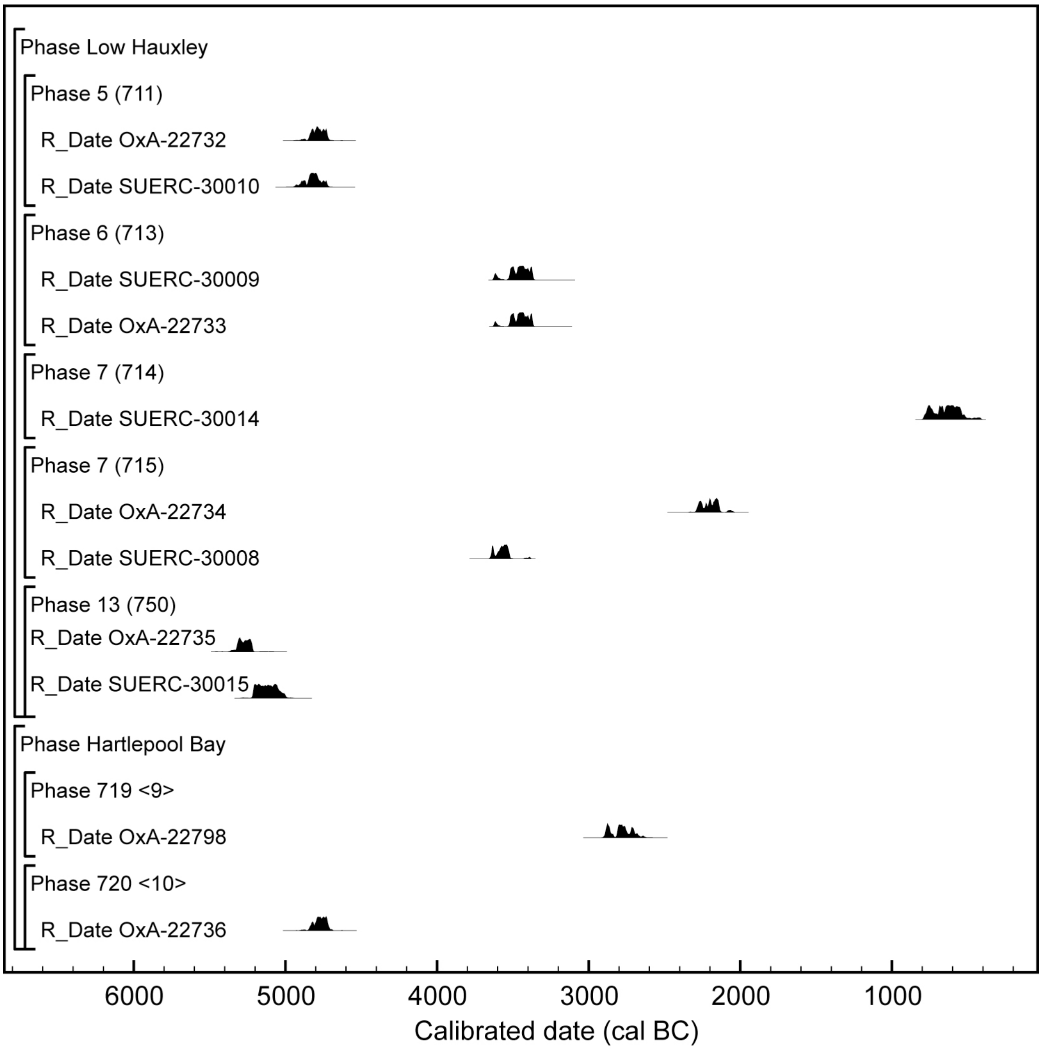

Fig. 6.3 Calibration of the Low Hauxley and Hartlepool Bay radiocarbon results by the probability method (Stuiver and Reimer 1993), using the IntCal09 calibration data (Reimer *et al.* 2009).

The Hartlepool Bay samples (from two points at the top of a buried organic deposit) are both prehistoric and clearly of different date, which suggests that if the samples are more or less *in situ* and the buried land surface between them is continuous, parts of it must have been substantially truncated, perhaps by dredging activities.

The $F^{14}C$ ('fraction modern') results are from samples with elevated radiocarbon contents, due to the 'bomb spike' in atmospheric ^{14}C levels caused by atmospheric nuclear testing in the 1950s and early 1960s. Kueppers *et al*'s (2004) calibration data has been used to convert these to calendar date ranges in Table 6.2 (Stuiver and Reimer 1986) and Fig 6.4 (Stuiver and Reimer 1993). The Crimdon Dene peat deposit thus appears to have formed in the late 1950s (or possibly in the mid-1990s). The two results from spit 1, taken for statistical consistency, have not been tested as the 'bomb spike' is so extreme in this period that leaves growing months apart would give inconsistent radiocarbon ages.

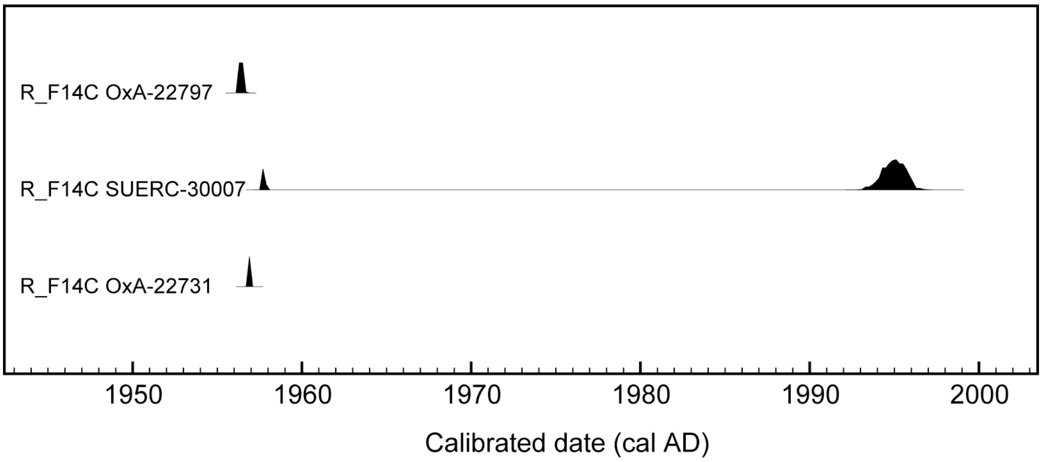

Fig. 6.4 Calibration of the Crimdon Dene radiocarbon results by the probability method (Stuiver and Reimer 1993), using the Kueppers et al (2004) calibration data.

Each of the sites that have been successfully sampled and dated as part of this project are discussed in greater detail below.

6.3 Hartlepool Bay

6.3.1 Location and background

The samples at Hartlepool Bay were taken from the North side of the bay between the headland and the harbour (NGR: NZ 5662 3357). The landscape is a small embayment with a sandy beach overlying the edge of the rock outcrop of the headland.


Fig. 6.5 The small embayment east of Victoria Harbour from where samples were collected.

6.3.2 Previous research

There is a long history of research and investigation of the submerged peats at Hartlepool Bay in the area around Seaton Carew. Samples taken from these peat beds and these have produced two sets of dates dating to the Early Bronze Age (Waughman *et al.* 2005). The report complied by Tees Archaeology details the results of all of these interventions and sampling programmes. Previous sampling was also undertaken as part of a commercial evaluation of Victoria Harbour which revealed similar organic deposits (O'Brien 2006).

6.3.3 Threat from erosion

The area subject to survey is not currently threatened by direct erosion due to a substantial covering of sand. However, during periods of storm activity this could easily be removed, as has been seen elsewhere along the coast, placing the deposits at risk. The deposits could also be threatened by any future development of the harbour entrance.

6.3.4 Pollen analysis

By Charlotte O'Brien

Pollen was poorly preserved in the samples from Hartlepool Bay. A few *Quercus*, *Corylus*, and Chenopodiaceae (goosefoot family) pollen grains, and fungal and fern spores were recorded (O'Brien 2010).

6.3.5 Radiocarbon dating results

Sample	laboratory code	$\delta^{13}C$ (‰)	radiocarbon age (BP)	calibrated date range (95% confidence)
719 top of peat	OxA22798	-28.3	4199±36 BP	2900-2660 cal BC
720 top of peat	OxA22736	-26.5	5901±33 BP	4850-4700 cal BC

Table 6.1 Radiocarbon results from Hartlepool Bay.

6.3.5 Summary and conclusions

Samples were taken from an organic layer identified as a possible desiccated peat from six separate cores. Two of the cores (719 and 720) provided suitable material for pollen analysis and C14 dating from the top of the sample. However, the sample was very wet and the lower portion of the samples had dropped from the chamber so samples from the base of any unit were unable to be obtained.

Sample 719 produced a date ranging from 2900-2660 cal BC and dates to the later Neolithic period. Sample 720 produced a date of 4850-4700 cal BC and dates to the Late Mesolithic. This broad date range comes from two samples of what was initially thought to be the same organic, possibly desiccated, peat layer as both samples were located within 10m of each other. This could indicate differential accumulation of separate organic deposits along this stretch of the coast, as several of the cores produced no material at all.

However, it is possible that these samples represent a continuous peat bed or land surface, and if this is the case it means that the peat that produced the Late Mesolithic date from the top of its profile must have been heavily truncated – having lost the Neolithic material above but that still survives in other locales of the bay as indicated by the other dated core. The truncation could have been caused by the construction of the harbour, the medieval town walls or by subsequent dredging activities.

Despite being truncated, these sediments represent a valuable historic asset as they contain material that can inform upon the coastal Late Neolithic and earlier environment. Coastal peats dating to this period have not yet been found elsewhere in the Tees region and so they represent a significant palaeoenvironmental resource that would repay further and more detailed investigation and recording. The sediment is currently protected by a thick layer of sand and as a result is not at any immediate threat of erosion, but may eventually be exposed and placed at risk as a result of rising sea level.

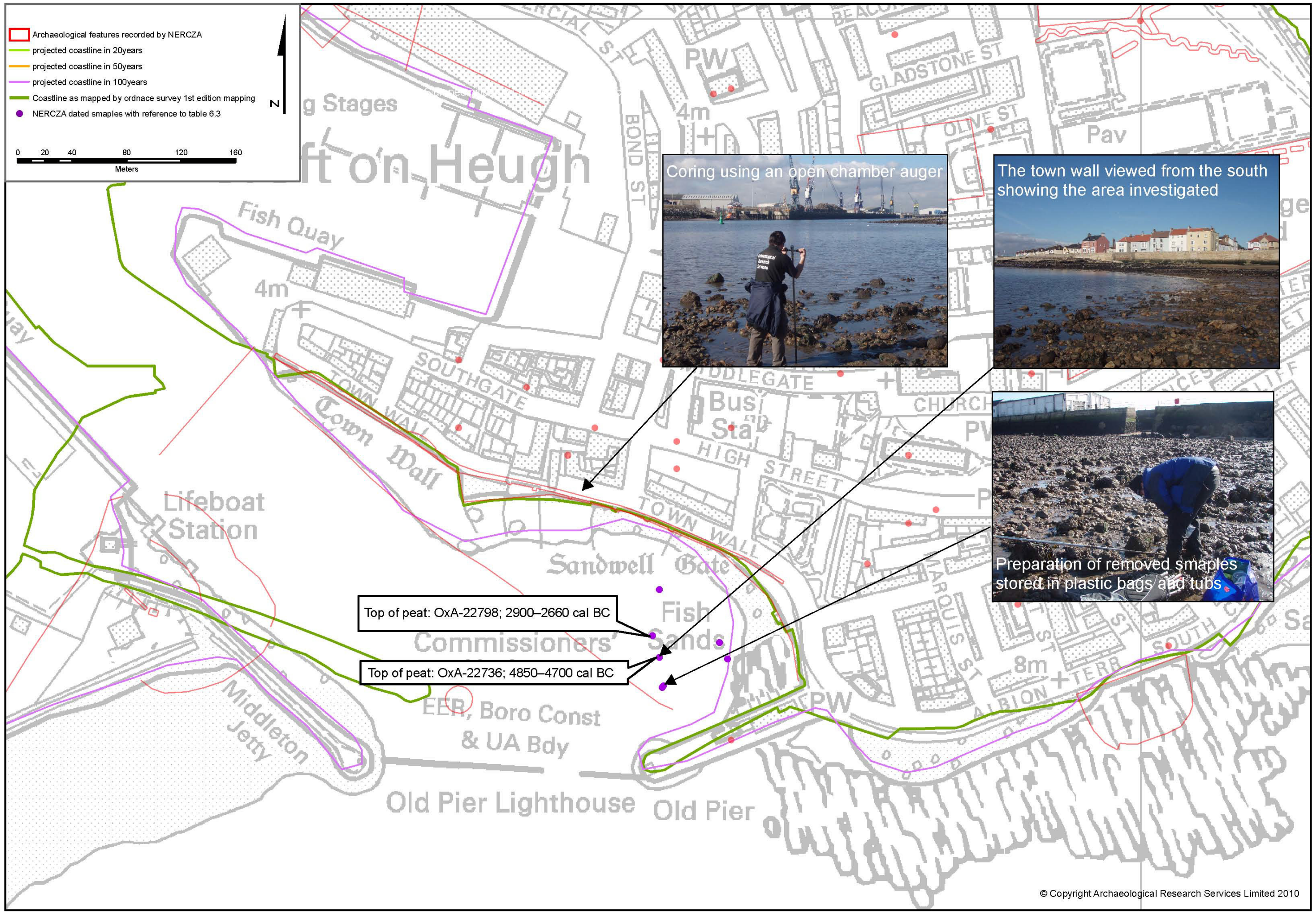

Fig. 6.6 Location of samples recovered from Hartlepool.

6.4 Crimdon Dene

6.4.1 Location and background

Crimdon Dene is located on the Durham coast north of Hartlepool (NGR NZ 48913 36566). The geology of the area is Magnesian Limestone overlain by boulder clay. The coastal cliffs are broken by narrow, deeply incised valleys, or 'Denes', that wind their way to the coast.

6.4.2 Previous research

Although the lithic scatter site and 'forest bed' at Crimdon Dene has been seen and recorded previously (Raistrick and Westoll 1933), no palaeoenvironmental sampling has previously been undertaken in the area. The details of the previous archaeological research and current field survey are provided in section 5.5 of this report.

Fig. 6.7 Crimdon Dene viewed from the cliff to the south of the estuary mouth.

6.4.3 Threat from erosion

There is an ongoing risk of erosion and destabilisation of the dune cliff, combined with erosion caused by the cutting back of Crimdon Beck and this has led to a high rate of retreat. This is described in detail in section 5.5.12.

6.4.4 Pollen analysis

By Charlotte O'Brien

Pollen was not recorded in Spits 1, 3 and 4 from Crimdon Dene, and the only pollen noted in Spit 2 was a *Pinus* (pine) grain. A few diatoms and fungal spores were noted in Spit 1 (O'Brien 2010).

6.4.5 Radiocarbon dating results

Sample	laboratory code	$\delta^{13}C$ (‰)	radiocarbon age (BP)	calibrated date range (95% confidence)
Spit 1	OxA-22731	-25.4	1.06020±0.00294 $F^{14}C$	Cal AD 1957
Spit 1	SUERC-30007	-26.9	1.1209±0.0045 $F^{14}C$	Cal AD 1957-96
Spit 2	OxA-22797	-30.6	1.03979 ±0.00328 $F^{14}C$	Cal AD 1956-7

Table 6.2 Radiocarbon results from Crimdon Dene.

6.4.5 Summary and conclusions

The deposit sampled at Crimdon Dene is clearly a modern deposit and is therefore not related to the flint scatter as was initially thought possible. Despite apparently fitting the location, as described by Coupland in 1936, the deposits observed were most likely formed in the 1950s or even as late as the 1990s. This could indicate that the layer observed by Coupland in the 1930s has been subsequently buried by episodes of dune creation and stabilisation. An alternative explanation is that the visible extent of organic material observed as containing worked flint in the 1920s and 30s has now been eroded away through natural processes. Further work could usefully be undertaken to try and relocate and record the potential location of the flint scatter as sea level rise and coastal retreat continues.

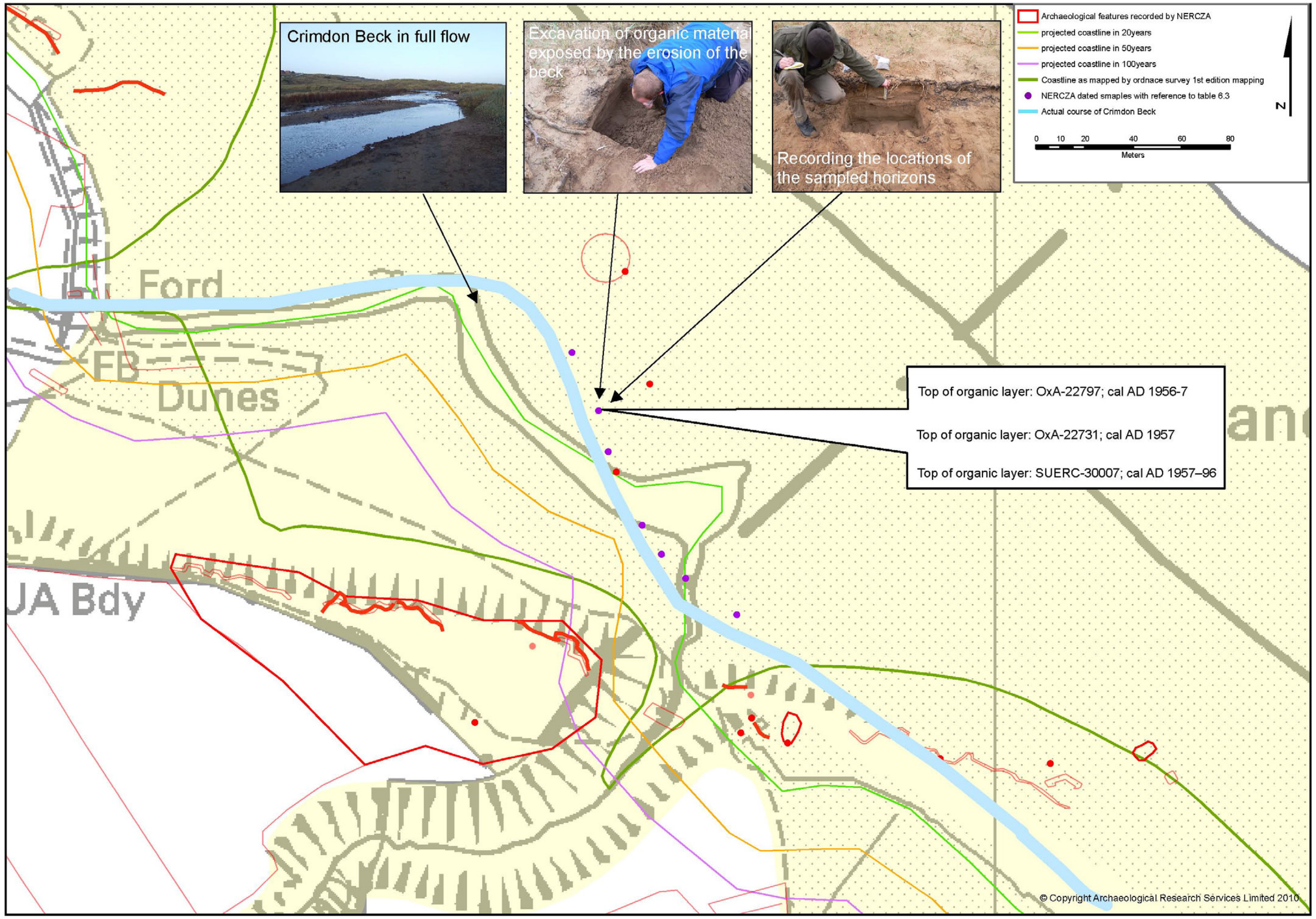

Fig 6.8 Location of samples collected from Crimdon Dene

6.5 Low Hauxley

6.5.1 Location and Background

The main archaeological site at Low Hauxley comprises an area of locally high ground that forms a small hillock or knoll. The archaeological remains on this knoll include a Mesolithic occupation site and a Beaker-Early Bronze Age period cemetery. Since this period there has been a considerable accumulation of dune sand across the site and this has been subject to a complex sequence of geomorphological processes (Innes and Frank 1988). These processes have meant that the landscape has seen a number of significant changes since the beginning of the Holocene.

To either side of the knoll are 'peat' beds that can be followed along the cliff section for several hundred metres to the north. However, not all the peat layers are from the same sediment unit and so each unit has been carefully mapped and photographed (see Fig 6.1). Some of the units have been investigated before, Low Hauxley A and B, and the priority of this survey was to record and date those peats that had not previously been examined. This included the newly discovered peat at a lower elevation that contained the remains of human and animal footprints (Low Hauxley E).

Fig. 6.7 View along the cliff face at Druridge Bay with a recently eroded block of peat collapsed onto the foreshore from peat formation Low Hauxley B (June 2009).

The site looks directly out on to the North Sea. The sea has evidently cut back into the dune system since the Bronze Age meaning that the cemetery is now a coastal site, although when it was originally in use it would have been set back from the shore on a knoll surrounded in full, or in part, by coastal wetlands or lagoons. The current foreshore in front of the dune system comprises a rocky foreshore with interbedded sandstone, mudtsones and coal, all of which outcrop in the inter-tidal and foreshore area, depending on the amount of beach sand cover at any one time. To the rear of the dune system a huge swathe of land has been exploited for open cast coal extraction which has meant that the strip of sand dunes is the only surviving band of natural surficial deposits, and which seals an extremely rich palimpsest of archaeological remains, especially in the central and northern part of Druridge Bay (see also separate 'Review of archaeological interventions and site condition' by Waddington 2010). Currently this precious and well-preserved resource is now under active and severe erosion from the seaward side (SMP 2).

A Devensian blue-grey weathered till, which varies in depth along the coast, directly overlies the solid geology (Innes and Frank 1988). The cemetery, at which a rescue excavation took place as part of this project (Waddington and Cockburn 2009), is positioned on a localised high point approximately 100m north of the Bondicarr Burn where debouches into the North Sea. The dune sand that seals the prehistoric archaeology and peat deposits along this section of coastline have an average depth of 3.5m, although this varies between 3m and 4m. Within the sand dunes are thin lenses of organic material which represent old land surfaces and turf lines (palaeosols) that have formed during episodes of dune stability since the Early Bronze Age and thus show the potential of the dune system to provide palaeoenvironmental information on later periods as well. These buried soils represent the top of the dune system during earlier periods prior to further accumulation.

Inset within the glacial till, and below the dune system, are organic peaty deposits. These deposits are sometimes described as 'ancient forest bed' or 'inter-tidal peat', though in the case of Low Hauxley they are probably more accurately described in most cases as in-filled lagoons. These thick bands of peat, typically up to 1m in thickness, have been the subject of earlier work (Frank 1982; Innes and Frank 1988; Farrimond and Flanagan 1996 and Wilson *et al.* 2001). They contain the visible remains of old trees and have produced archaeological material including chipped flints from Low Hauxley B (Jim Nesbitt pers comm.). One of the peats close to the Low Hauxley cemetery, Low Hauxley B, is known to span the Neolithic-Early Bronze Age periods (Drury 1995) and the long peat exposure at the northern end of Druridge Bay, Low Hauxley A, has been estimated at having built up over a *c.*1900 year period (Frank 1982), although dating as part of this project suggests the origin of this peat is earlier than previously thought and in parts has accumulated over a *c.*3000 year period.

Fig. 6.8. Area of shell midden, possibly Mesolithic in date, exposed in the cliff face immediately above the till deposit. This had been eroded away by the time of the 2009 excavation.

6.5.2 Previous research

A full review of previous archaeological and palaeoenvironmental research and investigation can be seen in the accompanying report (Waddington 2010).

6.5.3 Threat from erosion

The threats faced by the resource at Low Hauxley are discussed in detail in section 5.9.9 of this report.

6.5.4 Pollen analysis

By Charlotte O'Brien

Pollen was present in all of the samples from Low Hauxley except context (1000). *Alnus* (alder) pollen was abundant in several, for example contexts (706), (709), (711), (713) and (715), while *Sphagnum* spores were predominant in contexts (705) and (708). Other species noted were *Quercus* (oak), *Corylus* (hazel), *Salix* (willow), ferns including *Polypodium* (polypody), Poaceae (grasses), Ericaceae (heathers), *Betula* (birch), *Pinus* (pine) and herbaceous taxa including *Plantago lanceolata* (ribwort plantain), Fabaceae (pea family) and Apiaceae (carrot family) (O'Brien 2010). The various peats at Low Hauxley have all shown good preservation of botanical macro and micro fossils with the collective potential to inform on palaeoenvironmental reconstruction from the Late Mesolithic through to the Early Iron Age, as well as hosting archaeological remains dating from all of these periods.

6.5.5 Radiocarbon dating results

Sample	laboratory code	$\delta^{13}C$ (‰)	radiocarbon age (BP)	calibrated date range (95% confidence)
711 (Low Hauxley A)	OxA-22732	-26.2	5915 ±31 BP	4850–4710 cal BC
711 (Low Hauxley A)	SUERC-30010	-28.8	5940 ±35 BP	4930–4720 cal BC
713 (Low Hauxley C)	SUERC-30009	-28.5	4675 ±35 BP	3630–3360 cal BC
713 (Low Hauxley C)	OxA-22733	-26.8	4674 ±30 BP	3630–3360 cal BC
714 (Low Hauxley D)	SUERC-30014	-28.9	2505 ±35 BP	790–510 cal BC
715 (Low Hauxley D)	OxA-22734	-27.8	3776 ±29 BP	2290–2050 cal BC
715 (Low Hauxley D)	SUERC-30008	-28.7	4790 ±35 BP	3650–3510 cal BC
750 (Low Hauxley E)	OxA-22735	-25.5	6296 ±34 BP	5330–5210 cal BC
750 (Low Hauxley E)	SUERC-30015	-28.1	6160 ±35 BP	5220–4990 cal BC

Table 6.3 Radio carbon results from samples collected at Low Hauxley.

6.5.5 Summary and conclusions

The dated samples from the various peat exposures at Low Hauxley reinforce the view of these organic units being separate geomorphological entities, with each formed at a different time period, although in most cases with periods of overlap.

For ease of identification each of the visible peat layers at Low Hauxley has been given a letter A-E (Fig 6.9 and Table 6.3 above). A trend, perhaps significant, that can be noted from the dating of the deposits is that the on-set of peat accumulation gets younger from North (A) to South (D), with the exception of layer E, which is the earliest and most shortlived of all the deposits, but which is at an altogether lower altitudinal level.

Low Hauxley E has provided the earliest dating evidence (sample 750 in table 6.3), and this is in line with expectations given that the layer is at a lower elevation than the other observed peat layers. The dates of 5330–5210 cal BC and 5220–4990 cal BC, show that this peat formed during the late Mesolithic period in the final centuries of the 6th millennium cal BC. This layer also contained worked timber showing cut marks, apparently made by stone tools, and the impressions of human and animal footprints were also observed on its surface. Although the sample only provided dates for the basal deposit, the deposit is very shallow being only 6cm thick, and so was probably only shortlived as a wet peaty deposit. In order for the footprint impressions to have survived the peat must have been soft and damp when they were made and then become dried out, and perhaps covered in sand, very shortly afterwards. Therefore, it is difficult to entertain a scenario whereby the footprints could be much later than the *terminus post quem* provided by the Late Meoslithic dates from the base of the deposit. This makes both the peat, the footprints and the substantial quantity of worked wood surviving in this deposit highly significant historic assets, and extremely rare ones, which are undoubtedly worthy of further investigation (see section 7.3.2), particularly as this is a section of coastline under continuous and severe erosion due to rising sea levels. This peat layer has high potential to yield further archaeological material and dating evidence for this significant period of human history about which little is known from this region. Furthermore, it has the opportunity to shed light on much bigger questions relating to the final drowning of the North Sea, the Mesolithic coastal settlement of northern England as well as details of how people lived, procured resources and adapted to and manged their environment. These are questions of national and international significance and this site, which is under severe and continuous erosion, has the ability to contribute significant information to these questions. . The layer is currently protected by up to 1m of sand in places, however this is removed during storm events and the peat layer exposed and further eroded. As a result once this peat layer becomes exposed again, usually in the winter months, further recording and sampling should be undertaken. This is discussed in further detail in section 7.3.2.

Low Hauxley A was the next oldest dated layer, returning dates from the base of the layer of 4850-4710 cal BC and 4930-4720 cal BC. This immediately post-dates the layer containing the footprints and also started to form in the Late Mesolithic. Investigation of this layer has revealed numerous protruding tree trunks and logs indicating that it has the potential to produce worked timber similar to that retrieved from Low Hauxley E. Mesolithic flints have also been reported as coming from this layer (Jim Nesbitt pers comm.). The upper lens of this sediment unit was dated to the Late Bronze Age 1060-840 cal BC during an earlier study by Innes and Frank (1988). This is evidently another significant prehistoric resource of high palaeoenvironmental and archaeological potential. This peat is currently exposed in the cliff face and is actively eroding. This layer can be seen along with the other exposed peat layers and knoll site at Low

Hauxley, as the most threatened group of archaeological resources on the North East Coast (see section 7.2). By comparing the accurately surveyed positions of these peat layers and the Mesolithic-Early Bronze Age archaeological site on the knoll with the SMP2 projected coastlines, the SMP projection data can be seen as woefully inadequate. The current position of the exposed peats are already beyond the projected 20 year and 50 year shoreline projections and are only just within the 100 year projected future coastline (see Fig 6.9). Clearly, the SMP2 study has underestimated the rate of coastal erosion along this stretch of coast and it is in need of urgent review.

Low Hauxley B has already been dated in some detail by Tipping (see Drury 1995) and so no samples were submitted for dating from this unit. This unit is under the same ongoing threat as Low Hauxley A. This peat has a basal date of 3650-3350 cal BC and a date form the top of the horizon of 710-210 cal BC, ie. Neolithic-Iron Age date (see review document, Waddington 2010).

Low Hauxley C has returned dates of 3630-3360 cal BC and 3630-3360 cal BC from the base and this consistency between the two dates shows a formation period for the peat in the Early Neolithic broadly contemporary with the formation of Low Hauxley B. This layer has also been observed to contain flintwork and is threatened by ongoing and rapid erosion as with Low Hauxley A and B.

Low Hauxley D is located directly south of Low Hauxley C and has returned dates of 2290-2050 cal BC and 3650-3510 cal BC at the base of the deposit and a single date of 790-510 cal BC from the top of the deposit. If the earlier date is correct then it would again indicate a date of formation co-eval with Low Hauxley B and C. However, the later, Beaker period date, could suggest that the earlier date is from residual material. Given that this sample is from a natural deposit though, it is equally possible that it is the sample producing the later of the two dates that is intrusive. Currently it is not clear either way which date more accurately reflects the on-set of peat accumulation at Low Hauxley D. Either way it appears that peat formation ceased in the Early Iron Age. This layer also contains significant sized logs and tree stumps that can be seen protruding from the deposit. This excellent survival indicates the potential for the presence of more worked timber, as with all the other peat beds at Low Hauxley.

The dating programme undertaken by this project has provided a much more detailed understanding of the various peats and their formation and cessation dates at Low Hauxley. They have provided date ranges from the Mesolithic through to the Iron Age, with one peat, Low Hauxley A, appearing to encompass the Mesolithic-Neolithic transition. The extent of survival of archaeological and palaeoenvironmental remains along the coast at Low Hauxley providess a unique opportunity to investigate the development and change of a prehistoric landscape through Late Mesolithic – Iron Age times. Additional evidence, such as the preserved human and animal footprints and timber worked with stone tools that have only been recently discovered, shows the high potential for further remains and discoveries to be made, as well as the undoubted significance of these palaeoenvironmental and archaeological resources. The level of threat, especially to the north of the Bondicarr Burn (Fig 6.9), can be seen as extremely high with many significant archaeological and environmental deposits experiencing ongoing destruction.

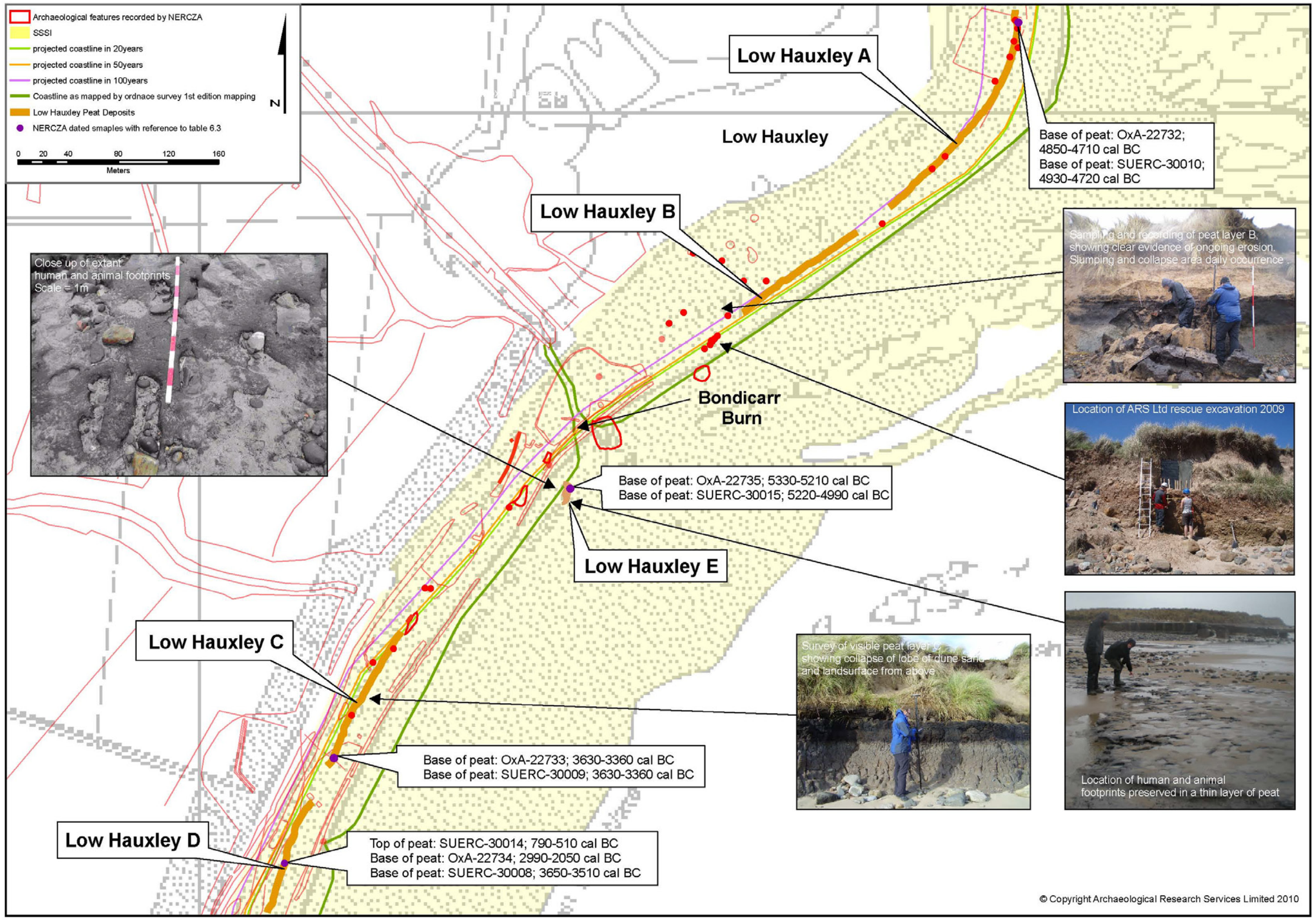

Fig. 6.9 Location of peats and dated samples at Low Hauxley.