Low Hauxley

[NU 284 019]

J. Innes

Introduction

The site of Low Hauxley in south Northumberland is important as one of the most extensive coastal exposures of mid-Holocene deposits in north-east England, with complex sequences of fluvial, peat and dune sand sediments, associated with multi-period archaeological material. Lithology, pollen stratigraphy and radiocarbon dating have been published by Frank (1982) and Innes and Frank (1988), and Farrimond and Flanagan (1996) have reported lipid geochemistry results. Data from Low Hauxley have been valuable in reconstructions of sand dune initiation and development (Orford *et al.,* 2000) and sea-level history and coastal change (Plater and Shennan, 1992; Horton *et al.,* 1999a, b; Shennan *et al.,* 2000a, b). Orford *et al.* (2000) have completed a borehole and radiocarbon dating programme in the Hauxley dune system. Archaeological excavations have been carried out by Bonsall (1984), with associated palaeoenvironmental research by Tipping (unpublished) and further radiocarbon dating (Hardiman *et al.,* 1992). Lancaster University Archaeological Unit have undertaken an archaeological excavation and borehole survey of the sand dune cordon, underlying sediments and beach exposures, which included several palaeoenvironmental reports (Lancaster University Archaeological Unit, 1995). The site is within the Low Hauxley Shore SSSI.

Description

Low Hauxley lies at the northern end of Druridge Bay and comprises a variety of mid- to late-Holocene sediment successions preserved in the coastal zone, either exposed in low cliffs at the head of the beach or concealed beneath an overburden of later Holocene sand dunes (Figure 8.54). Cordons of blown dune sand are characteristic of much of the Northumberland coast, usually along shallow embayments between rock headlands; the 9 km stretch of dunes at Druridge Bay is one of the longest (Orford *et al.,* 2000). The sand dunes are draped over the rock outcrops and till deposits of the last glaciation (Taylor *et al.,* 1971; Lunn, 1995). Although the coastal embayments are choked with sand, the dune cordon itself tends to be thin, usually much less than 300 m in width, with only the most seaward ridge of any real height and the rest comprising low ridges, or a thin dune apron. Carboniferous Middle Coal Measures underlie Druridge Bay (Taylor *et al.,* 1971) and opencast mining behind the dunes has further narrowed the sand body and created a lagoon now managed as a nature reserve. Orford *et al.* (2000) note that deep, unvegetated blowouts open to the beach indicate that the dune system at Druridge Bay is undergoing active reworking. The deposits at Low Hauxley are sheltered to the south of the northern rock headland of Druridge Bay, although peats are exposed in the smaller embayment to the north of this headland, both under the dunes and low on the beach. These have been described by Shennan *et al.* (2000a). Intertidal peats analogous to these and the Low Hauxley sequence are exposed at the southern end of Druridge Bay near Cresswell (Horton *et al.,* 1999a, b) and the whole of the Druridge Bay area is a key location for the study of Holocene environmental history.

The main exposure at Low Hauxley (Figure 8.55) is a thick peat with extensive wood remains, which rests upon till and lies beneath the dune overburden and is exposed in low cliffs at the head of the beach. The peat is about 1 m thick in the northern part of the exposure, where tree stumps protrude from it at the base and in mid-section and branches and other wood remains are common. The peat attenuates rapidly to the south until it becomes increasingly sandy and feathers out against the rising till surface. It has been removed by erosion to the north. The till generally is red, but is heavily weathered to a blue colour in its upper levels where exposed. Sandy, possible fossil-soil horizons can be seen in places at the till surface. The till rests on a probable interglacial wave-cut rock platform, which is covered by modern beach sand (Lunn, 1995). It is this till, peat and dune sand section, represented schematically in (Figure 8.55), that has been described and analysed (Frank, 1982; Innes and Frank, 1988; Farrimond and Flanagan, 1996) and used to illustrate the area's coastal evolution (Gehrels and Innes, 1995; Innes *et al.,* 1997) and sea-level history (Plater and Shennan, 1992).

The whole exposure is at present undergoing substantial marine erosion.

The base and top of the thick peat bed have been radiocarbon dated to 4720 ± 50 years BP (SRR-1421) and 2810 ± 40 years BP (SRR-1420) respectively (Innes and Frank, 1988), and a tree stump rooted in the till was dated 4890 ± 50 years BP (SRR-1422). A date of 980 ± 50 years BP (SRR-1583) also was obtained on marine shells occurring as a lag deposit in a dune slack horizon almost 1 m above the peat bed. Apart from the wood remains, the peat bed is well humified and contains very few macrofossils. Loss-on-ignition measurements by Frank (1982) showed the peat to contain little inorganic material, except in the upper 20 cm, where an increasing sand fraction occurred prior to the deposition of the blown-sand body. Pollen analysis of the peat (Figure 8.56) revealed a later Holocene assemblage post-dating the Elm Decline, which supported the radiocarbon chronology (Innes and Frank, 1988). Four local pollen-assemblage zones were recognized: LH-1 (*Alnus–Quercus*), LH-2 (*Betula–Alnus*), LH-3 (*Quercus–Alnus*)and LH-4 (*Alnus–Quercus–Calluna*). Pollen concentration was low in zone LH-3, high in zones LH-2 and LH-4, and very high in zone LH-1. Two phases were noted where a range of dry-land weed pollen became very common: near the top of zone LH-2, where the bog surface became drier and colonized by trees, and at the top of zone LH-4 before the burial by dune sand.

Farrimond and Flanagan (1996) have examined the same peat section, using molecular geochemical techniques, to investigate the lipid input to the sediment of in-situ plant debris. They compared this lipid stratigraphy with the pollen record. Comparable trends were observed in the two stratigraphies, particularly in the change from wooded conditions to a more diverse flora, with increased herbs and *Sphagnum.* With the exception of the *Sphagnum* indicators, the lipid evidence did not correlate well in detail with the pollen evidence of vegetation change. The wider source area of the pollen assemblages compared with the in-situ origin of the plant remains generating the lipid data probably is responsible for the difference. The authors concluded that the two types of data were complementary and could be used together in environmental reconstruction.

Low Hauxley has been the scene of two phases of archaeological excavation, which have produced important geological data. Bonsall (1984) reported the exposure of two Bronze Age burial cairns resting upon the pre-dune land surface. The buried soil beneath one of the cairns also contained a Late Mesolithic midden deposit, with carbonized plant material, shells, bones and fish remains. This multi-period site and the threat of its loss by erosion prompted detailed study of its associated natural sediments to place it within a secure palaeoenvironmental context (R.M. Tipping, pers. comm.). The archaeological sites were located upon a mound of till and the gleyed palaeosol that underlies the Bronze age cairns was seen to pass northwards into

organic fine detritus muds and moss peats within a basin in the till. This basin was designated 'Low Hauxley-B' by Tipping. These organic facies have an increasing sand fraction in the upper levels, which signals their imminent overblowing by dune sand. A fine grey clay underlay the organic muds. A similar basin lay to the south of the till mound, but the site of Low Hauxley-B is the southernmost extension of the organic sediments examined by Innes and Frank (1988). The sediments at Tipping's Low Hauxley-B are mainly lacustrine detrital muds, which contain no wood remains or other macrofossils. His detailed pollen analyses of the muds, however, indicated that they covered broadly the same time period as Innes and Frank's section. This was confirmed by a series of five radiocarbon dates (Hardiman *et al.,* 1992).

An archaeological evaluation of the site area, from Bondicarr Burn to north of the main peat outcrop, was undertaken by Lancaster University Archaeological Unit (1995), prompted by the continuing threat of loss due to coastal erosion. Excavation was limited to the area with cultural remains, but environmental sampling extended to the wider site. Nine boreholes were made through the sand to the rear of the dune ridge, and organic deposits were proven in five of them, with a maximum peat thickness of 50 cm. The Bronze Age cairns were confirmed as resting upon a long, low ridge of till lying normal to the coastline and with a maximum elevation of about 5 m OD. Beneath the cairns is the buried soil surface, which contained some Late Mesolithic flintwork and this rests on sandy till, over shale bedrock. Survey of the exposed peat sections produced similar results to the earlier studies, but an example of a dune slack layer well above the peat, probably corresponding to Frank's (1982) dated horizon, produced a shell assemblage including *Ostrea edulis, Littorina littorea, Littorina littoralis* and *Gibbula* sp. (Issitt *et al.,* 1995). Extensive soil studies of the buried soil surface and palaeocatena were undertaken by Payton and Usai (1995), as well as the soils associated with the initial stages of sand overblowing of the site. Bone (Stallibrass, 1995) and botanical (Huntley, 1995) reports also were completed.

Interpretation

The pollen stratigraphy of Innes and Frank (1988) can be interpreted as representing the drowning of terrestrial woodland by alder swamp-carr, with a very slow rate of peat accumulation in LH-1 and a natural succession to drier fen-carr environments in LH-2. *Betula* and *Quercus* roots and stumps in the peat in upper zone LH-2 indicate a drier bog surface and the herbaceous weed pollen, including *Plantago lanceolata,* may well indicate local prehistoric woodland clearance. Catchment clearance may have increased runoff to the mire, as zone LH-3 was a period of much wetter conditions and rapid bog growth, causing the demise of birch and oak woods on the bog surface. Zone L11–4 reflects an increase in disturbed ground around the mire, encouraging heathland and open vegetation. This may have been the result of further woodland clearance, or the natural instability associated with approaching dune-sand environments. A great increase in pollen frequencies of aquatic herbs suggests that the emplacement of the sand barrier caused local ponding of water within the mire system around 2810 ± 40 years BP.

Several of the pollen taxa in the upper levels of LH-4 are of coastal type and Frank (1982) suggested a dune system migrating landward as the process driving environmental change at Low Hauxley soon after 3000 years BP This mechanism is supported by the recent work of Orford *et al.* (2000), whose date of 2420 ± 60 years BP (AA-23505) from their core DR-4 at Hauxley, as well as a similar date of 2330 ± 60 years BP (HAR-8973) from Tipping's site at Low Hauxley-B (R.M. Tipping, pers. comm.; Hardiman *et al.,* 1992), also records a sand sheet overblowing terrestrial freshwater environments during this period. Orford *et al.* (2000) also have reported several radiocarbon dates from Druridge Bay and nearby sites that are analogous to Frank's (1982) date of *c.* 1000 years BP for major dune slack development. They use the Low Hauxley sequence in their model for typical sand dune deposition in southern Northumberland, where aeolian sand overlies in-situ freshwater organic sediment over till, which they term 'unconformable normal regressive deposition'. In this model dates on the top of the organic sediment reflect the timing of aeolian sand invasion of the site rather than initial dune initiation. Hence dates several centuries apart occur within a small spatial area, as around Low Hauxley. Such landward sand movement occurs under conditions of relative sea-level rise, often when deceleration in the rate of rise is occurring. During the past 3000 years, therefore, there has been a transgressive shoreline with onshore sand movement in southern Northumberland. Orford *et al.* (2000) also note that dune building phases tend to be site-specific, so the Low Hauxley dune history cannot be applied directly to other sites in the area, and the history for south Northumberland is quite different to that in more northerly parts of the county.

The organic deposits at Low Hauxley-B (R.M. Tipping, unpublished) are broadly time equivalent to those from Low Hauxley (Innes and Frank, 1988) and part of the same palaeocatena, but they represent different depositional environments. The two profiles therefore allow detailed spatial reconstruction of mid- to late-Holocene landscape change in the area. The archaeological sites were located on drier ground on the edge of the Low Hauxley-B channel or basin, which contained a watercourse and then a small pond. In contrast, peat formation began at Low Hauxley on higher ground, with paludification within damp woodland, perhaps also in a depression that has now been partly removed by coastal erosion. Although there are detailed differences in local environments, the overall sequence of water-table fluctuations at the two sites are similar. The silty clay beneath the organic strata at Low Hauxley-B reflects fluvial deposition in a small silt-laden stream and the expansion of aquatic pollen at the start of the limnic mud layers records ponding of this stream and deepening water. This open-water environment continues until mid-profile, when a drier phase occurs, with Cyperaceae temporarily replacing the aquatic indicators. Higher water levels and aquatic types then return until the arrival of sand in the stratigraphy near the top of the organic layers, when aquatic taxa decline sharply again. This wet–drier–wet–sandy succession corresponds exactly to Innes and Frank's Low Hauxley record, with the generally wetter hydrosere at Low Hauxley-B explained by its lower altitude, organic formation starting in the channel or basin feature almost half a metre below that at Low Hauxley.

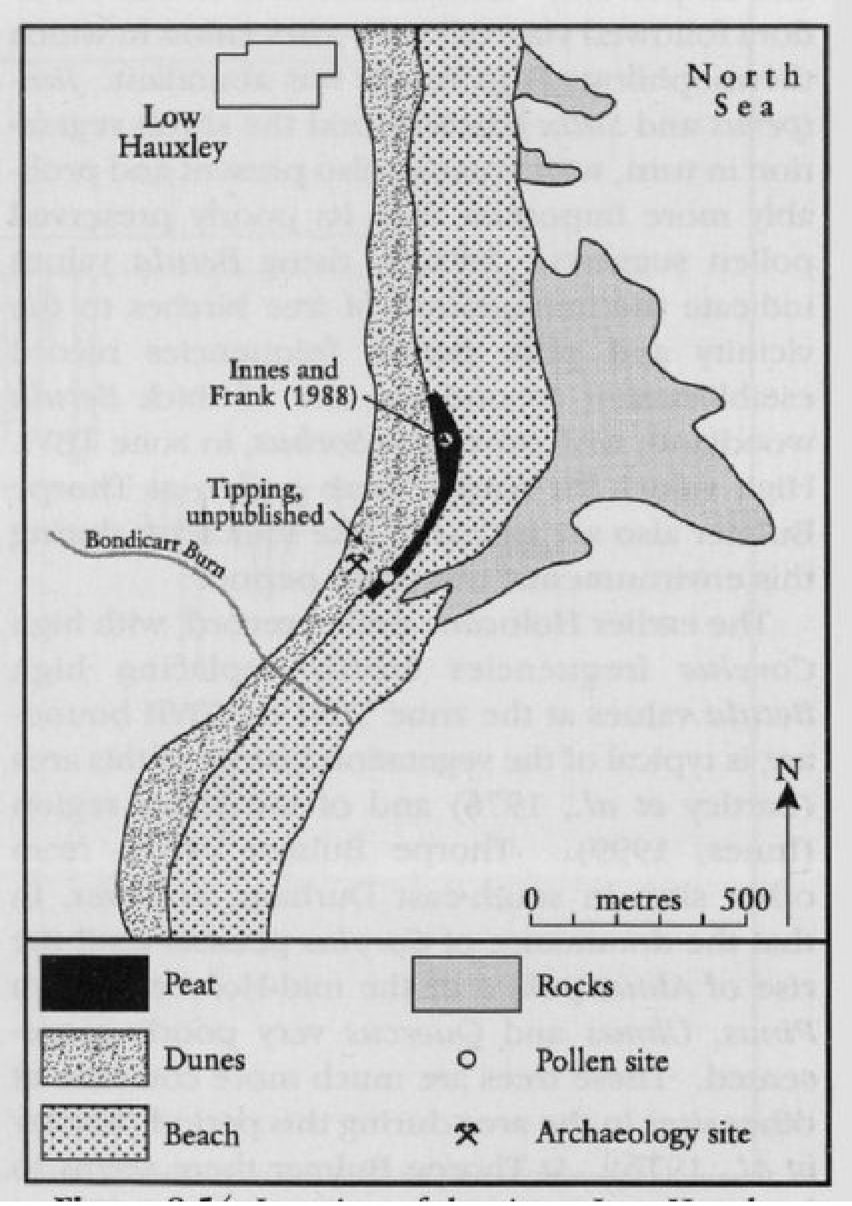
A single process is likely to have initiated organic accumulation at both Low Hauxley sites. Although there is no evidence of coastal conditions at the base of the Low Hauxley sequence, the sub-organic clay at Low Hauxley-B contains dinoflagellate cysts *Spiniferites* and *Operculodinium* and coastal pollen taxa, such as Chenopodiaceae, *Armeria* and *Artemisia.* The sea was clearly not far away when the basal clay and mud deposits were forming at Low Hauxley-B after 5000 years BE A rising sea level may well have had an influence in raising coastal water levels through ponding at both locations. Although generally there is more evidence of probable woodland clearance activity at Low Hauxley-B and a generally more open vegetation, it is difficult to estimate the impact of human catchment activity on hydrological and depositional changes at either Low Hauxley site. The clearest correlation of pollen evidence for woodland clearance between the two sites occurs in the drier phase in mid-profile in each case, dated to the mid- to late Bronze Age. The presence of the Low Hauxley Bronze Age sites explains this, the Low Hauxley-B profile adjacent to these sites having the clearest pollen evidence for human activity. Radiocarbon dates on human bone from both burial cairns (LUAU, 1995) were close to 3500 years BP, corresponding to the age of the clearance activity. The renewed flooding that took place in the upper profile at both sites is more likely to be the result of renewed positive movement of sea level than to the effects of forest clearance.

Plater and Shennan (1992) and Shennan *et al.* (2000a) have used the two radiocarbon dates on the main peat-bed boundaries at Low Hauxley (Innes and Frank, 1988) as limiting data for constraining the sea-level curve for Northumberland. As these dated lithological contacts have no direct evidence of intertidal deposition, they cannot be related to a past reference tidal level. They can indicate only a maximum limiting altitude for sea level at that time, which was above contemporary Mean High Water of Spring Tides. The radiocarbon date of Tipping (pers. comm.) on the clay–peat boundary at Low Hauxley-B is at lower altitude and would have been closer to MHWST at that time. It also is a limiting date for sea-level reconstruction purposes, although the possible evidence for coastal influence that it contains suggests it may not have been far above exceptional high tides, and perhaps reached under storm conditions.

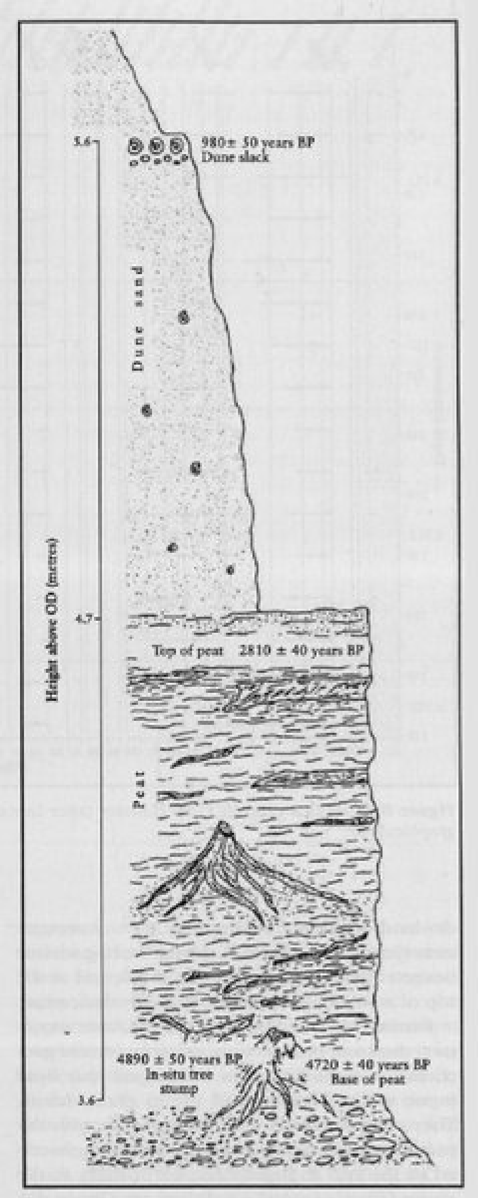
Conclusions

Low Hauxley is a complex concentration of mid-to later Holocene sediments that is important on several counts. It has been central to the establishment of a sand dune chronology for this part of the Northumberland coast, and has been valuable in the reconstruction of sea-level history. The preservation of a buried soil palaeocatena beneath the dunes allows spatial study of landscape_ development prior to dune emplacement. Different types of organic deposit originating in contrasting wetland environments permit reconstruction of coastal zone vegetation changes and hydroseral successions. The deposits record the impact of later prehistoric farming and forest clearance on the landscape and are associated with multi-period cultural and environmental remains.

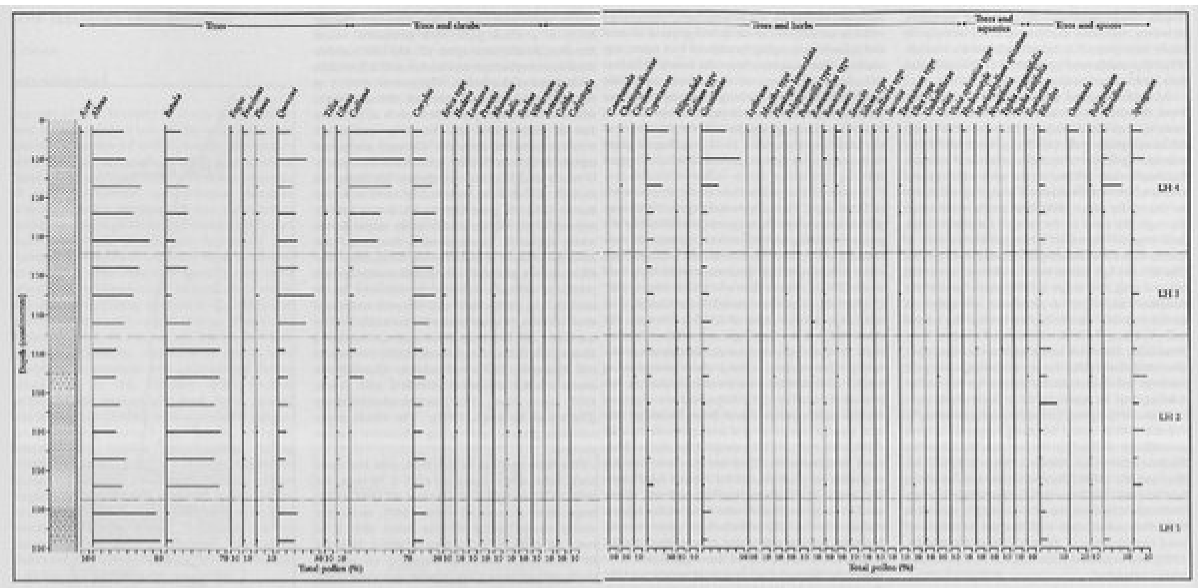
References



(Figure 8.54) Location of the site at Low Hauxley.



(Figure 8.55) Stratigraphy of the site at Low Hauxley.



(Figure 8.56) Pollen diagram, Low Hauxicy (after Innes and Frank, 1988). See (Figure 8.1) for key to the stratigraphical log.