Formby Point

(SD 26 06)

Potential GCR site

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Introduction

Formby Point is part of the Sefton coast dunes, which occupy 1285 ha (Doody, 1989), forming a natural coastal defence some 15 km long and 4 km wide at its maximum extent and locally rising to 30 m above sea level. This coastal dune barrier has been influenced by processes both in the Ribble and Mersey estuaries and in the eastern Irish Sea (Smith, 1982; Pye, 1990) and present-day sediment transport and deposition are dominated by strong tidal currents and moderate wave-energy conditions. The result is a predominantly sandy, multi-barred foreshore (Parker, 1975) backed by coastal dunes that are of major conservation importance in a European context for animals and plants (Atkinson and Houston, 1993).

The Holocene coastal sediments in this locality preserve a record of changing geomorphology since the sea-level rise that started at the end of the last glacial, and they provide much evidence for changing palaeoenvironments along this coastline, in contrast to the extensive areas of peat mossland inland from the dune barrier. The latter area is underlain by Holocene marine and estuarine silts, peats and other deposits of Late Devensian age where the stratigraphy, age, palaeoecology and evidence for sea-level change has been studied intensively (De Rance, 1869b, 1877; Reade, 1871; Gresswell, 1937, 1953; Wray *et al.,* 1948; Tooley, 1974, 1976, 1978a, 1985a, b; Huddart, 1992; Plater *et al.,* 1993 and Plater *et al.,* 2000c). Until recently few investigations had considered the morphostratigraphy and age of the dune barrier and its underlying deposits, but this has been rectified by the work of Pye (1990), limes and Tooley (1993), Neal (1993), Pye and Neal (1993a, b), Pye *et al.* (1995), Gonzalez *et al.* (1997) and Huddart *et al.* (1999a, b). The nature of the marine transgressions, their recognition and understanding are crucial to the understanding of the prehistoric archaeology (Cowell and Innes, 1994) and it is in some of these foreshore, marine sediments that finds of contemporaneous human, animal and bird footprints (Cowell *et al.,* 1993; Roberts *et al.,* 1996; Gonzalez *et al.,* 1997; Huddart *et al.,* 1999b) and animal bones (Huddart *et al.,* 1999b) have been made. A multidisciplinary approach to understanding the sediments in which this archaeological material has been found, which includes palaeoenvironmental analysis using Foraminifera, ostracods, diatoms, shells, grain size and the dating of the stratigraphical succession has been presented by Gonzalez *et al.* (1997). The exposure of these sediments is the result of the rapid erosion of the beach and dunes at Formby Point, where the sand dunes have an average rate of erosion of up to 3 m per year (Pye and Neal, 1994).

Description

Sediments below the dunes

A drilling programme to investigate the morphostratigraphy and age structure of the dune belt and its underlying deposits to the west of Downholland Moss was undertaken by Neal (1993) and Pye and Neal (1993a, b, 1994). Shell and auger holes were drilled to a maximum depth of 14.6 m along three transects between Ainsdale and the south side of Formby ((Figure 8.107) and samples were collected for sedimentological and micropalaeontological analysis and for ^{14}C and optically stimulated luminescence dating. The Holocene deposits are underlain by Triassic bedrock, glacial till and Shirdley Hill Sand and the stratigraphy recorded is illustrated in (Figure 8.108). This stratigraphy provides no evidence that the sequences of brackish water and estuarine silts and peats beneath Downholland Moss and in the banks of the River Alt (Tooley, 1974, 1978a, b, 1980, 1985; Huddart, 1992) passed beneath the central and western part of the dune belt (Neal, 1993; Pye and Neal, 1993a, b, 1994) but instead the area was underlain by shelly marine sands that locally are muddy. A ^{14}C date of 5960 years BP was obtained from *Scrobicularia plana* shells from within these sands at –5.5 m

OD (Figure 8.108). The oldest date from within the dune system came from borehole F ((Figure 8.108) where an organic unit, interpreted as an intra-dune slack peat, gave a date of 5100 ± 70 years BP Outcrops of muddier units within the marine sands beneath the western dune margin can be seen along the eroded coast but these generally wedge out landwards. They are important because they contain contemporaneous imprints of human, animal and bird footprints.

The foraminiferal analyses from the boreholes shows the following general characteristics:

1. a generally high faunal diversity (between 38 and 66 species), except in borehole J where it is medium (26–33) and faunal dominance ranges from 13 to 29;
2. the *Elphidium* group is dominant ranging from 46–69%;
3. *Haynesina germanica* (equivalent to *Protelphidium germanicum* (cf. Downholland Moss) is ubiquitous from 3.2 to 32%;
4. there are a number of *Ammonia* species, with *Nonion pauperatum* and *Trifarina angulosa* in most samples;
5. small, often current winnowed species, such as *Buccella frigida, Lagena, Oolina, Bolivina* and *Fissurina* species generally are present;
6. *Planorbulina distoma* and *Cibicides lobatulus* often are present;
7. there are occasional forms of *Quinqueloculina, Virgulina, Bulimina* and *Nonionella* species, and *Miliolinella subrotunda, Buliminella elegantissima* and *Asterinigata mamilla* are present.

In the nearshore sequences with footprints, 15 samples were analysed, which showed the following general characteristics:

1. medium to high faunal diversity from 4 to 32 species and faunal dominance ranges from 14 to 73;
2. the *Elphidium* group is dominant ranging from 23 to 91%;
3. *Haynesina germanica* is ubiquitous from 7 to 19%;
4. *Ammonia beccari* occurs between 2–19%;
5. *Lagena, Oolina* and *Fissurina* species are often present in low quantities;
6. *Cibicides lobatulus* and *Planorbulina distoma* usually are present up to 10%;
7. most samples have *Miliolinella subrotunda, Rosalina, Quinqueloculina* and *Nonion* or *Nonionella* species.

Both the assemblages indicate a similar overall sedimentary environment. Most of the foraminiferal samples contained the gastropods *Hydrobia ulvae* and *H. ventrosa* and valves of *Abra alba* and many of the sediment samples contained shell debris, including *Macoma balthica, Cerastoderma edule, Ostrea edulis, Scrobicularia plana, Tellina tenuis* and *Littorina littoralis* (Gonzalez *et al.,* 1997).

The footprints and their stratigraphical position

The human, animal and bird footprints have been described by Cowell *et al.* (1993), Roberts *et al.* (1996), Gonzalez *et al.* (1997) and Huddart *et al.* (1999a, b) and appear discontinuously in a 4 km belt within the Holocene sediments (centred on SD 26 06), within a 100 m-wide belt in the intertidal zone, usually about 60 m west of the dune edge. It probably was Tooley (1970) who first observed (in 1968) and then photographed (in 1974), a number of ungulate hoof-prints, seemingly associated with small stakes. The first published photograph of 'cattle hoof-prints from 4000 year old peat' was taken by P.H. Smith (in Hale, 1985). It was suggested by Gonzalez *et al.* (1997) that Tooley's photograph may have been an aurochs hoofprint, with the stakes being alder roots growing down into dessication cracks in the mud and that Smith's illustration was of red deer hoofprints. Roberts began systematically recording the animal and bird footprints in 1989 and the human footprints in 1990 (Huddart *et al.,* 1999a) and a selective archive of over 3000 photographs has been made. The imprint-bearing sediments are mainly intertidal silts and muddy sands, based on their faunal content (Foraminifera, ostracods, diatoms and macrofossils (Gonzalez *et al.,* 1997)).

The sediments show lateral variations and the foreshore can be divided into two main areas ((Figure 8.109). An area north of 'Wicks Wood Gap' shows intertidal, finely laminated, layers of silt and sand, with the best preservation of human footprints (Figure 8.110) and (Figure 8.111). To the south of 'Wicks Wood Gap', around the Lifeboat Road area, there is a sequence of dark grey silty sands with several layers of organic sediments and coarser sands that has allowed a detailed stratigraphy to be constructed (Figure 8.112). It is possible to note the change from nearshore, intertidal sedimentation, with the dominance of *Elphidium* Foraminifera and the diatom *Paralia sulcata,* supporting a relatively sheltered, mid to upper foreshore environment overlain by dune–dune-slack sediments, which have only a few reworked or no Foraminifera (Gonzalez *et al.,* 1997). The 'Wicks Wood Gap' where no imprint-bearing sediments have been observed over the past eight years, was investigated using a JCB to excavate 27 trenches up to 2 m deep, but only orange sand and no silts were found. The human and animal footprints have been found in four main areas, forming different assemblages. Sector 1 ((Figure 8.109) shows human, red and roe deer, crane and unshod horses; sector 2 shows red and roe deer; sector 3 shows human, red and roe deer, crane and aurochs; sector 4 shows red and roe deer, aurochs and domestic ox. Almost all the human footprints have been found within sectors 1–3 and over 145 trails have been recorded (Roberts *et al.,* 1996). It has been possible to calculate a mean adult male height of 1.66 m. and mean female height of 1.45 m. At Formby Point though the footprints of children are predominant and where adult males are present, they are often associated with red deer tracks and they indicate an above-average speed and cadence (Roberts *et al.,* 1996). The much slower movement of women and children would suggest a different economic activity. In some of the human footprints it is possible to see abnormalities, such as missing toes, the fusion of two toes, congenital bunions and arthritis and the footprints of possibly pregnant women have been observed. In sector 4 there are at least two different footprint sets where the younger set of prints, consisting of cattle, red and roe deer, are preserved in an organic sand, with alder roots and desiccation cracks within it. The alder roots have been dated to 3230 years BP (Pye and Neal, 1993a, b), 3333 years BP and 3649 years BP (Gonzalez *et al.,* 1997). The older set of prints is preserved in black, silty sands, interbedded with thin silt layers. Here large aurochs hoof-prints are associated with red and roe deer tracks.

At Formby Point the following animal bones have been recovered over the past six years: aurochs and red deer jawbones, both showing cut marks, a complete set of red deer antlers (Figure 8.110) and a dog jawbone. Most of the finds are concentrated at the Lifeboat Road entrance to the beach and are associated with layers of blue silt and organic-rich black sands formed in a dune-slack environment (Gonzalez *et al.,* 1997). Although the stratigraphical position of the red deer antlers is not precisely located, it came from intertidal silts and has been dated to 4425 years BP (S. Stallibrass, pers. comm., 2001). The dog jawbone was found in a horizon dated to 3649 years BP (Huddart *et al.,* 1999a, b).

Interpretation

Regional significance of the footprints

Over the past 9000 years the coastal areas of south-west Lancashire experienced a total rise in sea level of 20 m (Tooley, 1978a) and it is under these rapid, but oscillating, changes in the coastal environment in which there has been the preservation of human and animal footprints in the intertidal zone at Formby Point. There were three major transgressions that reached as far inland as Downholland Moss. A fourth transgressive event occurred that deposited silts in small embayments at Formby and the Altmouth and a final transgression is inferred from the evidence at Lifeboat Road where an organic sand with alder roots overlies a thin layer of blue silt. Detailed stratigraphical and sedimentological analyses in relation to the dune system (Pye, 1990; Neal, 1993; Pye and Neal, 1993a, b, 1994; Pye *et al.,* 1995) show that the present central and western dune system, which formed after *c.* 2500 years BP, rests on marine sands to a depth of –7.5 m OD, which were present before 5910 years BP.

The human prints are at least 3649 ^{14}C years old around Formby Point and they indicate that during the Neolithic–Bronze Age there was human activity and although there is no proven age for the lower stratigraphical animal footprint set, it is conceivable that they could be as old as the Later Mesolithic (*c.* 8800–6000 years BP). There is evidence of settlement along the coastal mosslands south of the Alt estuary at this period, where the reduction of flint pebbles and the manufacture of implements took place, al though there is an absence of microliths. Although evidence for residential sites is missing, it is possible that coastal–estuarine locations could provide a range of resources to sustain larger groups for longer time periods, as has been suggested by Bonsall (1981) for the Mesolithic sites on the Cumbrian coast. On the Sefton coastal lowland there were large areas of swamp and subsequent fen, in hollows within the deciduous woodland. Easy movement would be difficult across this terrain and therefore a more open coastal foreshore would provide easier access for both animals and humans, in an area rich in food sources (plants, shellfish, fish, wildfowl and animals). The woodland growing on the drier Shirdley Hill Sands soils that surrounded the wetlands would have provided habitats for ungulates, such as aurochs, wild pig and deer, and edible plants. Cowell and Innes (1994) suggest that the sandier soils had less dense woodland and again could have provided easier passage through the woodlands than clay soil areas, and would have been easier to clear if necessary. An even clearer route would have been along the coast and the footprints are some evidence for this. It is possible then that the lower prints are Mesolithic in age, but it seems just as likely that all the prints are Neolithic and the younger set certainly are. Archaeological evidence (Cowell and Innes, 1994) shows Mesolithic–Neolithic sites in the Alt valley, and Neolithic axes have been found at Hightown and west of Little Crosby. In the Early Bronze Age an economic pattern based on mobility and cattle grazing has been suggested (Fleming, 1971), although it is probable that hunting and gathering still played an important role in this area. Evidence from Woodham Knoll, Little Crosby (Cowell and Innes, 1994) suggested that the fens were being used for summer pasture for cattle and that the associated settlement was on the sandy soils above the wetland. During the winter months the fens and the nearby estuary could have been used for wild-fowling and fishing, whereas the cattle were moved to higher land. The possibility therefore is that the upper footprints are Late Neolithic in age and that the cattle and human prints were caused by summer grazing on the dunes, utilizing the dune slacks for freshwater. Overall, Huddart *et al.* (1999b) concluded that the Sefton coast was used both as an easy access route for humans and animals, because farther inland it was either extensively wooded or extensively waterlogged, and also that it was used for a combination of hunting and gathering and cattle grazing at various prehistoric time periods between the Late Mesolithic and the Early Bronze Age.

Sedimentary environments associated with the footprints

The sedimentological and fossil evidence (Gonzalez *et al.,* 1997) shows that the foreshore sequence below M4a in (Figure 8.112) is terrestrial dune and the sequence below is nearshore, intertidal marine in origin. However, within this sequence there is evidence for considerable lateral and vertical grain-size change. For example, the 'Wicks Wood Gap' sands, with no silts, together with the presence of a shallow valley running E–W towards Downholland Moss, may indicate the presence of a former outlet of the Downholland Brook or a creek (Huddart *et al.,* 1999a). However, it is possible that these sands represent a normal foreshore sequence of sand ridges and backshore environments instead of a fluvial sequence (Huddart *et al.,* 1999b). The overall foraminiferal assemblage from Formby Point indicates a shallow, inner shelf environment, with relatively high-energy conditions indicated by *P. distoma* and *C. lobatulus,* rather than the saltmarsh-restricted marine lagoon suggested for the Downholland Moss marine sequences (Huddart, 1992). There are many inner and outer shelf species and water depths generally were in the order of 10–60 m, with a preference for the shallower end of the range. There are many small shelf Foraminifera that could be transported easily (Murray and Hawkins, 1976). Gonzalez *et al.* (1997) show the similarity between the foreshore and borehole samples and the dissimilarity between these and the Downholland assemblage. The Alt Bridge and Abraham's Bridge assemblages (Huddart, 1992) indicate a link between the intertidal foreshore and the marine lagoon–saltmarsh behind the dune barrier in an estuary. Hence the evidence from the Foraminifera suggests that the foreshore sedimentary sequence with the footprints is very similar to the modern nearshore sedimentary environment and this would be supported by the included ostracods, diatoms and marine macrofossils.

A Holocene evolution model for Formby Point

Tooley (1974, 1978a) concluded that Holocene sedimentation started on the Sefton coast around 8000 years BP, when a peat at the base of a borehole at Long Lane, Formby accumulated. A similar peat is found at the base of the Holocene sequences east of Southport (Neal, 1993), but the age should be treated with some caution because it is based on altitudinal correlation with a similar, dated peat beneath Lytham Common, north of the Ribble. Tooley (1976, 1978a) and Huddart (1992) demonstrated that marine transgressions of the coast between 8000 and 5600 years BP, alternated with periods of tidal flat and marsh sedimentation on Downholland Moss and continued at the Altmouth until 4550 years BP The ^{14}C date of 6000 years BP from the base of borehole A (Figure 8.108) and the stratigraphical and palaeoecological evidence suggests that the intertidal and subtidal muddy to clean shelly sand identified beneath the dunes around Formby were the lateral equivalent of the silts, clays and peats of Downholland Moss. The data suggest a more open coastal configuration at this time, with upper intertidal mud flats and saltmarshes lying to landward of extensive intertidal and subtidal sand flats (Figure 8.113). A very wide intertidal sand flat possibly would have afforded sufficient protection for upper intertidal mud accumulation and saltmarsh development in the Downholland Moss area, although there is some evidence that regional wind/wave energies were also lower at this time (Lamb, 1982; Musk, 1985).

There is direct evidence that by at least 5100 years BP low coastal dunes were present in the area around Ainsdale National Nature Reserve (NNR) above a high-energy, intertidal sandy silt sequence (borehole F, (Figure 8.108). Also stratigraphical and pollen analytical work on Formby Moss (Stoney, 1988) identified dune sand intercalations within peat that post-dated the Elm Decline, a little after 5000 years BP.

Tooley (1992) suggested that the relict tidal creeks on Downholland Moss, mapped by Huddart (1992) in the south and Neal (1993) to the north, were associated with the most recent tidal flats to develop in the area between 6000 and 5600 years BP The pattern of these creeks, with the drainage to the west and then to the south on Downholland Moss and to the west and north-west landward of the Ainsdale and Birkdale dunes, suggests that a north–south barrier was in existence at this time (Huddart, 1992). This barrier appears to have extended from just north of the mouth of the River Alt to at least as far as the present-day Ainsdale NNR. The presence of this barrier, combined with the relatively static sea levels and increased wetness of the Atlantic period, may have assisted the widespread replacement of saltmarsh by freshwater marsh behind the barrier after 5100 years BP.

Radiocarbon dating of peat beneath the eastern margin of the dune belt suggests that between 5100 and 3400 years BP there were a number of dune activity phases, with thin sheets of dune sand overblowing the western margin of the mosslands. The intertidal muddy sediments exposed on the foreshore at Formby Point formed before 3250 years BP as intertidal flat deposits onlapped a pre-existing sandy barrier beach. A phase of barrier growth therefore appears to be indicated between 5100 and 3250 years BP and the intertidal muds and sandy beach sediments may well have been capped by low emergent beach bars or islands, which allowed deposition of the muddier sediments in their lee and also supplied sand-grade sediment for subsequent dune formation. Deposition of the intertidal mud units also may have been favoured by a possible regional reduction in wave energy during the Sub-Boreal period, as atmospheric circulation over Britain had reached its weakest post-glacial phase, with westerlies continuing to take a more northerly track over Europe than at present (Lamb, 1982; Musk, 1985).

The intertidal muds at Formby Point appear to have been buried by dune sand relatively rapidly, sand being blown as far inland as far as borehole L (Figure 8.107) to form low dunes. This dune unit was then stabilized and capped by a peat-humic horizon dated at between 2500 and 2250 years BP. At Formby Point the peat shows mature oak woodland, with the dune sand beneath being deeply podzolized. This corresponded with the Sub-Atlantic period of cooler and wetter conditions, which apparently favoured large-scale dune stabilization and pedogenesis on' Formby Point and elsewhere in Britain and Europe (Tooley, 1990). (Figure 8.113)c indicates a schematic palaeoenvironmental reconstruction for *c.* 2300 years BP.

Documentary and archaeological evidence suggests that much of the sand belt remained largely stable until the early Middle Ages (Jones *et al.,* 1993), probably as a result of relatively storm free conditions in the period AD 400■1200 and a possible slight fall in relative sea level. During the 13th century a major phase of coastal erosion and dune formation was initiated (Figure 8.113)d. There is documentary and archaeological evidence for a number of settlements lost or abandoned in the period AD 1300–1700 as a result of sand blow, coastal erosion and severe flooding (Jones *et al.,* 1993) caused by the climatic instability of this period, with both severe droughts and storms between AD 1200 and 1400 and slightly wetter and more stormy conditions during the 'Little Ice Age' (Lamb, 1982; Musk, 1985). The initial dune phases were low sand sheets that developed unhindered by a significant vegetation cover. After the large-scale introduction of marram grass into the area in the 17th century (Ashton, 1909, 1920; Jones *et al.,* 1993), higher dune forms seem to have developed and the thick unbroken dune sand sequences that cap boreholes A, F, G, I and L owe their origin to this phase of dune activity.

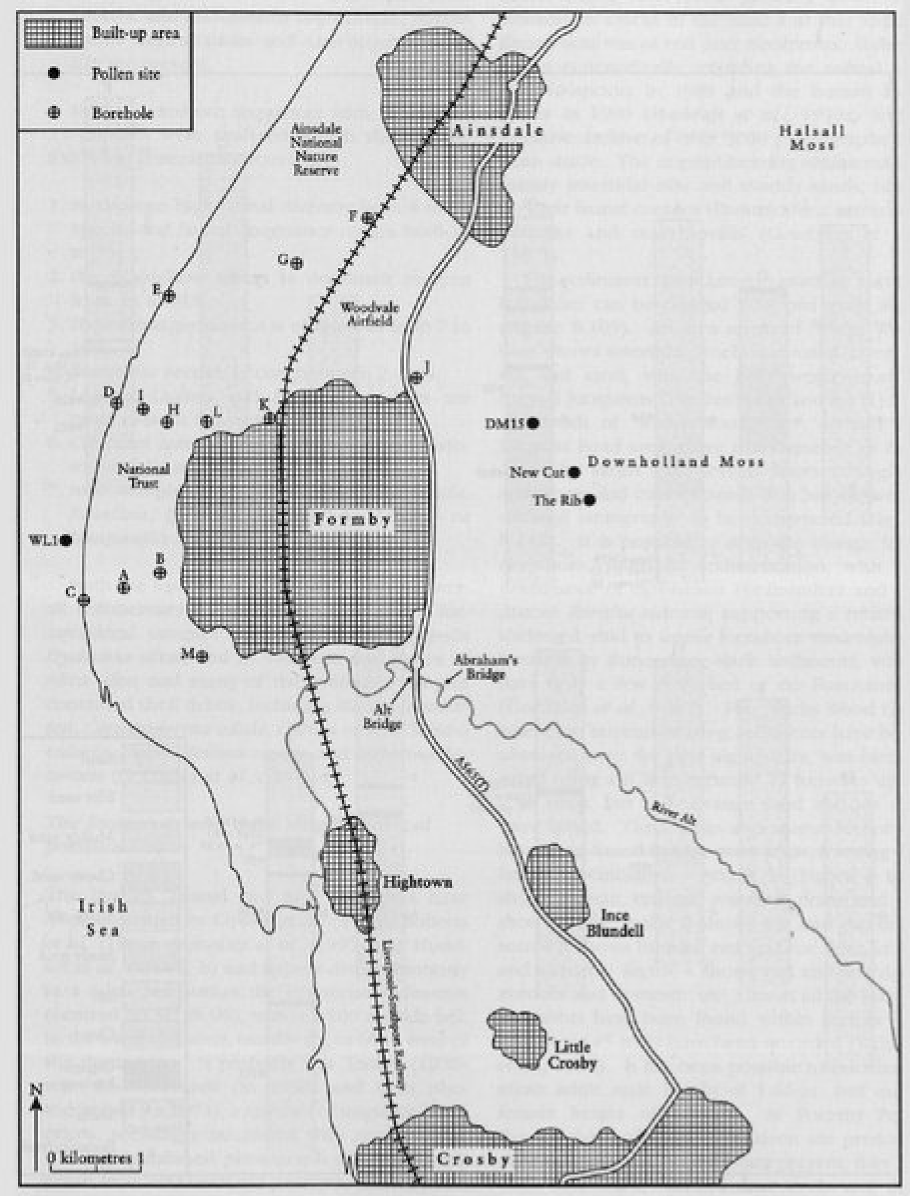
The final phase of dune activity has been more localized, associated with coastal erosion around Formby Point, which was initiated around 1900. This has led to sand sheet and retrogradational foredune ridge development immediately landward of the erosional shoreline. The causes and mechanisms of this erosion have been examined by Pye and Neal (1994), who concluded that the onset of this erosion was mainly the result of an increase in the occurrence of storm-force westerlies and destructive waves around the turn of the century. Erosion subsequently was augmented by bathymetric change and increased wave focusing on to Formby Point, a decrease in the return period of extreme tidal levels, a continued upward movement of relative sea level and the abandonment of dune and foreshore management practices between 1900 and the late 1970s.

Conclusions

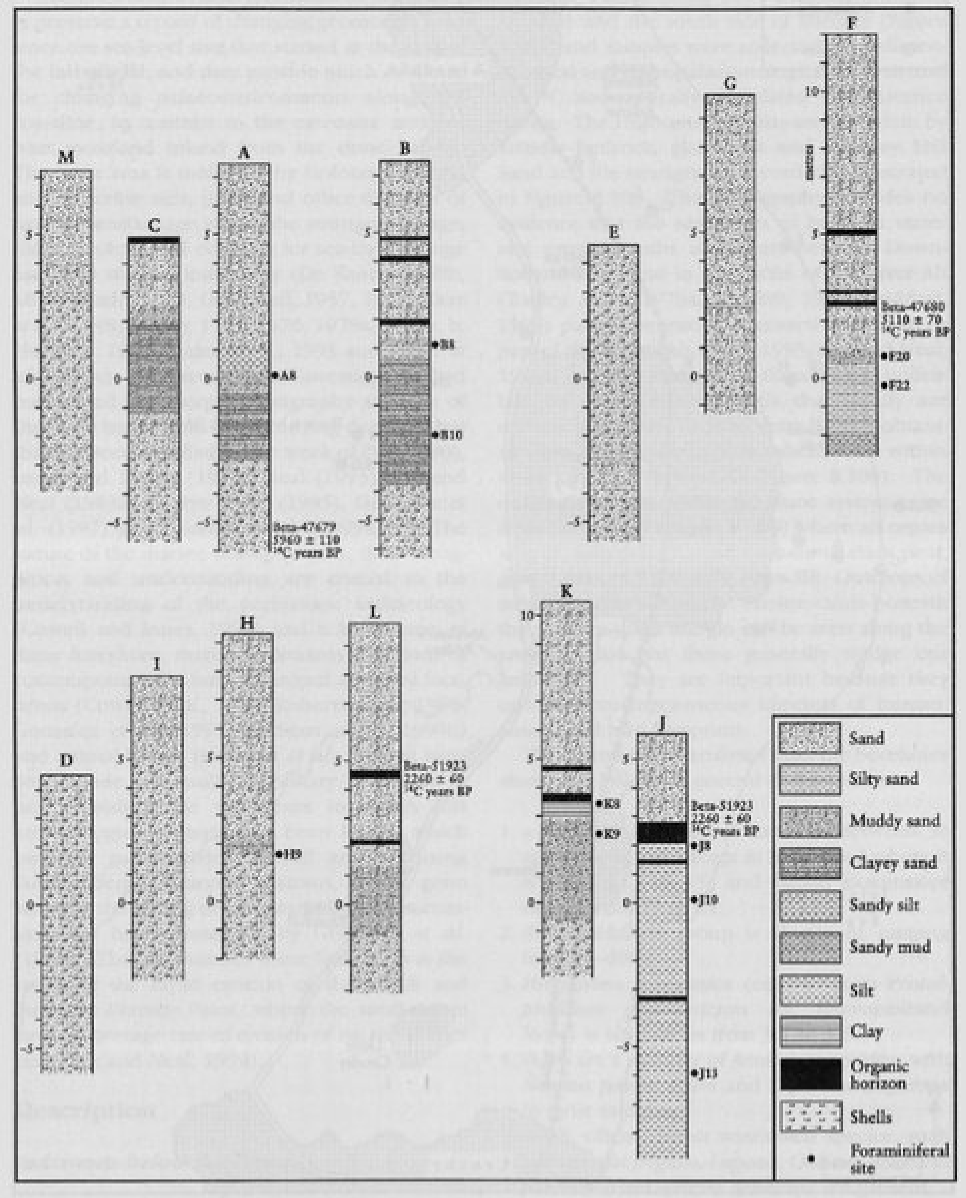
Formby Point has provided a chronology and model for the development of the important dune system on the Sefton coast during the Holocene since the rise of sea level after the last glacial. It has been dominated by both regional and local changes in climate, sea level, sediment supply and human activity. The barrier is of the static type as defined by Thom (1974, 1984) and Thom *et al.* (1978), but there have been a number of progradational phases punctuated by periods of erosion and transgressive dune activity. Its development has proved complex and there is still much uncertainty about the precise chronology and morphology of the coast, especially in the earlier Holocene, prior to 7000 years BP Links with the Downholland Moss sequences have been suggested, although the silts exposed on the modern foreshore are not linked with the Downholland Silts inland.

In general there is a paucity of recorded animal and human footprints worldwide and therefore the number of prints, their accurate recording and their good preservation is an important part of the archaeological evidence for human activity at two stratigraphical levels on the Formby foreshore. Relationships between the animal and human footprints and the archaeological record have been suggested and the development of this type of footprint evidence is rare. It allows studies of the species represented, calculation of height, pace and stride in the case of humans and produces direct evidence of the close association between animals and humans. Only one other area in Britain has intertidal animal and human footprints and that is the Severn estuary (Aldhouse-Green *et al,* 1992; Bell, 1995). The intertidal exposures provide a rich and varied source of palaeoenvironmental and archaeological data but the prehistoric landscapes exposed are ephemeral and are immediately eroded and will continue to do so during rising sea levels.

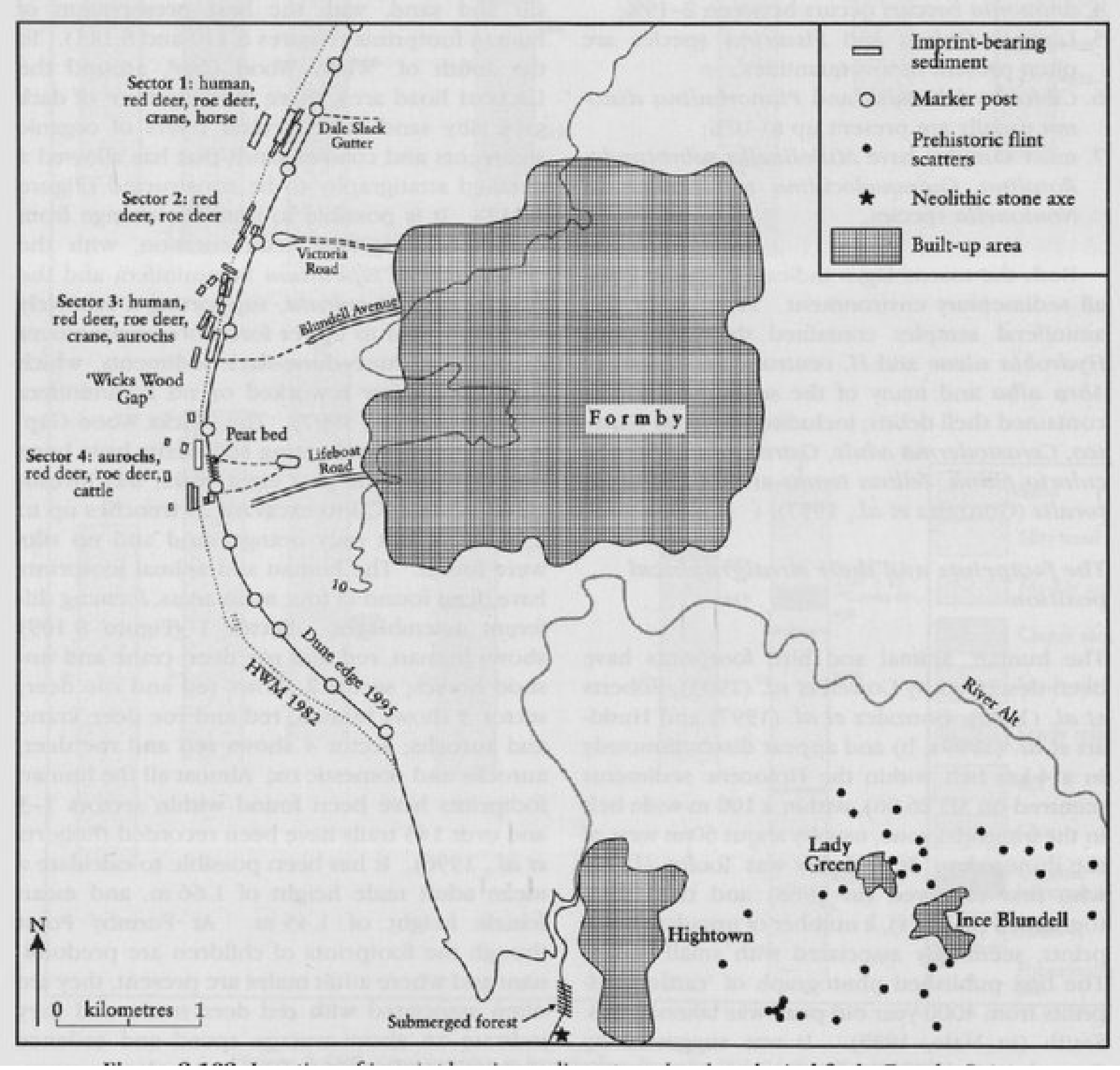
References



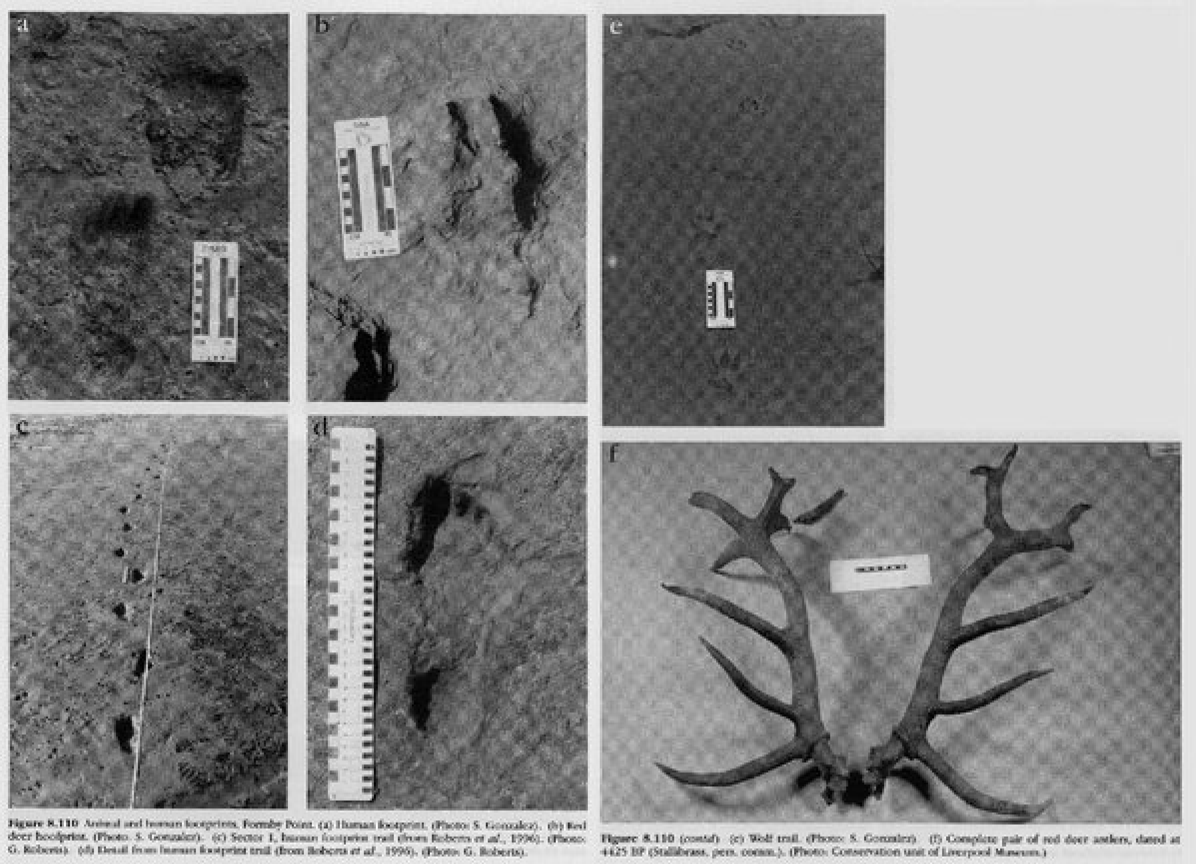
(Figure 8.107) Location of boreholes, Formby Point.



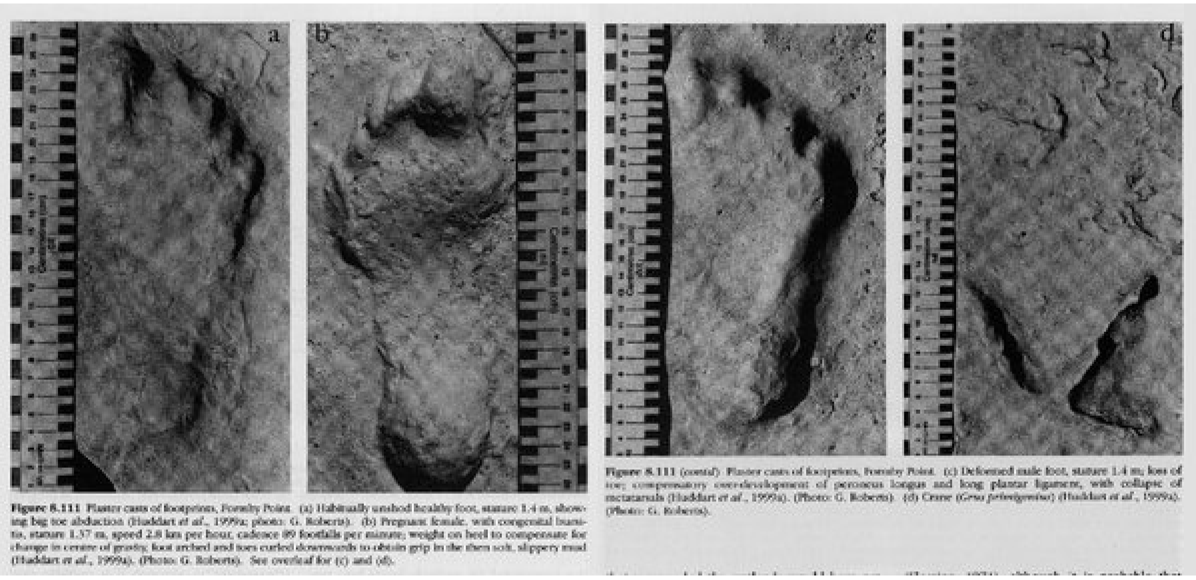
(Figure 8.108) Stratigraphy in boreholes, Formby Point (after Neal, 1993).



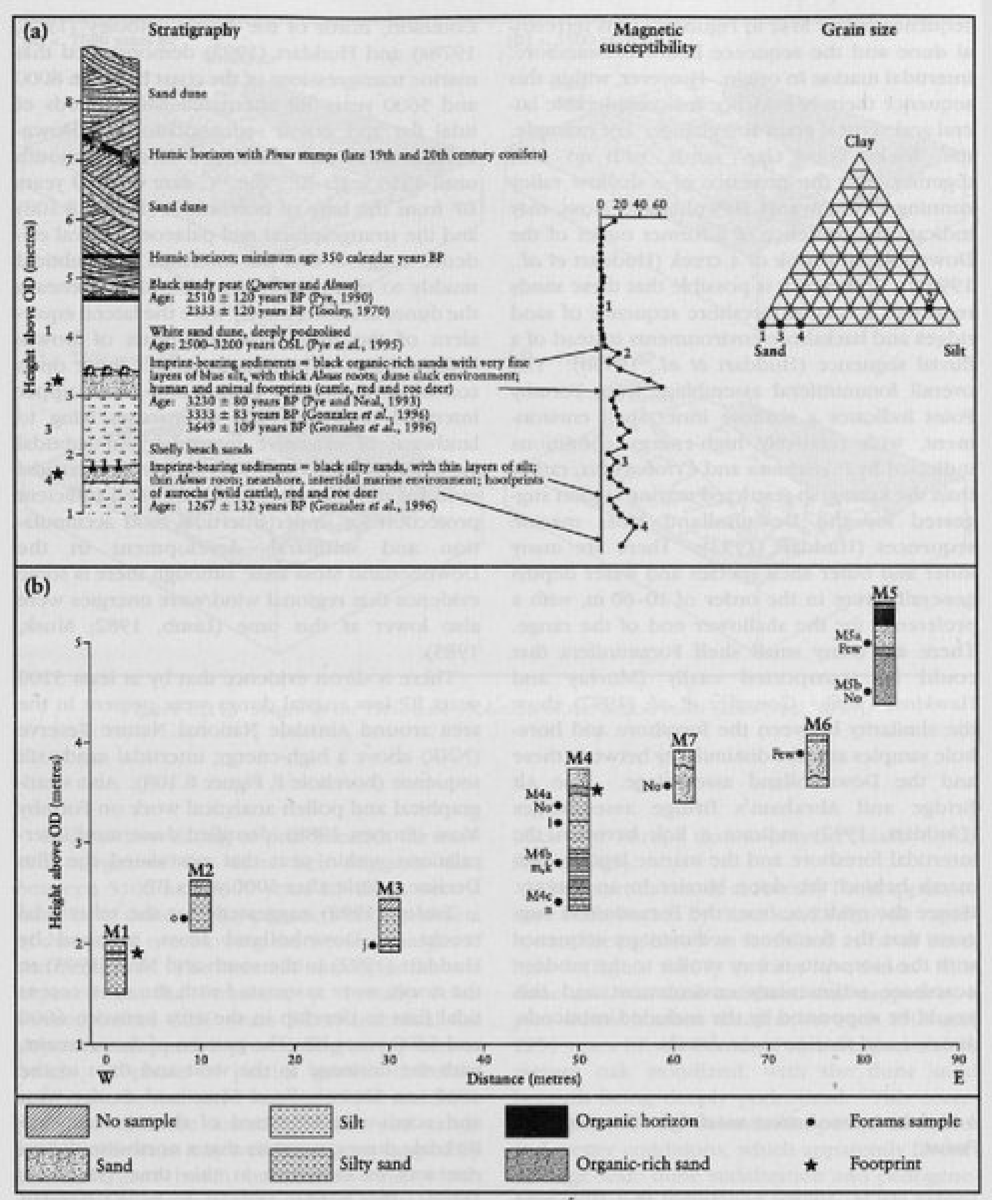
(Figure 8.109) Location of imprint-bearing sediments and archaeological finds, Formby Point.



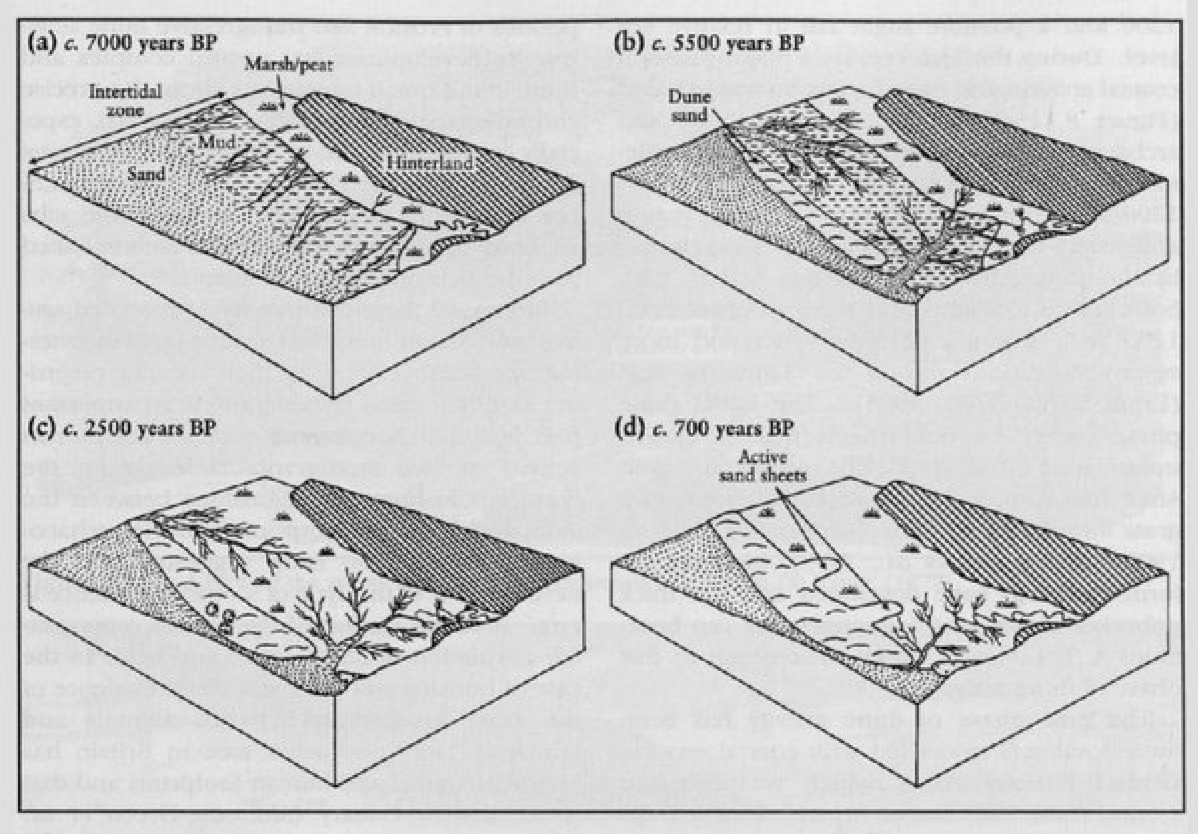
(Figure 8.110) (contd) (e) Wolf trail. (Photo: S. Gonzalez). (I) Complete pair of red deer antlers, dated at 4425 BP (Stallibrass, pers. comm.). (Photo: Conservation unit of Liverpool Museum.)



(Figure 8.110) Animal and human footprints, Formby Point. (a) Human footprint. (Photo: S. Gonzalez). (b) Red deer hoofprint. (Photo: S. Gonzalez). (c) Sector 1, human footprint trail (from Roberts et al., 1996). (Photo: G. Roberts). (d) Detail from human footprint trail (from Roberts et al., 1996). (Photo: G. Roberts).



(Figure 8.111) Plaster casts of footprints, Formby Point. (a) Habitually unshod healthy foot, stature 1.4 m, showing big toe abduction (Huddart et al., 1999a; photo: G. Roberts). (b) Pregnant female, with congenital bursitis, stature 1.37 m, speed 2.8 km per hour, cadence 89 footfalls per minute; weight on heel to compensate for change in centre of gravity, foot arched and toes curled downwards to obtain grip in the then soft, slippery mud (Huddart et al., 1999a). (Photo: G. Roberts). (c) Deformed male foot, stature 1.4 m; loss of toe; compensatory over-development of peroneus longus and long plantar ligament, with collapse of metatarsals (Huddart et al., 1999a). (Photo: G. Roberts). (d) Crane (Grus primigenius) (Huddart et al., 1999a). (Photo: G. Roberts).



(Figure 8.112) (a) Stratigraphy at Formby Point. (b) Stratigraphy at Lifeboat Road area, Formby Point.