# MESOLITHIC TO NEOLITHIC COASTAL ENVIRONMENTAL CHANGE: EXCAVATIONS AT GOLDCLIFF EAST, 2002

**by M. Bell[1], J.R.L. Allen, S. Buckley, P. Dark, and S.K. Haslett**

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*This is the second interim report on a project investigating the ecology of coastal environments and the interplay between natural factors and human agency in the period* c. *6500-3500 Cal BC. Work during 2002 concentrated on survey and excavation of later Mesolithic sites at Goldcliff East which are intertidal and were successively inundated by Holocene sea-level rise. Occupation horizons contained lithics, bones, including those of fish, and preserved organic environmental evidence. The survey area includes submerged forests of Mesolithic date, and extensive spreads of charcoal with evidence that trees and reeds were burnt. Human and animal footprint-tracks of Mesolithic date have also been recorded. The report also includes evidence of tree orientation in the submerged forest and analysis of foraminifera assemblages from a probable last glacial beach that underlies the Mesolithic occupation horizon.*

## INTRODUCTION (MB)

The first report on the three year NERC funded research project on Mesolithic to Neolithic Coastal Environmental Change *c.* 6500-3500 Cal BC (Bell *et al* 2002) recorded that during the course of survey Mesolithic occupation evidence, charcoal spreads and human and animal footprint-tracks were located in the embayment at Goldcliff East. During 2002 additional funding support was obtained from Cadw so that these archaeological sites could be investigated and it is with this fieldwork and aspects of related environmental context provided by the NERC project that this second interim report is principally concerned. Fieldwork took place between 8th August and 11th September 2002 supplemented by small-scale fieldwork on 28-30th March 2002. Only limited aspects of post-excavation work are discussed here and this will be the subject of future papers.

A Mesolithic site had previously been excavated between 1992-4 in the intertidal zone west of Goldcliff and a final report on that site has been published (Bell *et al* 2000). In 2001 exploratory excavation took place of Sites A and B east of Goldcliff and these were the subject of further excavation in 2002 (Figure 1). An area of the upper submerged forest was cleaned and planned as the location for the main palaeoenvironmental sampling pit at Goldcliff East (Site J). This area also turned out to be rich in Mesolithic artifacts and excavations took place here for the first time. This site was high in the tidal frame and could be excavated even at neap tides and at spring tides for about 3 times longer than Sites A and B which are located low in the tidal frame where work was necessarily limited by narrow tidal 'windows'.

In addition to excavation of Mesolithic occupation surfaces, further recording of human and animal footprint tracks in laminated sediments took place at Site C, where some recording had taken place in 2001, and Site E which was identified this year and where Rachel Scales developed excavation techniques to reveal footprint tracks buried within laminated sediments. Further work was done on the submerged forests, particularly by Scott Timpany on the detailed cleaning, planning and recording of trees on the lower peat around Site D and the upper submerged forest at Sites J and K. All oaks of sufficient size have now been planned and sampled by Nigel Nayling for the project's dendrochronological programme, the remaining few being sampled in 2002. EDM survey of the intertidal zone was further extended by Heike Neumann.

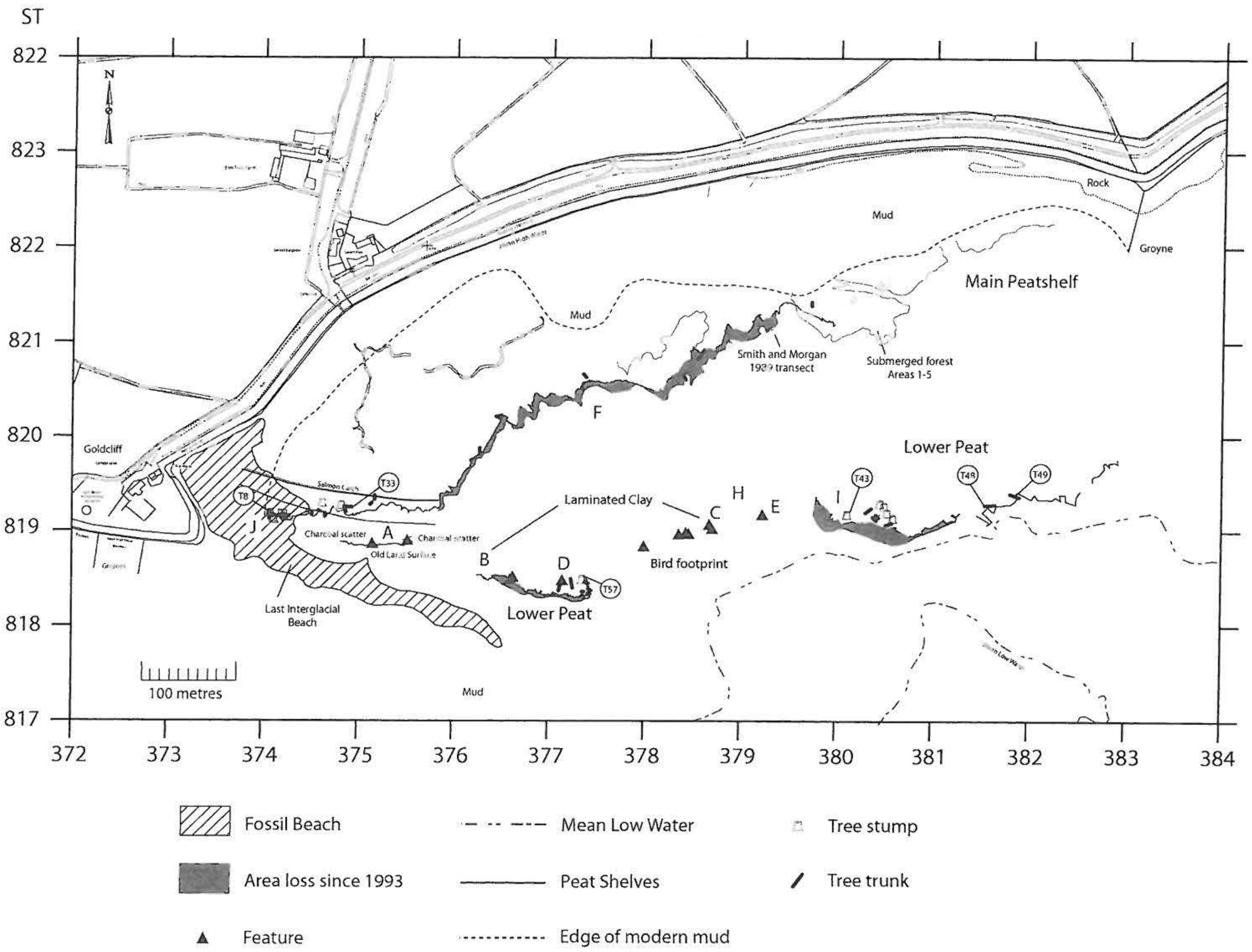


*Figure 1: The intertidal zone at Goldcliff East showing outcrops of intertidal peats and the main excavation and survey areas of 2002. Survey by H. Neumann and S. Buckley; Map base: © Crown Copyright Ordnance Survey. An EDINA Digimap / JISC supplied service.*

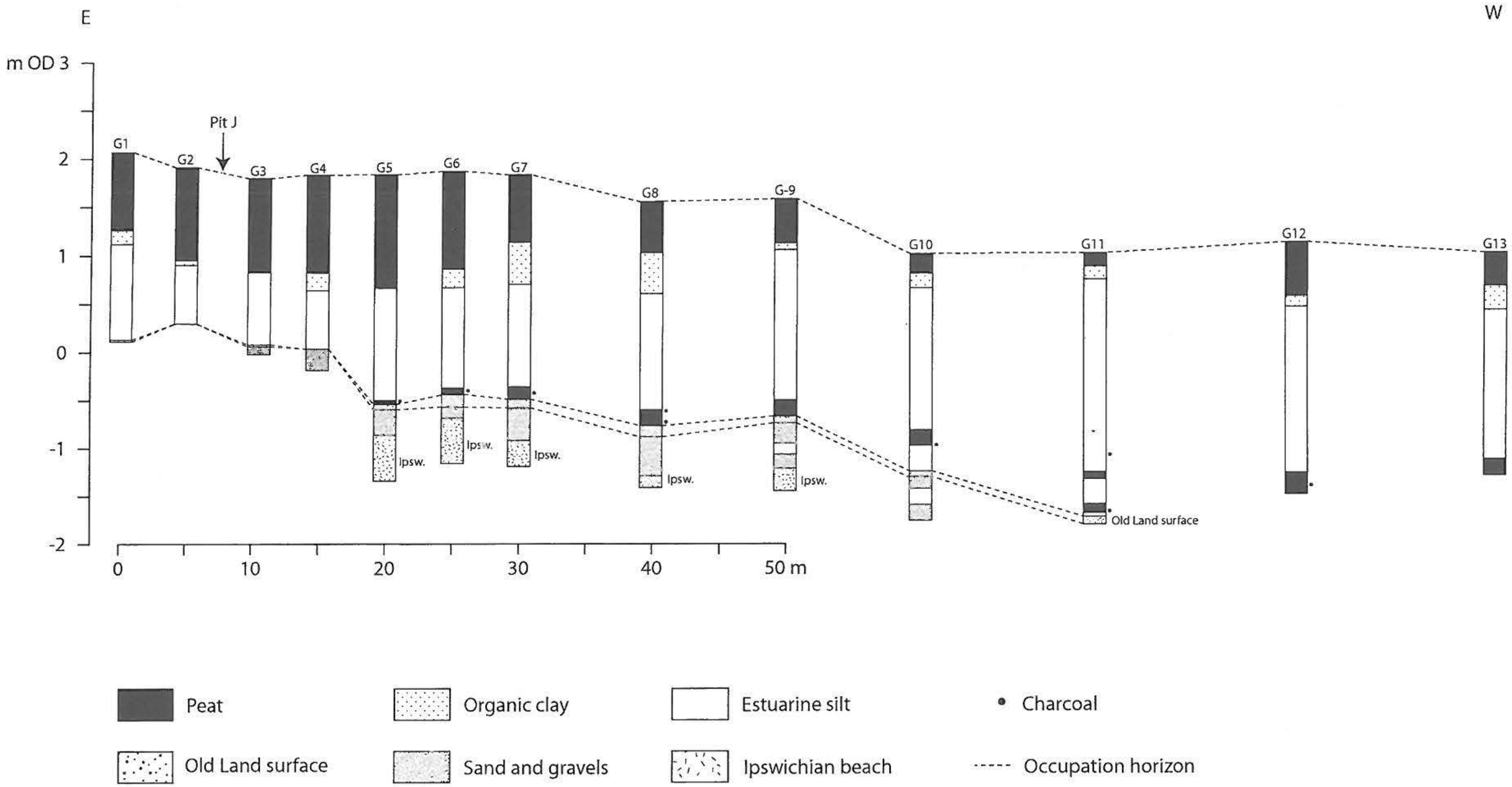


*Figure 2: Stratigraphic coring transect from the upper peat shelf running east from site J. Survey by H. Burg.*

| Unit | Sediments | Radiocarbon date | Calibrated range |
|---|---|---|---|
| **TOP** (x) | Minerogenic estuarine sediments | | |
| (ix) | Thin reed peat | | |
| (viii) | Minerogenic estuarine sediments | | |
| (vii) | Upper main peat, vegetation history investigated by Smith and Morgan (1989). The peat shows the following succession: | | |
| | -reed and sedge peat stage followed by raised bog conditions | from 5020+/- 80 BP (Car-652) to 3130+/-70BP (Car-644) | From 3970-3650 Cal BC to 1530-1210 Cal BC |
| | -fen wood peat of the upper submerged forest | from 5850+/-80 BP (Car-658) to 5360 +/-80 BP (Car-656) | From 4910-4490 Cal BC to 4350-3990 Cal BC |
| | -reed peat | 5950+/-80BP (Car-659) | 5050-4610 Cal BC |
| (vi) | Laminated silts with partings of sand. Minerogenic estuarine sediment associated with many animal and human footprint tracks. | | |
| (v) | Thin peat developed on old land surface, occupation at Site B. Lower submerged forest trees. | 6770+/-70 BP (Beta-60761) | 5800-5530 Cal BC |
| (iv) | Old land surface rich in charcoal and locally artifacts, occupation at sites J, A, B. | 6480+/-70BP (Car-1502) | 5610-5310 Cal BC |
| (iii) | Stony head containing Trias Red Marl | | |
| (ii) | Stony head containing Lias limestone | | |
| (i) **Bottom** | Sandy and pebbly Ipswichian beach cemented as sandrock locally. | | |

*Table 1: Outline of the main Pleistocene and Holocene sedimentary and organic units at Goldcliff East and their dates where known.*

Linked to this project are four postgraduate student research projects. The main project interim report is followed by short reports from these researchers outlining aspects of their work: footprint-tracks (Rachel Scales), submerged forests and coastal plant communities (Scott Timpany); investigation of the nearest wetland-dryland edge context at Llandevenny (Alex Brown) and insect assemblages from later prehistoric contexts at Redwick, a site which was investigated as part of this project in 2001 (Emma Paddock).

Radiocarbon dates in this paper have been calibrated using the OxCal calibration programme (Ramsey 1995, version 3.5) which employs the INTCAL 98 calibration dataset (Stuiver *et al* 1998).

## STRATIGRAPHIC SEQUENCE (MB)

The promontory at Goldcliff has been shown by Allen (2000) to have been the remnant of a formerly much larger island of Triassic and Jurassic Beds. The former margins of the island were discovered by Allen to be marked by breccio-conglomerates and sandrock deposits representing a last interglacial beach overlain by head and Holocene sediments (Allen 2000, Fig 2.1). For much of the Holocene this bedrock rise would have been an island surrounded at high tide by water and at low tide by mudflats, saltmarsh and at times reedswamp, fen woodland and raised bog (Bell *et al* 2000, Chapter 17). Today the island remnant lies within reclaimed wetland behind the seawall. To the east of the former island is the embayment in the seawall to which we give the name Goldcliff East. Figure 1 shows the outcrops of the main stratigraphic units within this embayment and the locations of the main sites investigated.

The stratigraphic sequence at Goldcliff East was illustrated schematically in Bell *et al* (2002, Fig 4). During 2002 a more detailed coring investigation of the stratigraphic sequence was carried out by Helena Burg and Alex Brown. Figure 2 shows part of the sequence from the edge of the former island at Site J east along the upper peat shelf. The overall stratigraphic sequence at Goldcliff East is summarized from top to bottom in Table 1.

Not all units are present everywhere. The two types of basal stony head (ii and iii) only occur locally and in places the Holocene old land surface has developed on Pleistocene sandy sediments. On the transect shown in Figure 2 the upper peat (vii) is little more than 1 m thick. However, that transect is close to the seaward edge of the upper peat shelf and here the upper raised bog peat has, but for small remnants in places (eg the north edge of Area J), been eroded away. To the north landward a greater thickness of peat including the overlying raised bog is present. The top three units (viii-x) are exposed north of the illustrated transect and are therefore not shown on Figure 2.

The most important point to appreciate is that the earlier Holocene old land surface (iv) dips east from the former bedrock island (Allen 2000), and the main archaeological sites occur therefore at decreasing OD heights to the east (Table 2).

| Site | OD Height |
|---|---|
| Site J | +1.49 m OD |
| Site A | -1.60 m OD |
| Site B | -3.39 m OD |
| Site D | -3.9 m OD |
| Site I | -3.7 m OD |

*Table 2: Goldcliff East: OD heights of the archaeological sites investigated*

The old land surface does not represent a single chronological episode because burial of this surface was diachronous (ie time transgressive). On Sites B and D, low in the present-day tidal frame, the old land surface was covered by a thin peat (v). At an intermediate level in the present-day tidal frame, where the dip of the old land surface is greatest, peat did not form and the old land surface is covered by laminated minerogenic sediments (vi). This occurs at both Site A and the lower areas of Site J, as Figure 2 shows, Site J is between 0-10 m along that coring transect. Higher within the present-day tidal frame, within the area of Site J the minerogenic sediment thins and disappears with the result that in the south west corner of Site J the old land surface is directly sealed by the upper peat (vii) and submerged forest, (Figure 6).

It follows from this that the Holocene old land surface (iv) contains successively buried episodes of human occupation spanning the period of stratigraphic units (iv) to the beginning of (vii) above. This sloping surface will have been subject to diachronous inundation as a result of the Holocene transgression preserving a chronosequence of different stages of coastal Mesolithic activity. The sequence starts at Site D *c.* 6770+/-70 BP (Beta-60761; 5800-5530 cal BC). The date when the highest occupation at Site J was sealed by peat has not yet been directly determined. This can be estimated, however, as west of Goldcliff island thin estuarine sediments sealing Mesolithic occupation were subject to peat development at a similar OD height at 5820+/-50BP (Grn-24143; 4800-4540 Cal BC, Bell *et al* 2000, Fig. 4.4). The local sea-level curve indicates that peat growth at Site J occurred from *c.* 4300 cal BC (Bell *et al* 2000, Fig 17.2). Thus the Goldcliff East sequence is likely to preserve successive episodes of human activity extending over between 1000 and 1400 years. There is thus the potential to look at changes in material culture, environmental relations and economy in the later Mesolithic.

The potential of this investigation at Goldcliff East is strengthened by the fact that the earlier Smith and Morgan (1989) pollen study 700 m east of Site J produced evidence of a landnam episode immediately following the elm decline (around 3650 Cal BC). This must relate to activity on

Goldcliff island, because it is the only dryland for 5.5 km. Two other clearances occurred in the later Neolithic and early Bronze Age. There is thus considerable potential to further investigate changing environmental relationships and economy before and after the introduction of agriculture.

## EXCAVATION AND SIEVING METHODS (MB)

Excavation of the basal Holocene land surface (iv) took place at three sites progressing east from the former island edge at successively lower elevations: Sites J, A and B. Before excavation each area was cleaned of mud by washing with buckets of seawater on the retreating tide, and removing remaining mud with slurry scrapers, trowels and plastic spatulas. A smaller scale mud removal operation had to be undertaken each day on the retreating tide: its extent depending on the amount of redeposited mud laid down by that tide. A surface plan was made of the existing exposure of sediments, accompanied by a contour survey at 0.5 m intervals. Excavation areas were divided into a 1 m grid and generally excavation proceeded one grid-square at a time. Where possible adjoining squares were taken down in sequence to reveal larger surface areas of key stratigraphic horizons. Horizons with occupation were carefully excavated by trowel and plastic spatula. All finds were plotted using three-dimensional coordinates, an easting, a northing and a level so that plots of the spatial and vertical distribution of artifact types can be prepared.

All the sediment from occupation horizons was hand sieved using a 1 cm mesh. This was done by agitating the sieve in shallow seawater. The sediments also had to be broken up by hand and, in practice, this meant that the majority of artifacts retrieved by sieving were initially detected by feel. Consequently many artifacts smaller than the mesh size of 1 cm were recovered during the closer examination of sediment which took place during the hand sieving stage. In addition one bag of sediment (average 4 litres of sediment) was removed from the foreshore from each horizon with occupation evidence in each grid square for flotation sieving on dryland. Sieving was done using a modified version of the Siraf-type flotation tank. On Site B this strategy was later modified during the excavation so that all the sediment from the occupation horizon was subject to flotation.

## SITE J (SB and MB)

During 2001, preliminary survey was carried out on the upper peat shelf to record (Fig 1) and sample those trees which were of oak (and some others) for dendrochronology (Bell *et al* 2002). In 2002 the aim on Site J (Figure 3) was to make a detailed plan of a sample area of the upper submerged forest and put down an environmental sampling pit within this area close to the edge of the former island. However, when the site was cleaned a previously undetected occupation horizon was revealed below the peat at *c.* 1.5 m OD. Thus this area unexpectedly became one of the main areas for excavation. This discovery was particularly fortunate because Site J is high in the tidal frame and can thus be excavated at every low tide and even at neap tides. It is exposed for about three times longer than the sites lower in the tidal frame.

### *The submerged forest*

The broad scale recording and survey of submerged forest oak trees at Goldcliff East was completed in 2002 when the last few remaining oaks were sampled. Research then proceeded to the next stage of the study with the more detailed examination of vegetation composition and succession in key sample areas. Aspects of this research are outlined in the associated paper by Scott Timpany (this volume). One of the sample areas was Site J, where a number of trees had previously been sectioned as part of the dendrochronological programme: these included a large buttressed fallen stump, Tree 8. Here a 10 m square area was planned. As Figure 3 shows, in the south-west corner of this area sandy sediments underlying the peat were exposed and in the old land surface on these sandy sediments evidence of Mesolithic occupation was found. Once the submerged forest had been planned, numbered wood samples were taken from trees exposed on the surface of the peat and later from the sections exposed during excavation. In total 71 samples were recovered, 40 from the peat surface itself and a further 31 from excavated sections. Detailed interpretation of these samples must await the full

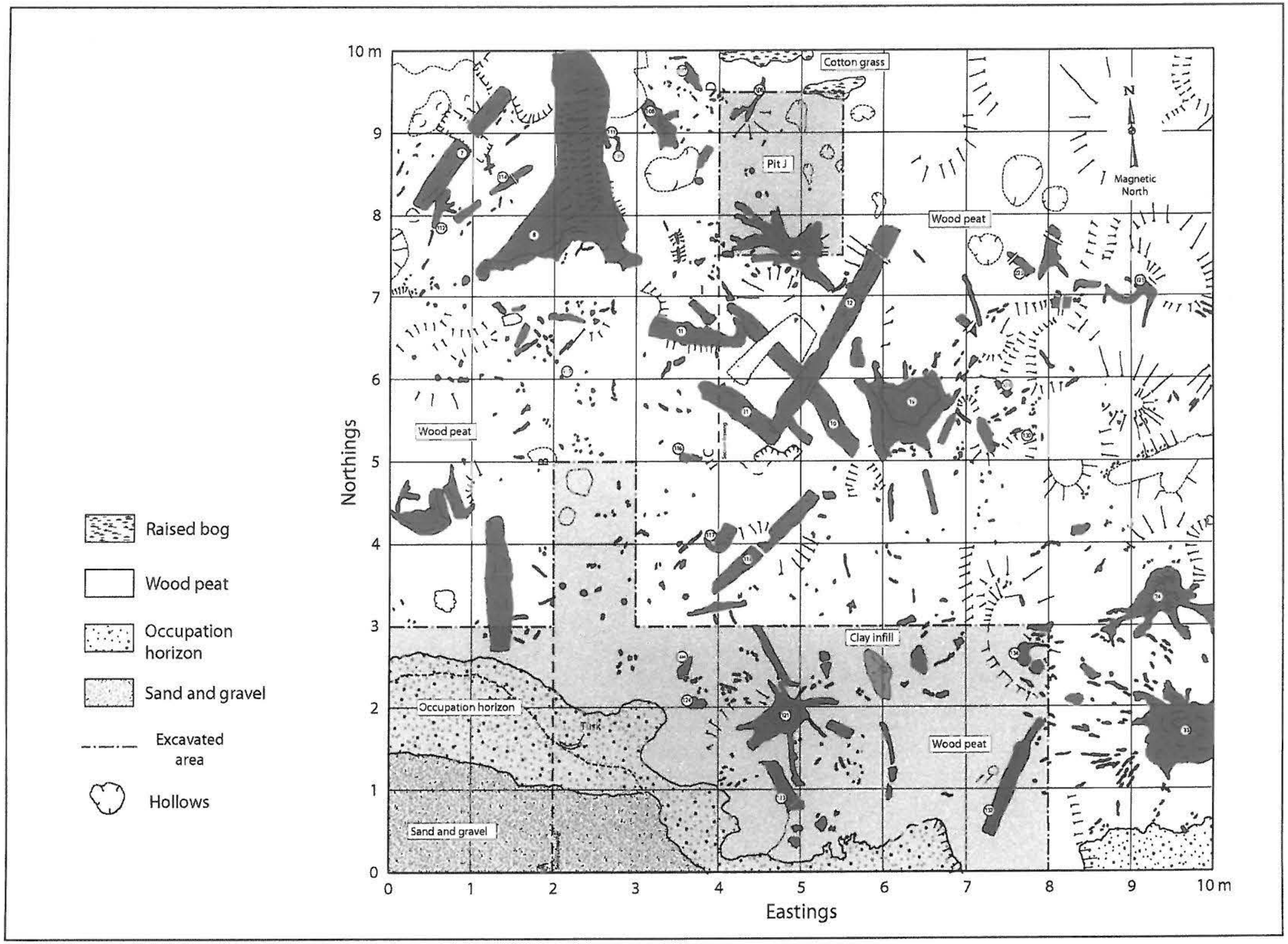


*Figure 3: Pre-excavation plan of Site J showing the submerged forest and underlying occupation horizon and sandy sediment. The excavated squares are shaded with darker tones. Drawing S. Buckley.*

*Figure 4: The excavation of Site J. The upper ledge is the peat surface with submerged forest trees, the excavation has here reached underlying estuarine silts and, in places, the Mesolithic old land surface. Photo. Edward Sacre.*

results of the wood identifications, but alder, birch, hazel, oak and, perhaps, willow have been provisionally identified. When plotted the species distributions will produce a clearer picture of the ecology of the submerged forest floor and plant succession within this wetland edge environment.

*Excavation and stratigraphic sequence*

Excavation in this area began in the south-west corner where the occupation horizon outcrops and artifacts had first been noted. In all an area of 29 m², mostly on the south side of Area J, was excavated as indicated by grey tone on Figure 3. Excavation proceeded by the removal of the peat and below that the estuarine silt. The latter had feathered out by the west edge of Trench J; thus the limit of estuarine sedimentation (vi) lay within the excavated area. Having removed these deposits the underlying old land surface could be excavated (Figure 4).

The stratigraphic sequence can be summarized with reference to a north- south section (Figures 5 and 6), the location of which is shown on Figure 3. This section includes the face of a trench (Fig 3, A-B) dug along easting 2-3 m. It is continued in a stepped fashion by the section of Pit J cut on the north side of the area to investigate the sequence where it was more deeply buried (Figure 6) and from which the main sequence of environmental samples was taken. The sedimentary evidence from these excavations is supplemented by Helena Burg's auger survey, the west end of which runs along the north side of Area J (Figure 2).

*Figure 5: The stratigraphic sequence in sampling Pit J. Peat is underlain by estuarine clay and below this the darker Holocene occupation layer developed on sandy sediments. Photo. Edward Sacre.*

The main sedimentary contexts, from the most recent deposits to the earliest, in the excavated area are as follows:

*Context 330*

Raised bog peat: *c.* 8 cm thick only survived close to the north edge of Pit J where on the surface of the peat there were clumps of cotton grass, *Eriophorum* spp. (Figure 3). This demonstrates that raised bog originally extended across the area and must accordingly have extended almost to the margins of the former island. It has been almost entirely removed here by coastal erosion down to the surface of the more resistant upper submerged forest peat. The peat surface west of Goldcliff island has been shown to be similarly affected by erosion (Bell *et al* 2000, Fig. 4.2). In Smith and Morgan's (1989) transect some 650 m to the north-east, the raised bog was 0.8 m thick.

*Context 327*

Peat: Up to 85 cm thick in Pit J. This comprises an upper horizon of wood peat. Most of the wood north of northing 5 on Figure 3 relates to this upper wood layer, including the substantial oak Tree 8 and many of the other trees sampled in this area for dendrochronology. Charred wood fragments were found within the upper wood layer. Below this the peat contains little wood and some of that is roots from overlying layers. This is clearly visible in the sections (Figures 5 and 6) and across the middle of the plan (Figure 3) there is also a sinuous band, in most places 2 to 4 m wide, with only a few small wood fragments. In

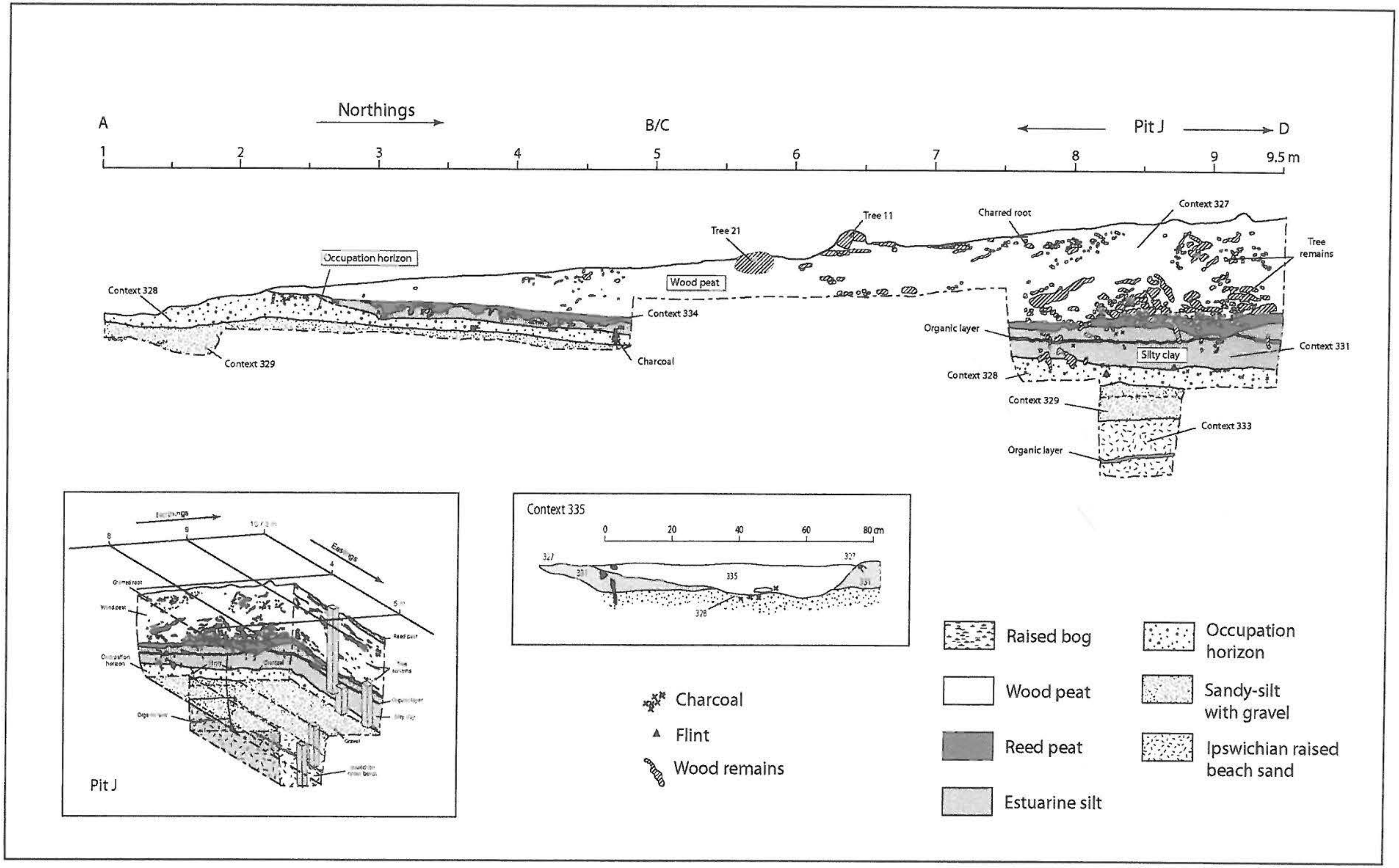


*Figure 6: Stratigraphy on Site J north to south showing the occupation layer sealed by silty clay and peat both thickening to the north. Inset shows an isometric drawing of the stratigraphy in Pit J showing the main monoliths for environmental analysis. Drawing by S. Buckley.*

the lower part of the peat there is another very woody layer (Figures 5 and 6). Most of the trees south of northing 5 m on Figure 3 probably belong to this lower wood layer. Roots from these trees penetrate the underlying estuarine clay and, in some instances, extend as far as the occupation horizon below that.

*Context 334*

Reed peat: A thin band of discontinuous peat, *c.* 5-10 cm thick, occurs at the interface between estuarine clay and the overlying wood peat. The boundary marks a change in hydroseral succession to drier conditions. Its base is highly irregular and is most probably attributable to animal trample that can be seen within the trench section. In addition, there is evidence of mixing related to small mammal activity at this interface (see below).

*Context 331*

Estuarine silt: This layer thickens to the north and east where, in Pit J, it reaches a thickness of 35-45 cm thick reflecting increased estuarine sedimentation away from the former island edge. At the interface between the upper unit of the clay and the overlying peat there is clear evidence of intermixing. Various processes had contributed to the irregular nature of this boundary: (1) tree roots penetrating the underlying estuarine clay from above, (2) marine erosion indicated by pebbles of clay of contrasting shades of grey/blue, and (3) bioturbation by small mammals (see below). This layer is thought to relate to estuarine sediment accumulation against the edge of the former island. Rather surprisingly, even at the very limits of estuarine sedimentation within Site J there were, in places, traces of laminations with silt layers separated by partings of fine sand and evidence of ripples on the surface of laminations. Some charcoal fragments, lithic artifacts and bones were found in this layer, including near its surface a microlith, implying continued activity and deposition in the upper saltmarsh.

*Context 328*

Mesolithic occupation horizon: Sandy silt with a few gravel grade small stones, abundant charcoal, worked lithic artifacts and bone forming a distinct occupation horizon on a Holocene old land surface *c.* 10-15 cm thick. Within the excavated area this old land surface dips to the north-east at *c.* 7.5°. Some roots are present in the uppermost layer, but a generally sharp boundary between this and the overlying clay suggests there has been little reworking of this horizon.

*Context 329*

Dark grey sandy sediment, possibly head: 27 to 23 cm thick at 0.45 m OD, with fine gravel present throughout and some larger pebbles. No artifactual remains were recorded within this context.

*Context 333*

Sandy sediment (not bottomed) with shell fragments of probable last interglacial date (see Haslett below). In Pit J, within this sediment at a depth of 1.6 m there was a slightly more organic horizon, *c.* 4 cm thick, which may represent a stabilization surface. Unfortunately pollen was not preserved in this sediment.

### *Features*

One feature, Context 335, was initially observed within the lower wood peat as an oval area of clay (Figure 3: Easting 6 m; Northing 2-3 m). When fully exposed it was an area 84 cm by 43 cm of bowl-shaped section (Figure 6). It penetrated through the thin underlying estuarine silts to the sandy old land surface below. The basal fill was a thin layer of organic silt. The feature was D-shaped in plan and is likely to represent a tree-throw pit, in the root mat of which the underlying horizons had been tilted at 45° when a small tree from the lower wood horizon blew over. Interestingly, the tree itself did not in this case survive (although roots were present at its base) hinting at the possibility of differential wood preservation within these peats, or possibly deliberate removal. The feature contained some charcoal fragments and one worked flint.

More common in occurrence were small oval patches of *c.* 5 cm diameter with a fill of peaty clay at the interface between the estuarine alluvium (Context 331) and the peat (Contexts 334 / 327). These invariably contained clusters of

2 to 5 hazelnuts. They had clearly been concealed in little scrapes which were especially numerous around the base of Tree 37. Squirrels were almost certainly responsible and the evidence of their activities is a welcome reminder of the role of small mammals and other faunal agents in the ecodynamics of these coastal woods.

### *Artifacts and their distribution*

The total number of artifacts recorded in three dimensions from Site J was 1057, of which the vast majority were from the sandy Mesolithic occupation horizon (Context 328). Artifacts were concentrated in the top 10 cm of this layer with some occurring down to 20 cm. Smaller numbers of artifacts came from the overlying estuarine silts (Context 331) and some charcoal and possibly worked lithics from the peat (Context 327). Figure 7 shows the distribution of worked lithics, bone and charcoal excavated so far. Identification of the finds has yet to be fully completed. Most of the lithics represent debitage, but there are also tools including a number of microliths and cores. The Mesolithic occupation horizon has also produced a small number of pieces of worked wood including the point of a stake and fragments which may derive from the splitting of timber (R. Brunning pers comm).

Already, some interesting patterns are emerging from the artifact distributions and these will help to identify the areas for further excavation planned in 2003. The density of artifacts appears to decrease to the east of the site. Lithic artifacts were mainly concentrated in an area of diameter *c.* 2.6 m centred on square 2/2. Lithics, charcoal and several large pieces of well preserved bone, were particularly concentrated in Pit J, where they occurred at the interface between the sandy old land surface and the estuarine silts. Many of these bones were of red deer and some had cut marks. Bone discard associated with butchery seems therefore to have taken place a little way away from the main lithic scatter at the very edge of the saltmarsh. The prospect of being able to identify Mesolithic activity areas on the basis of these artifact distributions, as was achieved to some extent on the site to the west of Goldcliff Island (Bell *et al* 2000, Figs 4.5-6), appears to be good, particularly since the distributions of finds can be compared with the evidence from sieving and environmental analysis.

One or more samples were taken for sieving on dryland from each square metre of occupation horizon excavated, with virtually all the occupation surface in Pit J recovered for sieving. A total of 60 samples were taken from Site J of which 55 (total 268 litres of sediment) have so far been sieved, although examination of the sieve residues has, at this stage, been very limited. The main sequence of environmental samples was taken from Pit J. Monolith tins (Figure 6, inset) were taken for pollen, and smaller samples for sediment analyses and for foraminifera were taken from the sediments below the peat. Some preliminary foraminifera results are presented below by Simon Haslett. In addition, a complementary series of bulk samples were taken from the exposed pit section for beetle analysis by Emma Paddock.

## SITE A (MB)

Fieldwork in 2001 had located a band of charcoal-rich sediment with artifacts dipping to the east, representing a probable old land surface at *c.* -2.2 m OD developed on sandy sediments and buried by estuarine alluvium. This area is exposed for a maximum of about 3 hours at spring tides and is not fully uncovered at neap tides. Small-scale excavation and sampling had taken place in 2001. In 2002 an area 15 m by 6 m was cleaned and planned, although within this area 34 m² of the northern part remained covered by thicker recent mud. Where the occupation horizon outcrops, 23 m² was excavated in 1 m² units (Figures 8 and 9). Figure 10 shows the outcrop of the main stratigraphic units. The excavation produced a 15 m long section through the sediments which is shown in Figure 10. At the base (Context 317) is a sandy sediment with small gravel grade pieces of flint and quartz. So far no artifacts have been found which are clearly *in situ* within this sediment and it is tentatively interpreted as a sandy Pleistocene deposit. Only a small area of this has so far been exposed in section and it requires further investigation.

On this sandy deposit is the probable old land surface (Figures 8-10) which, in the planned area,

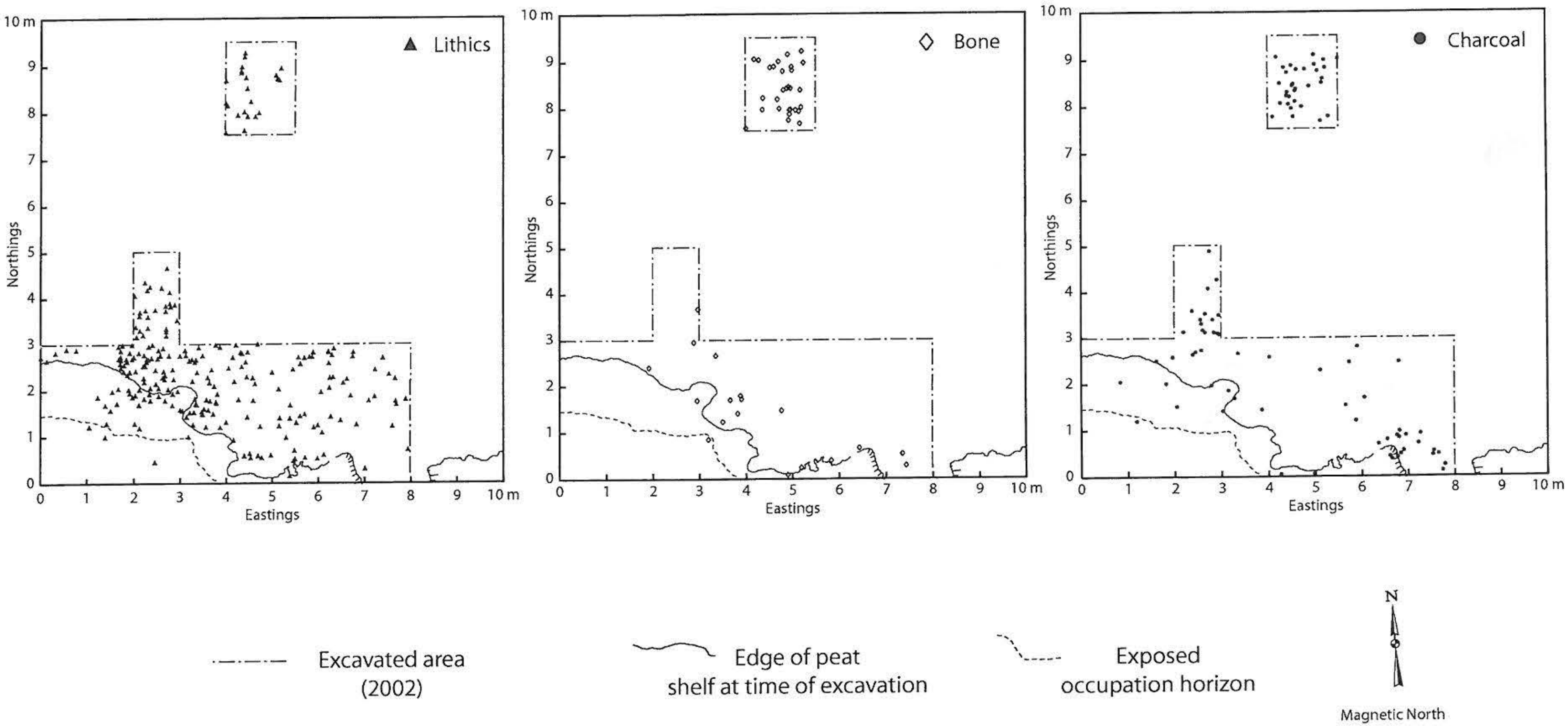


*Figure 7: The distribution of artifacts in Trench J and Pit J. Drawing S. Buckley and C. Ball.*

*Figure 8: Excavation of the Mesolithic occupation surface Site A. Photo. Edward Sacre.*

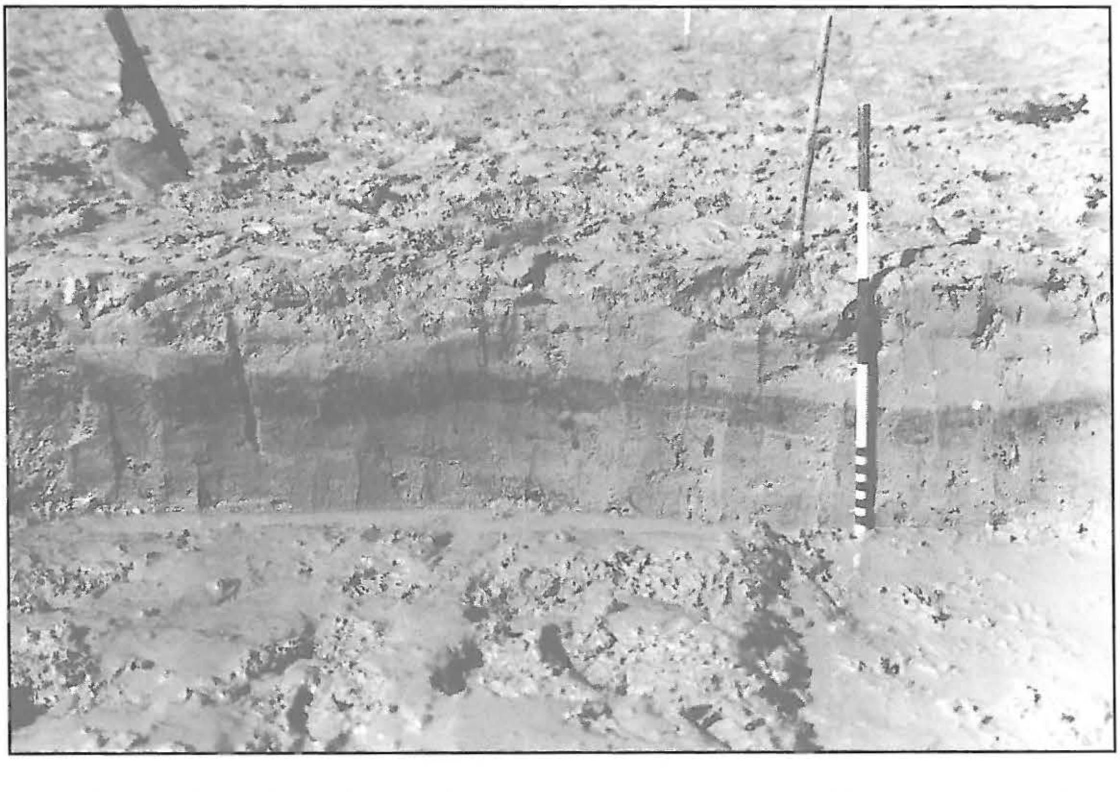

*Figure 9: The stratigraphy at Site A. The darker charcoal-rich Mesolithic occupation horizon is underlain by sandy Pleistocene sediments and overlain by estuarine silts. Photo. Edward Sacre.*

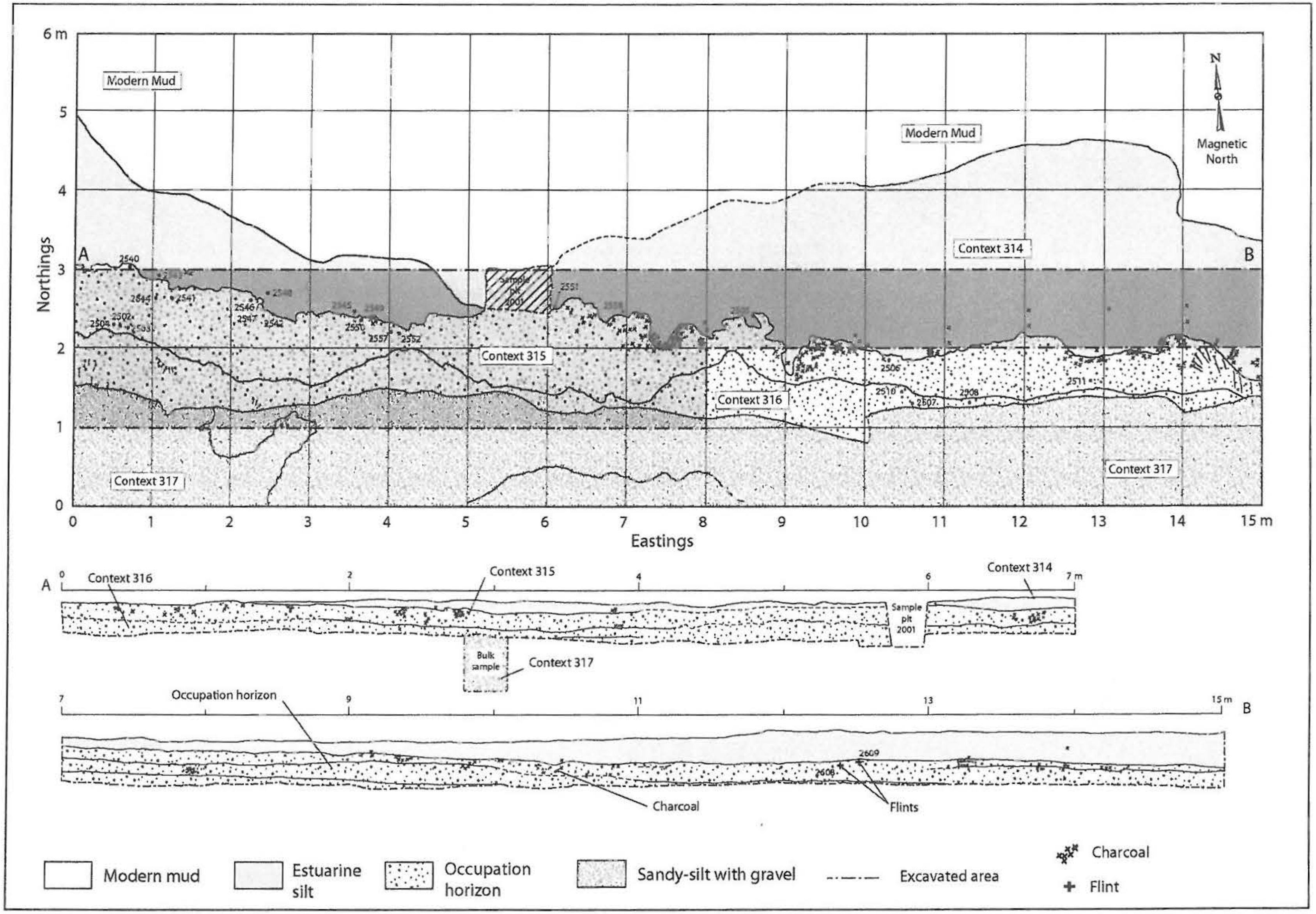


Figure 10: Pre-excavation plan and section of Site A. The excavated squares are shaded with darker tones. Drawing: S. Buckley.

has an outcrop 0.5-1.5 m wide. It has a sandy basal horizon (Context 316) 16 cm thick with an irregular basal boundary. This layer contains occasional pieces of charcoal and a few pieces of flint debitage. Above this is a dark grey (Gley 1 4/N) sandy silt (Context 315) of thickness 7-10 cm; this is the main Mesolithic occupation horizon. Charcoal is very abundant and in places forms up to 5% of the sediment volume, thus accounting, in part, for the dark colour of this surface (Figure 9). Figure 10 shows the occurrence of charcoal and lithics (represented by numbered spots), which were visible at the time when the pre-excavation plan was drawn. Artifacts were concentrated on the surface of the layer with reduced occurrence at depth. This is consistent with activity on a land surface.

Sediment samples were taken from every metre square for flotation sieving. Only a small number have so far been sorted. Fish bones, some calcined, occur and there are also fish scales. Waterlogged plant remains are also present. No peat had developed on the occupation surface here but the preservation of organic evidence implies that estuarine transgression occurred very soon after occupation. Above this is an abrupt transition to bluish grey (Gley 2 5/5b) silty clay (Context 314). This is the main estuarine unit which occurs widely at Goldcliff East, and is found elsewhere between the basal peats, which it overlies, and the main peat shelf which it underlies. In the basal 2 cm of the estuarine unit there are occasional pieces of charcoal but no flints. This is consistent with only slight surficial reworking of the occupation horizon during the transgression.

## SITE B (MB)

In 2001 Mesolithic activity was identified in a thin peat overlying a sandy Pleistocene deposit. The site is at *c*. -3.4 m OD. At this height the window of tidal exposure is very limited. The site is not exposed at neap tides and at spring tides it is only exposed for a maximum of 2 hrs 40 minutes, limiting the amount of excavation which is possible. During the 2001 season the partial excavation of a trench 6 m by 1 m was undertaken, and from this monolith 4070 was obtained for pollen analysis. In 2002 an area 10 m by 6 m was cleaned of recent mud and planned (Fig. 11). Outcrops of the sediments are broken by shallow gullies between which are ridges, both trending in a north-north-east to south-south-west direction. At the eastern part of the planned area peat outcrops have been reduced to islands. This microtopography has been described by Allen (1987), elsewhere in the Severn Estuary, as streamwise erosional structures. They are produced by strong currents which here, in the base of the channel, sweep around the bedrock exposure of the Goldcliff promontory.

An area of 22 m² has been excavated so far. At the base of the excavated sequence is a sandy sediment with gravel grade pebbles (Context 322) which is thought to be Pleistocene. On this there is an organic sandy silt (Context 321) which is interpreted as a Holocene old land surface. This contains charcoal and artifacts, and is overlain by a thin peat (Context 319) within which charcoal, bones (many calcined), and lithic artifacts are also present. The distribution of charcoal and calcined bones suggests that the main concentration of artifacts is in the base of the peat (Context 319) and in the underlying sandy old land surface (Context 321). This points to activity at the estuary edge on the pre-transgression land-surface and in the initial stages of waterlogging when peat started to form, which is generally considered to be around the height of mean high water spring tide.

Finds from the occupation layer (321) included a sandstone roundel (3846) of diameter 103 mm and thickness 30 mm which showed evidence of deliberate shaping and had surfaces indicating they had been used for grinding. Nearby was a cobble (3845) with one battered end which may have been a pounder. Many of the larger bones within this layer were quite fractured, possibly as a result of animal trample, and had to be block lifted. Within the peat a marked concentration of calcined bone and charcoal (Context 320) *c*. 1.5 m in diameter was investigated in 2001 and 2002. This may represent a hearth. Above this a clayey peat (Context 323) is locally preserved. This transitional layer appears, at least partly, to be the result of animal activity because a small number of possible deer footprint-tracks (Figure 11) were found in the peat and filled with silt. Overlying silty clays (Context 318) only survived in a small

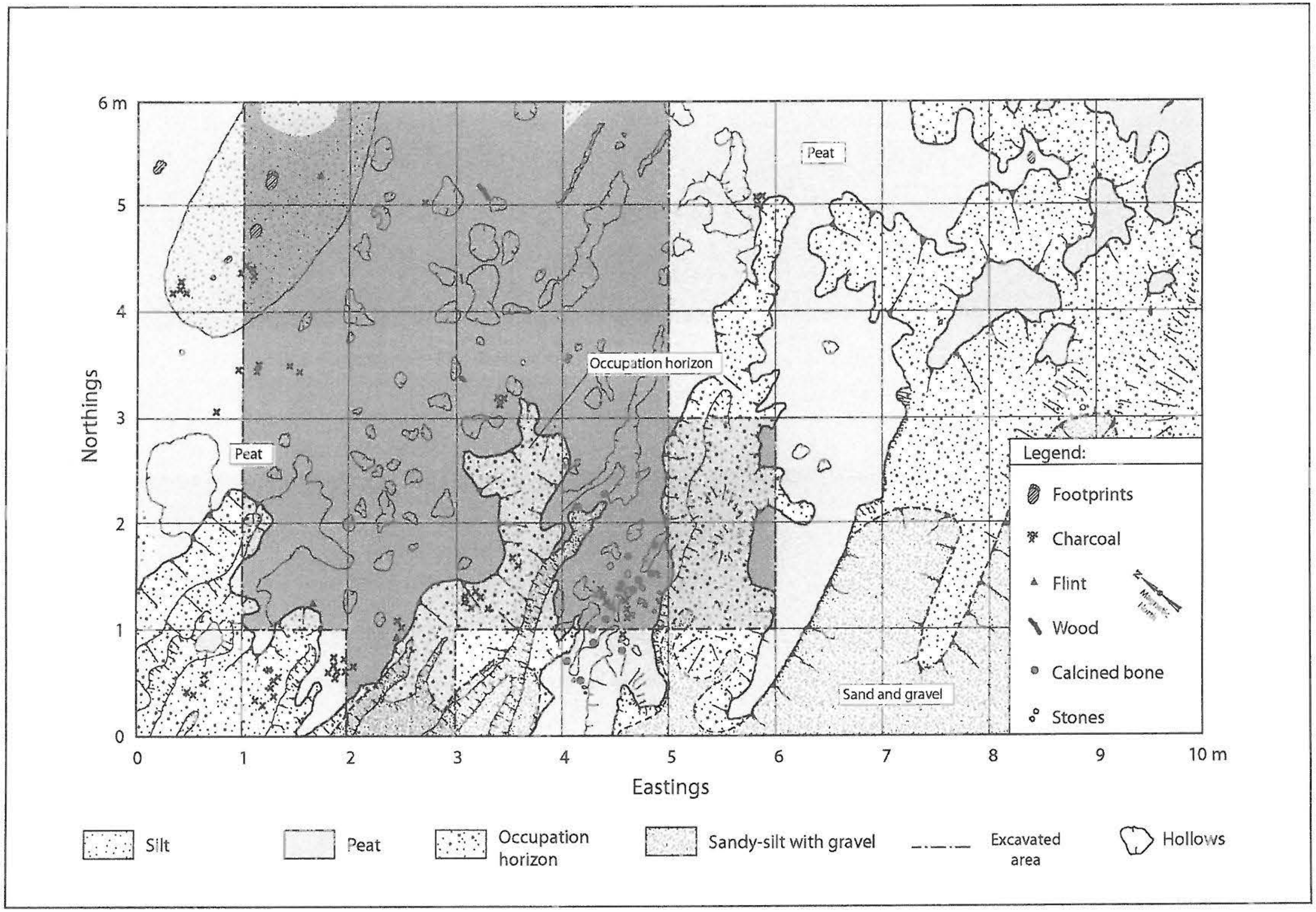


*Figure 11: Pre-excavation plan of Site B showing peat overlying the old land surface and head. The excavated squares are shaded with darker tones. Drawing: S. Buckley.*

area in the north-west edge of the planned area. However, immediately to the west the deposits planned are overlain by several metres of silty clays, which at Goldcliff East, form the main minerogenic unit between the thin basal peat represented in Trench B and the main peat shelf which is exposed about 100 m to its north-west. When the original trial trench (easting 4-5 m) was excavated here in 2001, the peat at the north end of the trench was overlain by silty clays. By the time of the 2002 excavation the outcrop of the silty clays had retreated 2.5 m to the north-west and was reduced to a small area within the trench. This demonstrates how rapidly the swift currents in this area are eroding the Mesolithic stratigraphy.

In view of the small tidal window during which Site B could be excavated, and the likelihood of excellent preservation associated with the peaty occupation horizon, the excavation strategy was modified half way through the 2002 season. After that no sieving (1 cm mesh) was done on site and all the sediment from the occupation horizon was bagged and carried back for flotation on dry land, not without considerable physical effort on the part of those involved. The total number of samples flotation-sieved was 136, comprising in all 495 litres of sediment. Only a few have so far been sorted, but these contained much calcined bone with fish bones and uncarbonised seeds and beetles.

## SITE D (MB)

This was 50 m east of Site B and was part of the same thin peat exposure, here at –3.9 m OD. In 2001 a small trench was cut to investigate the stratigraphic sequence associated with a tree trunk which had been sampled as part of the dendrochronology programme. At this point the peat was overlain by 5 cm of grey estuarine silt. The peat was 11 cm thick and within it were silt laminations. Below the peat was 9 cm of estuarine silty sediment overlying a sandy probable Holocene old land surface 8 cm thick developed on a sandy sediment with gravel grade stones of probable Pleistocene age. Monolith 4071 from this sequence has been subject to pollen analysis by Dr Petra Dark who outlines some preliminary results below.

## SITE I (MB)

This is an outcrop of the lower peat which extends from 50 m east of Site E along the foreshore for at least 300 m. The peat surface is at c -3.7 m OD, a similar height to Site D. Associated with the peat are 5 tree stumps and 6 trunks, the suitable examples of which were sampled by Nigel Nayling for the dendrochronology programme in 2001 and March 2002. At the base of the thin peat is a buried sandy soil with gravel grade stones overlying stony head, with charcoal fragments frequently recorded at the soil/peat interface. One or two flint flakes have previously been found here (Bell *et al* 2000, 367, Map 16), but none was seen in 2002. The only excavation in this area has been small trenches excavated in April 2002 to investigate the stratigraphic context of three trees which had previously been sampled for dendrochronology. Each was associated with charcoal and in the case of T43 (Figure 1) the roots were burnt.

## SITE C (MB)

This site was within the laminated minerogenic silts with partings of fine sand which lie stratigraphically between the basal peat and the main peat shelf. The site is at c. -3.3 m OD and the maximum period for which it is exposed at a spring tide is *c.* 2 hrs 20 minutes. Human and animal footprint-tracks were observed in this area in 2001 and those in an area 12 m by 5 m were planned and many of them were also traced (Bell *et al* 2002, Fig 6). In 2002 the substantial area of mobile sand, which overlies the laminated sediments, covered part of the area exposed in 2001. Significant erosion of the laminated sediments had also taken place between the two seasons, removing many of the footprints recorded in 2001 and exposing others. The earlier survey area was extended to cover 34 m north-south and 15 m east-west, of which part was covered by modern sand and gravel. By comparing the two survey plans it can be established that the average rate of horizontal erosion of the outcrops of individual laminations in the year 2001-2 was 1.68 m (range 1.45-2.2 m). Clearly these footprints represent a fragile and vulnerable archaeological resource. Detailed tracings and casts of footprints in this area were made by Rachel Scales (see below). The best preserved was a trail of child's

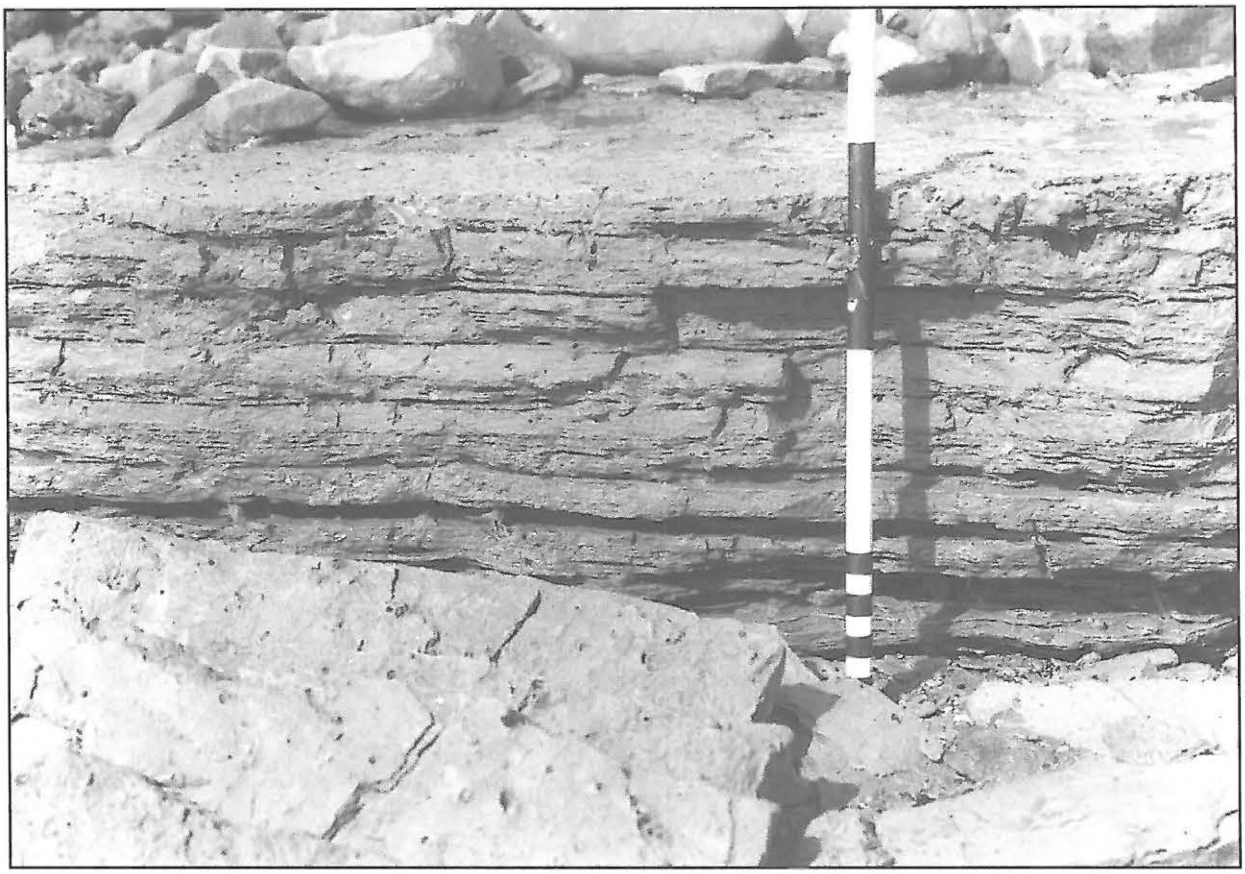

*Figure 12: Site E detail of the laminated sediments, silts with partings of fine sand in which animal and human footprint tracks are widespread. Photo. Edward Sacre.*

footprints 6111 (Scales below, Figure 5). There were also many footprints of crane, smaller birds (Scales below Figs. 2 and 3), deer and one print of an aurochs.

## SITE E (MB)

In this area, 50 m east of Area C, an eroding stepped cliff forms the edge of a permanent body of water in the base of the estuary which never drains. The laminated sediments are well exposed by this eroding cliff (Figure 12). Human footprint tracks were observed and recorded by Rachel Scales in April 2002 on narrow steps within this sequence. In summer 2002 Rachel Scales excavated the laminated sediments to expose a much more extensive area of previously buried and sealed prints forming footprint trail 6113 (Scales below Fig. 4), as she describes below. This demonstrates without question that the footprint tracks are stratified within the laminated sediments as had been previously argued on other grounds (Bell *et al* 2002, 37). The main excavated area of tracks occurs at about –4 m OD. Below them on the outcrop of another lamination an area of crane prints was recorded in March 2002 at -4.45 m OD. Nearby, 16 m north, higher laminations at –3.2 m OD exposed a trail of 16 rather eroded adult human footprint-tracks (6094) also recorded by Rachel Scales.

## SITE F (MB)

Laminated sediments are also well exposed at the base of the upper peat shelf and upper submerged forest as illustrated by Bell *et al* (2002, Figs 1 and 2). On one lamina 0.5 m below the peat at ST377820 13 deer prints were exposed in March 2002, when a plan and section of their location was made and they were traced and some examples block-lifted by Rachel Scales.

## UNSTRATIFIED LITHIC ARTIFACTS AT GOLDCLIFF EAST (MB)

Within the Goldcliff East embayment low in the tidal frame there occur a number of gravel and cobble bars and beaches where strong currents create accumulations of stones (Bell *et al* 2002, Fig 2). These have yielded a steady harvest of unstratified worked lithic material. The most interesting such item, found by Edward Sacre, has been identified by Prof N. Barton (Oxford Brookes University) as a probable leaf piece of Palaeolithic date which was found in shingle close to Site B. A small flint axe/adze of Mesolithic type was also found by Derek Upton unstratified in gravel near Site D. Mr Upton had previously found a Mesolithic axe/adze in 1996 *c.* 230 m east of Site E (Bell *et al* 2000, Fig 4.7). A few unstratified flakes and a core were also found in gravel at Site C and between Sites C and E. Such artifacts, it must be presumed, have eroded from Mesolithic horizons. They may have been eroded from the basal landsurface and the peat which developed on it where artifacts have been recorded in Sites J, A and B. It is also possible that some of the unstratified material also comes from the laminated estuarine silts which occur closer to the points at which most of them have been found. No *in situ* lithic artifacts have so far been found in the laminated sediments, however Mesolithic human activity during the formation of these sediments was extensive as the footprint-tracks show.

## PRELIMINARY RESULTS OF POLLEN AND MICRO-CHARCOAL ANALYSIS OF THE SEQUENCE FROM SITE D (PD)

Pollen and micro-charcoal analyses are under way on a 50 cm-long sediment monolith removed from Site D (Sample 4071), 50 m from the spread of Mesolithic artifactual material and charcoal in Site B. A sequence from Site B itself will be analysed in due course, but Site D offers the potential of greater resolution of the palaeoenvironmental record because the lower peat is thicker (10.5 cm) and the site appears to be slightly removed from the main focus of human (and animal) activity, and thus is less likely to have been affected by trampling.

Analytical work has concentrated on the layer of peat, which is 'sandwiched' between minerogenic deposits. The upper part of the peat contains several thin layers of clay, assumed to represent temporary estuarine inundations of the peat surface before the main inundation marked by the transition to minerogenic material. Below the peat, 9 cm of silty clay material overlies what appears to be a buried land surface.

For pollen and micro-charcoal analyses contiguous samples 0.5 cm thick were removed from the peat, with a wider interval for the minerogenic deposits (in which the pollen was sparse and poorly preserved). Chemical sample preparation followed standard procedures, with addition of *Lycopodium* tablets for calculation of pollen and charcoal concentrations. Pollen grains were counted using a Leica DMLB microscope at a magnification of 400x until a total of 300 identifiable pollen and spores had been reached (occasionally fewer where pollen was sparse). Pollen percentages were calculated on the basis of a sum including all identifiable pollen and spores, excluding those of obligate aquatics. Charcoal abundance was estimated by point counting (Clark 1982). Some of the charcoal could be identified as 'graminoid' (from members of the grass family) by the presence of characteristic stomata and epidermal cells. A smaller proportion (not illustrated) showed anatomical features indicating a woody origin, but wood charcoal of the sizes considered here (mostly < 180 micrometres) rarely shows distinctive anatomy. Charcoal with insufficient diagnostic anatomical detail to enable identification of the plants represented is classed as 'charcoal undifferentiated' and includes both woody and herbaceous species.

Figure 13 presents preliminary results of pollen and micro-charcoal analyses of samples at 1 cm intervals from the peat and immediately over- and under-lying deposits. The principal pollen types only are shown. Space permits only a few observations on the interpretation of the sequence, but it is clear that there are two main episodes of abundant charcoal, the second of which contains a substantial component of graminoid charcoal. Much of this charcoal resembles that of the common reed (*Phragmites australis*), as previously noted at Star Carr (Dark 1998; Hather 1998) (Figure 14).

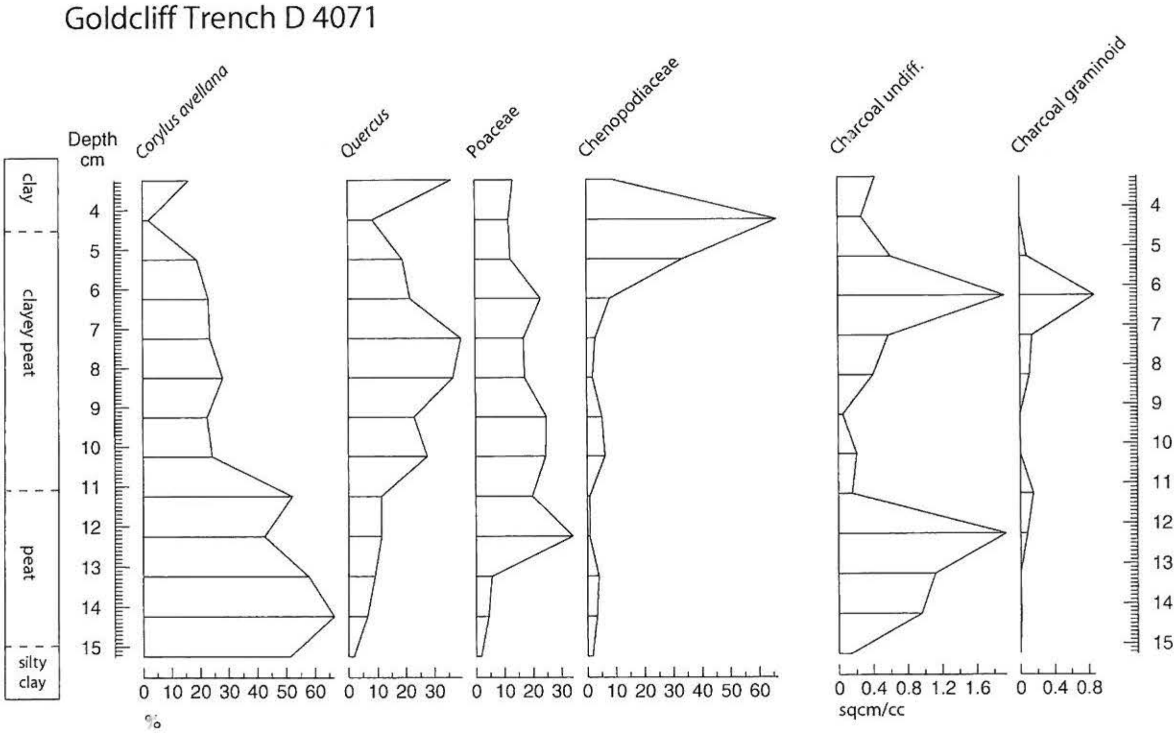


*Figure 13: Summary results of preliminary pollen and charcoal analyses from Goldcliff East Trench D (sample 4071). For explanation see text. (Analysis and diagram by Petra Dark).*

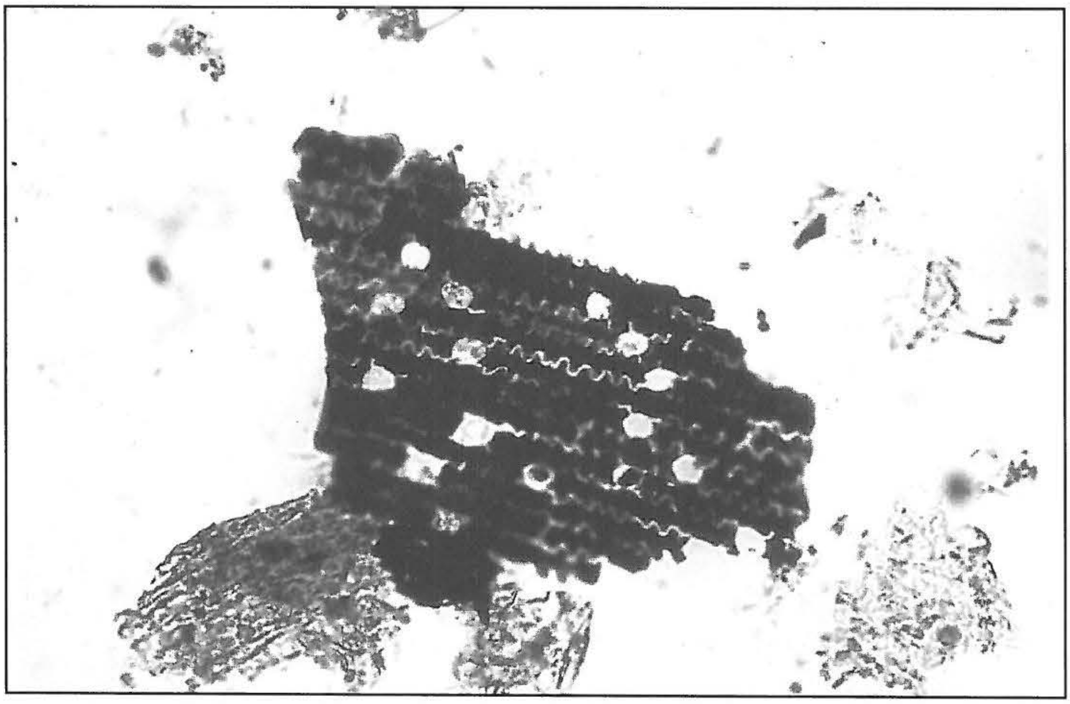

*Figure 14: Charcoal particle from the 6-6.5 cm sample from Trench D, photographed at a magnification of 400x. Several epidermal cells are present, with sinuous outlines resembling those of the common reed,* Phragmites australis. *(Photo: Petra Dark).*

The pollen evidence reflects both the local wetland vegetation and the character of woodland on the drier soils at the wetland edge and further inland. The local wetland vegetation probably consisted of a mixture of sedges (Cyperaceae) and reeds initially, but the rise of the pollen curve for Poaceae indicates the point at which reedswamp developed at the site. As the frequency of estuarine inundation (indicated by mineral layers in the peat) increased, reedswamp began to give way to saltmarsh (represented by the Chenopodiaceae curve).

At the start of the sequence woodland in the area was apparently dominated by hazel (*Corylus avellana*) with some oak (*Quercus*), but there is a change to dominance by oak from 11 cm. Intriguingly, the period of hazel abundance corresponds with the first of the two charcoal phases. The change to oak dominance occurs after charcoal values decline, and oak pollen percentages rise to nearly 40% in the 7-7.5 cm sample. This value is sufficiently high to suggest that oak was growing locally, indeed a few oak stumps and trunks are present on the peat exposure at Site D. The nearby Goldcliff island is also likely to have served as a refugium for tree species, including oak, as conditions became wetter.

Oak percentages decline again at the time of the second charcoal phase. While a substantial proportion of this charcoal apparently reflects fires in the reedswamp, it is possible that oak woodland was also burned. In this context it is notable that some of the oak trunks at Site I, associated with a contemporary peat exposure to the east of Site D, show signs of charring as noted above.

While the possibility that the fires represented in the two burning episodes in Site D are of natural origin cannot be entirely excluded at this stage, the artifactual evidence for contemporary late Mesolithic human activity at nearby Site B and elsewhere at Goldcliff means that a human cause is likely. Patches of woodland and reedswamp may have been accidentally ignited by sparks from isolated campfires, but it is also possible that the burning represents a deliberate attempt to alter the environment. Reedswamp burning may have been used to increase the attractiveness of particular wetland areas to herbivores, and so provide a focus for hunting activities (*cf* Mellars and Dark 1998). Oak trees may have been burned to try and control their encroachment onto the wetland area (which provided a variety of resources not available in woodland), while burning of woodland on dryland areas may have been designed to encourage flowering (and hence nut production) of hazel by reducing competition with oak.

Initial results are thus providing hints of the character of human-environment interaction at the woodland-wetland transition in the later Mesolithic period. Pollen and microcharcoal analyses will soon be completed for contiguous samples through the peat, as well as more broadly spaced samples from the minerogenic deposits, and these will be accompanied by analyses of macroscopic plant remains and radiocarbon dating. The results should shed further light on the effects of fire on the local vegetation, the duration of burning episodes, and hopefully indicate whether burning was a seasonal activity.

## SUBMERGED FOREST TREE FALL-DIRECTIONS AT GOLDCLIFF EAST (JRLA)

Strong winds are the commonest non-human agents which bring significant change to individual trees and to wildwoods in Britain. Windprune sees the loss of leaves, twigs and even small branches, and begins with winds of near gale strength. Depending on species and context, gale force and stronger winds may either uproot a tree, overturning it completely (windthrow) or tilting it until supported by neighbours (windtilt), or break off the crown at a position along the otherwise undisturbed trunk (windsnap). Windsnap, windtilt and windthrow have all been recognised in the so-called 'submerged' or 'fossil' forests of chiefly early and mid-Holocene date exposed on the shores of the Severn Estuary Levels. Insights into the strong-wind regime of these times can be obtained by measuring the fall-directions of the trees (Allen 1992, 1993, 1995). Such winds, especially through the action of the gust accompanying them, open up the tree canopy, creating new small-scale environments and renewing the species succession. Threshold effects of strong winds will also vary according to the ground and tree conditions such as surface wetness and leaf cover.

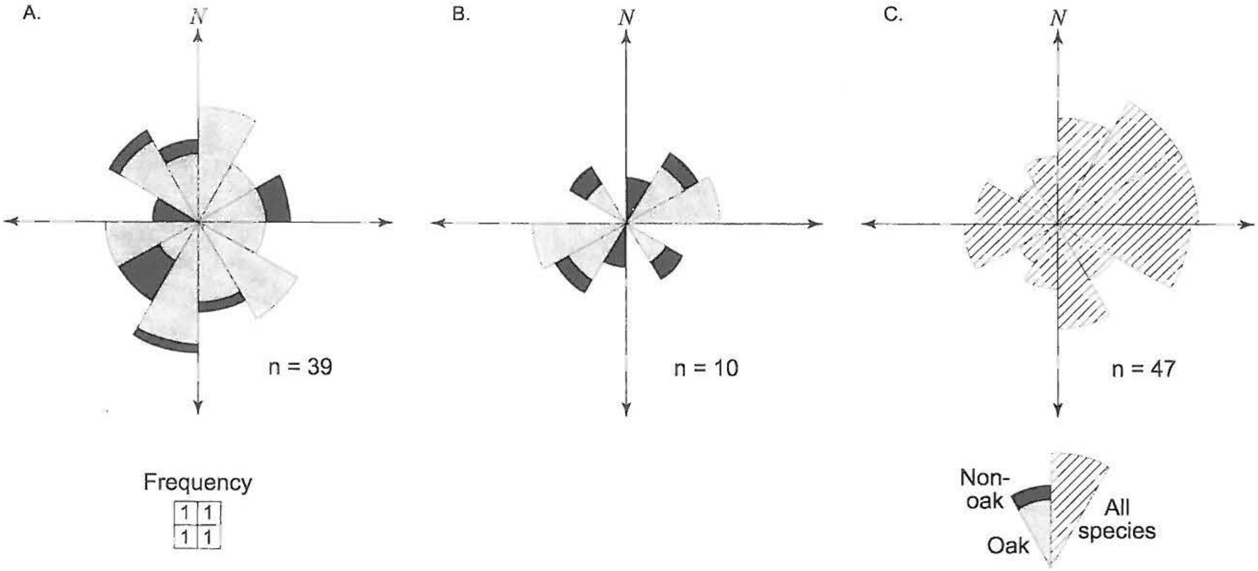


*Figure 15: Frequency distribution of directional data, relative to magnetic north, from fallen trees associated with the peats at Goldcliff East. A- orientations measured during the present survey of the main and lower peats. B- alignments gathered during the present survey of the main and lower peats. C- orientations measured during an earlier survey (main peat only) including some data from Goldcliff West (data of Allen 1992).*

The attitudes of trees associated with the main and lower peats at Goldcliff East were measured using a magnetic compass by a number of individuals during 2001/02, in order to complete this aspect of the present survey. Tree orientation - the direction toward which the tree fell - was ascertained in the case of a total of 39 prostrate or tilted oaks and 10 non-oaks, using as criteria one or more of the location of the root-ball, the sense of taper of the trunk, and the position of the acute angle where a branch joined the trunk. The alignment was recorded of the prostrate trunks of ten further trees (three non-oak) to which these criteria could not be applied. In both samples there is a heavy emphasis on oaks from a woodland in which other species appear to have been at least as, if not more, frequent. There is also a heavy emphasis on those trees in Goldcliff East which lie immediately to lee of the island.

In order to avoid false emphases, the rose-diagram (Figure 15A) shows the frequency distribution of orientations in terms of the area rather than the length of each 30° sector. The distribution is polymodal and appears to record strong winds which box the compass from the north-north-east, south-east, south-south-west and north-west. A more constrained pattern is suggested by the smaller sample of alignments (Figure 15B). This distribution points to strong winds from either the west-south-west or east-north-east, with a subordinate alignment of north-west to south-east.

The frequency-distribution of orientations shown in Figure 15A contrasts sharply with an earlier sample of orientations (Figure 15C) drawn at random largely from the peat shelf at Goldcliff East but with some collected from Goldcliff West. This sample (Allen 1992, Table 3, Figure 18 locality 9) reveals a concentration of orientations toward an easterly point. The sample obtained during the present survey is also difficult to reconcile with the evidence of 25 orientated trees, accompanied by a similar number of stumps and root stools, mapped previously over an area *c.* 1000 m$^2$ on the peat ledge at Goldcliff East (Allen 1992, Figure 16B). Most of these trees, a few of which contributed to the more widely-cast random sample, fell toward the north-east quadrant, as in that sample. A few point toward either south-easterly or north-westerly points. Only the sample of tree alignments (Figure 15B) seems compatible with earlier work.

The modern wind regime affecting the Severn Estuary Levels is known in considerable detail from measurements made over the last 30 years at Cardiff Airport (Rhoose) and Avonmouth (Allen 1992, Figure 22). There are small differences between these localities, but at both the most frequent and strongest winds blow from the west and west-south-west, the general directions also suggested by the mid Holocene trees (Figure 15B, C).

## INTERGLACIAL FORAMINIFERA FROM GOLDCLIFF (SH)

A sample (Goldcliff East 5161 Site J Pit, Context 333, 5 cm above organic-layer; Figure 6) was collected from the suspected interglacial sand and analysed for foraminifera. The sample was processed by washing over a 63 μm sieve, but examined under reflected light in three different size fractions: a >500 μm fraction, a 125-500 μm fraction, and a 63-125 μm fraction. The 63-125 μm fraction was barren of foraminifera, whilst the greater than 500 μm fraction was composed entirely of cemented aggregates, some of which had a few foraminifera specimens embedded in the aggregates, but usually not enough showing to identify them. However, the 125-500 μm fraction yielded a fairly abundant and well-preserved assemblage of calcareous foraminifera. Therefore, it is recommended that future foraminifera analysis on these sands be undertaken on the 125-500 μm fraction only. Indeed, Knudsen and Austin (1996) also recommend that the >125 μm fraction is adequate to 'catch' most if not all foraminifera in Late Pleistocene marine sediments.

The foraminifera assemblage is detailed in Table 3. It is dominated by *Cibicides lobatulus* and *Elphidium margaritaceum*, with 18 other species present. Within the size fraction examined, there was variation in test size and preservation was good, therefore, the deposit is unlikely to have been transported, and the microfossils may be *in situ*. Haslett (1997) reports on a foraminifera assemblage recovered from the interglacial sands exposed on the foreshore at Goldcliff, in the 'gully' (Table 3), the linear depression which lies between Sites A and B to the north and the raised area of Ipswichian beach to the south (Figure 1). Once more, *C. lobatulus* and *E. margaritaceum* were seen to dominate that assemblage, and the assemblage as a whole was taken to represent *in situ* deposition in a subtidal environment.

Based on information from Andrews *et al* (1984), Haslett (1997) suggested the subtidal deposits seen at Goldcliff represented the seaward end of the interglacial coastal gradient, as higher interglacial intertidal and beach deposits had been found further inland below the Gwent Levels. Two samples from an inland location at Llandevenny have also been examined and the results reported briefly in Allen (2001). The data for these samples are given in Table 3, demonstrating similar dominant species, but within a lower abundance and diversity assemblage, with specimens showing signs of abrasion and sorting. These characteristics are indicative of a beach deposit (Haslett *et al* 2000), and support the idea of an interglacial coastal gradient shelving offshore, with Goldcliff as an island permanently surrounded by the sea at the time the sand was deposited. Haslett (1997) also stated that typical salt-marsh species, that are very common in the modern Severn Estuary, are entirely lacking from Goldcliff, and also from the Burtle Beds of the Somerset Levels (Kidson *et al* 1978). He suggested that the 'interglacial Severn Estuary perhaps lacked the widespread saltmarshes that characterize it at present' (p. 136). This theory was explored in Allen (2002) who has concluded that the Ipswichian Severn Estuary was a predominantly wave-dominated environment.

## CONCLUSIONS (MB)

The Mesolithic period has been identified by Cadw as particularly under represented in the archaeological record of Wales (R. Turner pers comm 13.5.02). There have been few recent scientific investigations. A recent survey of lithic finds in South East Wales (Locock 2000) demonstrates that many sites are represented by scatters of small numbers of artifacts but excavations have been very few and there are hardly any sites with associated bone or environmental evidence. This lack of work on the Mesolithic is equally true of most areas of England. The contrast is dramatic with the recent major advances in understanding of, previously

| Species | Goldcliff 5161 (Site J Pit) | Goldcliff Haslett (1997) | Llandevenny (Allen 2001) Borehole 16 4022 8679 | Llandevenny (Allen 2001) Borehole 4045 8671 |
|---|---|---|---|---|
| **Estuarine species** | | | | |
| *Ammonia beccarii batavus* | 0 | 0 | 17.2 | 9.4 |
| *Ammonia beccarii limnetes* | 0.9 | 2.1 | 0 | 0 |
| *Ammonia beccarii tepida* | 4.5 | 1.6 | 0 | 0 |
| *Cibicides lobatulus* | 32.4 | 18.6 | 51.7 | 59.3 |
| *Elphidium margaritaceum* | 20.7 | 46.1 | 13.7 | 3.1 |
| *Elphidium williamsoni* | 3.6 | 0 | 0 | 0 |
| *Haynesina germanica* | 1.8 | 13.7 | 3.4 | 15.6 |
| **Extra-estuarine species** | | | | |
| *Bolivina pseudoplicata* | 5.4 | 1.6 | 0 | 0 |
| *Brizalina variabilis* | 0.9 | 0.5 | 0 | 3.1 |
| *Buccella frigida* | 2.7 | 0 | 0 | 0 |
| *Bulimina marginata* | 0 | 2.1 | 0 | 0 |
| *Cassidulina obtusa* | 0 | 1.6 | 0 | 0 |
| *Cyclogyra involvens* | 0.9 | 0 | 0 | 0 |
| *Elphidium crispum* | 0 | 0 | 10.3 | 3.1 |
| *Elphidium earlandi* | 0 | 1.1 | 0 | 0 |
| *Elphidium excavatum* | 0.9 | 2.1 | 0 | 0 |
| *Elphidium macellum* | 3.6 | 0.5 | 0 | 0 |
| *Fissurina marginata* | 2.7 | 0 | 0 | 0 |
| *Fursenkoina fusiformis* | 0 | 0.5 | 0 | 3.1 |
| *Gavelinopsis praegeri* | 0.9 | 0 | 3.4 | 0 |
| *Glabratella millettii* | 6.3 | 1.1 | 0 | 0 |
| *Lagena* spp. | 3.6 | 0.5 | 0 | 0 |
| *Quinqueloculina dimidiata* | 0.9 | 0 | 0 | 0 |
| *Quinqueloculina oblonga* | 0 | 0.5 | 0 | 0 |
| *Quinqueloculina seminulum* | 2.7 | 0 | 0 | 0 |
| *Rosalina williamsoni* | 0.9 | 0 | 0 | 3.1 |
| *Trifarina angulosa* | 3.6 | 4.4 | 0 | 0 |
| **Total specimens** | **111** | **182** | **29** | **32** |

*Table 3: Analysis of Foraminifera from probable interglacial beach sediments in Goldcliff East Pit J, sample 5161, an exposure previously reported by Haslett (1997) at Goldcliff East and borehole sites at Llandevenny (Allen 2001).*

neglected, Palaeolithic archaeology in both England and Wales and with major advances in Mesolithic archaeology in Scotland and many areas of coastal continental Europe. In England and Wales models of the Mesolithic remain overwhelmingly dominated by evidence from the single early Mesolithic site of Star Carr. The explanation has always been the paucity of other sites with sufficiently good preservation to achieve a rounded view of the diversity of Mesolithic lifeways. In reality this is due, not so much to a lack of sites, as to a reluctance among archaeologists to investigate those in unfamiliar or difficult conditions. Lithic sites with bones and peats have been known for over a century in the Bristol Channel at Westward Ho! and various sites in Pembrokeshire. What has been lacking is sufficiently detailed investigation of coastal sites of this type. The present project aims to contribute to the redress of this situation.

Excavations at Goldcliff East in 2002 have matched and exceeded the potential recognized as the result of limited pilot work in 2001. Occupation horizons on the old land surface which dips east of the former Goldcliff Island were clearly progressively buried by estuarine sediments, peat and silts, as a result of Holocene sea-level rise. Burial of the sites occurred in sequence, east to west D->B->A->J between about 5700-4300 Cal BC over a period variously calculated as between 1000 and 1400 years. It should eventually prove possible to make a broad correlation between human and animal footprint tracks at various levels within the minerogenic laminated sediments and the successively buried occupation sites on the island edge. The sequence as a whole has considerable potential for investigation of changes of material culture, economy and environmental relations in the later Mesolithic.

The research potential of this sequence is augmented by the fact that the environmental sequence extends through the later Mesolithic and the Neolithic. Smith and Morgan (1989) have previously identified evidence of landnam type clearances involving some cereal growing on Goldcliff island, the earliest of them *c.* 3650 Cal BC. The peat deposits now located on Site J must have been within a few metres of the island edge at the time of their formation, providing a particular opportunity for investigation of activity on the former island. Goldcliff offers further potential for comparison and contrast of economy and environmental relationships on either side of the transition to farming. Dramatic environmental changes occurred within the time frame of this project, 6500-3500 Cal BC, the later Mesolithic and Neolithic period in the study area, and it will be interesting to see to what extent these are also reflected in changes of material culture and economy.

The approach adopted by this project is to examine these questions not from a narrow and purely anthropogenic perspective but in the wider context of the range of environmental processes and disturbance factors, including human agency. This diversity of factors interacted to create the dynamic ecology and human coping strategies of the coastal zone. Many different studies currently at various stages of post-excavation analysis are contributing to the progressive refinement of our picture of the changing coastal ecology in the study area. These include pollen and macrofossil work on the composition and succession of the vegetation communities, evidence for marine transgressive and regressive phases from sediments and foraminifera, the effects of storms on tree-throw etc. Faunal agents also leave their mark, ranging in scale from the large mammals' footprint-tracks to the small-scale of squirrel activity in the burial of nut caches on Site J.

Of particular interest from the point of view of disturbance factors is the widespread evidence for burnt trees. Work during the first field season at Redwick, 4.3 km east of Goldcliff East led to the identification of a number of charred trees and extensive charcoal horizons (Bell *et al* 2002). Charred trees have also been found at Goldcliff East, Site I, and at Goldcliff the distribution of charcoal is also extensive. From Site D Petra Dark (above) describes evidence of two distinct burning episodes and demonstrates that not just trees, but also reeds, were burnt. Dendrochronological research by Nigel Nayling (2002) has shown that some of the trees at Goldcliff East and Redwick cross match and together they create a floating chronology of *c.* 420 years (Nayling 2002, Fig. 16). Thus the burning episodes at both sites appear to be broadly coeval. At Goldcliff East charcoal concentrations at Sites J, A and B are associated with artifacts. However charcoal also occurs up to 460 m east of the artifact scatter and 4.3 km east at Redwick, where no artifactual evidence of Mesolithic activity has been found. Such extensive charcoal distributions and large charred trees can not be explained as campfires. Wildfire, however caused, is a possibility which must be seriously considered. However, given the close association between burning and artifacts on many of the Goldcliff sites, it is more probable that the burning is the result of human activity. Mesolithic burning has been widely attested in the British uplands (Simmons 1996) and there is a well documented early Mesolithic example at Star Carr (Mellars and Dark 1998). Extensive evidence of Mesolithic burning has not been previously identified in a coastal context.

Particularly in a coastal context in which a range of disturbance factors would naturally have contributed to the creation of vegetation mosaics at various successional stages, it is perhaps problematic to conceptualize burning in solely practical, functional terms, as a way of increasing landscape productivity for grazing animals and plant foods. Perhaps social factors, relating perhaps to the deliberate marking of areas of landscape may also have been important. We may also speculate that hunter-gatherer communities are likely to have been adept at reading the signs of modified vegetation communities for evidence of the nature, seasonality, movement routes and conceivably even the social affinity of groups which used an area periodically (Bell forthcoming).

Evidence from the Mesolithic site west of Goldcliff island (Bell *et al* 2000) indicated that site was occupied in winter for activities including fishing, raw material acquisition, tool making and hunting. As the post excavation work progresses, models of Mesolithic activity developed on that site can now be critically examined using the larger body of evidence emerging from the site east of Goldcliff island.

At each of the sites we have identified, occupation horizons and environmental sequences are undergoing active erosion by the sea. Horizontal erosion rates of the laminated sediments with footprints have been shown to average 1.68 m per year. The threat to this archaeological resource is manifest. The sites identified clearly have great potential to fill existing gaps in our knowledge of the Mesolithic and to address many of the key research problems of the later Mesolithic and the transition to the Neolithic. Accordingly further excavation is planned in 2003 and it is hoped that this will complete the field stage of the present project.

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