ARCHAEOLOGICAL AND PALAEOENVIRONMENTAL EVALUATION OF PORLOCK BAY AND MARSH

by Matthew Canti, Veryan Heal, Simon Jennings,
Richard McDonnell and Vanessa Straker

Introduction

Porlock Bay is located on the southern side of the Bristol Channel, on the north coast of Somerset (NGR: SS88004850). The area of land known as Porlock Marsh extends between a shingle ridge which separates it from the sea and the 10m contour. The area is designated as a Site of Special Scientific Interest and apart from an area of reed marsh which is of particular importance for birds, consists mostly of enclosed pasture.

Longshore drift provides a supply of pebbles for the shingle ridge from further west along the coast, but this process is not maintaining the ridge at present and a break-through by the sea is anticipated within about two years. The National Rivers Authority intends to adopt a policy of managed retreat, which will mean that the shingle ridge will no longer be maintained either naturally or artificially. Despite past maintenance, some flooding of the marsh has occurred every few years, the most recent event taking place in 1990. At present some maintenance is still being attempted at the western end of the ridge by the landowner; the eastern part of the area is owned by the National Trust.

The archaeological and palaeoenvironmental potential of Porlock Marsh and the foreshore of Porlock Bay have been apparent since at least the later nineteenth century, when in a rare instance of antiquarian activity on Exmoor, Boyd-Dawkins not only recorded submerged forest and peat deposits, but also recovered worked flints attributed to the Mesolithic (Boyd-Dawkins 1870). The archaeology of Exmoor received less attention from antiquarians or archaeologists than many other moorland areas (but see Grinsell 1969, 1970a, 1970b; Ellison and Fowler 1977; McDonnell 1980a, 1980b, 1982, 1986). The appointment of an archaeologist to the staff of Exmoor National Park Authority in 1991 encouraged investigation of the unexplored wealth of the historic landscape and provided a co-ordinator for the survey and recording which has since begun.

One of the first sites to be brought to the attention of the archaeologist was the submerged forest in the inter-tidal zone of Porlock Bay, which had been observed by Richard McDonnell to be eroding rapidly. The threat to these deposits from wave action was clear. In response to this, a survey of the extent of the deposits was carried out by the Royal Commission on Historical Monuments of England (RCHME) and some samples of the exposed peat beds were taken by Vanessa Straker in late 1991. The probability of the submerged forest and peat deposits extending beneath the ridge and into Porlock Marsh was considered high and stratigraphic work by Simon Jennings for a study of the Holocene development of the Porlock Coast re-inforced this theory (see below).

In 1994 the added threat of imminent marine incursion through the ridge, with its inherent risk of erosion of the surface archaeological features and contamination/disturbance of the deposits beneath, led to an approach to English Heritage to fund an evaluation of the area prior to the predicted incursion. The project incorporated a rapid assessment of the archaeology (R.R.J.McD), a grid-based programme of coring to sample the sediments and assessment of sub-samples (V.S, M.C *et. al.*). This was approved, with fieldwork beginning in early 1995, coinciding with a period of heavy rain

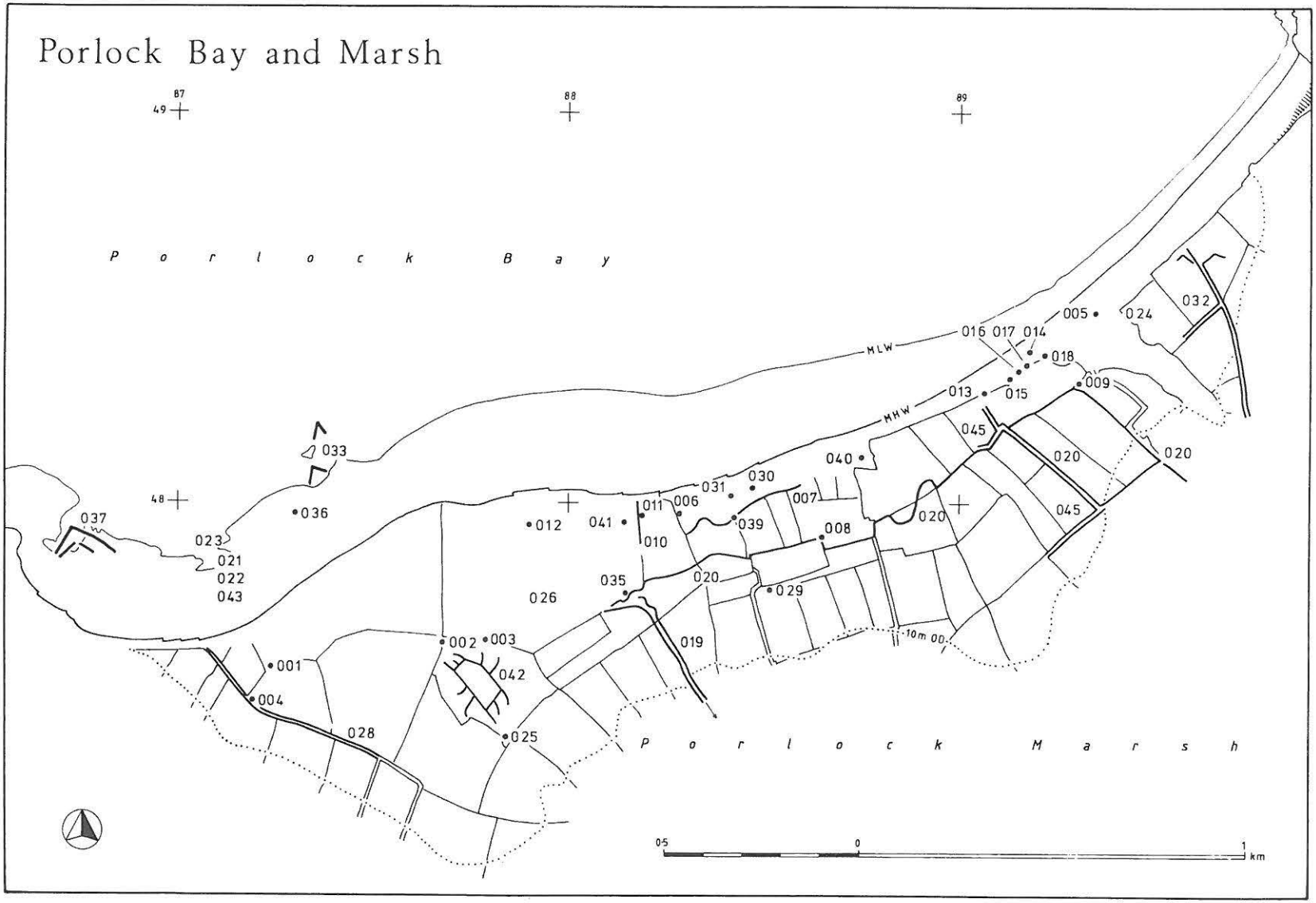


Figure 22. Porlock: Location of sites (i).

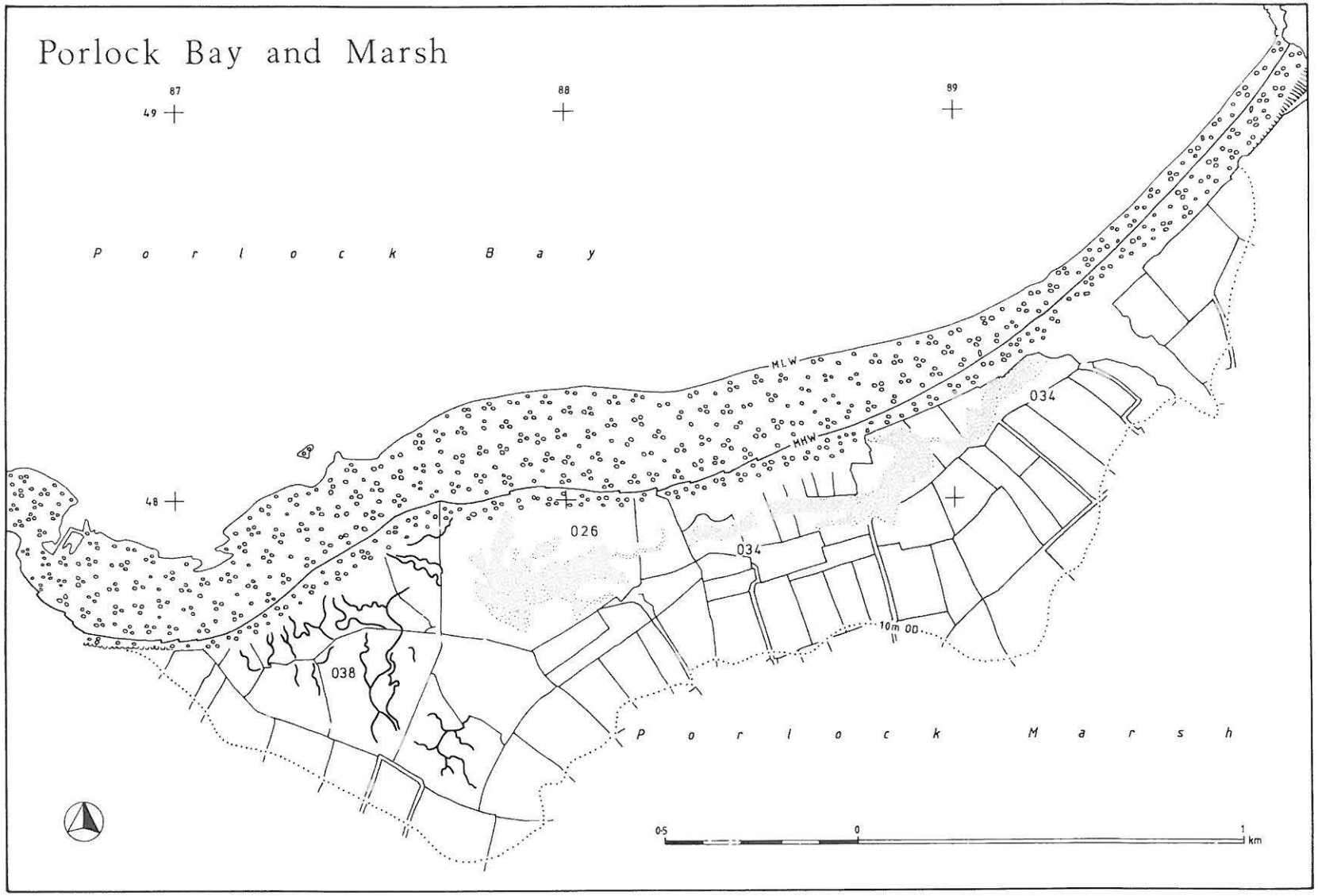


Figure 23. Porlock: Location of sites (ii).

and flooding which rendered some sampling areas unavailable. The work was completed during better conditions in May 1995. The grid was surveyed by the RCHME, who also carried out a metric survey of the area as part of their current Survey of Exmoor. Sub-sampling and assessment of pollen, plant macrofossils, diatoms and foraminifera was co-ordinated by Vanessa Straker and the stratigraphy examined by Matthew Canti.

We report below a summary of the preliminary findings of the evaluation, the final report will be submitted to English Heritage and it is intended to publish it in due course.

Rapid Archaeological Assessment

by Richard McDonnell

Introduction

This account of the rapid preliminary assessment of the cultural and palaeoenvironmental resource of Porlock Marsh and the intertidal section of Porlock Bay summarises a fuller record of the assessment prepared for the Exmoor National Park Authority (ENPA) (McDonnell 1995a). The assessment of the documentary and cartographic evidence was undertaken at the Local History Library, Taunton Castle and the Somerset Record Office, Taunton. For a list of the aerial photographic and cartographic sources consulted see McDonnell (1995a). The fieldwork was undertaken during February and March 1995 by Richard McDonnell and Keith Faxon.

Area of assessment

The area of the assessment includes Porlock Marsh and the intertidal part of Porlock Bay and lies between the l0m OD contour and Chart Datum (CD). In Porlock Bay the value for CD is -5.20m OD, giving a vertical range of 15.20m. The western limit lies east of a line drawn seaward of Gibraltar Cottages at Porlock Weir while the eastern limit is formed by Hurlstone Point. The area between the l0m contour and the shingle ridge, called Porlock Marsh, extends for 147.25ha. The area between the shingle ridge and CD, Porlock Bay, extends for some 85.25ha. The total area is therefore in the region of 232.5ha.

The record

At the beginning of the assessment there were five sites recorded on the National Monument Record (NMR) and six on the County Sites and Monument Record (SMR). With the exception of the additional fish weirs (037) the SMR and NMR sites were the same.

As a result of this preliminary assessment a total of 45 records were raised. Thirty sites (66%) were recorded as structures, earthworks or extant deposits in the field. Many of these features were also recorded by other sources of evidence. Seven sites (15%) were recorded only from documentary sources, five sites (11%) were recorded only from cartographic sources and three sites (7%) were recorded only from aerial photographic sources. An inventory of records is presented in Table I with the location of the sites shown in Figures 22 and 23.

The archaeological landscape record

The existing landscape on Porlock Marsh suggests a phased history of enclosure. There is evidence of possibly earlier marsh edge or upper foreshore boundaries reflected in the form of hedges and rhynes creating long, continuous, boundary features. A morphological examination of the enclosure landscape above the 10m contour resulted in the identification of two blocks of probably medieval fields that extend northwards onto the marsh. These blocks cross the linear boundary features on the marsh at right angles and, though incorporating them, may

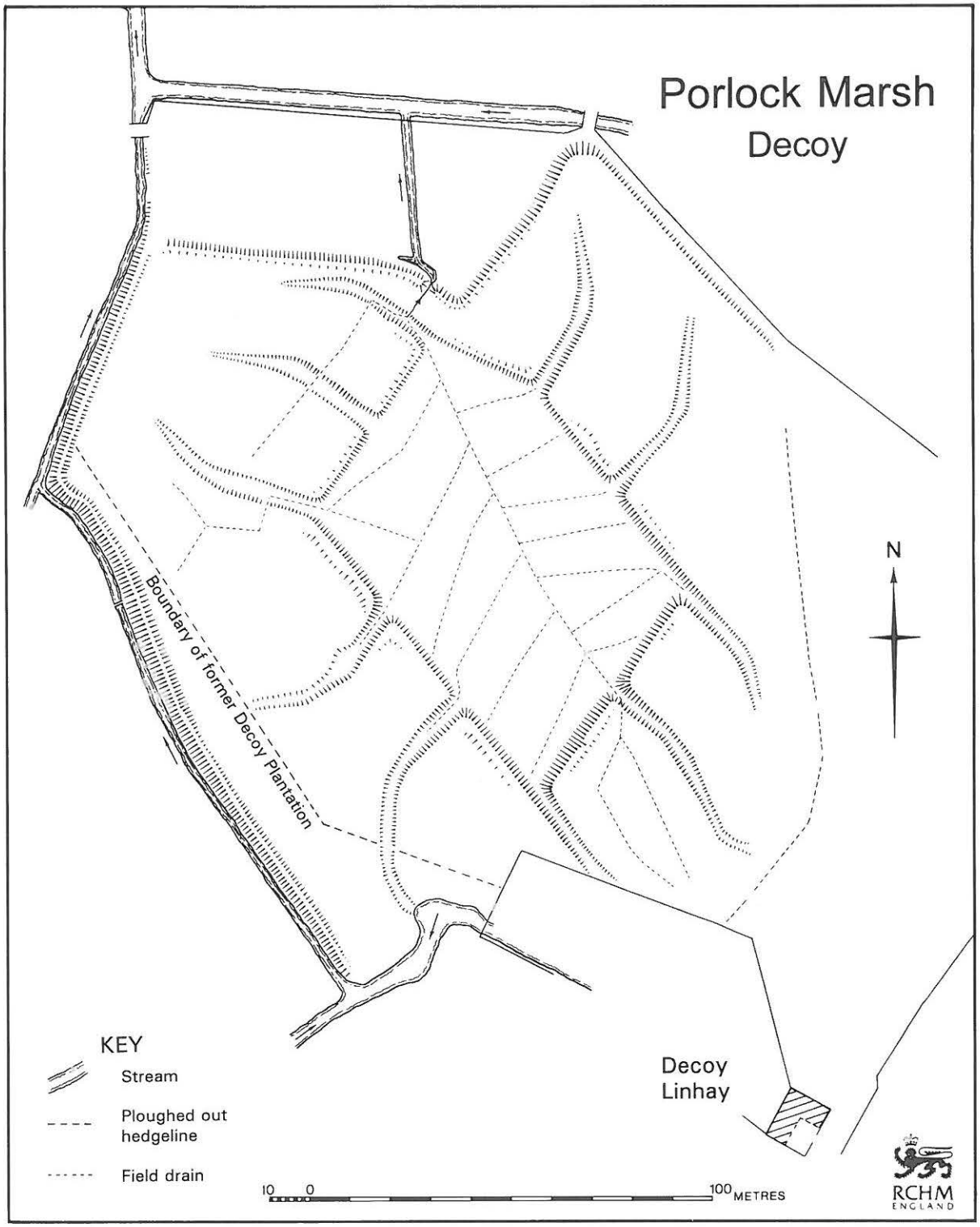


Figure 24. Porlock Marsh: Duck Decoy, earthwork survey by the Royal Commission on Historical Monuments of England (RCHME, Crown Copyright).

also post date them. An understanding of the process of enclosure on the Marsh may only be possible by examining the enclosure of the lower part of the Vale of Porlock.

The extensive water management system designed to transport fresh water is likely to have been created for the agricultural improvement of the saltmarsh sward or for its continued management. In either, or both, cases fresh water would have been required to flush brackish water through the system. The leats recorded on the marsh (007; 020) all appear to be fed from the eastern, Bossington, end of the area. The leat 020 is fed by what was the tail race of Bossington Mill (Isabel Richardson pers. comm.) and extends for 2.5km (Figure 22). There are a series of grypes and ditches that connect the leats which probably functioned as a form of water meadow. The cartographic evidence suggests that this system was still operational at the beginning of the twentieth century.

The Duck Decoy (042) (Figure 22) is an example of a large coastal decoy, the only one of its type in Somerset (McDonnell 1984). It comprises a five sided pond with ten pipes and survives as an earthwork in remarkably good condition (Fig 24). It is not clear if the linhay (025) at the southern end of the decoy ground contains any part of the fabric of the decoyman's house or whether it was built with the stone from that building. For discussion of this and a detailed description of the decoy see Sainsbury (1994).

The name Porlock (027) has been interpreted as meaning the enclosure by the harbour from the Old English *port+loca* (Ekwall 1977; Mills 1991). No evidence of a harbour was recorded during this assessment though there are a number of possible locations.

One such site may lie at the northern end of the two substantial banks (019) that flank and contain the course of the Town Brook and extend above the 10m contour beyond the area of this assessment. At their northern end they diverge to form a mouth opening into the area of the marsh that appears to have been continually flooded since at least the early eighteenth century (026) (Figures 22 and 23). The bank on the east side is 11m wide and up to 2.5m high, the bank on the west side is up to 15m wide and 2.5m high. The size of these earthworks suggests a sea defensive role and appear disproportionally large for the size of the Town Brook even in flood conditions.

Mesolithic material

The deposits of peat (021) and submerged forest material (022) that outcrop intertidally are described below. The archaeological significance of these deposits is enhanced by the nineteenth century account of stratified flint and chert artefacts (043) being recovered from the surface of the head material where it is sealed by deposits of peat (Boyd-Dawkins 1870). This material was attributed at the time to the early Neolithic, now known as the Mesolithic.

Mesolithic artefacts have been also been found at the eastern end of the area from the field on the east side of the Horner lagoon immediately behind the shingle ridge. The items (024) were recovered by A. D. Hallam in 1956 (SMR 33990) and comprised "cores, trimmings and a fragment of a microlith".

The intertidal material, though unlocated, is significant in the context of rising sea levels during the Holocene and may also be relevant to the study of Mesolithic coastal economies. In the event of more Mesolithic material being recovered it might usefully be compared with similar material from Hawkcombe Head. This site has been interpreted as a seasonal hunting camp (Norman 1982) which, though lying only 3.5km to the south west of the coastal sites in Porlock Bay at the head of a valley which rises behind Porlock, is at 420m OD.

Intertidal assessment

The assessment of the intertidal zone was undertaken on the 19th of March 1995 on one of the lowest spring tides of the year. Unfortunately a north westerly wind combined with a strong sea breeze held back the ebb which did not fall more than 20m from the seaward end of the outfall pipe on Bossington Beach. Local fishermen reported that the large areas of kelp seen in the sea should have been exposed intertidally on that particular tide.

The intertidal zone of Porlock Bay will require additional fieldwork to bring it up to a similar level of assessment as the area of the marsh. Further work in both the lower and the mid tide range will be required. With the exception of the small bay on the east side of Porlock Beach, which contained deposits of red sand, peat and mud, the intertidal zone was covered with large shingle and boulders up to one metre wide or long. Progress over this surface is slow and small items of archaeological significance will be easily missed. The shingle surface on Porlock and Bossington beaches make this a particularly difficult intertidal environment to assess.

Two stone built fish weirs (037) and a smaller rubble walled tidal pond (036) were located. The two weirs below Mean Low Water (MLW) (033) were not located and were originally recorded from the aerial photographic evidence (McDonnell 1980a).

Topographic geomorphology

The topography of the area was recorded by field assessment of the aerial photographic evidence. There are five distinct zones.

At the eastern end of the area the alluvial surface of the marsh is cut by a shallow, relict creek system (038). The southern grounds in which this system appears are reseeded pasture and lie on a terrace some 1 to 2 m higher than the ground to the north. The boundary between the two areas is formed by a distinct break of slope which may represent either a wave-cut feature or the remains of a warth edge mud cliff. The lower ground, immediately behind the shingle ridge, is more characteristic of saltmarsh with a low level of agricultural intervention based on rough grazing.

The second zone comprises that part of the marsh which appears to have been flooded since at least the early eighteenth century (026). A survey of 1650 reported that "Fowling at the Pill in the winter season" had been leased out (Somerset Record Office (SRO) T/PH/gc 5). The area currently flooded, for ornithological purposes, (026) is first recorded cartographically on a map of 1710 where it is annotated "Porlock Pill or Fish Pond" (SRO T/PH/gc 15, c/2794). On this map there is a break in the shingle ridge on the north side of the 'pond' suggesting that it was tidal at this time. The annotation 'Pill' also suggests tidal conditions though these may have occurred only on spring tides. Kendall (1937) quoting from the Victoria County History mentions a coastal survey of 1625 where there is a reference to a "little creek" at Porlock. A large tidal pond behind the shingle ridge might also be considered as another possible harbour site.

The shingle ridge lies without break across the seaward side of the marsh and forms a well defined, steep faced, linear feature. On the landward side, between the Horner lagoon and the area of the fish pond (026), there are a series of lower, shingle fans and spreads forming a discontinuous surface in a band up to 200m wide and 1.3km long. There are two large areas from which shingle material has been quarried (040; 041) and other areas where there is a suspicion of similar disturbance. This material appears to lie on the surface of the Holocene alluvium that outcrops intertidally.

The putative palaeochannels (034) were identified from both the aerial

Table 1: Porlock Survey: Inventory of records

PRN	NGR	Name and location
001	SS 721 4758	Masonry bridge
002	SS 8768 4764	Masonry bridge
003	SS 8779 4764	Masonry bridge
004	SS 8720 4749	Earthworks
005	SS 3919 4846	Peat deposit in side of Horner Lagoon
006	SS 8828 4797	Building remains (clubhouse for golf course)
007	SS 8830 4791-SS 8860 4805	Leat
008	SS 8865 4791	Wall
009	SS 8930 4830	Pill box
010	SS 8817 4800-SS 8818 4789	Wall
011	SS 8818 4798	Earthwork
012	SS 8790 4794	War memorial moved from crash site 035
013	SS 8906 4828	Pill box on Bossington Beach
014	SS 8918 4839	Pill box on Bossington Beach
015	SS 8913 4832	Lime kiln at rear of Bossington Beach
016	SS 8915 4834	Lime kiln at rear of Bossington Beach
017	SS 8917 4835	Lime kiln at rear of Bossington Beach
018	SS 8922 4838	Lime kiln at rear of Bossington Beach
019	SS 8815 4774-SS 8832 4752	Linear earthworks
020	SS 8810 8773-SS 8958 4086	Leat
021	SS 8715 4780	Peat on beach
022	SS 8715 4780	Submerged forest on beach
023	SS 8705 4790	Crash site of Junkers 88 (approx. location)
024	SS 8935 4850	Mesolithic cores, flakes and microlith
025	SS 8784 4740	Decoy linhay, ?formerly decoyman's house
026	SS 8790 4785	Porlock pill or fishpond
027	SS 8800 4600	Port (place name evidence)
028	SS 8706 4762-SS 8755 4704	Lower road to Porlock Weir
029	SS 8852 4778	Site of building E of Sparkhayes Lane
030	SS 8847 4804	'Old limekiln' OS 1931. Site of
031	SS 8842 4802	Site of building W of 'Old Limekiln'
032	SS 8958 4865-SS 8974 4823	Site of Marland Lane
033	SS 8735 4808 SS 8737 4816	Stone built fish weir Stone built fish weir
034	SS 8830 4790-SS 8920 4830	Palaeochannels on the marsh
035	SS 8815 4777	Crash site of USAF B-24D Liberator [see 012]
036	SS 8730 4797	Stone built fish weir Porlock Beach
037	SS 8674 4790	Pair of stone built fish weirs Porlock Beach
038	SS 8740 4760	Palaeocreek system on W side of Marsh
039	SS 8842 4796	Remains of wall
040	SS 8875 4810	Shingle quarry
041	SS 8815 4795	Shingle quarry
042	SS 8776 4754	Ten pipe Duck Decoy surviving as earthwork
043	SS 8700 4780	C19th record of Mesolithic material on beach
044	SS 8800 4700	Crash site of Fairy Albacore, Porlock Marsh
045	SS 8905 4825-SS 8922 4786-SS 8952 4811	Lane on tithe map

photographic evidence and the field assessment. These features extend for some 1.3km, through the shingle fans, between Horner lagoon and the site of the "Fish Pond" (026). There are two interpretations of these features. It is possible that the channels represent a former course, or courses, of Horner Water which, instead of passing through the shingle ridge into the sea, as it does at present, flowed behind the ridge to the west and into the sea by way of the Pill (026). A more likely explanation, however, is that they were not primarily water courses but the areas between the shingle fans which later became channels and filled with alluvium. The palaeochannels (034) shown in Figure 23 are plotted from the aerial photographic evidence which does not include some of the detail evident in the field.

The fifth zone is that currently enclosed and managed as pasture and arable and lies generally above 6m OD.

Assessment of stratigraphy and environmental potential of sediments at Porlock Marsh: a summary of results

by Matthew Canti and Vanessa Straker

Introduction

The archaeological potential of the Marsh centres on the fact that forest and peat beds are visible in the intertidal zone at the western (Porlock Weir) end of Porlock Bay and that in the past worked flint and chert have been found associated with them (Boyd-Dawkins, 1870). It was felt that these deposits could extend behind the shingle ridge beneath Porlock Marsh and that the archaeological potential of the Marsh should be evaluated before inundation and erosion by the sea took place. This report summarises the results of the environmental assessment of the buried deposits; a full report is shortly to be submitted to English Heritage.

The English Heritage-funded assessment complements the coring and analysis that has been done by Simon Jennings, concentrating on the submerged forest bed of the intertidal area and a small part of the Marsh behind the shingle ridge. His work formed part of a project examining the Holocene development of the Porlock coast partly summarised below (page 62).

Methodology

A programme of coring was carried out to examine the stratigraphy of the Marsh sediments and provide material for environmental assessment. The work was done by Geodrive Ltd. using a powered soil sampling system. This machine operates by drilling a gouge into the soil and then levering it out on a jacking system. Normally, the gouge is examined and sampled in the field, before being cleaned out ready for reuse. If laboratory sampling is required, a special type of gouge can be used which allows the retrieval of a plastic insert containing the whole core. Holes were positioned along a grid (see Figure 25) which had been surveyed in position and levelled to OD by the RCHME, Richard McDonnell and Keith Faxon. Sediment description and logging was carried out by Keith Faxon under the guidance of the authors. The core logs were examined and 4 insert cores were then taken in specified locations (grid points 2, 4, 9, 39 see Figure 25) where deep stratigraphy comprising silts, silty clays, sandy clays and bands of peat was encountered. The inserts were positioned to sample the extent and range of these sediments and provide material for environmental assessment. Elsewhere the coring revealed that the sediments consisted of shallow silty topsoil above solifluction deposits.

The inserts were taken back to the Department of Geography, Bristol University and described and sub-

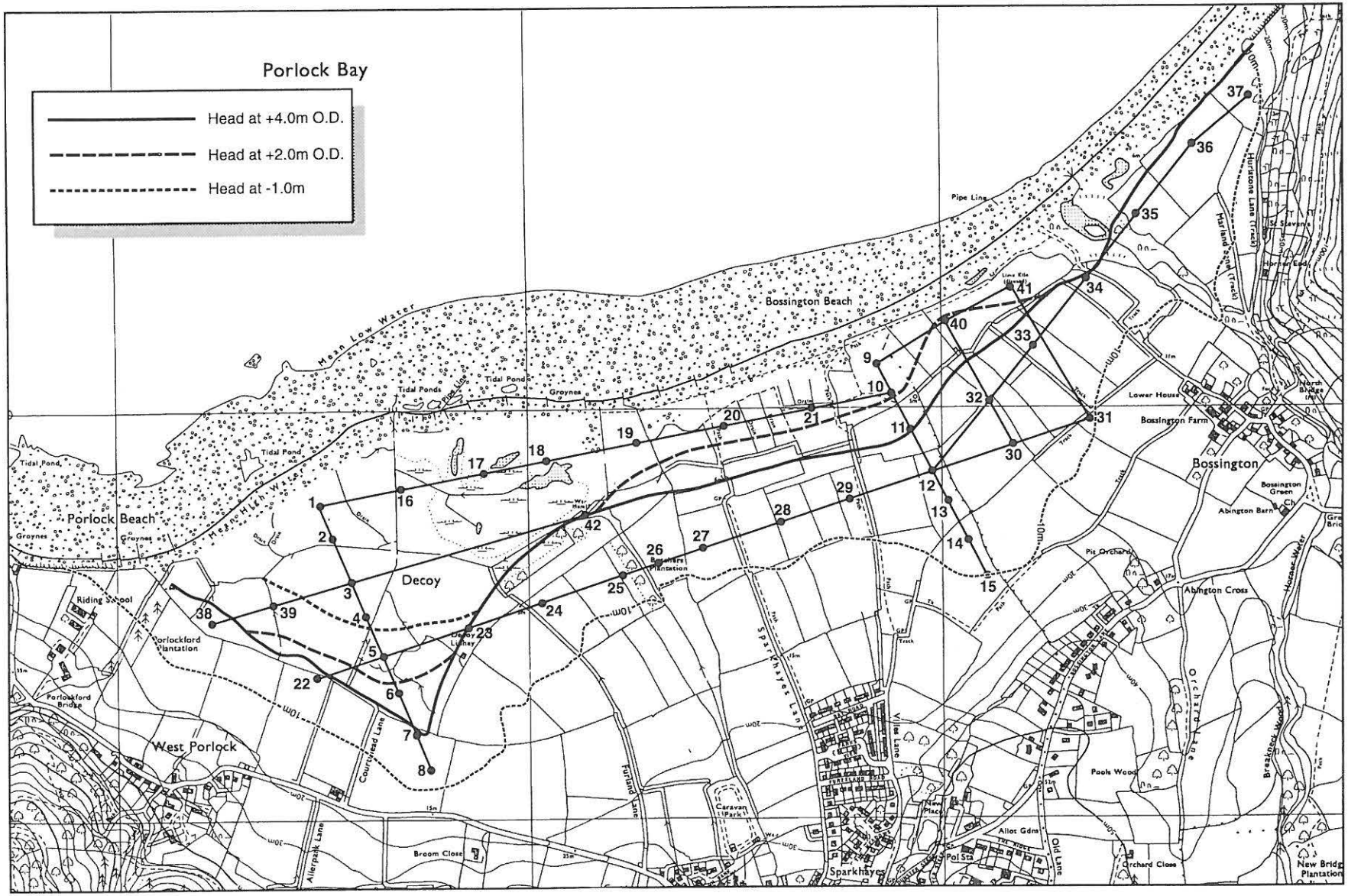


Figure 25. Porlock Bay and Marsh: Showing the coring grid.

sampled for assessment of the potential for plant macrofossil, pollen, diatom and foraminifera analyses to establish the nature of sediment accumulation in Porlock Marsh and the history of the local and regional vegetation development. As the sediments had to be sampled by coring, the sample size was too small for assessment of insects, and not ideal for plant macrofossils. Diatoms (unicellular algae with frustules of silica) and foraminifera (single celled protozoans some of which secrete a calcareous shell or construct one from detrital grains) can provide information on past salinity levels and the environments of sediment deposition, while plant macrofossils and pollen allow reconstruction of the vegetation in the area. Plant macrofossils provide information on the immediate and local vegetation and pollen represents both the local and more regional vegetation. The specialist assessments were carried out by N.Cameron (diatoms); M.Godwin (foraminifera); D.Weir (pollen) and J. Jones (plant macrofossils).

Results

The lithostratigraphy has been drawn up as illustrated by the transect 1-8 (Figure 26). In this area, the sediments reached a depth of more than 9m at core point 2. A thin basal peat developed above the underlying head (solifluction deposits) at *c.* -5.5m OD and two other peats at *c.* 8.5m and 5.3m depth (*c.* -2.5m OD and *c.* -1.25m OD) intercalated with silty clays were also recorded in some cores. As Figure 26 shows, two bands of peat were present in core 2, two bands in core 3 and one in core 4. The other transects are not included in this report and will be published in Heal *et al.* (forthcoming), but peat was also found in core 16 where 3 thin bands near the base of the 9.5m core were intercalated with and overlain by silty clays. A single band of peat was also recorded in core 39. The results of the coring have been used to plot contours of head depth above and below OD (Figure 25) and show clearly that a deep embayment extended inland at the western end of the Marsh. From about grid point 6 southwards and 23 eastwards the head was located at +2m OD and above, covered by, at some locations, as little as 0.5-1m of clays and topsoil.

The summaries presented below should be regarded as provisional as they are based on assessments designed to show potential rather than provide detailed results. The individual specialist reports they are based on will be presented in Heal *et al.* forthcoming.

Insert 2 (Close to core 2 on Figures 25 and 26)

The stratigraphy above the head (solifluction deposits) was 9.95m thick, the deepest encountered in the survey.

Summary

Alder carr and freshwater pools were eventually succeeded by conditions typical of upper saltmarsh. This was followed by a return to freshwater alder carr (*c.* -5.5m OD) which was subject, at least occasionally to marine inundation. Subsequent to this, a very thick layer (3m) of marine silty clay was deposited which may at times have been deposited in a permanently inundated channel, rather than in a saltmarsh. Temporary retreat of the sea followed, with the development of freshwater swamp resulting in renewed peat development (at *c.* -2.5m OD), but this was followed by a return to saltmarsh conditions. An episode of increased freshwater and brackish, rather than marine, conditions at *c.* +0.8m OD may relate to the development of a channel through the saltmarsh, which would have received freshwater runoff, or the creation of a lagoon. This was itself subsequently overlain by renewed saltmarsh development.

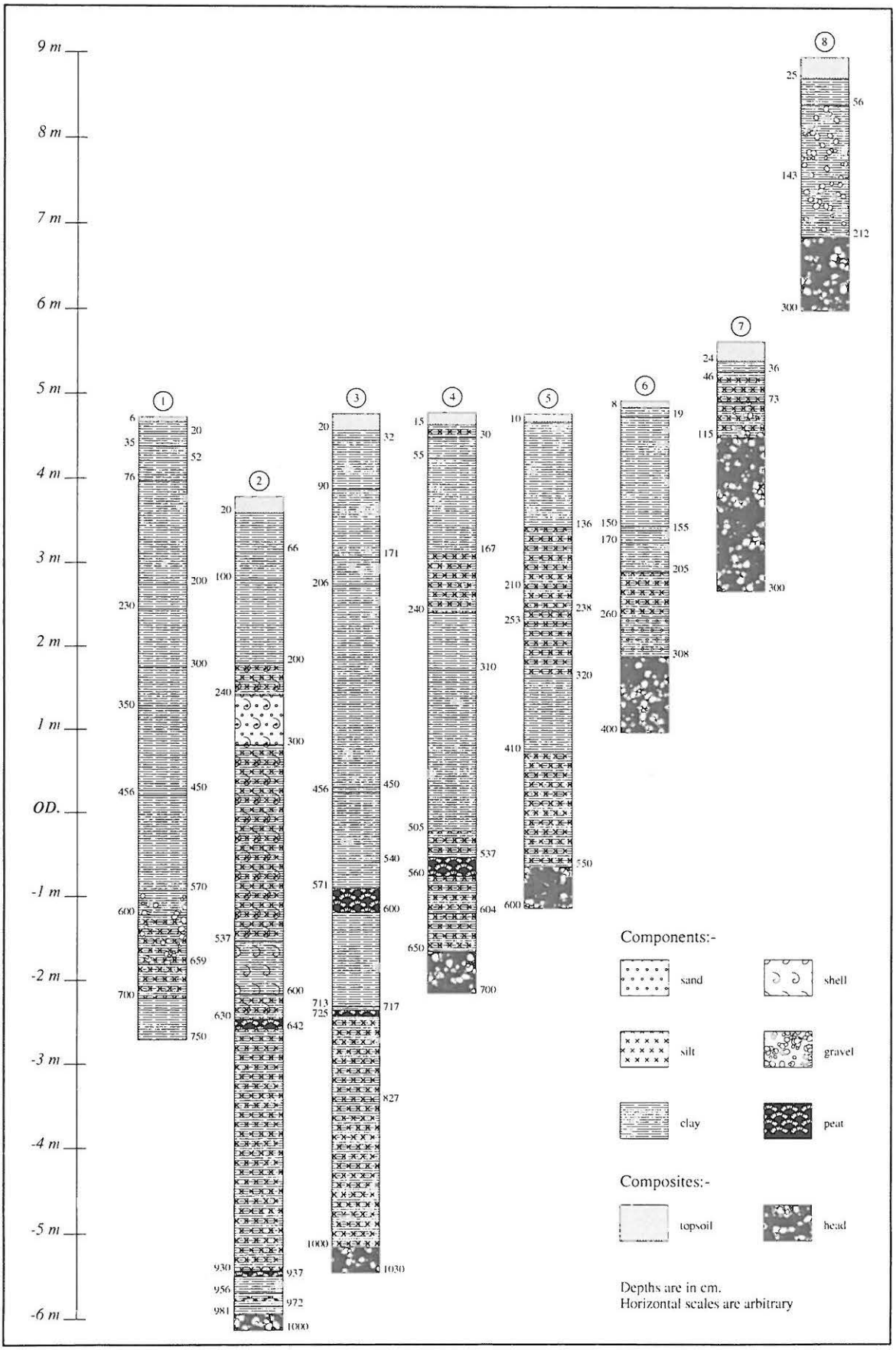


Figure 26. Porlock: Inserts 1-8 showing component stratigraphy.

Insert 4 (Close to core 4 on Figures 25 and 26)

The stratigraphy overlying the solifluction deposits was 6.75m thick and is shown in Figure 26.

Summary

As in Insert 2, the sediments sampled by Insert 4 demonstrate varied environmental conditions at the base which became increasingly influenced by marine conditions or saltmarsh development before marine retreat allowed the development of sedge swamp and then alder carr (at *c.* -0.4 to-0.6m OD). Marine conditions returned, but towards the top of the sequence although no further peat developed, the increased influence of freshwater is evident (*c.* +1.5m and +3m OD). This could, perhaps, result from increased freshwater runoff flowing in a channel or ponded up in a lagoon.

Insert 39 (Figure 25)

5.90m of clays, peat and silty clays accumulated above the solifluction deposits.

Summary

Brackish water, probably saltmarsh, conditions are replaced by largely freshwater alder fen (*c.* -0.7 to -1.15m OD) during a temporary reduction in marine influence. Saltmarsh conditions return, followed by two possible episodes of increased freshwater input (*c.* +1.1 and +2.6m OD), which did not result in the development of peat-forming vegetation and may relate to the presence of channels through the saltmarsh, or a lagoon. The increased freshwater input has been noted in the upper 3-4m of all three inserts from the western end of Porlock Marsh.

Insert 9 (Figure 25)

3.0m of silts and clays accumulated above rounded pebbles in a yellowish grey silty clay matrix which may be the remains of beach deposits or a precursor to the shingle ridge.

Summary

Marine influenced conditions (only represented by a poorly preserved diatom assemblage) at the base of the sequence are succeeded by predominantly freshwater assemblages (from *c.* +2.1m OD), containing evidence of pastoral and arable land-use. There are possible indications from the diatom assemblage that marine influence returns at about +3.5m OD.

The sediments sampled in this insert are different from those at the western end of the Marsh. Although peat did not form, evidence of past land-use is afforded by pollen preserved at about 2.5m below the present surface (*c.* +2.1m OD). These sediments were probably deposited in a channel which would have run roughly parallel to, and on the landward side of the present shingle ridge. McDonnell's work on the surface archaeological features has also suggested that a channel or channels existed in this area. During the course of the project, it was observed that even temporary movement of the shingle at the Bossington end of the ridge can cause the Horner Water outfall to become blocked resulting in substantial ponding-up of water and diversion of the stream parallel to the shingle ridge.

Conclusion

The results of this work have demonstrated that the palaeoenvironmental potential evident in the intertidal zone extends inland behind the present coastal defence as a large inlet between lobes of solifluction debris. So far, no cultural material comparable with that published by Boyd-Dawkins (1870) has been recovered from the cores

behind the shingle ridge, but it is entirely possible that there are areas of early prehistoric occupation surviving which have not been picked up in the cores, some of which were 200m apart. The sediments in Porlock Marsh hold a long record of Holocene vegetation development and coastal change, though the inclusion of alder pollen in the basal peat from insert 2 suggests that this does not predate *c.* 8000 BP. Radiocarbon measurements for the peats are awaited, but the dates obtained by Jennings (see below) suggest that peat did not form after 5000BP. The pollen evidence from Insert 9 demonstrates that the inorganic sediments also hold a record of human activity in the area.

Acknowledgements

We are very grateful to Julie Jones, David Weir, Mike Godwin and Nigel Cameron, whose specialist reports we have taken the liberty of summarising for this paper.

The Holocene development of the Porlock coastal environment

by Simon Jennings

Relative sea-level rise

Relative sea-level (RSL) rise in the Bristol Channel during the Holocene was characterised by a rapid rise from approximately -35m MHWST datum (equivalent to approximately -30m O.D.) around 9000 BP to -8m MHWST datum by about 6000 BP, after which the rate of rise slowed dramatically. This broad pattern of RSL change was recognised by Hawkins (1971, Figure 3) and by Heyworth and Kidson (1982, Figure 3). New radiocarbon dated sea-level index points from Porlock, covering the period from 7800 BP to 5000 BP, confirm this RSL trend. These index points are represented by the vertical contact between organic and minerogenic deposits. Pollen analysis indicates that these contacts are associated with their contemporary MHWST level. The new index points are illustrated in Figure 27, where they have been superimposed upon an "error envelope" which summarises the RSL data presented in Heyworth and Kidson (1982, Figure 3). All but one of the new index points fall within this envelope. The one outlier, the oldest of the index points, may indicate a slower rate of RSL rise between 7000 to 8000 BP than has been determined previously, although more RSL index points from around that time are needed to confirm this. There are very few index points of this age and elevation on Heyworth and Kidson's original sea-level graph, so that the RSL trend in the Bristol Channel for the early Holocene is poorly constrained.

The impact of RSL rise on coastal development at Porlock

Lithostratigraphic data from the submerged forest bed and from the marsh at Porlock show that it was during the period of more rapid RSL rise that the organic beds formed, and that conversely, since the slowing of RSL rise around 5000 to 6000 BP, deposition has been exclusively minerogenic. Pollen analysis shows that alder carr became established during organic-deposition episodes, while the minerogenic deposits represent periods of low energy, estuarine conditions, established by inlets through a barrier beach (Cooper *et al.* 1995). The sediments associated with the submerged forest bed illustrate this sequence. The stratigraphy from seven boreholes in two transects (Figure 28) through the forest bed revealed a sequence of interbedded silty clays with thin organic horizons, resting upon soliflucted material (Figures 29 and 30). This sequence is essentially repeated in the sediments below Porlock Marsh (Figure 26).

A series of alternations between freshwater (organic) and estuarine

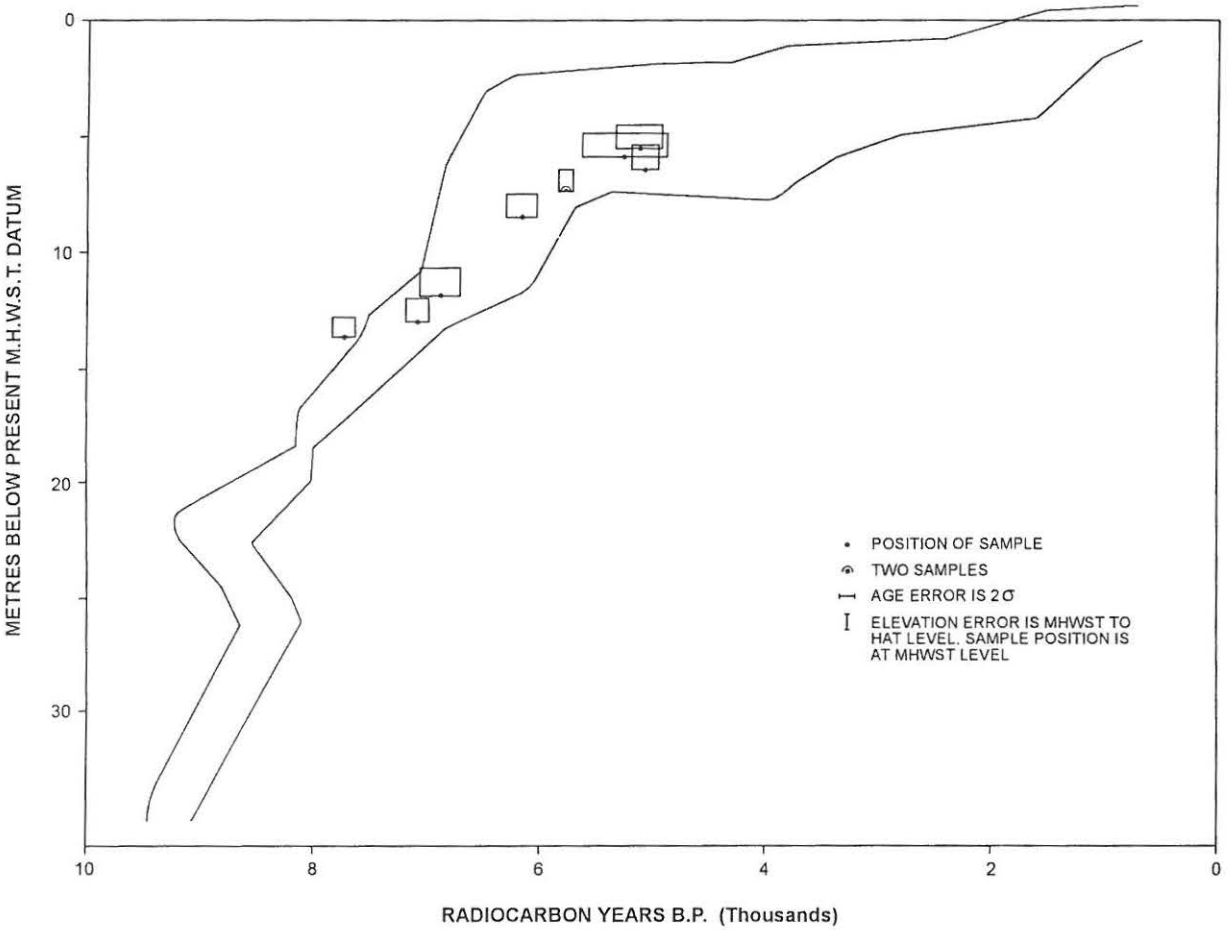


Figure 27. Porlock: Sea-level index points superimposed upon a summary sea-level error envelope from Heyworth and Kidson (1982, Figure 3). The elevation datum is Mean High Water Spring Tides. The radiocarbon dates are uncalibrated.

(minerogenic) conditions occurred at Porlock between 7730 ± 50 BP (Beta -81655) and 5070 ± 60 BP (Beta-81653), with rapid changes between these two environments. The abrupt termination and subsequent re-establishment of marine conditions at the lower and upper boundary respectively of each organic layer suggests that these environmental changes were probably the result of closing and opening of tidal inlets within the Porlock barrier beach system. The apparent abruptness of the environmental change at the upper boundary of the organic layers may be the result of erosion of organic material, and 'erosional contacts' were recorded in the stratigraphy of some of the boreholes. However, the preservation stratigraphically of the transitional stage from woodland to estuarine conditions at the termination of organic deposition is attested to by biostratigraphic and lithostratigraphic evidence from some of the boreholes. The pollen record from the top of the organic layers and into the overlying silty clays was examined at four sites in the marsh - submerged forest area (Cooper *et al.* 1995), and shows a transition from woodland to reedswamp or to a sedge-dominated environment, prior to the onset of estuarine conditions, which are usually represented biostratigraphically by the pollen of salt marsh taxa. In some boreholes, for example BH7 (Figure 30), an organic silty clay overlies the

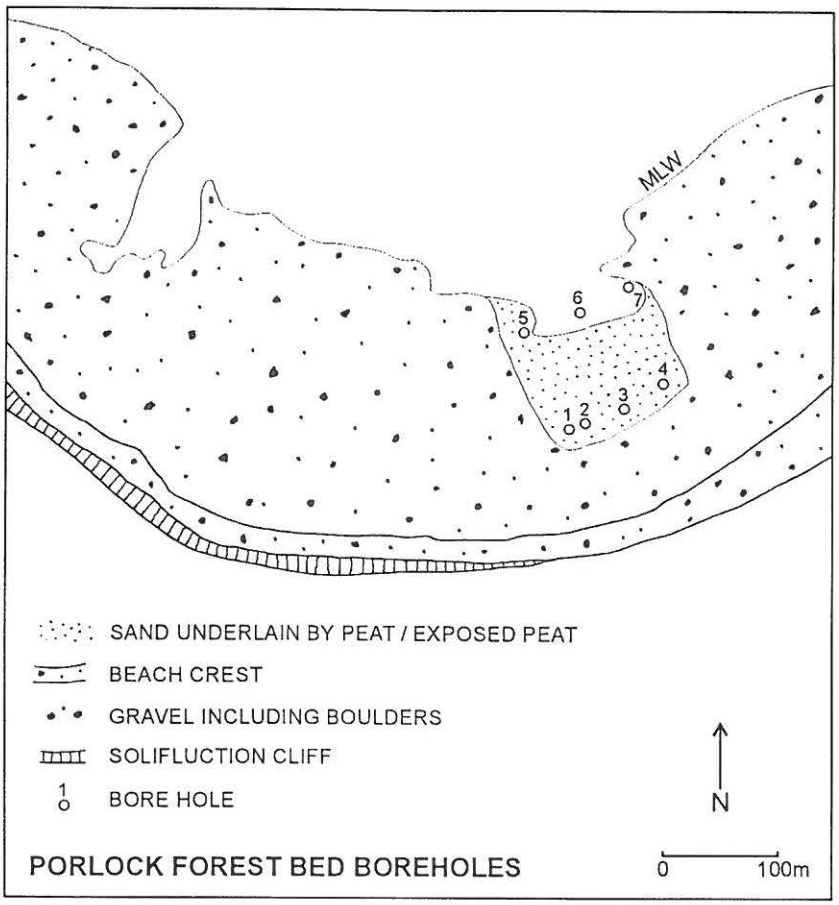


Figure 28. Porlock: Location of the forest bed boreholes.

main organic layer, indicating that at some sites, the upper boundary of the organic layers is preserved.

Alder carr, and associated organic deposits, have not formed close to the Porlock shoreline since approximately 5000 BP. Although the evidence for more recent alder carr development may have been eroded from the foreshore beds, this is not likely to have happened on the marsh behind the beach. This change to exclusively minerogenic sedimentation from around 5000 BP may have been the result of material eroded from the slopes following anthropogenic disturbance. Archaeological work near Exmoor at Westward Ho! has shown evidence for anthropogenic activity there since the Mesolithic (Balaam *et al.* 1987). However, there is no evidence for anthropogenic impacts during the mid-Holocene in the pollen record from Porlock. Anthropogenic disturbance, on a scale large enough to be responsible for a switch to minerogenic deposition around 5000 BP to the present day, and which from the Porlock marsh stratigraphy is represented by approximately 4.0m of infill, should be apparent at least in the upper part of the pollen records from the forest beds and from the peat below the marsh. Additionally, evidence from shell remains, foraminifera and diatoms (see Canti and Straker above) suggests that the upper 4.0m of infill below the marsh was mostly deposited under estuarine and lagoonal conditions, with episodes of increased freshwater influence. An alternative explanation for the cessation of organic deposition at Porlock since 5000 BP is a major change in barrier beach dynamics that

limited the closure of tidal inlets such that the formation of organic deposits and extensive alder carr was prevented. This change in barrier beach behaviour occurred after the RSL rise slowed significantly. Therefore, at Porlock there is evidence that the substantial mid-Holocene deceleration in the rate of RSL rise increased coastal sensitivity.

The link between increased coastal sensitivity and deceleration of RSL rise is established through the interplay between the rate of RSL rise and the release of sediment from cliff-line sources. The rate of sediment release (ie erosion and subsequent transportation down-drift) from cliffs will increase with increasing RSL rise. Within the geographical context of Porlock, solifluction deposits have played an important role in supplying sediment to the coastal system. These deposits originated from valleys incised into the Exmoor plateau during the last cold stage of the Quaternary, and they control much of the present relief behind the beach and the subsurface topography which governed the location of former tidal inlets. Where the deposits terminated in sea-cliffs they have functioned as important local sources of sediment through the Holocene RSL rise, although this supply has probably diminished during the Holocene as these deposits have been either re-worked, buried or released in lower volumes as the RSL rise rate reduced.

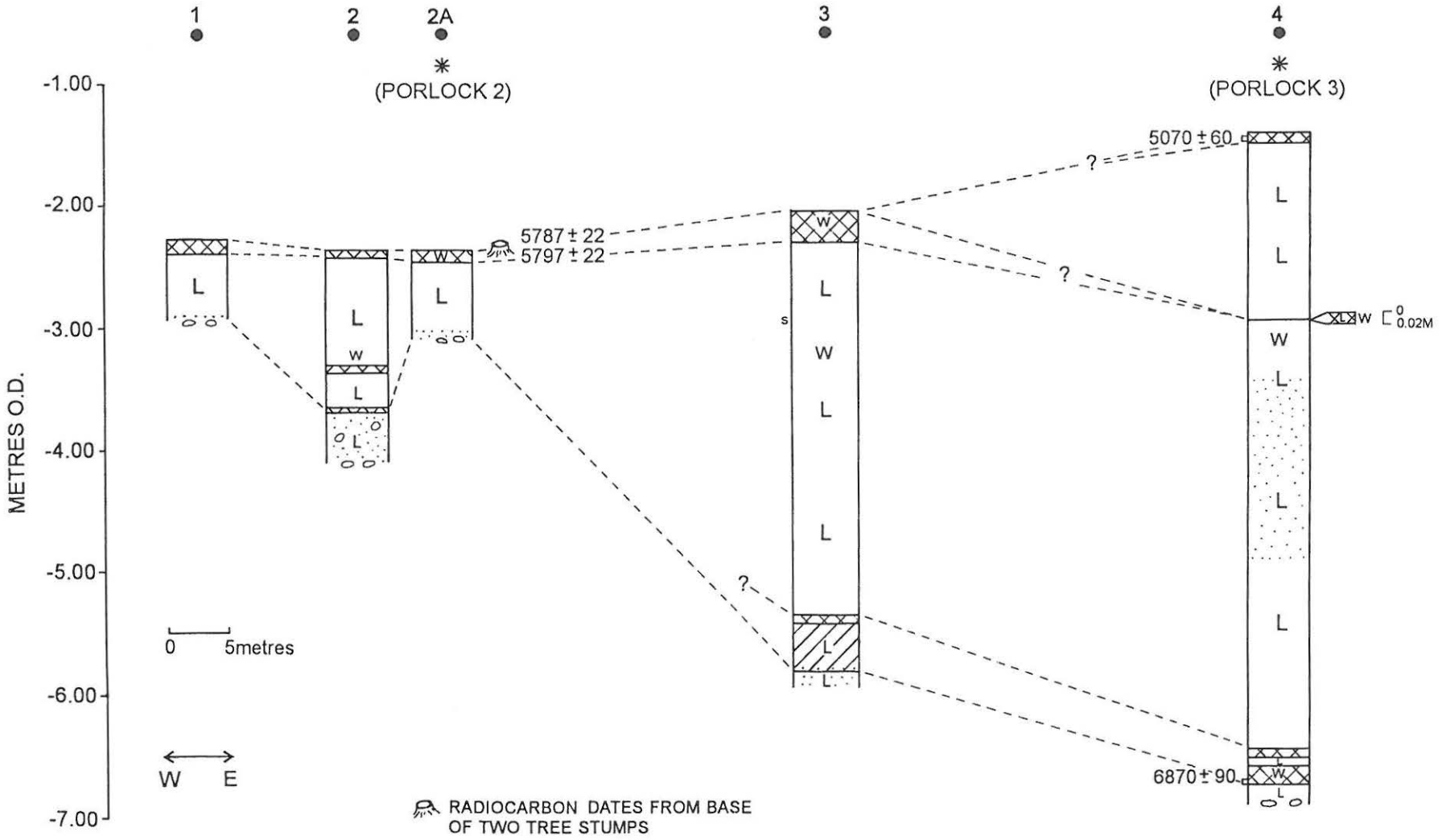
Cooper *et al.* (1995) have suggested that during the Holocene there was a critical RSL rise rate at Porlock that was slow enough to prevent continuous roll-over and inlet establishment, but fast enough to release sediment from cliff-lines in volumes sufficient to allow periodic closure of barrier inlets, with concurrent organic deposition in back-barrier areas. Assuming that the organic layers at Porlock represent this period of critical RSL rise rate, and that the contacts between organic and minerogenic deposits are sea-level index points, then threshold RSL rise rates, demarcating the upper and lower values of the critical RSL rise rate can be calculated to have been between approximately 6.6 mm/yr to 2mm/yr RSL rise. RSL rise rates of *c.* 2mm/yr were established around 5000 BP, soon decreasing further to between 1.3mm/yr to 1.0mm/yr, a rate which continued to the present day. These low RSL rise rates have been unable to release new material in sufficient volumes to maintain the closure of barrier inlets and allow organic material to accumulate in a freshwater, back-barrier environment.

Back-barrier sedimentation since 5000 BP

The main sources of sediment to the back-barrier area at Porlock over the last 5000 years have been from the sea via inlets and from material carried by the small streams that flow onto the marsh from Exmoor.

As the rate of RSL rise slowed during the mid-Holocene, reducing sediment supply to the barrier beach from long shore drift and increasing the rate of barrier roll-over, the original drift cell which had developed as the barrier formed in the early Holocene has broken down into the four smaller cells which can be recognised today (Cooper *et al.*1995). Associated with the break down of the original drift cell has been the thinning of the width of the barrier, promoting the establishment of tidal inlets, especially in the Porlock Marsh area. Given the large tidal range, these inlets may have only been active around the high water period of each tidal cycle. The volume of water exchange through the inlets would have been influenced also by the spring-neap cycle and by storm activity.

Periodically, drift pulses may have sealed the inlets, but seepage of sea water through the barrier at high water probably maintained a brackish, lagoonal environment, not conducive to



PORLOCK FOREST BED TRANSECT 1

Figure 29. Porlock: Lithostratigraphy of the forest bed boreholes of transect 1.

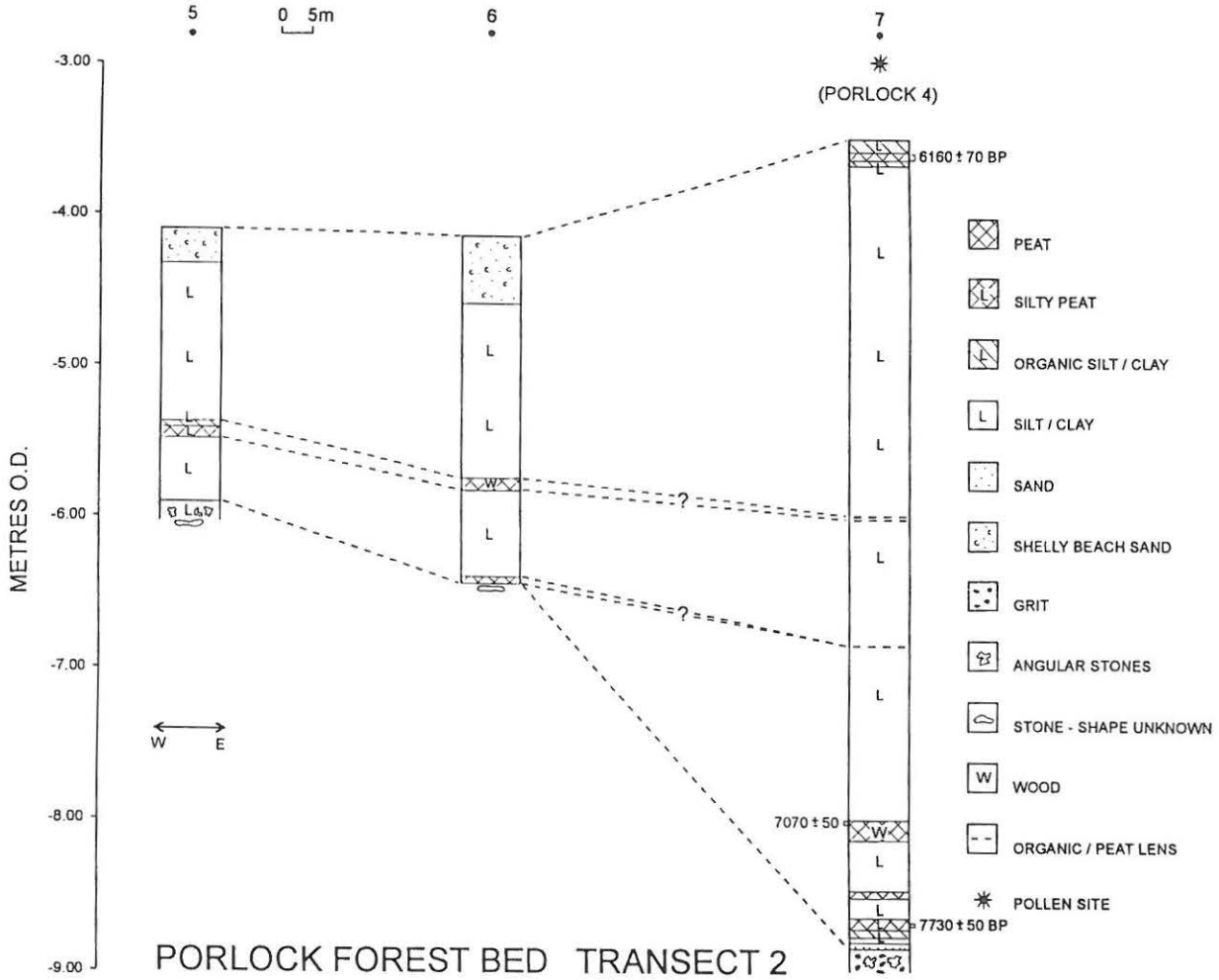


Figure 30. Porlock: Lithostratigraphy of the forest bed boreholes of transect 2.

the widespread formation of organic deposits, as had occurred earlier in the Holocene. During the episodes when the inlets were sealed, discharge by streams flowing onto the marsh area would have been ponded-up, which may explain the periods of increased freshwater conditions recorded by the diatom assemblages in the silty clays which overlie the organic deposits, as noted by Canti and Straker (above).

Anthropogenic impacts within the last 5000 years may have also contributed to the sediment budget of the back-barrier area. As discussed above, no evidence of forest clearance has been detected from the pollen record from the organic layers, although Canti and Straker (above) recorded the presence of pollen indicative of agriculture within the silty clays to the east of Porlock Marsh, which probably post-date the organic layers of the Marsh. The streams which discharge through Porlock Marsh may have transported anthropogenically-derived sediment from within their catchments, an area which includes the Exmoor plateau above Porlock which has experienced anthropogenic impacts since the mid-Holocene (Straker and Crabtree 1995). Furthermore, stream discharge is likely to have increased during forest clearance phases within catchments, resulting in periods of enhanced freshwater conditions on Porlock Marsh.

Former shore-line position

Coring traced the organic layers of the forest bed to just below the MLW position and it is likely that they continue further offshore. Since these layers date to 6160 ± 70 BP (Beta-81654) from BH7 and to 5,070 ± 60 BP (Beta-81653) from BH4 the mid-Holocene position of the Porlock barrier beach must have been seaward of the present MLW line. The beach has transgressed to its present position within the last 5,000 years, that is during the period of slow RSL rise.

Implications of the evaluation

by Veryan Heal

The foregoing appraisals of the archaeological evaluation by McDonnell, the analysis of core samples reported by Canti and Straker and the independent research work on intertidal peats by Jennings, provide a rare opportunity on Exmoor to consider human activity and its environmental context together. There has been very little palaeoenvironmental work carried out in the area, despite the existence of extensive upland blanket mire, wet flushes and the lowland deposits of Porlock Marsh; in many instances these lie in clear stratigraphic relationship to features of the historic landscape.

Porlock Bay and Marsh have a history of exploitation throughout much of the post-glacial period, their specific maritime and wetland resources having been utilised since the Mesolithic. A watching brief carried out on a pipeline through the Marsh, since this evaluation took place, has revealed several more flint scatters (McDonnell forthcoming), the relationship of which to the environmental changes recorded in the core samples may link environmental changes with datable prehistoric human activity. It is apparent from the results of the analyses that there are environmental events which may well be a product of human actions in and on the slopes around the Marsh. For example, the minerogenic regime which seems to have been established after *c.* 5,000 BP and the inorganic sediments in Insert 9 are suggestive of human activity and land use.

More recent use of the Marsh is recorded in the survival of the pattern of enclosure and of irrigation and drainage systems. These, and the use of the area to seaward of the shingle ridge, require further investigation in order to understand both the workings of the Marsh, its relationships with the hinterland of the Vale of Porlock, renowned for its rich soil, and its

foreshore and the use of the sea. The location of a mediaeval harbour, served by a tidal inlet or Pill through the ridge, remains a tantalising possibility. The evolution of the ridge, intermittently sealing the Marsh and being breached, requires further study to establish the relationships between these phases and human activity and the use of the different resources of land, marsh and saltmarsh.

Through this evaluation and incidental operations, we are gradually creating a fuller picture of the past of the immediate area. While itself offering specialised resources, this was linked with the exploitation of the wider area of Exmoor. The links were both close, as at Hawkcombe Head and more distant, as with the use of other topographic zones of the moor and beyond, for example in obtaining non-local supplies such as flint from Barnstaple Bay (Norman 1982).

On the higher moorland, field systems of prehistoric type can be observed engulfed by peat development and there are other wetland deposits in close proximity to major field monuments, which themselves preserve buried soils. There is clearly significant potential for further combined archaeological and palaeoenvironmental investigation which would enlighten our, as yet clouded, perception of the physical and chronological development of the landscape and concommitant human impact upon the natural environment.

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