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Author(s): Martin Bell and Heike Neumann

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Prehistoric intertidal archaeology and environments in the Severn Estuary, Wales

Martin Bell and Heike Neumann

Abstract

Estuaries, the interface between riverine systems and coastal environments, have great archaeological potential for interdisciplinary research. Extensive survey of 25km of coast in the Severn Estuary, Wales, databased using Autocad and GIS, is combined with more detailed investigation of 3km at Goldcliff. This demonstrates that coastal wetlands can preserve a diverse range of site types which contrasts with both terrestrial dryland contexts and other wetlands, such as the nearby Somerset Levels. Rectangular Bronze and Iron Age buildings, unique in Britain, trackways and other post settings are exposed on intertidal peat shelves. Activity on these former wetlands was particularly concentrated at the interface with marine flooding in the later Bronze Age and Iron Age, periods of major environmental change in both estuarine and riverine environments of the Severn. Activity seems to have been essentially opportunistic and seasonal, with evidence for cattle grazing and perhaps fishing. Marine inundation in the Iron Age was followed by Romano-British reclamation.

Keywords

Intertidal; Severn Estuary; peat; palaeoenvironmental; prehistory; wetland.

Introduction to estuarine archaeology

Estuaries preserve deep Holocene sediment sequences which represent a continuation of those of river systems. They offer comparable opportunities for the preservation of organic remains and wooden structures, which enhance the archaeological record by preserving types of evidence and classes of site seldom present in dryland contexts (Coles and Coles 1996). Estuaries and rivers offer similar resources: fishing, transport and seasonally available resources, with flooding at other times. Additionally, estuaries give access to rich marine environments.

Estuaries are subject to a combination of riverine, coastal and terrestrial environmental factors. At any given site the relative influence of each will vary through time, creating a

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highly dynamic geoarchaeological context which is, in important respects, distinctive from inland riverine environments. The archaeology must be seen in the context of coastal sedimentary and erosional processes and the intrinsic dynamics of wetland development and plant succession. A specific investigation is required of the formation and taphonomic processes whereby the sea buries and exhumes sites.

Dynamism is an especially important characteristic, with environmental change occurring on a multiplicity of time-scales, from the astronomically predictable, twice daily, tidal cycles, spring-tide cycles every two weeks, equinoctial cycles and longer-term astronomically related cycles. There is also the influence of longer-term secular climatic and sea-level changes. There are also sudden events, arising from perturbations in the atmospheric system, which produce storm surges and floods and, if critical thresholds are crossed, may trigger longer-term changes. Estuaries, with clearly defined environmental changes, which can be precisely dated by dendrochronology, are key contexts in which to investigate the relationship between environmental change and past human communities.

Increasingly from the 1980s the potential of coastal archaeology has been recognized in Britain through the Hullbridge project in Essex (Wilkinson and Murphy 1995), Westward Ho! (Balaam et al. 1987) and the Severn Estuary. Existing knowledge has been synthesized in a survey of *England's Coastal Heritage* (English Heritage 1996; Fulford et al. 1997). Examples from other countries include a long history of coastal related work on the Scandinavian Mesolithic (Fischer 1995) and, for later periods, the recently published coastal survey of Fyn, Denmark (Crumlin-Pedersen et al. 1996) and the Shannon estuarine survey of the Discovery programme in Ireland (O'Sullivan 1996).

The Severn Estuary

The Severn Estuary (Fig. 1), which opens into the Bristol Channel between England and Wales, displays an exceptionally full Holocene sedimentary sequence. It has the second highest tidal range in the world, a maximum of 14.8m at Avonmouth. Extensive exposures of sediments occur in an intertidal area up to 2.4km wide. Behind the sea wall on the Welsh side is a strip of reclaimed wetland, the Gwent Levels, up to 6km wide. On the English side, this is matched by levels, including those in Somerset, with a long history of archaeological work (Coles and Coles 1986). The Somerset and Gwent Levels have essentially comparable Holocene sequences (Smith and Morgan 1989: 163), although those in Gwent have more direct marine influence, being closer to the coast and lacking the dune bar present in Somerset. Surprisingly, the Gwent Levels have now revealed a striking diversity of prehistoric archaeology in an area which, until recently, was almost blank on archaeological distribution maps (e.g. Taylor 1980: figs 9.7–11).

A Roman inscription, found at Goldcliff in 1878, had long suggested the possibility of Roman military involvement in reclamation, as had Roman pottery finds (Boon 1980: 27). The extent and character of Roman drainage became clear in the course of sedimentary research in the 1980s (Allen and Fulford 1986). At about that time discoveries of wooden structures below present tidal levels, made by a local archaeologist Derek Upton, came to wider notice. Investigation and radiocarbon dates began to confirm Upton's discoveries as prehistoric (Whittle 1989: 203; Green 1989) and there followed increasing archaeological

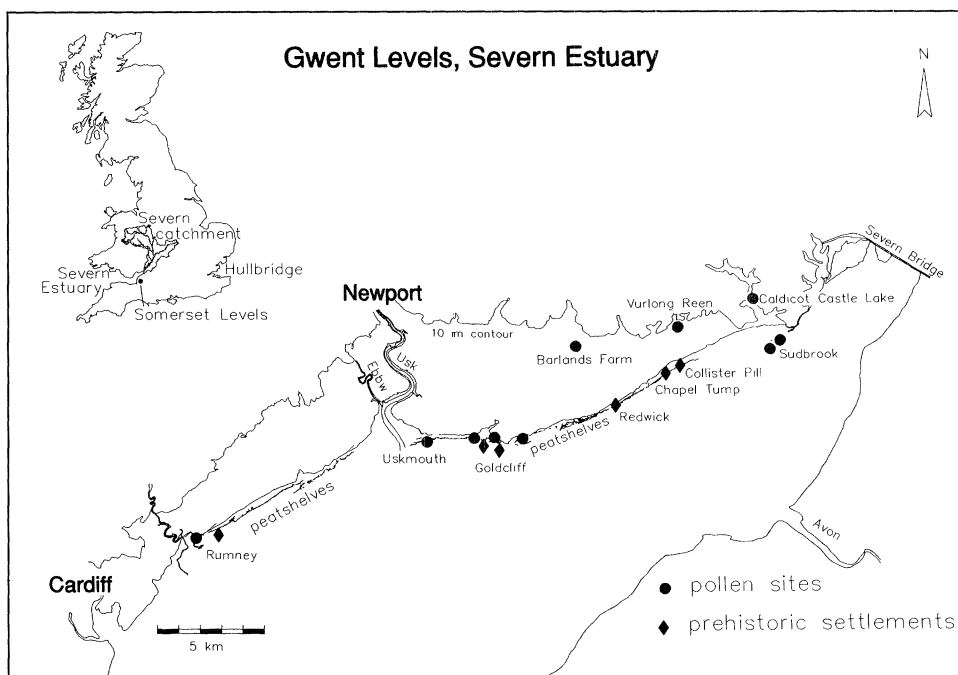


Figure 1 The British Isles showing the Severn Estuary in relation to the catchment of the Severn. On a larger scale is shown the Welsh intertidal peat survey with settlement sites and pollen sequences (only those on the Welsh side are shown).

activity by several organizations, coordinated by the Severn Estuary Levels Research Committee.

Here we synthesize aspects of prehistoric intertidal archaeology on the Welsh side. That research has been at two spatial scales. A detailed survey of 3km of intertidal area at Goldcliff between 1990 and 1994 was followed by an extensive survey of the Welsh intertidal zone, funded by the Board of Celtic Studies of the University of Wales from October 1995, which is ongoing. Complementing our focus on prehistory there have been programmes of research on Roman drainage (Fulford et al. 1994), medieval fishtraps (Godbold and Turner 1994), boats (e.g. Nayling 1996) and Roman to modern landscape archaeology (Rippon 1996).

A chronology is provided by 155 radiocarbon dates, of which a selection is given in Table 1 which provides full details of the original date, lab. no., calibration, etc. In the text we refer to the calibrated ranges BC/AD with the lab. no. to avoid any possible confusion. Calibrated dates are used because key parts of the Goldcliff sequence are dendrochronologically dated.

Survey method and techniques

Archaeological discovery is governed by marine erosion which picks out more resistant peat surfaces on which many of the sites have been found. The main peat shelf is a narrow

Uncal. yrs BP	Lab no.	Cal. yrs BC	Location	Source
Earliest peat (marking the beginning of the Middle Wentlooge Formation)				
5190 ± 80	SWAN-32	4240-3780	Goldcliff (west)	unpub.
5660 ± 80	CAR- 778	4720-4350	Goldcliff (east)	Smith and Morgan 1989, Fig 5
5680 ± 70	BETA-73058	4720-4350	Magor (lower peat)	Allen and Rippon 1997, Fig 3
5760 ± 70	BETA-63595	4790-4460	Vurlong Reen (main peat)	Walker and James 1993, Table 1
5920 ± 80	CAR-1501	5060-4660	Goldcliff (trench 15)	unpub.
6140 ± 100	OxA-3307	5240-4940	Uskmouth (lower peat)	Aldhouse-Green et al 1993, 20
Surface of raised bog (marking the end of the Middle Wentlooge Formation)				
2430 ± 70	BETA-73059	770-400	Magor	Allen and Rippon 1997, Fig 3
2510 ± 60	BETA-63590	810-470	Vurlong Reen	Walker and James 1993, 68
2580 ± 70	CAR-1438	910-490	Goldcliff (main peat)	Bell 1993, 97
2760 ± 70	SWAN-31	1100-800	Goldcliff (west)	unpub.
3130 ± 70	CAR-644	1540-1210	Goldcliff (east)	Smith and Morgan 1989, Fig 3
3640 ± 60	CAR-1499	2220-1880	Goldcliff (trench 15)	unpub.
Rectangular buildings				
2120 ± 90	GU-2912	390BC-30AD	Goldcliff 1	Bell 1992b, 15
2220 ± 60	CAR-1352	400-160	Goldcliff 2	Bell 1992b, 15
2200 ± 70	CAR-1437	400-100	Goldcliff 3	Bell 1993, Table 2
2140 ± 60	CAR-1435	380-40	Goldcliff 4	Bell 1993, Table 2
2150 ± 70	SWAN- 26	390-40	Goldcliff 6	unpub.
2380 ± 70	SWAN- 27	800-250	Goldcliff 7	unpub.
1930 ± 50	CAR-1503	50BC-220AD	Goldcliff 8	Bell 1995, 126
2930 ± 70	SWAN-225	1390-930	Redwick 4	unpub.
2940 ± 70	SWAN-226	1390-940	Redwick 2	unpub.
3060 ± 70	SWAN-227	1510-1100	Redwick 1	unpub.
2950 ± 70	SWAN-228	1400-990	Redwick 5	unpub.
Trackways				
1990 ± 60	SWAN-106	170BC-130AD	Goldcliff 1330	unpub.
2140 ± 60	CAR-1436	380-40	Goldcliff 1108	Bell 1993, 83
2140 ± 60	SWAN-105	380-40	Goldcliff 1311	unpub.
2200 ± 50	CAR-1504	390-160	Goldcliff 1130	Bell 1995, 129
2260 ± 60	CAR-1349	410-160	Goldcliff 1	Bell 1992b, 19
2290 ± 60	CAR-1350	550-150	Goldcliff 3	Bell 1993, 83
2400 ± 70	CAR- 960	770-390	Magor, Upton Hurdle	Trett and Parry 1986
Roundhouses				
2910 ± 70	CAR-402	1320-920	Chapel Tump I	Whittle 1989, 203
3080 ± 50	BETA-46951	1460-1210	Rumney 3	Allen 1996, 10
Other occupation				
2250 ± 60	BETA-39437	410-160	Rumney 1	Allen 1996, 10
2900 ± 60	CAR-991	1300-920	Cold Harbour	Whittle 1989
Other dates quoted in the text				
3180 ± 70	SWAN-104	1640-1300	Goldcliff (charcoal horizon)	unpub.
3439 ± 19	UB-3472	1780-1680	Caldicot boat	Nayling 1992, 8
3670 ± 60	CAR-1505	2210-1890	Goldcliff (charcoal horizon)	Bell 1995, 136
4900 ± 60	CAR-1500	3820-3610	Goldcliff (trench 15, below skull)	unpub.
6430 ± 80	GU-2759	5440-5280	Goldcliff (Mesolithic charcoal)	Bell 1995, 132

Table 1 Selected radiocarbon dates and calibrations for contexts in the Severn Estuary. Dates more recent than 6000 BP have been calibrated using OxCal v.2.18 based on the calibration curve by Stuiver and Kra 1986. Older dates have been calibrated using Stuiver and Becker 1993. Calibrations are on the basis of one standard deviation.

strip averaging 15–25m wide (Fig. 1 and Plate 1) and extends, almost continuously, over a length of about 25km, except where rivers and former palaeochannels cut through the main shelf. Contemporary mobile mud cover varies from tide to tide, both in extent and thickness, visibility of the peat surface depending on weather conditions. There was a need to develop methodologies appropriate to an area inundated twice daily by the sea in which

the extent of site exposure is constantly changing. Field survey took place over two months in February and March 1996 when increased storminess and higher tidal extremes had cleared much of the surface mud cover. However, much of the newly mapped information is based on the observations of Derek Upton, who has been visiting the area regularly for the last fifteen years, many of his discoveries being made after storm episodes. This highlights the need to visit at times determined by the whims of nature and also the importance of locally knowledgeable fieldworkers.

A logistical problem in intertidal areas is the lack of a base map. Ordnance Survey maps and charts do not provide adequate detail, which hampers exact location of finds and makes it difficult to understand finds within a wider context. Intertidal areas are characterized by a variety of environmental settings: different types of peat, variable stratigraphy and a network of palaeochannels. A fuller understanding of the links between archaeological distribution, peat types and drainage patterns provides a foundation of our attempt to regard discoveries, not in isolation, but within a contemporary environmental context. Recognition of regularities in the context of specific site types may ultimately lead to a predictive model for locating further sites.

Prior to the intertidal survey there was a mapping programme using aerial photographic data. Transcripts of recent colour stereo pairs of air photographs at a scale of 1:5,000 and 1:10,000 were prepared, paying particular attention to the morphology of the peat shelf and location of palaeochannels. These were digitized on AutoCAD producing a preliminary vector-based multi-layered map of the area. It is based on the OS National Grid and allows the generation of ten-figure grid-references automatically. This was followed by systematic fieldwalking of the entire area for the first time. Copies of the maps were taken into the field and further details on morphology of the peat shelves, palaeochannels and stratigraphy were added to complete the mapping programme. The preliminary map contained sufficient detail to enable navigation and accurate location of previously discovered sites. The maps were then updated and geometrically rectified to produce a base map accurate to within 5–10m. The sites and discoveries were mapped together with their stratigraphic and morphological context. Where necessary an EDM survey and conventional planning provided additional accuracy and detail.

In parallel to the development of the base map, a database (dBase V) was set up to integrate datasets such as radiocarbon and dendrochronological dates, key stratigraphic sites, pollen data and the location and description of all archaeological finds. Text modules linked to the entries offer more detailed description. These can be linked to the existing vector map through the implementation of a GIS. The system is designed to evolve as new data become available, which is inevitable given the dynamic nature of the estuary.

Sedimentary sequence

Archaeological research in the Severn Estuary is greatly aided by a long-standing programme of sedimentary research by Professor John Allen and his colleagues which itself has a significant archaeological dimension (e.g. Allen and Rae 1987; Allen 1987, 1990; Allen and Rippon 1997). This established the basic sequence and provides a conceptual framework for survey and site-based research. The Holocene marine clay and peat

complex classified as the Wentlooge Formation overlies bedrock, Quaternary fluvial gravels and head deposits. This has been informally divided into the lower, middle and upper Wentlooge Formations.

At the base there is bedrock, Quaternary fluvial gravels and head deposits, traces of early Holocene soil and then peat development reflecting Holocene sea-level rise. During the early and mid-Holocene deposition of fine-grained alluvium occurred; this constitutes the lower Wentlooge Formation, within which are horizontal laminations with human and animal footprints.

The middle Wentlooge Formation includes regression phases when peat growth occurred separated by transgressive phases of estuarine clay deposition. The number and thickness of the peats varies between two and five; some form distinct shelves or steps in the intertidal area (Plate 1). A thin lower shelf of reed peat, which developed locally into alder carr, is dated at Uskmouth 5240–4940 cal. BC (OxA-3307). No archaeology has yet been identified on this surface. Marine clay deposition was then followed by a thick and widespread peat which formed from c. 4700 cal. BC (Table 1). This peat represents a great bog which extended over much of an area some $32 \times 6+$ km, from Cardiff to the Second Severn Crossing. The bog was dissected at intervals by river palaeochannels which drained the levels in a north–south direction. The generalized sequence comprises: reed peat → alder carr → birch carr → raised bog. This succession was sometimes interrupted, or reversed, by marine flooding and clays. The main concentrations of archaeology we have identified are on the surface of the main middle Wentlooge peat and on a subsequent, more localized peat which contains some of the Goldcliff Iron Age structures.

In noting that most occupation is on these two peat surfaces we should also acknowledge the possibility of occupation at other levels within the peat, which are not at present exhumed, or in earlier peat horizons of which exposures are smaller and less frequent.

Marine clays, the upper Wentlooge Formation, directly seal roundhouses at Rumney and Chapel Tump, the rectangular buildings at Redwick and charcoal scatters at Cold Harbour. They all date to the late Bronze Age and it is inferred from this that some areas were inundated about 1200 cal. BC. Others were inundated between 900 and 400 cal. BC (Table 1). A higher wood peat overlying the main raised bog at Goldcliff was inundated around 300 BC in absolute years, as dendrochronological dates suggest (Hillam pers. comm.). There are earlier dates for the raised bog surface in parts of the Goldcliff site (Table 1), but in some cases (e.g. CAR-1499) there is evidence of erosion prior to burial. This highlights the asynchronous nature of the marine incursion. The upper Wentlooge clays accumulated very rapidly from the late Bronze Age onwards and were drained and reclaimed during the Romano-British period.

Site types in the intertidal area

The earliest finds are Palaeolithic stone tools from fluvioglacial gravels (Green 1989). Laminated sediments of the lower Wentlooge Formation contain very large numbers of animal footprints; human footprints are recorded on two sites, including Uskmouth, where they predate peat of 5240–4940 cal. BC (Aldhouse-Green et al. 1993: 14). A Mesolithic antler mattock is of similar date (Aldhouse-Green and Housley 1993). Two Mesolithic

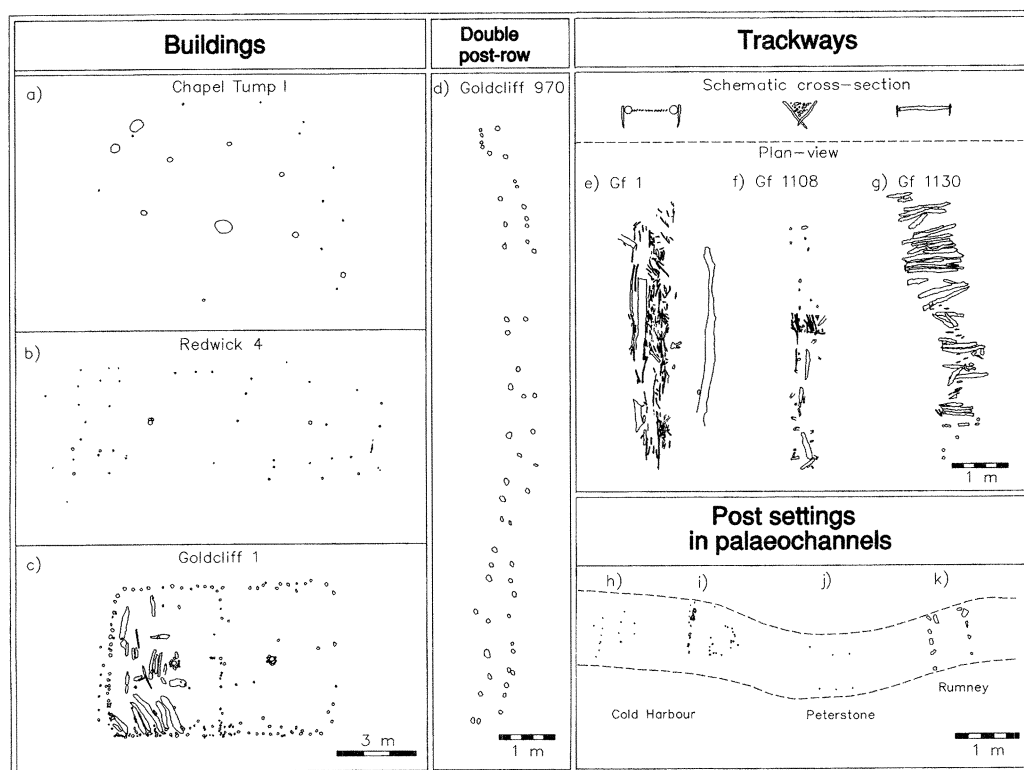


Figure 2 Examples of the main types of prehistoric structures on intertidal sites in the Severn Estuary.

tranchet axes are both unstratified. A lithic scatter at Goldcliff occurs on head deposits below the main estuarine sequence on the flanks of a former bedrock island. Flints, chert and tuff flakes and bone are associated with a charcoal layer dated c. 5440–5280 cal. BC (GU-2759). This covered $800 \times 300\text{m}$ and its scale may suggest Mesolithic clearance (Bell 1995: 135). Artefact nucleation, a hearth and posthole imply *in situ* activity at the edges of the estuary. This site is comparable to the dryland Mesolithic and Neolithic sites recorded in Essex by Wilkinson and Murphy (1995: 71) which were subsequently inundated as a result of Holocene sea-level rise. Sealed in this way they are better preserved than lithic scatters in most dryland contexts.

Three human skulls have been recorded in the estuarine sequence; two old finds from Newport (Locke 1971: 9) are undated, but their depth suggests a Neolithic or earlier date. Another, stratified in peat at Goldcliff, dates between 3820–3610 cal. BC (CAR-1500) and 2200–1880 cal. BC (CAR-1499). These skulls may relate to ritual deposition in estuarine contexts, such practices being well documented in rivers (Bradley and Gordon 1988) and bogs (Turner 1995). The only Neolithic artefact is a polished rhyolite axe (Green 1989: 196), activity in this period being mainly represented by the pollen record (see below). Unstratified Bronze Age finds include an early middle Bronze Age palstave and two middle Bronze Age spearheads (Green 1989: 196). By the middle Bronze Age there is also evidence for *in situ* activity on the peats.

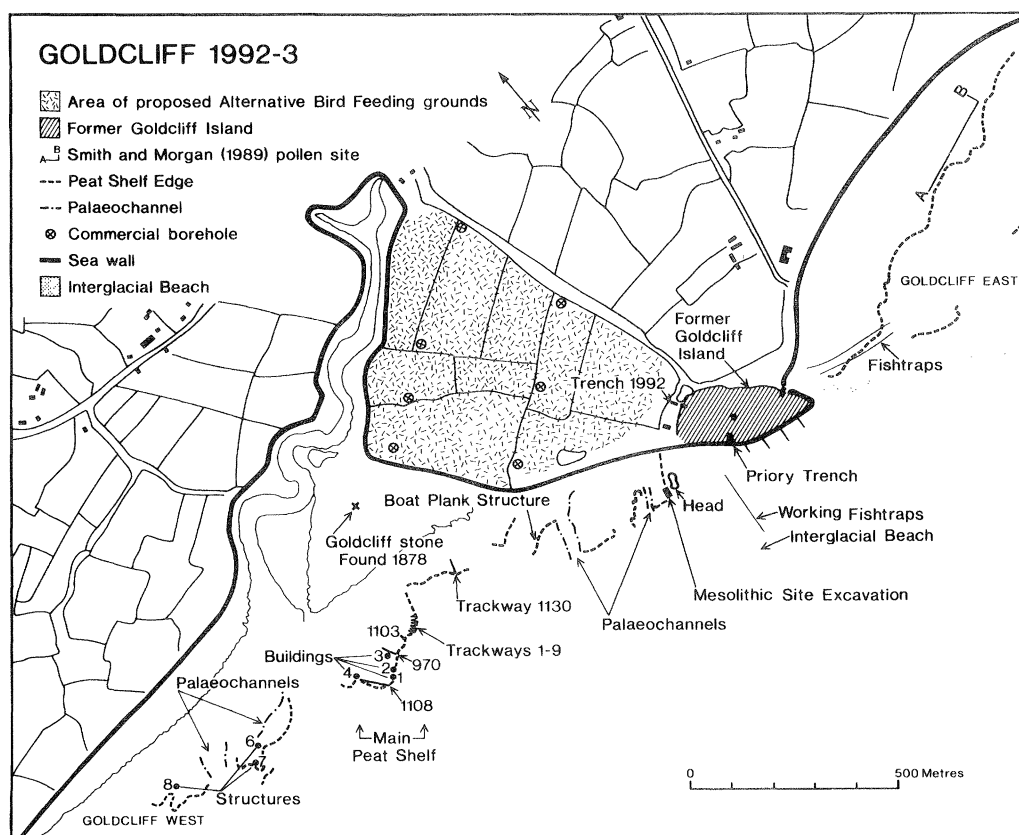


Figure 3 Plan of archaeological sites in the intertidal area at Goldcliff.

Circular post structures occur on the top of the main middle Wentlooge peat at Rumney in the form of a single incomplete circle 5m in diameter, dated 1460–1210 cal. BC (BETA-46951; Allen 1996: 10), and at Chapeltump (Fig. 2a) as a circle of inner roof supports and outer wall line of a structure 10m in diameter dated 1320–920 cal. BC (CAR-402; Whittle 1989: 203). Both structures are associated with fire-cracked flint, bone and pottery of middle Bronze Age, Trevisker type. Roundhouses are the characteristic structure type throughout the British Bronze and Iron Ages, occurring for instance on the estuary edge at Brean Down, Somerset (Bell 1990: 42). Other Bronze Age sites are not represented by such clearly defined structures. These include: Cold Harbour Pill, an irregular grouping of posts with pottery (Whittle 1989: 212); Chapel Tump 2, an artefact scatter; and Rumney, hearths (Allen 1996: 10). All of these sites are on the surface of the main middle Wentlooge peat; however, an artefact scatter, Rumney 1 (410–160 cal. BC, BETA-39437; Allen 1996: 10), is in an overlying organic layer, suggesting that some activity occurred later, roughly contemporary with Goldcliff.

At Goldcliff there are seven rectangular buildings, thirteen trackways and various other post alignments and settings of uncertain function (Fig. 3). This evidence for occupation on the peat shelves has a range of calibrated radiocarbon dates which span the Iron Age, but with a concentration in the early and middle part of that period (Table 1).

Dendrochronological dates for Buildings 1 and 2 and Trackway 1108 suggest construction in the fourth century BC. Building 1 (Fig. 2c) is the most complete structure, 5.6m wide by 8.4m long, with rounded corners, a narrow entrance in the middle of a shorter side and substantial axial posts (Bell 1992a: 13). It was constructed of closely set roundwood verticals, with diagonal wattles woven between. Roundwood flooring remained at one end and, in this corner, there were also internal plank subdivisions creating partitions; these separated areas 0.8m wide which are similar to those interpreted as animal stalls in a mainland European context. Dendrochronology by Jennifer Hillam (pers. comm.) gave a latest date of 392 BC, but sapwood was absent, so the structure was constructed after 382 BC, if ten years are allowed for the minimum amount of missing sapwood. A notable feature is the large number of cattle footprints in the palaeochannels which surround Structures 6 and 8 (Bell 1995: fig. 48).

The Goldcliff trackways are varied in terms of scale and method of construction. There are simple brushwood bundles crossing palaeochannels or intermittently running between buildings. The most frequent form was brushwood with roundwood laterals which were pegged to prevent the trackway spreading sideways (Fig. 2e). One trackway is more substantial, comprising roundwood laid at right angles to the line of the track, corduroy fashion, with occasional pegs to secure individual timbers (Fig. 2g). The final type (1108), comprising opposing diagonal split wood forming a cradle which supports brushwood and some planking (Fig. 2f), is similar to Bronze Age trackways in the Thames Estuary (Meddens 1996: fig. 4). Dendrochronology of this structure, one timber of which had some sapwood, but no bark edge, gives a felling date range between 336 and 318 BC (J. Hillam pers. comm.). It leads to Building 4, suggesting contemporaneity (Fig. 3).

A further distinctive type of structure at Goldcliff is a row of posts 0.3m apart running for 60m (Fig. 2d). Excavation showed that the structure was within the upper few cm of the peat; it is not therefore likely to be a fishtrap. It lacked a clearly defined horizontal surface and seems too narrow for a trackway. Wider parallel rows of pegs at Goldcliff are more likely to be the remains of eroded trackways.

The Redwick site (Plate 1 and Fig. 4) is the closest parallel for Goldcliff which lies 6.3km to its west. Four rectangular buildings have been identified; they are exemplified by Building 4 (Fig. 2b) which was 12.8×3.5 m. Originally it had three large axial posts and walls of small roundwood posts, apparently bow-sided. The Redwick buildings have possible hints of internal sub-divisions, but these are not so clearly defined as at Goldcliff 1. Again there was evidence of cattle hoofprints around some buildings. There are interesting differences between Goldcliff and Redwick. The latter buildings are longer, narrower and less substantially constructed; they are associated with fire-cracked stones and charcoal, both lacking at Goldcliff, which is most unusual among British prehistoric sites. The contrasts may be explained by the fact that Redwick is earlier: its radiocarbon dates are late Bronze Age, between 1510 and 930 cal. BC (Table 1). The two sites show the rectangular tradition lasting perhaps 700 years and overlapping with occupation of the Brean Down settlement, 25km away on the English side of the estuary, a site distinguished by roundhouses and abundant pottery (Bell 1990). The Goldcliff and Redwick structures are unique in British prehistory when most Bronze and Iron Age structures are round, excepting much smaller four- and six-posters. Poorly defined rectangular structures occur on some British sites, as for instance in the Marches (Stanford 1981: 82). More clearly defined,

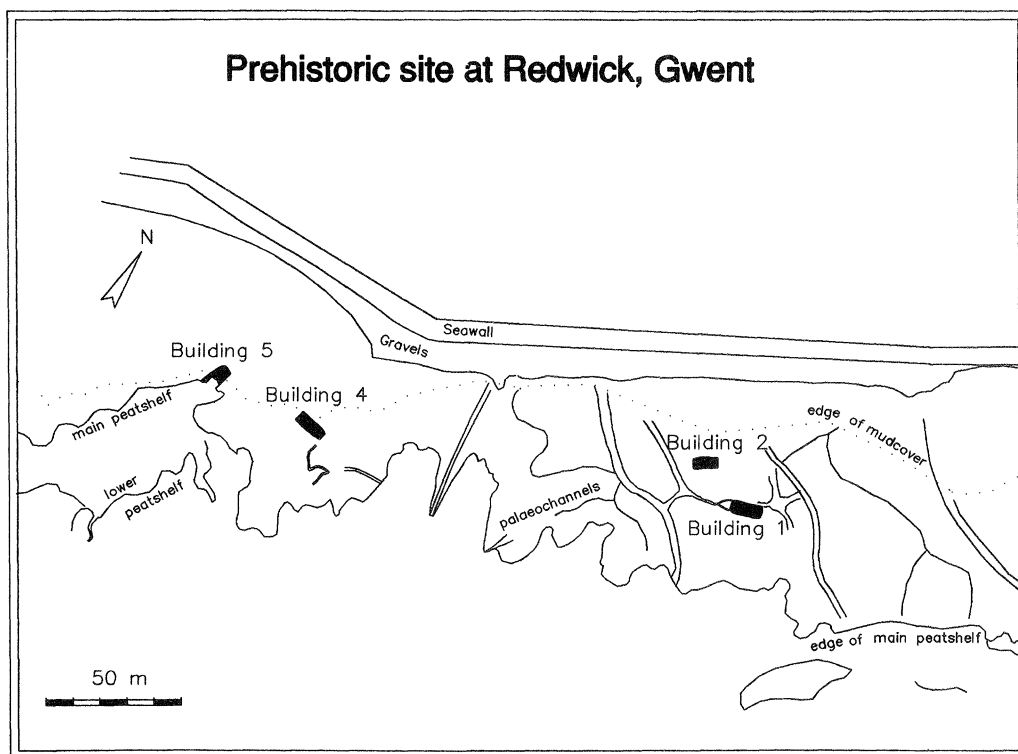


Figure 4 Plan of the Bronze Age settlement at Redwick.

larger structures are present in the early Iron Age at Crickley Hill on the Cotswolds (Dixon 1994: plate C24). Late Iron Age rectangular structures, at Danebury (Cunliffe 1993: 71), South Cadbury (Alcock 1972: 81) and Heathrow (Grimes and Close-Brooks 1993: 312), are all interpreted as specialized ritual structures on sites where most structures were round. None of the rectangular structures recorded from British prehistoric sites are of similar construction, or size, to the estuary examples. Comparable plans can be found among the later prehistoric structures of mainland Europe (e.g. Horn and Born 1977: 43; Andouze and Büchsenschütz 1992: 56; Louwe Kooijmans 1993: fig. 6.10). While we cannot exclude the possibility that these structures manifest a group, or idea, from abroad, there is no support for this from the material culture. It may be more appropriate to think in terms of a specifically wetland tradition, although this would be in sharp contrast to the Iron Age roundhouses on the English side of the Estuary at Glastonbury (Coles and Minnitt 1995: 32). Another possibility is that rectangular structures represent the cultural tradition of a community in south-east Wales.

Palaeochannels, mostly up to 2m wide, occur in many areas on top of the main middle Wentlooge peat. Arrangements of posts occur on several sites in these clay-filled channels. The clay which they contain relates to the marine transgression and, although none of these structures has so far been dated, they probably belong to the first millennium BC. Some channels also contain Bronze and Iron Age pottery and bones of domestic animals. Perhaps the most common arrangement, as seen at Peterstone, is roundwood driven in at

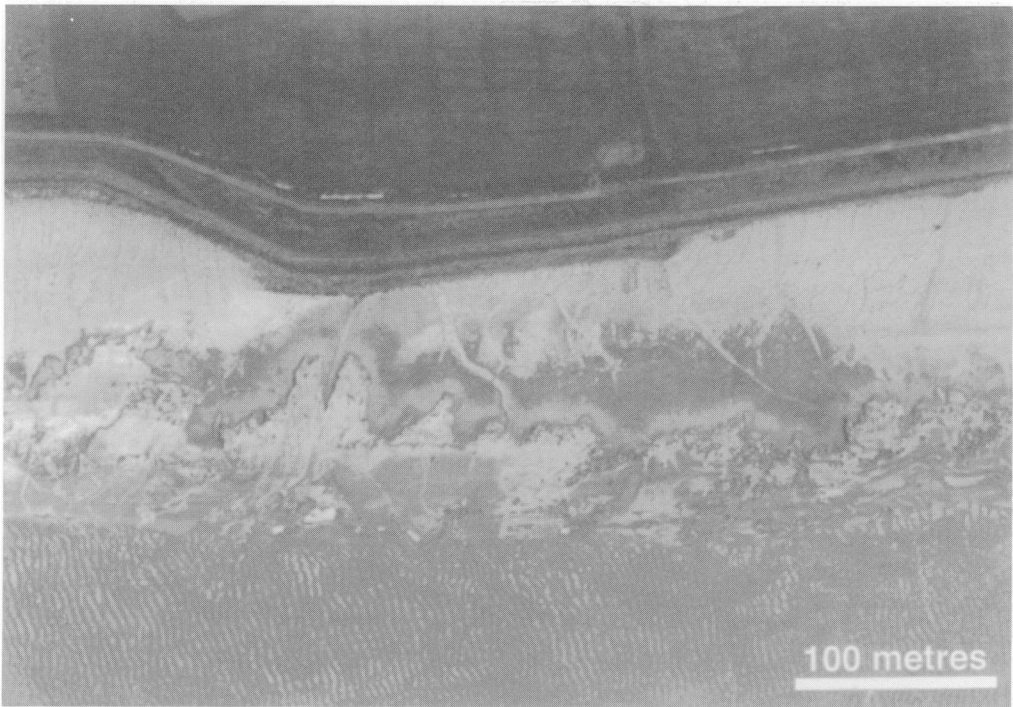


Plate 1 The intertidal peat shelf at Redwick (photo: Aerofilms Ltd 1993, extract of 8/3824).

irregular intervals along the edge of a palaeochannel. In a palaeochannel at Cold Harbour Pill there are posts along the channel axis associated with a roughly circular group of posts round which wattles had been woven (Fig. 2h and i). A different pattern at Rumney Great Wharf is a double line of split oak posts at right angle to the course of a 1.3m-wide palaeochannel (Fig. 2k). Other similar 1×1 m timber structures occur nearby, not specifically related to palaeochannels. A further type at Peterstone consists of four or six thin roundwood pegs along the side of the channel (Fig. 2j). All these structures are of unknown function, although the most likely explanation for most of them is that they relate to fishing activities. Together they highlight the capacity of these wetland contexts to reveal new types of regularly recurring structure.

Late Iron Age pottery from natural channels cutting the main peat shelf at Magor (Whittle 1989: 217; Allen and Rippon 1997), and the upper Wentlooge clays themselves, indicate some continuing activity during the marine transgression. This is also suggested by the Upton hurdle trackway, dated 770–390 cal. BC (CAR-960), crossing a palaeochannel at Magor (Trett and Parry 1986: 6), and by cattle footprints in the upper Wentlooge clay at Goldcliff, as well as locally at Cold Harbour Pill.

Finally, we should highlight the importance of rivers and estuaries as arteries of prehistoric communication and thus as areas particularly attractive for settlement (Sherratt 1996). Two planks re-used as a trackway at Goldcliff are identified from their sewing holes and raised cleats as from a sewn boat; dendrochronology, without sapwood, showed that it dated to after 1017 BC (J. Hillam pers. comm.). In the reclaimed levels a large plank from

another sewn boat in the Caldicot palaeochannel dated to 1780–1680 cal. BC (UB-3472). The potential of the estuary for boat finds is further emphasized by later boats: a Romano-Celtic example from below reclaimed levels at Barland's Farm (Nayling et al. 1994) and an intertidal, medieval example at Magor Pill (Nayling 1996).

Environmental evidence

In the Severn the interweaving of environment and archaeology is represented by the relationship between the archaeology and the main sedimentary changes, already described, and by several pollen sequences (Fig. 1). Three long pollen diagrams between them cover vegetational history between c. 5000 cal. BC and c. 700 cal. BC; two of these are from close to the northern edge of the reclaimed levels at Vurlong Reen and Barland's Farm (Walker et al. forthcoming) and the other is from the intertidal area at Goldcliff (Smith and Morgan 1989), 0.8km from a bedrock former island (Fig. 3). Shorter sequences relating to particular sites, or peat shelves, are from Uskmouth (Aldhouse-Green et al. 1993: 21), Caldicot Pill (Scaife 1995) and Caldicot Castle Lake (Nayling and Caseldine 1997).

Here we shall concentrate on the later prehistoric environmental sequence which relates to archaeology on the middle Wentlooge peat surface. There is evidence of human impact from the Mesolithic at Goldcliff and Vurlong Reen and pollen evidence of agriculture, particularly pastoralism, occurs after the elm decline at all three sites.

All three of the long pollen sequences indicate that the main episode of clearance of woodland surrounding the wetland took place in the early Bronze Age, around 2200 cal. BC (Walker et al. forthcoming). Burning episodes are represented by charcoal bands in sediments on the edge of Goldcliff island at 2210–1890 cal. BC (CAR-1505) and 1640–1300 cal. BC (SWAN-104). Thus, the dry ground fringing the levels constituted a largely cleared cultural landscape by the time of the Bronze Age occupation sites on the top of the middle Wentlooge peat. A range of environmental evidence from the Caldicot palaeochannel shows that the immediate surroundings of that site were open throughout the Bronze Age (Nayling and Caseldine 1997). Areas of woodland and scrub did, however, remain and were used to make the wooden structures at Caldicot and later Goldcliff.

During the Bronze Age the great raised bog of the Gwent Levels began to be inundated by the sea. Dates for the bog surface are given in Table 1. On some sites there is evidence that an erosion or oxidation phase took place before the peats were buried by minerogenic sediments. The chronology of inundation is a complex topic requiring further research, which is important in view of its close association with the main concentration of archaeological evidence. The Bronze Age roundhouses at Chapel Tump and Rumney, and rectangular structures at Redwick, as well as the several artefact scatters which imply occupation elsewhere, occur on the top of the main middle Wentlooge peat at the junction with overlying minerogenic deposits.

At Goldcliff (Fig. 3) the situation is more complex, probably due to a nearby palaeochannel. Peat growth continued into the Iron Age at Goldcliff West, while to the east the bog was inundated during the Bronze Age. Subsequently, a later peat developed, with alder carr in the area of Buildings 1–4 which appear, from the dendrochronological evidence, to have been constructed in the fourth century BC. Between here and the

bedrock island, where conditions remained wetter, there was reedswamp, crossed by a series of trackways.

Pronounced environmental changes in the late Bronze Age and Iron Age are recorded more widely within the region. In Somerset, marine inundation occurred up the Axe river valley as far as Glastonbury, between 1220–900 and 800–470 cal. BC (850 and 550 uncal. BC in Housley 1988: 82). In the Severn and its tributaries there is increased alluviation from the late Bronze Age (Shotton 1978: 31), up to five times modern levels in the lower Severn between 1000–0 cal. BC/AD (Brown 1987: 304). These changes are broadly coeval with major clearance in the Severn catchment. However, in the area of Brown's sites in the lower Severn there is recent evidence that the pattern of sedimentation is sea-level related (Hewlett and Birnie 1996: 59). That argument is supported by the widespread, broadly contemporary, deposition of the upper Wentlooge Formation which inundated the bogs in the estuary. This followed a phase when clay-filled cracks and palaeochannels indicate dessication of the bog surface. The evidence for dessication, together with the geographical scale and magnitude of the inundation, would seem to make it unlikely that there was a direct causal link to anthropogenically related increases in sediment supply in the catchment. A rise in relative sea level or increased storminess are more likely causative factors. Both could have prompted erosion of the bog margins, causing hydrological changes leading to dessication, shrinkage and final submergence. Increased marine influence leading to channel development, and thus drier conditions more suitable for settlement, is attested in Iron Age contexts on the Assendelver Polders in the Netherlands (Louwe Kooijmans 1985).

It would seem, therefore, that the marked environmental changes in the estuary are most likely to be related to the well-documented climatic deterioration which occurred around the beginning of the first millennium BC (Barber and Coope 1987: 210). It remains unresolved whether there is any connection between these changes and greater Iron Age alluviation in the Severn catchment, for which the hypothesis of anthropogenic causation has been favoured. Evaluation of the relative contributions of climatic change and anthropogenic factors would benefit from comparative studies on a range of catchment scales. This might include: (i) local colluvial slope processes (Bell and Boardman 1992), where the effects of individual settlements or storm events may be most readily disentangled; (ii) river valley sediments which, in the Severn catchment, draw on a full palaeohydrological literature (Gregory 1983; Gregory et al. 1987); and (iii) the estuarine environment offering particular opportunities for correlation with extra-regional environmental changes, such as sea level or climate. Dendrochronology is increasingly providing a precise time-scale which facilitates correlation. On a global scale this defines clusters of dates and discontinuities in tree-ring sequences which are of great importance in identifying periods of pronounced environmental change (Baillie 1995: 135), whatever the current controversies regarding their causes.

Conclusions

The evidence points to a concentration of human activity during two distinct episodes when similar marine transgressive scenarios obtained: the middle to late Bronze Age period of roundhouses at Chapel Tump and Rumney and rectangular buildings at

Redwick (Table 1), and the early Iron Age, c. 300–400 BC in absolute years, based on dendrochronological dates (J. Hillam pers. comm.). This would seem to imply that the early stages of marine transgression were particularly conducive to human activity, most obviously cattle grazing, as attested by hoofprints which are very numerous at Goldcliff and also occur at Redwick and on the edges of many of the palaeochannels on the middle Wentlooge peat surface. Several palaeochannels also frequently contain post settings which are likely to relate to fishing. There are indications that activity at Goldcliff may have been seasonal, concentrated perhaps in May to July (Bell forthcoming). Seasonal settlement is well attested in Iron Age wetland contexts subject to flooding, e.g. Meare in the Somerset Levels (Coles 1987: 251) and Farmoor on the Thames floodplain (Lambrick and Robinson 1979:134).

If the Severn Estuary sites were mainly seasonal then we must look for other settlements of these communities, probably in dryland contexts. Archaeology in a palaeochannel at Caldicot probably relates to an adjacent dryland settlement spanning the Bronze Age (Nayling and Caseldine 1997). The later phases of this site are contemporary with the estuary roundhouses and Redwick. In the Iron Age there are five substantial hill forts and a number of smaller enclosures on the inland margin of the levels, some with ancillary pastoral enclosures (Ordnance Survey 1967).

The upper Wentlooge clays inundated more than 840km² mostly between about 1200 cal. BC and 300 cal. BC (Table 1). Although it is now clear that the inundation occurred at different places over as much as 900 years, we can infer that it would have occurred as a series of humanly perceptible stages, relating particularly to storm-surge events. These changes must have impacted to a very significant extent on the lives and activities of communities round the Levels' margins who had made such extensive use of its resources for seasonal grazing, fishing, etc. How did wetland communities react to a changing environmental context? To what extent did they alter their environment as a response to change? Apparently only on a small and local scale: some clearance of fen woodland to construct Goldcliff Buildings 1 to 4, and creation of trackways to create, or sustain, communication across wet areas. There is no clear evidence of drainage. Pronounced palaeochannels around buildings at Goldcliff (Bell 1993: fig. 39) are part of a wider net-like and apparently natural pattern, although some human modification may have occurred. Many palaeochannels on the bog surface show clear evidence of human agency: posts, pegs and brushwood either locally or along the channel axis. However, most of these channels are markedly sinuous and appear to be of natural origin. In the Severn wetlands there is no sign in prehistory of drainage or major human alteration of the environment, as seen, for instance, during the Iron Age at the Assendelver Polder in the Netherlands (Brandt et al. 1987). The most significant environmental impact may have been from the grazing activities of herbivores, the footprints of which were so abundant at the peat/clay interface.

It is instructive to compare the emerging pattern of prehistoric activity from the Severn Estuary with other coastal wetlands. The Severn evidence is comparable to recent discoveries of oval huts, dated 1678–1521 cal. BC (3330 ± 25 BP, GrN-20976), on intertidal peat at Carrigdirty Rock on the Shannon in Ireland (O'Sullivan 1996: 64). Other wetlands show contrasting settlement histories. On the intensively studied Somerset Levels (Coles and Coles 1986), Neolithic and Bronze Age activity is represented by trackways and individual lost or deposited artefacts. Settlement on the wetland itself begins only in the Iron Age

with the establishment of Glastonbury and Meare in the third century BC (Coles 1987: 246; Coles and Minnitt 1995: 178). Paradoxically, where marine influence is greater in the Severn Estuary, settlement on wetland occurs a millennium earlier. This would seem to highlight the attraction of the combination of marine and terrestrial resources which estuaries offer. Yet much must depend on particular local circumstances. In the Essex estuaries occupation is confined to pre-inundation surfaces of Mesolithic and Neolithic date (Wilkinson and Murphy 1995: fig. 135), sites comparable to the lithic scatter at Goldcliff. In Essex, the waterlogged archaeology is not mainly associated with the peats, but with overlying minerogenic deposits, and it consists of specialized activities: tracks, fishing and landing places, but not settlements.

Although later prehistoric activity, particularly settlement, appears to be more abundant in the Severn than in other coastal wetlands, it does appear to have been of a largely opportunistic character. Settlement occurred during phases when particular combinations of environmental conditions obtained, especially when the bog was undergoing the early phases of marine inundation. Such opportunistic activity contrasts with the humanly modified character of the dryland environment by the middle Bronze Age. This must have marked the wetland out as a place where, until the end of the Iron Age, the forces of nature exceeded the social capacity or necessity for greater control.

The succeeding Roman period was very different, large-scale drainage taking place apparently with military involvement from the nearby fort at Caerleon. The much greater scale of social organization and economic demand, which Romanization created, replaced a system of essentially opportunistic prehistoric activity with one in which the dominance of human agency extended over the former wetland.

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Martin Bell
Department of Archaeology
University of Wales, Lampeter

Heike Neumann
Humber Wetlands Survey
Department of Geography
University of Hull

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