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# FLANDRIAN PEAT DEPOSITS AT HURST CASTLE SPIT

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ABSTRACT

The presence of submerged peat-beds at Hurst Castle Spit and at the Pennington Marshes is reported. The organic remains have been examined and suggest a Sub-Boreal age. Therefore, these peat-beds provide additional evidence for the postulated still-stand, or even temporary regression, at this time. The research potential of these and similar deposits in the Solent estuarine system is emphasised.

## INTRODUCTION

This note draws attention to previously unreported submerged peat-beds on the north shore of the West Solent, beneath Hurst Castle Spit and south east of the Pennington Marshes (Fig 1). Although similar peat deposits occur elsewhere in the Solent, the Flandrian history of vegetation and sea level change in the Solent estuarine system is still poorly understood.

Hodson and West (1972) describe extensive Sub-Boreal peat in Southampton Water between −3m and −6m OD. A peat bed of similar age, according to pollen analysis, and at a similar elevation, forms part of the Flandrian deposits of the River Yar at Yarmouth, Isle of Wight (Devoy 1972). West (1980) has suggested that a bed of tree roots and stumps between −6m and OD in Portsmouth Dockyard (Meyer 1871) may correspond to the peat deposits at Fawley, Southampton Water. Submerged forests occur elsewhere in the Solent estuarine system (West 1980), including Pylewell Lane, near Lymington, on the northern shore of the

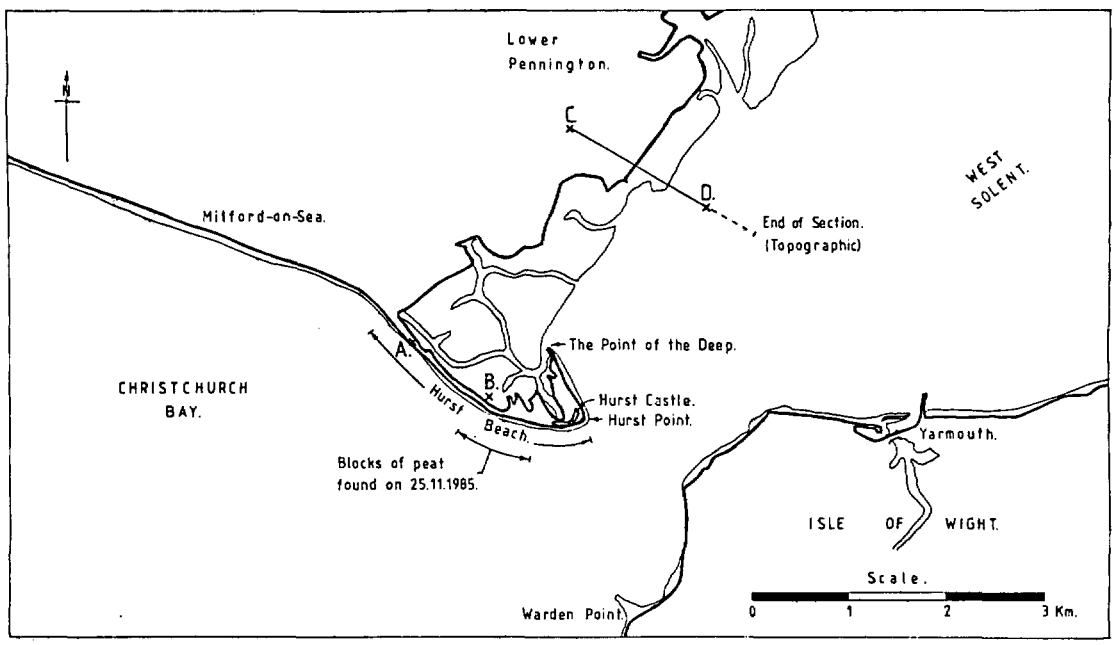


Fig 1. Location Map

West Solent (Shore 1893). In Poole Harbour, Devoy (1982) reports unpublished findings of freshwater deposits at similar elevations.

The Flandrian history of the Solent estuarine system is essentially one of a rising sea-level. However, the peat deposits have been interpreted by West (1980), Devoy (1982) and Barton and Roche (1984) as indicating a still-stand, or even a temporary regression, during Sub-Boreal times (approximately equivalent to the Neolithic and Bronze Age). Relative dating by pollen analysis, tentatively suggests that the peat at Hurst Castle Spit and the Pennington Marshes also represents another occurrence of Sub-Boreal peat deposits within the Solent estuarine system, and its age may be less than 5000 BP (before present).

## THE PEAT AT HURST BEACH

Hurst Beach is a transgressive feature and overlies the Flandrian saltmarsh deposits which occur to the northeast. They are often exposed on the foreshore of Hurst Beach at low tide. At A of Fig 1 (NGR 430150 090570) a borehole revealed the Flandrian sequence to consist of 2.5m of grey silty clay overlying at least 0.6m of sub-angular sandy gravel of Pleistocene age. The sandy gravel is very similar to the widespread, so-called 'Plateau Gravels' of South Hampshire, described by Keen (1980). At B of Fig 1 (NGR 43092 09001) hand-augering revealed a reddish peat at about −4m OD (Fig 2).

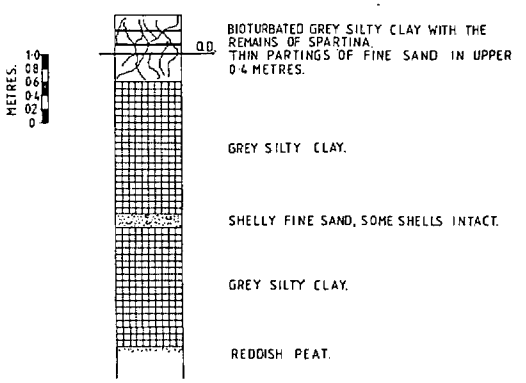


Fig 2. The geological succession at B (see Fig 1). The depths and levels are to within 0.25m accuracy.

This is overlain by about 5m of estuarine deposits, mainly consisting of grey silty clays, similar to those already described at A.

Terraced Pleistocene sandy gravels occur beneath the northern shore of the West Solent at Pennington (Fig 3). These terraces form the northern side of one of the Devensian(?) channels incised beneath mean sea level, described by Dyer (1975) and are analogous to those in Southampton Water (cf Everard 1954a; Hodson & West 1972; Barton & Roche 1984). A similar situation is thought to occur beneath Hurst Beach, so the thickness of the Flandrian deposits is largely controlled by the Pleistocene surface, as in Southampton Water (Hodson & West 1972). Therefore, the stratigraphic evidence strongly suggests that the peat at Hurst Beach is Flandrian, in much the same way as at Fawley (Hodson & West 1972). It is unlikely to be interglacial, as such deposits are rare in the Hampshire Basin. Where they have been preserved, it is within channels cut into the underlying Palaeogene or Pleistocene deposits, e.g. at Earnley, near Bracklesham Bay (West *et al.* 1984), at Selsey (West & Sparks 1960) and at Stone Point (Brown *et al.* 1975). The Stone Point site is significant, as it contains a podzolic soil profile, overlain by highly compressed laminated peat of Ipswichian age which is, in turn, overlain by fluvial gravels (Brown *et al.* 1975). This represents a considerably different stratigraphic sequence to that found at Hurst Beach.

A major storm surge occurred in the English Channel during 23rd November, 1984 (cf Henderson & Webber 1977). Tidal levels reached about 1.6m OD at Hurst Beach (surge 0.6m), allowing major overtopping and overwashing of its crest. Numerous blocks of peat were washed on to a 600m length of the crest near B (Figs 1 & 4). Blocks of estuarine mud are frequently washed on to Hurst Beach, because of its transgressive character and rapid recession (up to 3.5m/yr, measured at mean high water, 1968–1982). However, this is the only occasion when blocks of peat are known to have been deposited on Hurst Beach in the period 1979 to 1984.

At least 12 blocks of peat had long axes exceeding 0.2m. These large blocks all had short axes less than 0.1m perpendicular to bedding.

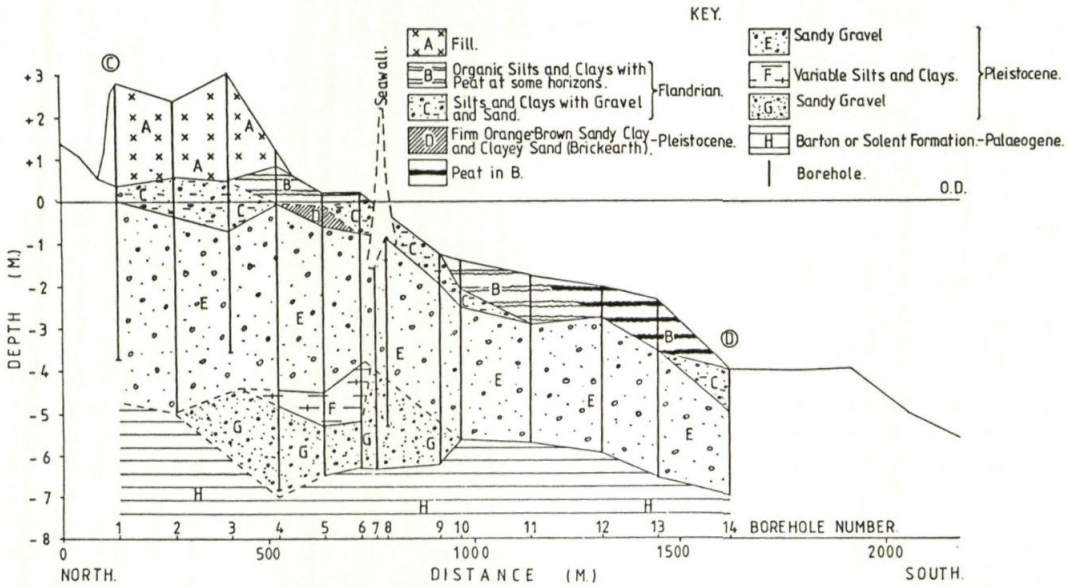


Fig 3. The geological succession along the line CD (see Fig 1). The vertical exaggeration is X100.

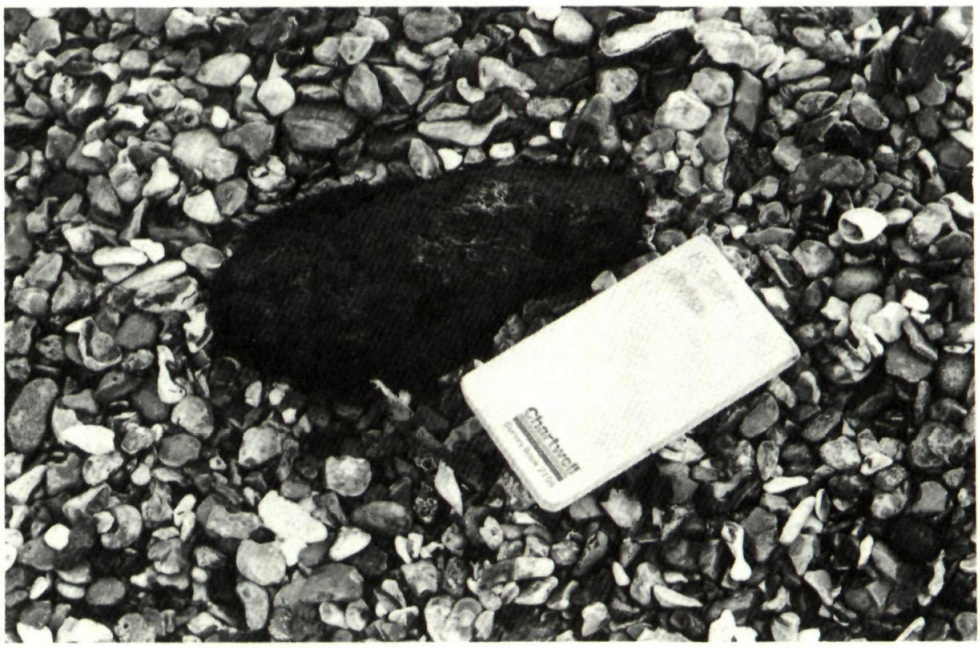

Fig 4. A block of peat on Hurst Beach on 25.11.84 near B (along axis 0.3m).

This suggests a lithological control of the thickness of the blocks, although transverse sphericity sorting during the storm surge may be significant (cf. Bluck 1967).

The blocks of peat had oxidised to a dark grey colour, but a fresh surface showed the distinctive reddish colour of the samples taken from the auger. The blocks of peat must be derived from the same, or a lower, horizon than the in-situ peat at B (Fig 2). Therefore, their age defines a maximum age for the in-situ peat at B.

Samples were collected from the auger and the blocks. An ignition test of two specimens from the blocks using the method of Skempton and Petley (1970), gave organic contents of 66% and 68%, respectively.

## THE ORGANIC REMAINS IN THE PEAT AT HURST

The macrofossil assemblages were analysed for peat samples taken from the auger core and from a large peat block deposited on the beach crest. Vegetative and reproductive remains, in approximately 20cm$^3$ samples, were identified, using gross morphology and cell structure. In addition, the pollen content from the large block was briefly examined.

*Macrofossils from the auger sample (c −4.3m OD)*

| | |
|---|---|
| Vegetative Remains: | 1 leaf of *Sphagnum* section Acutifolia (cf. *S. subnitens*) |
| | Stem fragments of *Molinia caerulea* |
| | Numerous monocotyledon roots, probably of *Molinia* |
| | Wood fragments of *Alnus glutinosa* |
| Reproductive Remains: | Type 16 fungal ascospores (van Geel, 1978) in association with the *Molinia* remains |
| | 1 seed of *Juncus* (undetermined) |

The humified matrix of the peat, preferential preservation of rootlets and the degraded state of the other remains indicates a fluctuating water-table during peat accumulation. As a consequence, the peat composition is strongly influenced by rootlet penetration.

*Macrofossils from the peat block*

| | |
|---|---|
| Vegetative Remains: | 1 degraded leaf of *Sphagnum* (undetermined) |
| | Moderately degraded *Phragmites australis* roots |
| | Wood, including twigs, probably of *Betula* |
| Reproductive Remains: | 9 seeds of *Betula* (undetermined) |
| | 2 sprorangia of *Pteridium aquilinum* |
| Invertebrate Remains: | Numerous carapace fragments of *Cladocera* |

*Pollen and spores from the peat block*

A brief analysis was carried out, which revealed only sparse preservation of pollen grains with some corrosion and insufficient for a meaningful percentage count. The pollen assemblage was composed of *Quercus* (oak), *Alnus* (alder) and *Betula* (birch) with *Osmunda regalis* (royal fern) present. This evidence allows only tentative conclusions to be drawn. Again, humification and rootlet preservation indicate a fluctuating water table during peat development.

## INTERPRETATION OF THE ORGANIC REMAINS

The peat sampled by the auger is presumed, from the stratigraphic evidence, to come from a Flandrian sequence. Ipswichian peat preserved between gravel strata at Stone Point included pollen from *Acer, Carpinus, Picea, Tsuga* and *Carya* (Brown *et al.* 1975). The absence of such interglacial species from the pollen assemblage in the peat block suggests that the block is also Flandrian. Both the auger and peat block samples contain strictly freshwater taxa (e.g. *Sphagnum* and *Cladocera*), and the presence of *Sphagnum, Molinia* and *Alnus* in the auger peat and *Sphagnum, Phragmites* and *Betula* in the peat block both suggest a 'poor-fen with carr' type of environment. The peats are also similar in that they have developed in a fluctuating water regime, and the presence of silt in the samples is indicative of some water movement. The two samples, therefore, must be derived from a sequence of similar peat beds or from different parts of the same deposit.

In the absence of radiocarbon dating, the age

can only be determined by comparing the species represented in the peat with the known chronology of species-immigration into Britain, following the last glacial. Dating by this method is more reliable if the local pattern of species immigration is known. In this respect, the presence of *Alnus glutinosa* is particularly significant. The establishment of *Alnus* in adjacent parts of the New Forest is thought to have occurred from 7000 BP onwards (Seagrief 1960; Barber 1975). The *Quercus – Alnus – Betula* pollen assemblage is similar to the other Solent peat beds and is suggestive of a post-Atlantic date. Furthermore, Godwin (1975) shows that the main expansion of *Pteridium aquilinum* and *Osmunda regalis* took place after 5000 BP. Taking this assemblage together, the peat block and the auger peat are unlikely to be older than Sub-Boreal.

## THE PEAT AT THE PENNINGTON MARSHES

A site investigation at the Pennington Marshes, 3km north of Hurst Beach, by the Southern Water Authority (C to D on Fig 1), revealed up to 1.2m of Flandrian sediment overlying sandy gravels of Pleistocene age (Fig 3). This sequence will be considered in detail elsewhere (Nicholls, in prep.).

Up to 1.2m of Flandrian soft, dark grey silty, clayey peat, with occasional bands of silty grey sand, overlies the edge of the lower terrace (Boreholes 12 & 13, Fig 3). These deposits change laterally into soft, dark grey silt with an organic content, sometimes with sand (Boreholes 10 & 11, Fig 3). The elevation of the peat, between −2.0 and −3.6m OD, suggests that it was formed during the same depositional phase as the peat deposits beneath Hurst Beach. Unlike the peats at Fawley (Hodson & West 1972), and Hurst Beach, it is not overlain by estuarine deposits. There has been net loss in the area of intertidal sediments in the Solent since at least the eighteenth century, with accelerated erosion of about 0.5m between Lymington and Keyhaven since 1970 (Tubbs 1980). Therefore, the peat may only be a remnant of a more extensive deposit.

No samples from the site investigation were available for examination.

## DISCUSSION

Peat is present at similar elevations at Hurst Castle Spit and southeast of the Pennington Marshes. Shore (1893) wrote of 'some black oak and other indications of bog and land growth . . . . . beneath the mud in Pylewell Lake', some 6km north east of Hurst Beach. Peat fragments are often found washed on to the northern shore of the West Solent after storms (Barber, pers. comm.), suggesting that peat is widespread in this area. On the southern shore, the infilled channel of the River Yar contains peats at approximately −10.5, −8.6 and, most significantly, −2.8 to −5.4m OD (Devoy 1972). Analysis of pollen also suggests a Sub-Boreal age for the uppermost peat bed, which consists predominantly of *Alnus* peat and moderately humified *Phragmites* – monocotlyledon peat. At Fawley, a *Betula – Phragmites* fen peat occurs beneath up to 4.5m of estuarine clay (Hodson & West 1972) and has been dated to 3600 BP (Godwin & Switsur 1966).

The formation of coastal peat is often attributed to the protection of barrier beaches (see Heyworth & Kidson 1982). Peat occurs beneath, or behind, shingle beaches at Orfordness (Carr & Baker 1968) on the east coast and at Fairlight (Eddison 1983), Chesil Beach (Carr & Blackley 1973) and Slapton Ley (Morey 1983) on the south coast. However, this possibility can be discounted at Hurst. Firstly, the recent recession rates (1867 – 1968) of 0.5 to 1.5m/yr for Hurst Beach (Nicholls 1985, 95) suggest that its precursor would have been several kilometres to the southeast when the peat was forming. Secondly, the widespread distribution of peat in the Solent area at a similar elevation demonstrates that it was formed as part of a regional, rather than a local, event.

Within the Solent estuarine system, peat development appears to have occurred along seepage lines, as at Fawley (Hodson & West 1972) and within infilled river channels, as at Yarmouth (Devoy 1972) and Southampton Water

(Godwin & Godwin 1940; Hodson & West 1972). These situations are comparable to extant mires in the New Forest and the Isle of Purbeck. The series of Pleistocene terraces in the New Forest (Everard 1954b; Keen 1980) continue beneath the northern shore of the West Solent (Fig 3) and may have been an important topographic and lithological control on peat development. Springs along the Pleistocene-Flandrian contact may have aided peat formation.

The radiocarbon date for the Fawley peat bed (Godwin & Switsur 1966) places it within the Sub-Boreal period. Pollen analyses for the age of other peat beds also indicate a major phase of peat accumulation some time during the Sub-Boreal, although this relative dating was not determined in relation to a local framework of vegetation history. Hodson and West (1972) consider the subsequent transgression at Fawley to have occurred during the Romano-British period on the basis of artifacts and faunal remains. The peat bed in Southampton Water at King George V Graving Dock (Western Docks) originates in zone IV (*c* 10,000 BP) at −6.15m OD (Godwin & Godwin 1940) but continues into the Atlantic and possibly later, before a marine transgression at −1.8m OD. The subfossil assemblages at Hurst Castle Spit indicate a probable Sub-Boreal age for the peat bed. Therefore, the latter provides further evidence for a regional still-stand, or temporary regression, in the Solent during this period.

It is clear that the submerged peat beds within the Solent, and adjacent areas, are of considerable value to future work on sea level and vegetation change in Southern Hampshire and Dorset. However, for the full potential of these deposits to be realised, a number of difficulties in sampling such sediments will have to be overcome and radiocarbon dates obtained. The authors hope that this paper may stimulate more interest in this important area.

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