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HENGISTBURY HEAD: THE VEGETATIONAL HISTORY.

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We are fortunate that Central Southern England now has a substantial corpus of data on Late-Devensian and Flandrian vegetational and environmental changes . This is due largely to the earlier pollen works of Seagrief at Wareham , Dorset and Nursling, Hants. (Seagrief 1959) and Cranes Moor, Hants. (Seagrief 1960). More recent analyses are those of Haskins (1978) in the Poole Harbour and Wareham region; Scaife (1980) in the Isle of Wight and Waton (1981, 1982) across the southern counties. From these studies it is possible to obtain a good insight into the likely environment of Hengistbury Head during the Late Devensian (zones I, II and III ; Upper Palaeolithic) and for the Flandrian I (Pre-boreal and Boreal early Mesolithic), Flandrian II (Atlantic later Mesolithic) and Flandrian III (Sub-boreal and Sub- Atlantic later prehistoric periods). Site specific data for Hengistbury Head here relys upon the earlier work of Campbell (1977) and two new pollen analyses of the peats in the Eastern Depression (SZ175905) and a palaeosol /buried old land surface underlying a field bank and ditch boundary on the west side of, and adjacent to the Eastern Depression. In order to provide an environmental background to Hengistbury Head a chronological discussion is given here which attempts to embrace the available data noted above and which provides an outline of the vegetation and environment relevent to the archaeology discussed.

I) THE UPPER PALAEOLITHIC: LATE-DEVENSIAN

This period spans 12,000-8,300BC embracing the upper Palaeolithic vegetation and is therefore contemporaneous with the Mace-Campbell site. Organic, waterlogged sediments suitable for pollen analysis spanning this period are rare in southern England. Tentative evidence for the Zone II Allerød interstadial (10,000-8,200BC) has been obtained from Morden 'A' in Poole Harbour (Haskins 1978) and from Gatcombe Withy Bed and Munsley Bog, Isle of Wight (Scaife 1980, 1982). These data are comparable with other areas of Britain in showing the presence of Betula scrub woodland of the often described 'Park Tundra' character' with a strongly herbaceous ground flora component. This undoubtedly relates to the climatic amelioration of the Allerød interstadial and the pioneer responses of Betula colonising bare open ground rich in nutrients/bases. Campbell's (1977) analysis of the minerogenic sediments of the Upper Palaeolithic site has not here been replicated. Although the published diagrams of Campbell contain details of only tree and shrub taxa, there is indication of such an open heliophilous herb vegetation throughout the Late Devensian with a marked response of Betula to temperature amelioration in Zone II and which is commensurate with the findings of Seagrief (1959), Seagrief and Godwin (1960); Haskins (1978) and Scaife (1980, 1982). At Hengistbury Head the Older Dryas (Zone III) which contains the upper Palaeolithic habitation site dated at 12,500+-1150bp (Barton and Huxtable 1984) in Campbells work shows evidence of typical late-glacial cold flora contain.g Helianthemum (of the few herbs which are recorded). The identification of Betula cf. nana and

Juniperus by Campbell must remain tentative since these minerogenic deposits are not suited to the detailed identification of these taxa.

More detailed analyses of sedimentary deposits spanning this period have ben carried out within the region and from which a clearer understanding of the herbaceous flora has been forthcoming. Seagrief (1959) Seagrief and Godwin (1960), Haskins (1978) and Scaife (1980) have shown that Betula woodland was growing in this region from the Allerød onwards. From analyses of two sites in the Isle of Wight (Scaife 1980,1982) it has been shown that a rich and varied heliophilous herbaceous component was present. This has characteristic phytogeographical and floral diversity and for which it has been suggested that the environment was during the Younger Dryas, one of largely open character. It has been argued from the presence of such herbs in the works of Seagrief and Haskins that a similar environment pertained for Hampshire and Dorset (Scaife 1980, 1982). The relatively greater percentages of both Pinus and Betula in these areas may in part be a function of these earlier pollen diagrams being calculated as a percentage of arboreal pollen rather than as a percentage of total land pollen which is a more appropriate representation of the contemporaneous flora (Scaife 1982). It may be argued therefore that the Allerød shows the presence of open Betula woodland (identified by Seagrief as B. pendula from macroscopic fossil remains). Pinus seems unlikely to have been present at any site during the late Devensian although the small percentages found are enigmatic since they may have derived from sporadioc local growth or as seems more likely because of its pollen dispersion characteristics, from long distance extra-local origins.

In contrast to this sparsely wooded environment is the markedly diverse herbaceous flora evidenced in the pollen record from all sites. This reflects the variety of microclimatic, edaphic and geological conditions present and which in turn created high levels of inter-species and community competition. In spite of certain problems which exist in the interpretation of plant communities from the pollen evidence (Moore 1980), it is possible to recognise a number of plant community types which were present during the Upper Dryas (Zone III) (Scaife 1980,1982). These have been based on contemporary analogues and include the following. Shrub communities; composed of *Juniperus*, ericoid taxa, *Betula nana* and *Hippophae rhamnoides*. Short turf communities; of similar character to that found in Upper Teesdale and mature chalk pasture today. *Helianthemum* and *Dryas octopetala* are characteristic indicators. Tall herb communities; in moister areas, these are evidenced by the characteristic taxa *Thalictrum*, *Sanguisorba officinalis*, *Filipendula*, *Polygonum bistorta* type (including *P. viviparum*), *Polemonium caeruleum*, *Valeriana* , *Scabiosa*, *Succisa*, and *Trollius europaeus*. Disturbed soils; intense periglacial activity and resulting soil instability is reflected by the presence of *Chenopodium* type (including *Atriplex*), *Polygonum convolvulus*, *Plantago major* and *Artemisia* species. Moister situations; wetter topographical situations of valley fen and mire supported sedge and *Sphagnum* communities and more eutrophic conditions of spring flushes contained floristically rich reed swamps.

From this evidence of openness of the environment during the Upper Dryas it can be suggested that this period was harsher climatically than previously postulated since there is strong evidence of reversion from Betula woodland in Zone II to open heliophilous herbaceous vegetation in Zone III. This view is now commensurate whith that of coleopteran workers who have shown that rapidly changing climate with declining temperatures in Zone III annihilated earlier more thermophilous Zone II elements of the fauna (Osborne 1971,1972,1974). Archaeologically this is interesting because the upper Palaeolithic site of Hengistbury Head spans the earlier period of Zone I and II (older Dryas and Allerød) and the absence of artifactual material from Zone III may be a response to these harsher environmental conditions.

THE EARLY MESOLITHIC; FLANDRIAN Ia-Ic.

Rapidly rising temperatures at 10,000 bp initiated the successional rise to dominance of the Flandrian forest. This period from 10,000 bp to 7,500 bp within which Hengistbury Head Mesolithic average date falls early (9750+-950 bp; Barton and Huxtable 1984) is one of dynamic vegetation throughout Europe. Early pollen work postulated that progressiveley rising temperature in the early post-Devensian period saw the development of woodland elements in response . Here again the coleopteran evidence shows that temperatures rose more rapidly to high mean annual temperatures shortly after 10,000 bp (Osborne 1974). Distinct vegetation changes evidenced from central southern England (Seagrief 1959; Seagrief and Godwin 1960; Haskins 1978; Campbell 1977; Scaife 1980,1982; Kerney et al. 1980) therefore reflects a complex response of plant communities to changing environmental cnditions and especially to competition and dispersal factors and maturation of soils. Synonymous with this domination of arboreal elements is the diminution of those herbaceous plant communities referred to above.

The commencement of Flandrian temperature amelioration is marked in the first instance by the expansion of Juniperus representing a transitional period of dynamic vegetation between the open vegetation of the late Devensian and the first appearance of true pioneer Betula woodland. Campbell's Hengistbury pollen diagram does not, however, illustrate this for the Zone III/FIa transition with only an increasing dominance during the earlier Zone I/Zone II amelioration. Juniperus has always been a problematic pollen type from both its recognition and preservation points of view and its absence at the Zone III/FIa interface at Hengistbury is probably due to these factors in the unsuitable minerogenic deposits. This early pioneer has however been evidenced from the Isle of Wight(Scaife 1980, 1982); Poole Harbour (Haskins 1978) and Surrey (Carpenter and Woodcock 1981) and from which it can be shown that mean July temperatures of greater than 12 degrees Celsius had been reached by 9,970 +- 50 bp (SRR-1433: Scaife 1980,1982). Subsequent to the Juniperus expansion and ultimately ousting it, Betula rapidly became the dominant woodland element in the pre-Boreal (FIa; Godwin's pollen zone IV). This is illustrated from Campbell's work on the Head and is undoubtedly a widespread regional phenomenon. Pinus pollen values also increase in the immediate post-Juniperus phase showing the real growth (as opposed to extra-regional long distance transportation) in the region. The Mesolithic archaeological site is apparently dated to 9750 +- 950 years by thermoluminescence (Barton and Huxtable 1984) and this falls within this early phase of Betula dominance. By FIb (Godwin's pollen zone V), Pinus had become widespread and the most outstanding feature of the early Boreal (Haskins 1978; Scaife 1980 p213) in most areas, ousting the preceding Betula woodland. However, Haskins (1978) has shown, some local continuation in its growth in the region. The massive spread of Corylus throughout Britain has been widely recognised and its association with Pinus, gave the often described Boreal pine-hazel forest of the Mesolithic. From numerous C14 dates now available, a markedly non-synchronous expansion of Corylus across Britain is indicated (Smith and Pilcher 1973). This is thought to be due to differing refugia providing sources for its migration. In the Hampshire Basin a relatively early date for its growth is apparent, after which it maintained its importance initially with Betula and Pinus and subsequently (FIc; Godwin's pollen zone VI) with Quercus and Ulmus. Interestingly, while high values of Corylus are illustrated in many pollen data already cited, Campbell's composite diagram fails to show any indication of such a maximum during the Boreal. Mesolithic conotations regarding hazel are widely known (Smith 1970; Jacobi 1978) and it can be noted that this is the period corresponding with Mesolithic occupation of the headland. Whilst in the past, arguments have centred on the effect of Mesolithic anthropogenic activity promoting Corylus growth, it might be postulated that its absence here may be due to Mesolithic forest clearance and occupation. Those relatively low percentages recorded by Campbell would therefore have derived from areas of regional dominance illustrated in other pollen data.

A further significant vegetation and therefore environmental change occurred in the early and middle Boreal with the arrival of Ulmus and

Quercus which largely ousted the Pinus forest of the early Boreal. The expansion of these taxa even over the small area of southern England now seems to be asynchronous with the rational limits of either taxa starting at different periods represented in a number of pollen sequences (Scaife 1982). Although as yet not accurately dated, the arrival and establishment of broad-leaved woodland may be placed at around the middle Boreal period (and was in fact used by Godwin to delimit his zone V/VI transition) at c. 8,500 bp. The archaeological implications of this change in environment have been discussed in terms of a change in artifact typology to small blade industries. During the late Boreal (FIc; Godwin pollen zone VI)'s there was regional variation in the relative dominance of Quercus and Ulmus. Godwin had used such variation to delimit his pollen zone VIa and VIb. Realistically, with more pollen data available for Southern Britain, it seems more plausible to postulate local edaphic circumstances as playing a greater role in determining the nature of the dominant. Although reaching substantial importance, Quercus and Ulmus apparently failed to remove Pinus totally and the latter's presence is noted during the later Boreal at Gatcombe Withy Bed and Munsley Bog, Isle of Wight, where it was only ousted at the onset of the Atlantic period (Flandrian II; pollen zone VIIa). This again may serve as an important aspect of environment consideration in the economy of the Mesolithic by providing diversity of habitats . Timber resources from these coniferous and mixed deciduous forests coupled with wetland valley areas and presumed low lying marshy areas of the Solent and English Channel, and the later establishment of the sea coastline in the late Boreal/Atlantic means therefore that the environment in general was more diverse then than at any period until the late prehistoric.

THE LATE-MESOLITHIC; ATLANTIC PERIOD

There are now a number of pollen sites in Dorset, Hants. and the Isle of Wight which span the Atlantic (Flandrian II ; Godwin's pollen zone VIIa) c7,500 to c5,000bp. Evidence from these suggests that the period was the culmination of the early Flandrian succession described above and which resulted in the full establishment of deciduous forest dominated by all the major tree types and which included a number of thermpohiles. The Atlantic has, in many earlier palaeoecological accounts and in recent archaeological literature been described as a period of climatic optimum having mixed deciduous forest (QUERCETUM MIXTUM). From the pollen of thermopohiles present and evidence throughout North West Europe, such a climatic interpretation seems correct. The idea of mixed deciduous (monoclimax) forest seems however less plausible and that of a polyclimax vegetation (Godwin 1975) is more likely. Scaife (1980) has discussed this in relation to the Atlantic vegetation of the Isle of Wight and southern England suggesting thatthe arboreal dominants were controlled to a larger extent by local edaphic, lithologic, hydrological and topographical factors. _Quercus_ and _Ulmus_ woodland may have only been of substantial importance in valley clay soil situations. Other arboreal elements also of a thermopohilous character such as _Tilia_ and _Fraxinus_ were apparently dominant over large areas of the chalklands and areas now supporting heathlands on sandy/podzolic substrates (Scaife 1980,in press; Scaife and Macphail 1984.

THE EASTERN DEPRESSION: PALYNOLOGICAL RESULTS

This forms an area of 1 hectare on the south side of the Headland which contains a maximum depth of 70cm Of dark black highly humified and structureless peat. The deposit occupies a longitudinal depression narrowing to the south where it is exposed in the cliff edge section. The cliff exposure of these peats has been progressively reduced during the period 1979-1985 by coastal erosion with the result that the peats of some depth occupying a narrower channel have since disappeared. Similar sections are found on the south west coast of the Isle of Wight where their fossiliferous character has long been recognised (Clifford 1936; Osborne-White 1921)and their possible Atlantic age given (Clifford 1936; Scaife 1980 and unpublished data). Placed in this context, it thought likely that the Eastern Depression forms the head-section of a similar and possibly related valley/topogenous mire occupying a former tributary of the Solent River system, as is the case for the Isle of Wight (Everard 1954 ; Wooldridge and Linton 1933). This has now largely disapeared leaving only the upper catchment basin like depression.

The depression now contains a relatively dry heathland flora although some Erica tetralix, Molinia and Juncus spp. remain from what must have been a damper, wet heath community. This fact is evidenced in the fossil pollen record which includes a number of taxa of damp ground and mire. This record includes that of Radiola linoides a rare but characteristic plant of wet sandy heaths and pond margins (see appendix III). It is thought that truncation and reduction of the valley soligenous mire on the south side by coastal erosion may have been responsible for this subsequent dehydration.

The now destroyed cliff section was initially sampled for pollen analysis in 1979 by S. College (Birmingham Univ.) and in 1980 by Scaife (unpublished data). Preliminary pollen analyses showed that the peats were rich in pollen being dominated by arboreal taxa. College (see appendix III) also sampled the podzolic soil horizons and looked at 8 samples from the Hh and Ea horizons. These showed variable pollen preservation but as might be expected ericaceous and Gramineae pollen was present in the uppermost horizons. In the basal levels some tree pollen was present but in low frequencies. Those taxa recorded included *Quercus*, *Ulmus*, *Tilia* nad *Corylus* type and *Ulmus*. These preliminary data are in accord with those found in the analysis of the sub-bank old land surface presented in this paper. College has also noted quantities of *Pinus* in the uppermost sample and this is likely to have derived from *Pinus* plantations during the last two centuries. This is a phenomenon seen in the uppermost most recent levels of a number of pollen diagrams from southern sites where it is often a useful indication of a modern date and also whether stratigraphical truncation of sediments has occurred.

During the excavation season of 1983, trial trenches were dug throughout the area of the Eastern Depression (see section . .). One of these trenches was selected for pollen analysis and a sequence of samples at 2cm intervals was obtained. Samples were prepared using standard techniques for the extraction of the sub-fossil pollen and spores (see appendix I). The results of the analysis are presented in diagram form (figures 1-3) with pollen calculated as a percentage of the total pollen sum. Spores are as a percentage of total pollen plus spores. A number of changes in the stratigraphical pollen record are evident and have been designated as local pollen assemblage zones (HH1-3). These are given from the base at 124cm upwards to the contemporary land surface. These changes are described and discussed below:

HENGISTBURY HEAD: EASTERN DEPRESSION

HH:1 70-62.5cm Characterised by higher values of the pollen of Ulmus, Tilia, Fraxinus and Gramineae and spores of Dryopteris type, Pteridium aquilinum and Polypodium. The zone is dominated by high values of Quercus, Alnus, Betula and Corylus type. Also noted are small quantities of Erica, Calluna, Filipendula and a peak in Rumex.

It is apparent that the environment was locally dominated by Quercus and Alnus and it is likely that the latter was growing in the wetter areas of the depression. Low Cyperaceae percentages and the presence of Alnus suggest that the site accumulated in a carr woodland environment with fringing woodlands comprising Quercus and Corylus. Other arboreal elements were probably only local to the site in small numbers, or as is likely, the pollen may represent a wider more extensive growth. High percentages of spores may be due to differential preservation in the basal mineral sediments but their good preservation as with the pollen would suggest that these were an important element of the vegetation at this time. Dating of these basal sediments is problematic (see below, since the peats, being highly humified, compacted and penetrated by rootlets, precluded reasonable sampling for C14 assay. In view of the changes seen, two possibilities exist. Firstly that this zone represents the period prior to the broadly synchronous and widely recognised Ulmus decline at c5,000bp and secondly, prior to that of the *Tilia* decline (recognised as being an asynchronous phenomena) variously dated from the late Neolithic to the late Bronze Age (see discussion section).

HH:2 (62.5-34.5cm) is delimited at its base by declining values of *Ulmus*, *Tilia* (seen more clearly if pollen percentages are calculated as a percentage of AP and not total pollen as given in Figure 1), Gramineae and spores and by increasing importance of Betula and Ilex. Two pollen assemblage sub zones have also been rcognised HH:2a (62.5-42.5cm)and HH2b (62.5-34.5cm) the latter by increasing *Quercus*, *Ulmus*, Gramineae and *Pteridium* percentages. *Plantago lanceolata* becomes constantly present. *Betula*, *Quercus*, *Alnus* and *Corylus* remain the dominant pollen taxa.

The vegetation throughout this zone remained dominantly *Betula*, *Quercus*, *Corylus* as in the preceding zone. Again few herbs are present with the exception of Gramineae which increase in the top of HH2a and throughout HH:2b. Cereal type pollen becomes consistent throughout the zone and it is possible that this zone represents a period of increased anthropogenic activity on the headland. It is within the zone HH:2b that the pollen analysis of the sub-bank old land surface (see below) may be correlated and the zone here broadly represents the Bronze Age environment of the headland.

HH:3 (34.5-0 cm). This zone is delimited by the massive increase of heathland taxa including *Erica*, *Calluna* and *Empetrum*. *Potentilla* type, *Rumex*, *Plantago* spp. Gramineae and *Pteridium* may also be related to the heathland ecosystem although their pollen morphology does not allow their separation to more ecologically diagnostic taxa. Pollen of *Radiola linoides* is also of special note here (see Appendix II). Total arboreal pollen declines sharply, although increases in *Pinus*, *Ulmus* (32-27cm), *Corylus*, *Fagus* and *Salix* are evident. Herbaceous diversity also increases sharply.

This zone represents a major ecological and environmental shift from conditions of deciduous woodland to its current status of open heathland. The heathland/ericaceous taxa noted above have low pollen production and/or dispersal characteristics and these attest their autochthoneity. The preceding zone HH:2 has indications of progressively increasing anthropogenic activity with the rise in herbs and some indication of woodland canopy opening with *Ilex*. No truncation of the peat profile was noted and the continuous /smooth pollen 'curves' for a number of taxa further confirms that this ecological change was contiguous with the underlying woodland environment. It seems therefore, that widespread clearance of this forest was carried out. This , however, post-dates the youngest levels of the soil pollen profile dated at 3,350+-90bp for the humic horizon (see discussion of Scaife <> Macphail). The initial levels of HH:3 show a peak of *Pteridium* which was perhaps a response to this clearance by fire or to soil deterioration consequent upon soil leaching. It is also noted that this is accompanied by relatively higher frequencies of cereal pollen and weeds of disturbed ground.

HENGISTBURY HEAD II: BANK OLD LAND SURFACE.

Pollen analysis was carried out through the old land surface from 30cm to 59cm. Samples below 59cm, extending into the b-Bhs and b-Bsg horizons, were also processed. Absolute pollen frequency (APF) calculations were made using the additioh of known quantities of exotic pollen and normal techniques were used for th removal of organic and inorganic detritus (see Appendix II). Pollen was only, however, found to be present in sufficient quantities from the middle of the b-Ea at 57-59cm upwards. This is thought to be due to the effects of repeated groundwater fluctuations occurring in the lower soil horizons (Macphail pers. comm.)

In the buried ground surface three broad horizons are recognised and whichcorrelate with the primary pedalogical divisions recognised (Macphail this volume) and the spectrum represented by the overlying bank soils.

I) b-H: 42-44cm. The uppermost humic horizon has been radiocarbon dated at 3,350+-90bp (HAR-6186; see Macphail <> Scaife). These levels produced remarkably high absolute pollen frequencies (up to 22 million grains per gram) with preparations resulting in pure pollen of well preserved character. This is undoubtedly due to the acid character of the raw humus horizons which have at other sites analysed by Dimbleby have roduced high absolute pollen frequencies. Because this horizon has not apparently been truncated it can be postulated that these levels are representative of the vegetation of the site at the time of construction of the bank. This spectrum is one of vegetation dominated by woodland elements which include-Betula, Quercus, Alnus and Corylus with few herbs represented. Ilex is present becoming more important (2% but note that this taxon is usually grossly underrepresented in pollen spectra due to its entomophilous character and small pollen production) and its significance is discussed below.

II) b-Ah 44-53cm The five levels of this zone similarly show high values of arboreal taxa (Betula, Quercus, Alnus and Corylus type with some Ulmus and sporadic occurrences of Tilia). This and the overlying humus (b-H) have the highest representation of Quercus (up to 65% AP). Shrubs are also represented with Ilex and Sorbus type (including Crataegus). Total quantities of herbs are low in frequency and diversity. Gramineae is present in higher values than the b-H although still of relatively lower values than the b-H although still of relatively low values (to 7% TP+Spores) and less than the preceding zone (10%). Cereal type pollen is present being defined here as Gramineae size >50u with large pore and annuli and relatively coarse columellate structure.

It is clear therefore that the vegetation of these upper soil horizons reflects a woodland ecosystem growing unusually on acid podzolic soils. Such a phenomenon has been previously discussed by Dimbleby (Dimbleby and Gill 1955) and is further discussed here (Macphail <> Scaife).

III) b-Ea: 53-59cm This is the basal zone of the soil pollen sequence. Vegetation of this zone as in subsequent soil horizons with dominant arboreal and shrub pollen comprised *Quercus*, *Betula*, *Alnus* and *Corylus*. Herbaceous pollen are few with *Filipendula* and Gramineae the only significant occurrences but at relatively low frequencies (10% and 2% TP respectively). Values of spores of *Dryopteris* type and *Pteridium* are high (40%TP). The existence of high frequencies of spores in the basal levels of soil profiles has often been noted in such pollen studies and as shown by analyses of the absolute pollen frequencies is often due to the effects of differential preservation in their favour. However, the high values of *Pteridium* (*P. aquilinum*) although difficult to interpret for this reason, may here represent the initiation of soil acidity which allowed the preservation of subsequently deposited pollen. This is important and is likely the first indication of soil to be deterioration (see Macphail<> Scaife). This may be due to the first effects of prehistoric anthropogenic activity or to the natural processes of soil deterioration on sandy soils through build up of raw humus and contained polyphenols.

IV) THE BANK STRUCTURE Pollen analysis was also carried out on the lower 12cm of the bank, which has a substantial humic content. As with the in-situ sequence, the pollen spectra is dominated by arboreal taxa. The only exceptional characteristic of the bank profile is the marked increase in *Ilex*. Because it is often underrepresented in the pollen spectra it can be implied thst it was an important constituent of the local flora in the area from which the soils were obtained in construction of the bank. It can be noted that the uppermost level of the in-situ 'H' horizon has a similar value of *Ilex*. This level was undoubtedly the top of the land surface and it is possible therefore that soils used in the bank were 'scraped'from surrounding areas. The *Ilex* present in the 'H' horizon may be further interpreted as due to the opening of the forest/woodland canopy in the period immediately prior to construction of the bank. *Ilex* today forms an important understorey shrub to Quercus and Fagus woodland in the New Forest and Parkhurst Forest, Isle of Wight. In situations of dense wood canopy and low light input flowering is sparse but may increase markedly with canopy opening. This may have been the case in the Hengistbury forest caused by increased anthropogenic activity.

Minor variation in the relative importance of the tree and shrub pollen spectrum occurs. *Corylus* type (22 %) and *Alnus* (15-30%) have slightly higher values than the preceding/in-situ soil levels. *Betula* (15-25%) and *Quercus* (20-30%) have lower frequencies. From this it can be suggested that the soils were obtained from areas of locally greater dominance of these taxa and thus illustrating some local variability in the structure of the woodland. Macphail (1984) has suggested that the bank was constructed from turves taken from the surrounding areas. Palynological data here fail to show conclusive evidence of this but, however,it is possible that degrees of soil disturbance during bank construction and the markedly high pollen frequencies may have masked any such evidence of turf structures as can sometimes be noted in such analyses (Scaife in press).

A DISCUSSION OF THE LATER PREHISTORIC VEGETATION OF HENGISTBURY HEAD.

It is unfortunate that the peats sampled from the Eastern Depression are of such highly humified degraded character and as such unsuited to radiocarbon dating.(The peat as noted above also contained numerous fine rootlets penetrating from above). In view of the consistency of the forest as represented in both pollen sequences,this poses some problems in the dating and interpretation of the pollen spectra and of the individual pollen assemblage zones. Pollen analyses of the two sections are however informative in showing clearly that the headland was forested throughout the later prehistoric period. Combined with Campbell's work, it is apparent that this situation was prevalent from the early Flandrian until the change to heathland represented in zone HH:3 (Eastern Depression). The changes in vegetation and environment can be seen to be one of a 'classic' early to middle Flandrian vegetation succession from Pre-Boreal pioneer Betula woodland through Pinus in the early Boreal. to the establishment of deciduous forest in the late Boreal and Atlantic periods which remained with some modification into the first millenium.

Pollen assemblage zone HH:1 has a pollen suite which although dominated by Quercus, Alnus, Betula and Corylus has values of Tilia, Fraxinus and Ulmus which are not represented in the soil pollen data from the sub-bank old land surface. This immediately poses the problem of dating because two interpretative possibilities exist. In regional pollen data the Atlantic period (FII) these taxa are frequently represented prior to the Ulmus decline at c.5,000bp. This might therefore mean that HH:1 is representative of the Atlantic climax forest just prior to the Ulmus decline and subsequent Neolithic activity. Alternatively, the presence of Tilia in southern England has been widely discussed (Scaife 1980; Baker et al. 1978) and its asynchronous anthropogenic decline recognised (Turner 1964). This decline has been variously dated from the late Neolithic at Borthwood Farm, Isle of Wight (Scaife 1980) to Saxon in Epping Forest (Baker et al. 1978). For the Hampshire Basin region a preponderance of dates, however show a middle Bronze Age reduction in its area of growth. The dating of the declines in Tilia and Ulmus at Hengistbury Head (HH:1/HH:2) is therefore enigmatic and requires further investigation by C14 dating of the lowest peat levels from incorporated wood (none was found during excavation of the trenches). Here, it is argued that the decline is later ie. the Tilia decline although ocurring at an earlier date than the middle to late Bronze Age dating of this event as often evidenced in the Hampshire Basin. This argument is based upon the following points:

i) Diagram HH:II shows no continuously high values of Tilia and Fraxinus although the top of the sequence has been dated at 3,350bp (HAR ......). If a middle /late Bronze Age decline had taken place it might be expected that Tilia would be represented within the pollen profile especially in the lowest levels of the b-Ea where Tilia would preserve well in the poorer preserving conditions of the sandy Ea.

ii) A marked secondary Ulmus regeneration is clearly seen in pollen diagrams throughout the region and which relates to middle or late Neolithic forest regeneration (Whittle 1978; Scaife 1980 and in press . This is not seen in these pollen diagrams and indicates therefore a later date for both pollen spectra.

iii) Tilia was widely dominant on sandy soils during the Atlantic period and after until its demise through anthropogenic activity. At c.5,000bp when Ulmus declines in many pollen stratigraphical sequences. Tilia often remains important until its decline in the late-Neolithic or Bronze Age after which it displays only sporadic records. It is, however, accepted that because of its entomophily and poor and local representation, any discussion of this taxon must remain site specific. Here, Tilia declines at HH:1/HH:2 from what are relatively low percentages to sporadic occurrences and which probably relates to growth not in very close proximity to the sampling site.

iv) Fraxinus, whilst undoubtedly a constituent of the Atlantic forest (as shown at Hengistbury by Campbell 1978) tends to show an increased response and more consistent record subsequent to the first Neolithic activity which is generally associated with the Neolithic Ulmus decline at c.5000bp. This is due to opening of the forest canopy allowing better pollen representation, or due to its colonisation of areas previously occupied by Ulmus. Here, Fraxinus is present at the base of HH:1 in low frequencies but subsequently declines rather than expands and which may therefore be construed as increasing human activities in the pollen catchment with forest clearance of areas of woodland.

v) Pollen of cerealia type is present in all zones to the base of HH:II. Whilst there is some evidence of pre-Ulmus decline in cereal pollen (Edwards and Hirons 1984) this is by no means unquestionably the case in southern England where the first cereal pollen records occur in close correspondance with the *Ulmus* decline (Scaife .n press). Pollen assemblage zone HH:1 is therefore likely to post-date the first introduction of arable agriculture in the Neolithic.

Although the arguments are somewhat tenuous and the necessity of adequate c14 assay obvious, it seems plausible that the pollen assemblage zone HH:1/HH:2 boundary is not the '*Ulmus* decline' but a later decline in *Ulmus* and other arboreal taxa perhaps due to anthropogenic or natural factors of deteriorating soil base status, not on the site, but at some distance. The very highly humified nature of the peats in the Eastern Depression and the correlation with the sub-bank soil pollen spectra (see below) imply that the 74cm of peat in zones HH:1 and HH:2 are a compacted and relatively long temporal sequence which from the above reasoning must extend back into perhaps the middle or late Neolithic.

The soil pollen sequence of Hengistbury Head II may be correlated with pollen asemblage zone HH:II in showing the domination of woodland prior to the construction of the bank and ditch at or just after 3,350+-90bp (1,400bc). Within the soil pollen diagram there is little indication of the major environmental change to the heathland ecosystem which is represented in its entirety in HH:3. This change must have occurred after 3,350bp and therefore heathland is of relatively recent origin when compared to the various dates for the expansion of heathland (Dimbleby 1962, 1974) obtained for the areas of Tertiary and Cretaceous sands of the Hampshire Basin and Weald respectively. These saw the expansion of ericaceous communities from the Mesolithic as at Iping Common (Dimbleby in Keefe *et al.* 1965) and Oakhanger Warren (Rankine *et al.* 1960) and a massive expansion during the Bronze Age (Dimbleby 1962a; Scaife and Macphail 1984 ; Scaife in press). At Hengistbury, radiocarbon dating of the soils 'H' horizon provides only a maximum age for this extension. It is likely, however, that the construction of this late Bronze Age bank marks the initiation of forest clearance and soil deterioration which was subsequently maintained in the late Bronze Age and Iron Age onwards with the extensive anthropogenic activity known to have occurred on the Headland (Scaife<>Macphail this volume).

IMPLICATIONS OF THE VEGETATIONAL HISTORY TO ARTIFACT DISTRIBUTION IN THE SOIL

From the preceding discussion, it will have become clear that Hengistbury Head, for much of its history, (10,000 to c. 1000 bc) was covered by woodland and that the later and contemporary heathland is a late phenomenon. The archaeological artifactual tephonomic problems outlined by Barton (Section....) must be considered in relation to this historical vegetation ecology. Whilst the heathland flora itself growing on acid podsolic soils might have been expected to fossilise the relative position of the flint artefacts and debutage within the soil by the cessation of faunal (earthworm) mixing, this might not be expected to be the case under deciduous woodland with mull humus. However, the pollen analysis of the old land surface and pedological investigations by Macphail illustrate that there is present here, an unusual acid podzolic soil which developed under a woodland canopy. Deciduous woodland with more normal and characteristic brown-earth soils would have suffered a substantial degree of worm sorting and soil (including pollen) homogenisation thus bringing about the disjunction of conjoined artefacts. Such an acid woodland soil as witnesed here probably had few earthworms which may have minimised such disaggregation.Any disturbance is likely to have been due to large scale root penetration and from tree-throw effects. It may also be postulated, that with the exception of large root bowl structures, the numerous fine rootlets of trees occupying the area may have had a bonding effect upon the soil and contained artefacts which thus minimised the overall level of stratigraphical and spatial disturbance. With regard to the absence of upper Palaeolithic artefacts in the sands below the peat in the Eastern Depression, which contrasts with numerous finds in the adjacent area, it is likely that fluvial activity resulted in surface erosion of the Eastern Depression. Such an erosional regime may have been caused by prehistoric activity on a local scale causing higher ground water table and surface water run-off consequent upon forest clearance. Such an effect has been evidenced in larger scale valley sedimentary alluvial sequences in Sussex (Scaife and Burrin 1983; Burrin and Scaife 1984; Scaife and Burrin in press). Initiation of peat accumulation may also be attributed to anthropogenic activity by similar processes of evapotranspiration reduction and consequent high ground water levels (Moore and Wilmott 1978; Scaife 1980). It must be noted, that there is only minor evidence in the pollen record of the basal peats of the Eastern Depression to attest to this. It can be pointed out, however, that much land has been lost to coastal erosion and that we are only here looking at the extreme upper flush area of a once more extensive peat/ fluvial system.

APPENDIX 1: POLLEN METHODOLOGY

pollen diagrams have been constructed from two sites. Firstly, highly humified humic/peat deposits in the Eastern Depression, and secondly, from the old land surface underlying the bank/ditch feature running along the western edge of the depression. These sites have been designated HH:I and HH:II respectively.

HH:I. Standard techniques were used for the extraction of the contained sub-fossil pollen and spores using procedures outlined in Faegri and Iversen (1964, 1974) and Moore and Webb (1978). Sampling interval of 4 cm was adopted using 1 ml of sample for the pollen preparation. This involved the deflocculation and disaggregation of the sediment using 10% NaOh. Coarser material was removed using 150u sieve; hydrofluoric acid digestion of silica; HCL (10%) for silica fluorides; and Erdtman's acetolysis of plant cellulose material.The concentrated pollen was stained with safranin and mounted in glycerol jelly. The contained pollen was extremely rich and in good state of preservation. A pollen sum of to was counted at each level. These have been calculated as a percentage of total pollen

(Diagram 1), and as a percentage AP in Diagram 2. Spores in both diagrams were excluded from the total count and are represented as a percentage of TP.

HH:II. Absolute pollen frequency techniques were used on these soils. A 2cm contiguous sample interval was used except across the 'H' horizon immediately underlying the field bank. A sample size of 1 gram dry weight for the humic levels and 2-3 grams for the more minerogenic levels (b.Ea; b.Bhs and Bsg). was used. Calibrated measures of exotic pollen (Garrya elliptica) were dded at the start of preparation. Subsequent preparation followed that outlined for HH:1. Pollen was again well preserved, extremely rich and attained a highest value of 22 million grains per gram of sample in the uppermost level of the in-situ mor/raw humus b.H horizon. As is normal with soil pollen APF, these diminshed to 7000 per gram at the base of the soil profile at 57-59cm in the b.Ea. Below this pollen was too sparse for counts to be made. Samples were prepared to a depth of 91-92cm (comprising the b.Ea; b.Bhs; and Bsg). Although below 57-59 cm (in the b.Ea) pollen sums of 300 rains (in the lowest soil levels analysed) to 1000 grains (in the humic) were counted. These are represented graphically being calculated as a percentage of total pollen and spores as is normal in soil pollen analyses (Dimbleby 1962a).

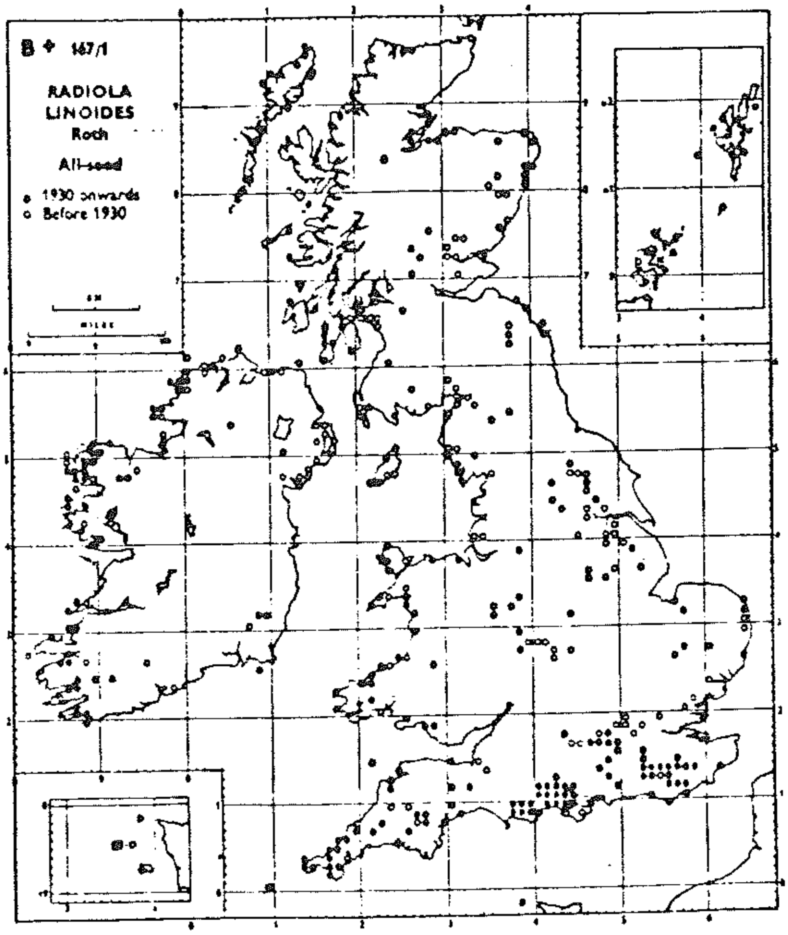
APPENDIX II: POLLEN of *Radiola linoides* ROTH (ALLSEED)

Family: LINACEAE (Clapham, Tutin and Warburg 1962). Is a small annual herb (1.5-8cm) having numerous small white flowers (has a dichasial cyme).

Ecology: grows on damp bare sandy or peaty ground on grasslands or heaths. Widespread but very local occurence over Great Britain. It has a more frequent occurrence in the Hampshire Basin.

Pollen: Spherical C3P3; large one size elements with centre spinule to bacula (Andrew 1984).

NOTES: A rare plant- known from sandy heath and wet heath areas of the new Forest (eg. Hatchets Pond). This taxon is not mentioned in Godwin (1975) and its pollen records from Zone HH:III of the Eastern Depression may well be a new fossil pollen record.


B ♀ 167/1
RADIOLA
LINOIDES
Roth
All-seed
● 1930 onwards
○ Before 1930
MILES

Andrew, R. 1984 'A practical pollen guide to the British flora'. QRA Technical Guide No1, Cambridge 1984.

Baker, C.A., Moxey, P.A. and Oxford, P.M. 1978. 'Woodland continuity and change in Epping Forest'. Field Studies 4,645-669.

Barton, R.N.E. and Huxtable, J. 1984 'New dates for Hengistbury Head, Dorset'. Antiquity 133-135

Burrin, P.J. and Scaife,R.G. 1984. 'Aspects of Holocene valley sedimentation and flood plain development in southern England' Proc. Geol. Assoc. 95,81-96.

Campbell, J. B. 1977 'The Upper Palaeolithic of Britain'. Oxford.

Carpenter, C.P. and Woodcock, M.P. (1981) 'A detailed investigation of a pingo remnant in western Surrey'. Quaternary Studies, 1,1-26. (City and North London Polytechnic publication).

Clapham, A.R., Tutin, T.G. and Warburg, E.F. 1962. 'Flora of the British Isles'. Cambrige Univ. Press.

Clifford, M. H. 1936 'A Mesolithic flora in the Isle of Wight.' *Proc. I.W. Nat. Hist. Soc.* 2,582-594.

Dimbleby G.W. 1962a 'Soil pollen analysis' *J.Soil Science* 12,1-11.

Dimbleby, G.W. 1962b 'The development of British heaths and their soils'. *Oxford Forestry Memoirs* No.23. Clarendon Press, Oxford.

Dimbleby G.W. 1976 'The history and archaeology of heaths'. In *'The Southern Heathlands'*. Ed. Sankey, J H P and Mackworth-Praed, H W Surrey Naturalists Trust. pp 38-52.

Dimbleby, G.W. and Gill, J.M. 1955 'The occurrence of podzols under deciduous woodlands in the New Forest'. *Forestry* 28,95-106.

Edwards K.J. and Hirons, K.R. 1984 'Cereal pollen grains in pre-elm decline deposits:implications for the earliest agriculture in Britain and Ireland'. *Journ. Arch. Science* 11,71-78.

Everard, C.E. 1954 'The Solent River: a geomorphological study'. *Trans. Inst. Brit. Geogr.* 20,41-58.

Faegri, K and Iversen, J. 1974 '*Textbook of pollen analysis*'.3rd Edition, Blackwell, Oxford.

Godwin, H 1975a 'The history of the British flora' 2nd Edit.Camb. Univ. Press

Godwin, H 1975b 'History of the natural forests of Britain: establishment, dominance and destruction'. Phil. Trans. R. Soc. B 271, 47-67

Haskins, L E 1978 'The Vegetational History of South-East Dorset' Unpubl.PhD Univ. Soton. Dept. Geography.

Jacobi, R J 1978 'Population and landscape in Mesolithic lowland Britain'. in Limbrey, S and Evans, J G 'The effect of man on the landscape:the lowland Zone' CBA Res.Rep. 21, 75-85

Keefe, P.A.M., Wymer, J.J. and Dimbleby, G.W. 1965 'A Mesolithic site on Iping Common, Sussex, England'. Proc. Preh. Soc. 31,85-92.

Kerney, M.P., Preece, R.C. and Turner,C. 1980. 'Molluscan and plant biostratigraphy of some late Devensian and Flandrian deposits in Kent'.Phil. Trans. Roy. Soc. B291,1-43.

Macphail, R.I 1984 'Soil report on Hengistbury Head'. AML..............

Moore, P D 1980b 'Resolutions limits of pollen analysis as applied to archaeology'. MASCA Journal 1 (4) 118-120

Moore , P.D. and Webb, J.A. 1978 'An illustrated guide to pollen analysi Hodder and Stoughton, London.

Moore, P.D. and Willmot, A. 1976.
'Prehistoric forest clearance and the development of peatlands in the uplands and lowlands of Britain'. VI Int. Peat Congress, Poznan, Poland 1976,1-15.

Osborne, P J in Peake, D S 1971 'The age of the Wandle gravels in the vicinity of Croydon. Appendix on the insect fauna of the organic deposit within the Wandle gravels'. Proc.and Trans of the Croydon Nat.History and Scientific Soc. 14 (7) 147-175.

Osborne, P J 1972 'Insect faunas of Late Devensian and Flandrian age from Church Stretton, Shropshire Phil. Trans. R. Soc. Lond B263

327-67

Osborne, P J (1974) 'An insect assemblage of Early Flandrian age from Lea Marston, Warwickshire, and its bearing on the contemporary climate and ecology'. Quaternary Research 4, 471-486.

Osborne White H.J. 1921 *'A short account of the Geology of the Isle of Wight'*. H.M.S.O. London.

Perring F.H. and Walters , S.M.1982 *'Atlas of British Flora'*. B.S.B.I.

Rankine, W.F, Rankine, W.M. and Dimbleby, G.W. 1960 'Further excavations at a Mesolithic site at Oakhanger, Selborne, Hampshire'. *Proc. Preh. Soc.* 26,246-262.

Scaife, R.G. 1980. 'Late-Devensian and Flandrian palaeoecological studies in the Isle of Wight'. Unpubl Ph.D. dissert. of Univ. of London, King's College.

Scaife, R G 1982 'Late-Devensian and early Flandrian vegetation changes in southern England.in Limbrey, S and Bell, M (eds) *'Archaeological aspects of Woodland ecology'*. BAR (Int.Ser)
146, 57-74

Scaife, R.G. in press 'The 'Elm Decline' in the pollen record of South East England and its relationship to early agriculture'. Symposia of Association for Environmental Association, Oxford 1984.

Scaife,R.G. and Burrin,P.J. 1983 'Floodplain development in and, the vegetational history of the Sussex High Weald and some archaeological implications'. Sussex Arch. Colls. 121.1-10.

Scaife, R.G. and Burrin,P.J. In press 1985 'The environmental impact of prehistoric ma as recorded in the Cuckmere floodplain at Stream Farm, Chiddingly'. Sussex Arch. Colls. 123,27-34

Scaife, R.G. and Macphail,R.I. 1983. 'The post-Devensian development of heathland soils and vegetation' In. Burnham,P. (ed.) 'Soils of the heathlands and chalklands' South-East soils Discussion Group (SEESOIL) 1,70-99.

Seagrief, S.C, 1956 'A pollen-analytic investigation of the Quaternary period in Britain'. Unpubl. PhD thesis of Univ. of Cambridge.

Seagrief, S, C, 1959 'Pollen diagrams from Southern England:Wareham, Dorset and Nursling, Hampshire New Phytol. 58,316-325

Seagrief, S C 1960 'Pollen diagrams from Southern England:Cranes Moor, Hampshire'. New phytol. 59, 73-83

Seagrief, S C and Godwin, H 1960 'Pollen diagrams from Southern England: Elstead, Surrey'. New phytol. 599, 84-91

Smith, A G 1970 'The influence of Mesolithic and Neolithic man on British vegetation: a discussion'. in Walker, D and West, R E (eds) 'Studies in the Vegetational history of the British Isles'. Camb.Univ.press

Smith, A G and Pilcher, J R 1973 'Radiocarbon dates and the vegetational history of the British Isles'. New phytol, 72, 903-914

Thorley, A 1971a 'An investigation into the history of native tree species in South East England using the pollen analysis technique'. Unpubl. PhD dissert. Univ.London King's College

Thorley, A. 1971b 'Vegetational history of the Vale of Brooks'. Inst. Br. Geog. Conf. Part 5, 47-50

Thorley, A. 1981 'Pollen analytical evidence relating to the vegetation history of the chalk' J. Biogeog. 8, 93-107.

Turner, J. 1962. 'The Tilia decline:an anthropogenic interpretation'. New Phytol. 63,73-90.

Waton, P V 1982a 'Man's impact on the chalklands: some new pollen evidence in Bell, M and Limbrey, S. '<u>Archaeological aspects of Woodland Ecology</u>'. BAR (Int.Ser) 146, 75-91.

Waton, P V 1982b 'A palynological study of the impact of man on the landscape of central southern England, with special reference to the chalklands'. Unpubl.PhD. Univ.of Southampton. Dept. of GeographY.

Whittle, A.R. 1978 'Resources and population in the British Neolithic'. <u>Antiquity</u> 52,34-42.

Wooldridge, S W and Linton, D L 1955 '<u>Structure surface and drainage in South-East England</u>'. (1955, 1964, 1968 impressions) G Philip and Son, London.

ACKNOWLEDGEMENTS

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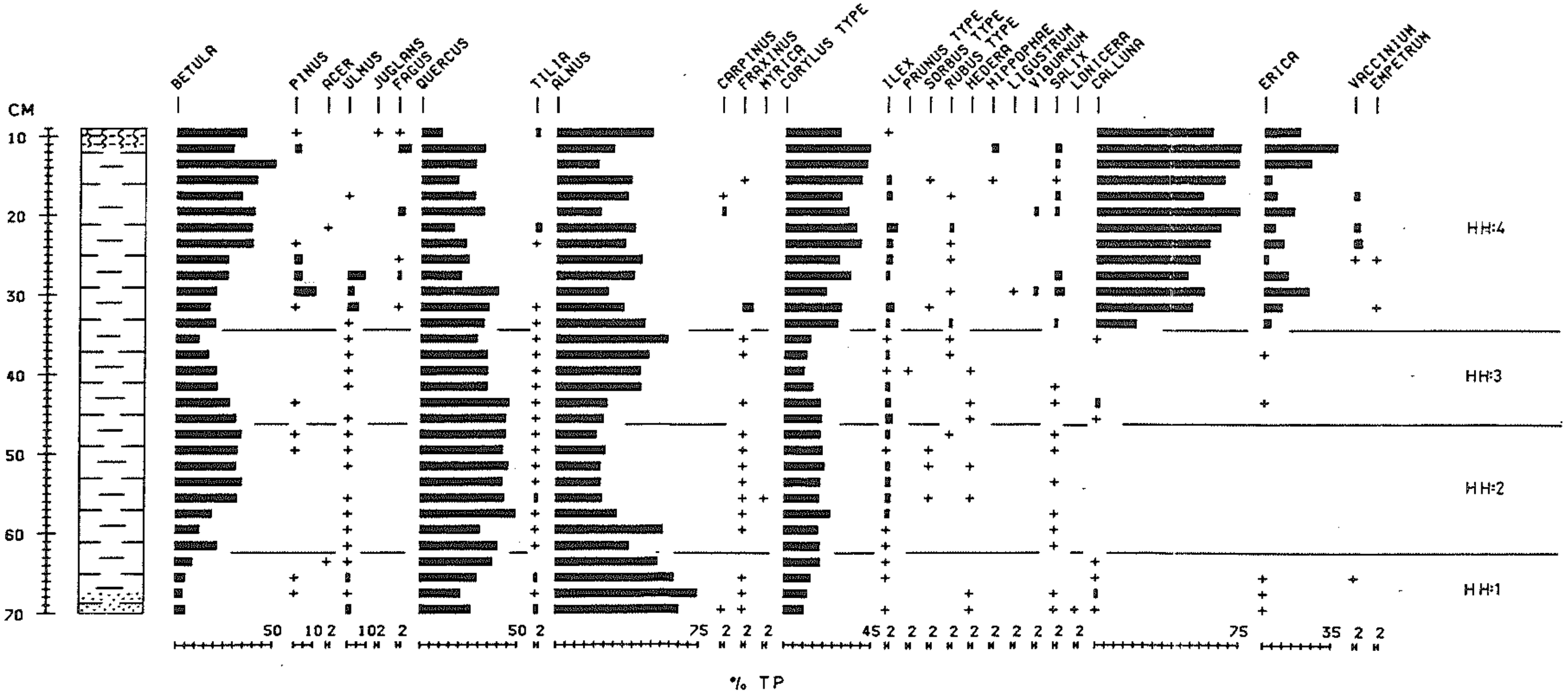
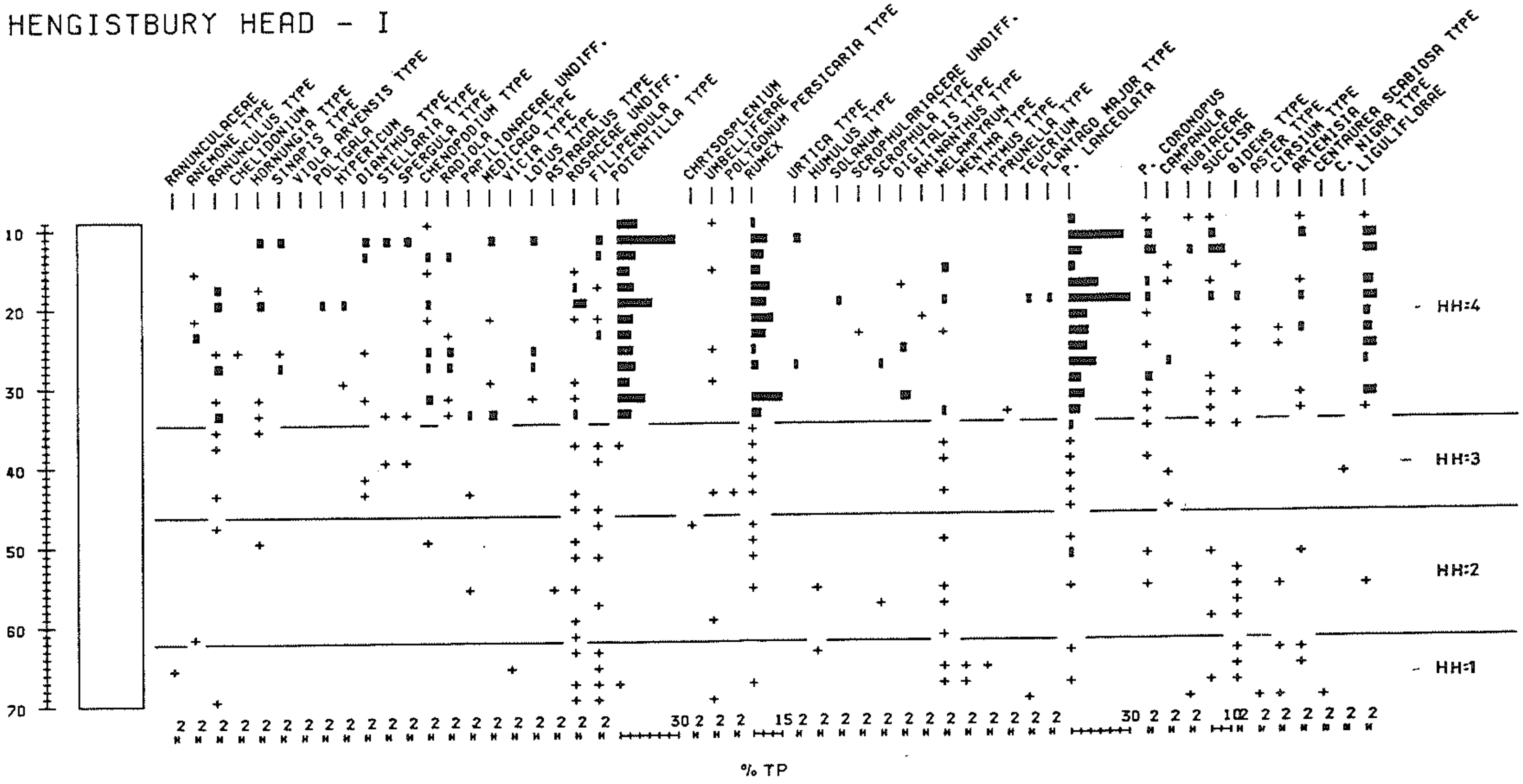
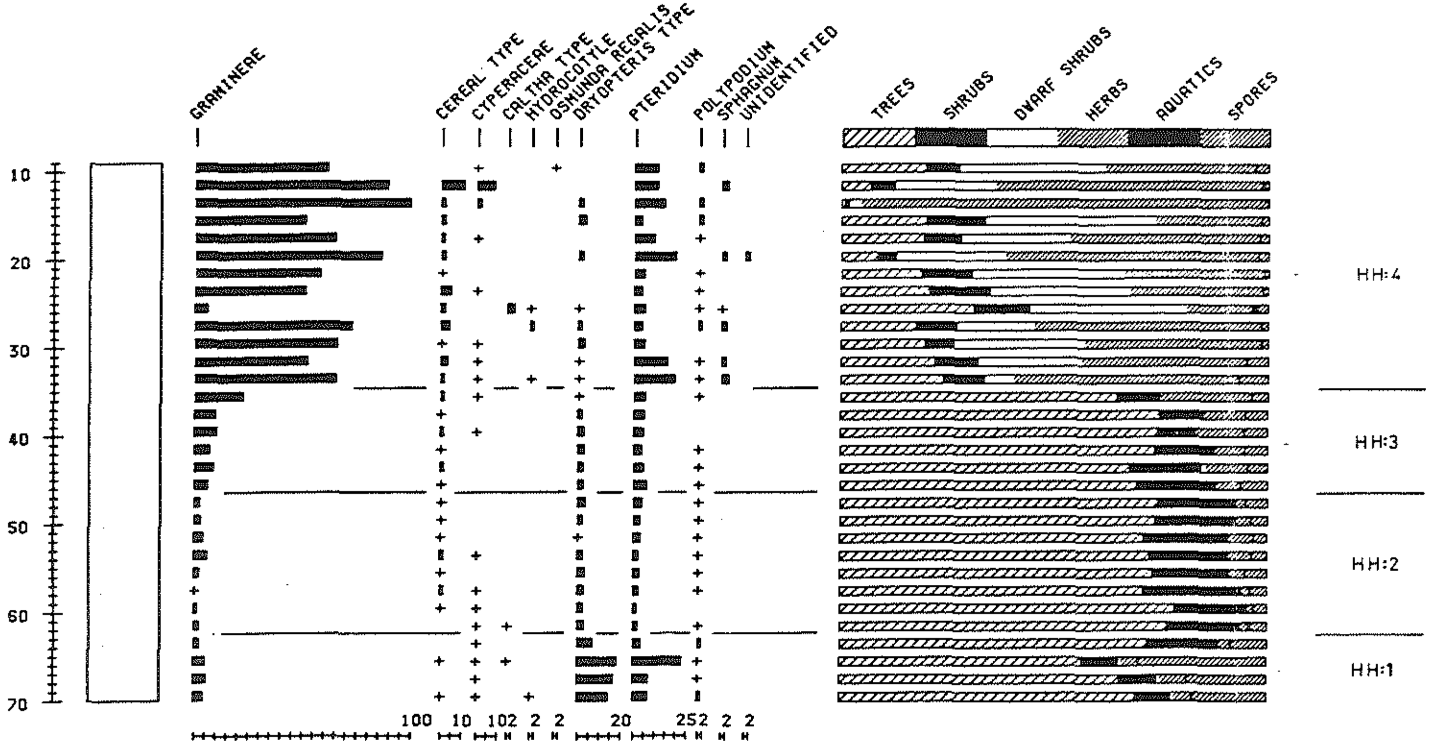
HENGISTBURY HEAD - I




HENGISTBURY HEAD - I
RANUNCULACEAE
ANEMONE TYPE
RANUNCULUS TYPE
CHELIDONIUM
HORNUNGIA TYPE
SINAPIS TYPE
VIOLA ARVENSIS TYPE
POLYGALA
HYPERICUM
DIANTHUS TYPE
STELLARIA TYPE
SPERGULA TYPE
CHENOPODIUM TYPE
RADIOLA
PAPILIONACEAE UNDIFF.
MEDICAGO TYPE
VICIA TYPE
LOTUS TYPE
ASTRAGALUS TYPE
ROSACEAE UNDIFF.
FILIPENDULA
POTENTILLA TYPE
CHRYSOSPLENIUM
UMBELLIFERAE
POLYGONUM PERSICARIA TYPE
RUMEX
URTICA TYPE
HUMULUS TYPE
SOLANUM
SCROPHULARIACEAE UNDIFF.
SCROPHULA TYPE
DIGITALIS TYPE
RHINANTHUS TYPE
MELAMPYRUM
MENTHA TYPE
THYMUS TYPE
PRUNELLA TYPE
TEUCRIUM
PLANTAGO MAJOR TYPE
P. LANCEOLATA
P. CORONOPUS
CAMPANULA
RUBIACEAE
SUCCISA
BIDENS TYPE
ASTER TYPE
CIRSIUM TYPE
ARTEMISIA
CENTAUREA SCABIOSA TYPE
C. NIGRA TYPE
LIGULIFLORAE
10
20
30
40
50
60
70
HH:4
HH:3
HH:2
HH:1
2
30
15
10
% TP

HENGISTBURY HEAD - I



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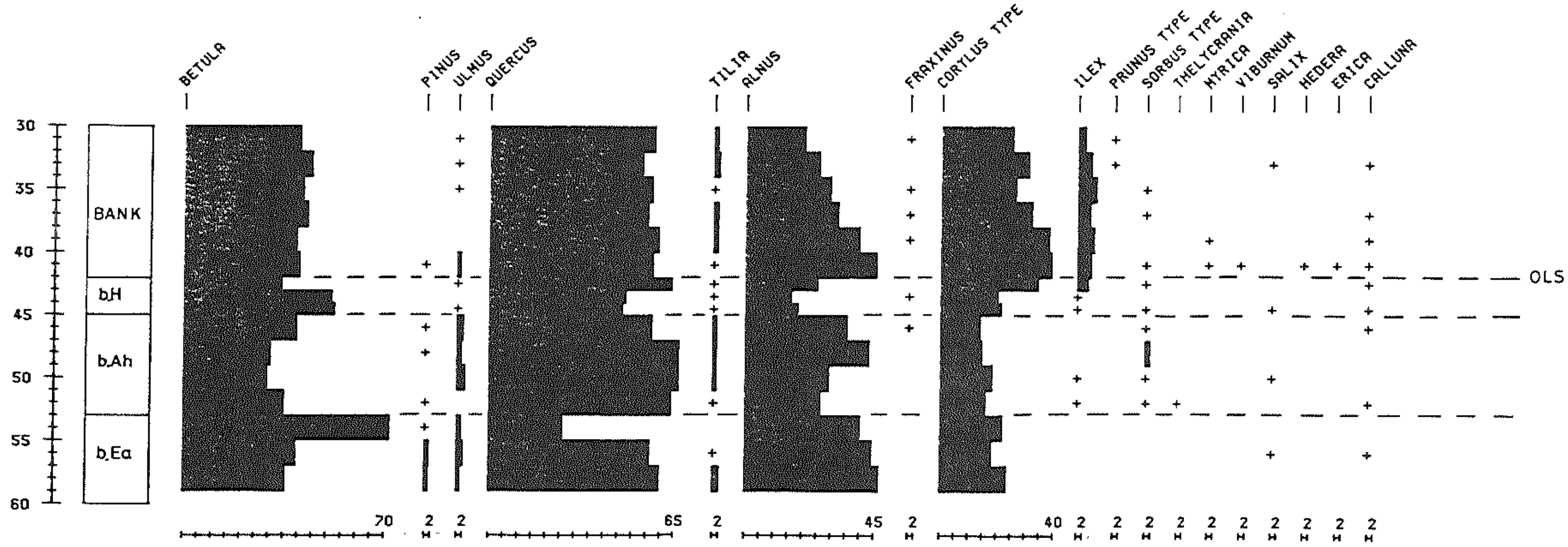

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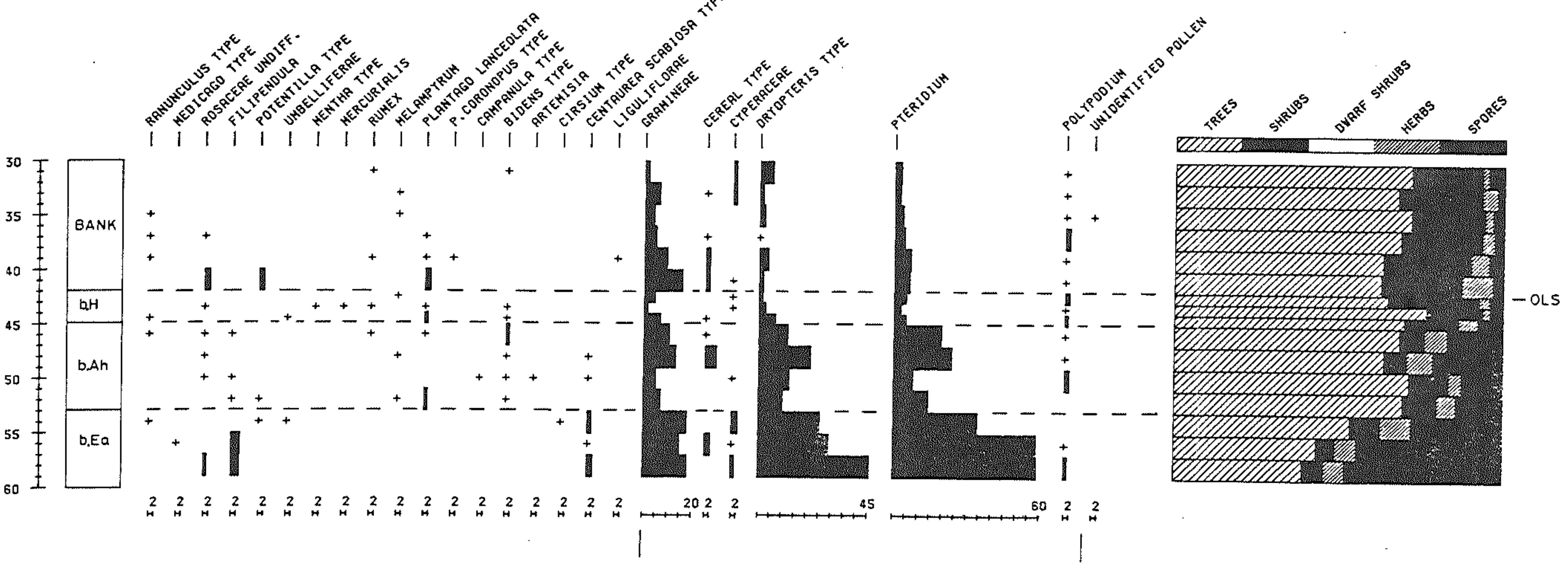

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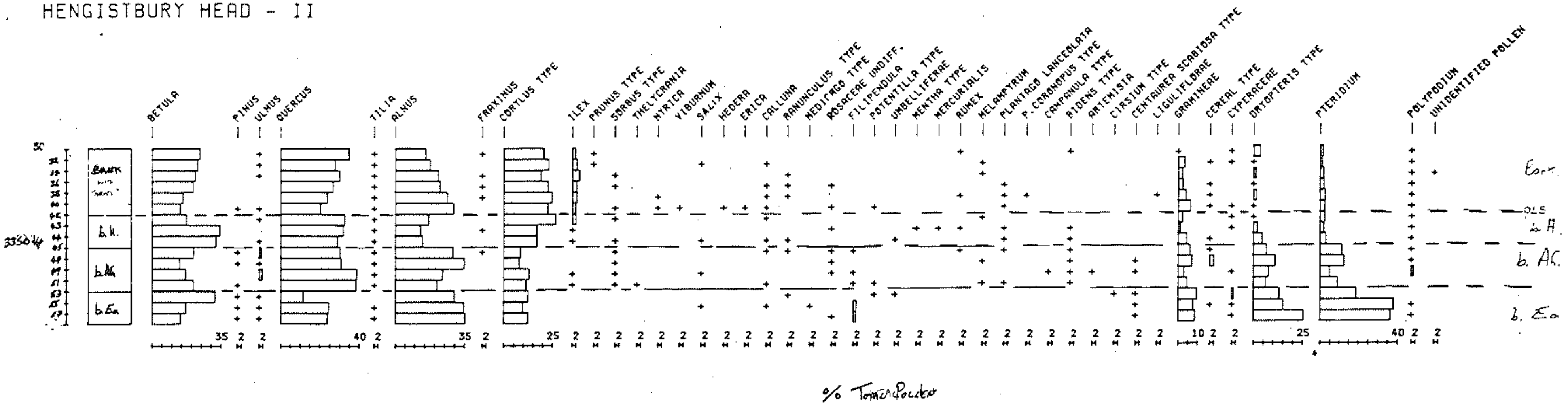

DEPTH	9	11	13	15	17	19	21	23	25	2	27	29	31	3
BETULA	36	10	31	48	48	25	44	41	31	2	26	22	18	3
PINUS	1	1	0	0	0	0	0	1	4	3	3	11	1	0
ACER	0	0	0	0	0	0	1	0	0	0	0	0	0	0
ULMUS	0	0	0	0	1	0	0	0	0	8	8	3	5	1
JUGLANS	1	0	0	0	0	0	0	0	0	0	0	0	0	0
FAGUS	1	2	0	0	0	2	0	0	1	1	1	0	1	0
QUERCUS	10	11	17	22	39	20	19	24	28	2	20	42	36	4
TILIA	2	0	0	0	0	0	3	1	0	0	0	0	1	1
ALNUS	50	10	13	45	52	14	46	37	51	3	39	28	36	6
CARPINUS	0	0	0	0	1	1	0	0	0	0	0	0	0	0
FRAXINUS	0	0	0	1	0	0	0	0	0	0	0	0	5	0
MYRICA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CORYLUS TYPE	39	26	44	75	57	30	65	67	44	4	49	28	42	5
ILEX	1	0	0	2	3	0	6	3	3	1	1	0	4	2
PRUNUS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SORBUS TYPE	0	0	0	1	0	0	0	0	0	0	0	0	1	0
RUBUS TYPE	0	0	0	0	1	0	2	1	1	0	0	1	0	2
HEDERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HIPPOPHAE	0	1	0	1	0	0	0	0	0	0	0	0	0	0
LIGUSTRUM	0	0	0	0	0	0	0	0	0	0	0	1	0	0
VIBURNUM	0	0	0	0	0	1	0	0	0	0	0	2	0	0
SALIX	0	1	1	1	3	1	0	0	0	3	3	5	0	2
LONICERA	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CALLUNA	154	101	175	231	175	180	208	150	134	8	88	135	103	3
ERICA	22	20	19	4	9	11	6	11	2	1	13	31	10	5
VACCINIUM	0	0	0	0	3	0	3	4	1	0	0	0	0	0
EMPETRUM	0	0	0	0	0	0	0	0	1	0	0	0	1	0
RANUNCULACEAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ANEMONE TYPE	0	0	0	1	0	0	1	3	0	0	0	0	0	0
RANUNCULUS TYPE	0	0	0	0	4	2	0	0	1	3	3	0	1	5
CHELIDONIUM	0	0	0	0	0	0	0	0	1	0	0	0	0	0
HORNUNGIA TYPE	0	1	0	0	1	2	0	0	0	0	0	0	1	1
SINAPIS TYPE	0	1	0	0	0	0	0	0	1	1	1	0	0	0
VIOLA ARVENSIS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYGALA	0	0	0	0	0	1	0	0	0	0	0	0	0	0
HYPERICUM	0	0	0	0	0	1	0	0	0	0	0	1	0	0
DIANTHUS TYPE	0	1	1	0	0	0	0	0	1	0	0	0	1	0
STELLARIA TYPE	0	1	0	0	0	0	0	0	0	0	0	0	0	1
SPERGULA TYPE	0	1	0	0	0	0	0	0	0	0	0	0	0	1
CHENOPODIUM TYPE	1	0	1	1	0	1	1	0	2	1	1	0	3	0
RADIOLA	0	0	1	0	0	0	0	1	3	2	2	0	1	1
PAPILIONACEAE UNDIFF.	0	0	0	0	0	0	0	0	0	0	0	0	0	2
MEDICAGO TYPE	0	1	0	0	0	0	1	0	0	0	0	1	0	6
VICIA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LOTUS TYPE	0	1	0	0	0	0	0	0	2	1	1	0	1	0
ASTRAGALUS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROSACEAE UNDIFF.	0	0	0	1	2	4	1	0	0	0	0	1	1	2
FILIPENDULA	0	1	1	0	1	0	1	2	0	0	0	0	0	0
POTENTILLA TYPE	11	14	6	7	12	13	9	7	9	9	9	6	16	1
CHRYSOSPLENIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UMBELLIFERAE	1	0	0	1	0	0	0	0	1	0	0	1	0	0
POLYGONUM PERSICARIA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RUMEX	2	3	4	5	14	5	14	8	2	3	3	0	19	7

TABLE 1; Peat Depression

URTICA TYPE	0	1	0	0	0	0	0	0	0	1	1	0	0	0
HUMULUS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOLAMUM	0	0	0	0	0	1	0	0	0	0	0	0	0	0
SCROPHULARIACEAE UNDIFF.	0	0	0	0	0	0	0	1	0	0	0	0	0	0
SCROPHULA TYPE	0	0	0	0	0	0	0	0	0	1	1	0	0	0
DIGITALIS TYPE	0	0	0	0	1	0	0	0	3	0	0	0	5	0
RHINANTHUS TYPE	0	0	0	0	0	0	1	0	0	0	0	0	0	0
MELAMPYRUM	0	0	0	3	0	1	0	1	0	0	0	0	0	2
MENTHA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THYMUS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRUNELLA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TEUCRIUM	0	0	0	0	0	1	0	0	0	0	0	0	0	0
PLANTAGO MAJOR TYPE	0	0	0	0	0	1	0	0	0	0	0	0	0	0
P. LANCEOLATA	3	13	4	3	24	28	11	11	11	1	15	6	8	8
P. CORONOPUS	1	1	3	0	2	1	1	0	1	0	0	3	1	1
CAMPANULA	0	0	0	1	1	0	0	0	0	1	1	0	0	0
RUBIACEAE	1	0	1	0	0	0	0	0	0	0	0	0	0	0
SUCCISA	1	1	5	0	1	1	0	0	0	0	0	1	1	1
BIDENS TYPE	0	0	0	1	0	1	0	1	1	0	0	0	1	0
ASTER TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CIRSIUM TYPE	0	0	0	0	0	0	0	1	1	0	0	0	0	0
ARTEMISIA	1	1	0	0	1	1	0	2	0	0	0	0	1	1
CENTAUREA SCARIOSA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. NIGRA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LIGULIFLORAE	1	2	4	0	6	4	3	4	7	1	1	0	6	1
GRAMINEAE	159	267	6182	120	257	369	155	109	7	2	253	204	112	2
CEREAL TYPE	0	4	1	2	2	1	1	5	2	4	4	1	3	2
CYPERACEAE	1	3	1	0	1	0	0	1	0	0	0	1	1	1
CALTHA TYPE	0	0	0	0	0	0	0	0	4	0	0	0	0	0
HYDROCOTYLE	0	0	0	0	0	0	0	0	1	1	1	0	0	1
OSMUNDA REGALIS	1	0	0	0	0	0	0	0	0	0	0	0	0	0
DRYOPTERIS TYPE	0	0	1	4	0	1	0	0	1	1	1	3	1	1
PTERIDIUM	12	4	10	4	14	15	5	4	6	4	4	5	19	3
POLYPODIUM	2	0	1	2	1	0	1	1	1	1	1	0	1	1
SPHAGNUM	0	1	0	0	0	1	0	0	1	2	2	0	2	5
UNIDENTIFIED	0	0	0	0	0	1	0	0	0	0		0	0	

DEPTH	33	35	37	39	41	43	45	47	49	51	53	55	5
BETULA	30	64	106	126	125	123	141	172	159	138	194	164	9
PINUS	0	0	0	0	0	1	0	1	1	0	0	0	0
ACER	0	0	0	0	0	0	0	0	0	0	0	0	0
ULMUS	1	1	1	2	2	0	2	3	1	1	0	3	2
JUGLANS	0	0	0	0	0	0	0	0	0	0	0	0	0
FAGUS	0	0	0	0	0	0	0	0	0	0	0	0	0
QUERCUS	48	159	217	207	199	200	198	223	211	200	239	223	2
TILIA	1	3	6	5	2	2	2	5	1	2	5	6	2
ALNUS	68	321	304	263	257	115	109	104	126	100	129	122	1
CARPINUS	0	0	0	0	0	0	0	0	0	0	0	0	0
FRAXINUS	0	2	1	0	0	1	0	2	1	2	1	2	2
MYRICA	0	0	0	0	0	0	0	0	0	0	0	2	0
CORYLUS TYPE	55	82	79	65	98	98	104	112	118	113	126	110	1
ILEX	2	4	7	4	10	10	14	9	5	8	13	12	9
PRUNUS TYPE	0	0	0	1	0	0	0	0	0	0	0	0	0
SORBUS TYPE	0	0	0	0	0	0	0	0	4	2	0	1	0
RUBUS TYPE	2	1	1	0	0	0	0	1	0	0	0	0	0
HEDERA	0	0	0	2	0	1	3	0	0	1	0	2	0
HIPPOPHAE	0	0	0	0	0	0	0	0	0	0	0	0	0
LIGUSTRUM	0	0	0	0	0	0	0	0	0	0	0	0	0
VIBURNUM	0	0	0	0	0	0	0	0	0	0	0	0	0
SALIX	2	0	0	0	3	1	0	2	1	0	4	0	2
LONICERA	0	0	0	0	0	0	0	0	0	0	0	0	0
CALLUNA	38	4	0	0	0	7	1	0	0	0	0	0	0
ERICA	5	0	1	0	0	1	0	0	0	0	0	0	0
VACCINIUM	0	0	0	0	0	0	0	0	0	0	0	0	0
EMPETRUM	0	0	0	0	0	0	0	0	0	0	0	0	0
RANUNCULACEAE	0	0	0	0	0	0	0	0	0	0	0	0	0
ANEMONE TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
RANUNCULUS TYPE	5	2	1	0	0	2	0	1	0	0	0	0	0
CHELIDONIUM	0	0	0	0	0	0	0	0	0	0	0	0	0
HORNUNGIA TYPE	1	1	0	0	0	0	0	0	1	0	0	0	0
SINAPIS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
VIOLA ARVENSIS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
POLYGALA	0	0	0	0	0	0	0	0	0	0	0	0	0
HYPERICUM	0	0	0	0	0	0	0	0	0	0	0	0	0
DIANTHUS TYPE	0	0	0	0	2	1	0	0	0	0	0	0	0
STELLARIA TYPE	1	0	0	1	0	0	0	0	0	0	0	0	0
SPERGULA TYPE	1	0	0	1	0	0	0	0	0	0	0	0	0
CHENOPODIUM TYPE	0	0	0	0	0	0	0	0	1	0	0	0	0
RADIOLA	1	0	0	0	0	0	0	0	0	0	0	0	0
PAPILIONACEAE UNDIFF.	2	0	0	0	0	1	0	0	0	0	0	1	0
MEDICAGO TYPE	6	0	0	0	0	0	0	0	0	0	0	0	0
VICIA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
LOTUS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
ASTRAGALUS TYPE	0	0	0	0	0	0	0	0	0	0	0	1	0
ROSACEAE UNDIFF.	2	0	2	0	0	1	1	0	2	1	0	1	0
FILIPENDULA	0	0	3	1	0	0	1	1	0	2	0	0	1
POTENTILLA TYPE	10	0	1	0	0	0	0	0	0	0	0	0	0
CHRYSOSPLENIUM	0	0	0	0	0	0	0	1	0	0	0	0	0
UMBELLIFERAE	0	0	0	0	0	1	0	0	0	0	0	0	0
POLYGONUM PERSICARIA TYPE	0	0	0	0	0	1	0	0	0	0	0	0	0
RUMEX	7	4	1	5	2	4	0	1	1	2	0	1	0

URTICA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
HUMULUS TYPE	0	0	0	0	0	0	0	0	0	0	0	1	0
SOLANUM	0	0	0	0	0	0	0	0	0	0	0	0	0
SCROPHULARIACEAE UNDIFF.	0	0	0	0	0	0	0	0	0	0	0	0	0
SCROPHULA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	1
DIGITALIS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
RHINANTHUS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
MELAMPYRUM	2	0	1	2	0	2	0	0	1	0	0	2	1
MENTHA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
THYMUS TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
PRUNELLA TYPE	1	0	0	0	0	0	0	0	0	0	0	0	0
TEUCRIUM	0	0	0	0	0	0	0	0	0	0	0	0	0
PLANTAGO MAJOR TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
P. LANCEOLATA	8	7	2	6	5	3	2	0	4	6	0	2	0
P. CORONOPUS	1	2	0	1	0	0	0	0	0	1	0	1	0
CAMPANULA	0	0	0	0	1	0	2	0	0	0	0	0	0
RUBIACEAE	0	0	0	0	0	0	0	0	0	0	0	0	0
SUCCISA	1	1	0	0	0	0	0	0	0	1	0	0	0
BIDENS TYPE	0	1	0	0	0	0	0	0	0	0	2	1	1
ASTER TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
CIRSIUM TYPE	0	0	0	0	0	0	0	0	0	0	0	1	0
ARTEMISIA	1	0	0	0	0	0	0	0	0	1	0	0	0
CENTAUREA SCABIOSA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
C. NIGRA TYPE	0	0	0	0	1	0	0	0	0	0	0	0	0
LIGULIFLORAE	1	0	0	0	0	0	0	0	0	0	0	1	0
GRAMINEAE	275	154	68	67	43	41	28	11	14	19	35	11	3
CEREAL TYPE	2	7	4	8	3	6	3	2	1	4	7	3	6
CYPERACEAE	1	2	0	2	0	0	0	0	0	0	1	0	3
CALTHA TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0
HYDROCOTYLE	1	0	0	0	0	0	0	0	0	0	0	0	0
OSMUNDA REGALIS	0	0	0	0	0	0	0	0	0	0	0	0	0
DRYOPTERIS TYPE	1	2	12	17	16	10	11	16	10	4	12	19	1
PTERIDIUM	25	28	32	27	23	20	29	19	14	15	14	16	1
POLYPODIUM	1	2	0	0	4	1	3	1	3	1	2	3	1
SPHAGNUM	5	0	0	0	0	0	0	0	0	0	0	0	0
UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0	0	0	

DEPTH	57	59	61	63	65	67	69
BETULA	90	93	122	46	39	22	36
PINUS	0	0	0	0	3	1	0
ACER	0	0	0	4	0	0	0
ULMUS	2	3	3	4	12	5	17
JUGLANS	0	0	0	0	0	0	0
FAGUS	0	0	0	0	0	0	0
QUERCUS	238	231	227	201	232	126	189
TILIA	2	2	3	0	11	2	12
ALNUS	152	422	215	286	499	453	473
CARPINUS	0	0	0	0	0	0	1
FRAXINUS	2	3	0	0	8	2	3
MYRICA	0	0	0	0	0	0	0
CORYLUS TYPE	147	155	125	120	124	80	83
ILEX	9	6	1	5	1	0	1
PRUNUS TYPE	0	0	0	0	0	0	0
SORBUS TYPE	0	0	0	0	0	0	0
RUBUS TYPE	0	0	0	0	0	0	0
HEDERA	0	0	0	0	0	1	1
HIPPOPHAE	0	0	0	0	0	0	0
LIGUSTRUM	0	0	0	0	0	0	0
VIBURNUM	0	0	0	0	0	0	0
SALIX	2	2	1	0	0	2	1
LONICERA	0	0	0	0	0	0	2
CALLUNA	0	0	0	1	5	7	7
ERICA	0	0	0	0	4	1	2
VACCINIUM	0	0	0	0	1	0	0
EMPETRUM	0	0	0	0	0	0	0
RANUNCULACEAE	0	0	0	0	1	0	0
ANEMONE TYPE	0	0	1	0	0	0	0
RANUNCULUS TYPE	0	0	0	0	0	0	1
CHELIDONIUM	0	0	0	0	0	0	0
HORNUNGIA TYPE	0	0	0	0	0	0	0
SINAPIS TYPE	0	0	0	0	0	0	0
VIOLA ARVENSIS TYPE	0	0	0	0	0	0	0
POLYGALA	0	0	0	0	0	0	0
HYPERICUM	0	0	0	0	0	0	0
DIANTHUS TYPE	0	0	0	0	0	0	0
STELLARIA TYPE	0	0	0	0	0	0	0
SPERGULA TYPE	0	0	0	0	0	0	0
CHENOPODIUM TYPE	0	0	0	0	0	0	0
RADIOLA	0	0	0	0	0	0	0
PAPILIONACEAE UNDIFF.	0	0	0	0	0	0	0
MEDICAGO TYPE	0	0	0	0	0	0	0
VICIA TYPE	0	0	0	0	2	0	0
LOTUS TYPE	0	0	0	0	0	0	0
ASTRAGALUS TYPE	0	0	0	0	0	0	0
ROSACEAE UNDIFF.	0	1	1	1	0	1	1
FILIPENDULA	1	0	0	1	2	3	2
POTENTILLA TYPE	0	0	0	0	0	2	0
CHRYSOSPLENIUM	0	0	0	0	0	0	0
UMBELLIFERAE	0	1	0	0	0	0	1
POLYGONUM PERSICARIA TYPE	0	0	0	0	0	0	0
RUMEX	0	0	0	0	0	6	0

URTICA TYPE	0	0	0	0	0	0	0
HUMULUS TYPE	0	0	0	1	0	0	0
SOLANUM	0	0	0	0	0	0	0
SCROPHULARIACEAE UNDIFF.	0	0	0	0	0	0	0
SCROPHULA TYPE	1	0	0	0	0	0	0
DIGITALIS TYPE	0	0	0	0	0	0	0
RHINANTHUS TYPE	0	0	0	0	0	0	0
MELAMPYRUM	1	0	1	0	1	3	0
MENTHA TYPE	0	0	0	0	1	1	0
THYMUS TYPE	0	0	0	0	1	0	0
PRUNELLA TYPE	0	0	0	0	0	0	0
TEUCRIUM	0	0	0	0	0	0	1
PLANTAGO MAJOR TYPE	0	0	0	0	0	0	0
P. LANCEOLATA	0	0	0	1	0	2	0
P. COROHOPUS	0	0	0	0	0	0	0
CAMPANULA	0	0	0	0	0	0	0
RUBIACEAE	0	0	0	0	0	0	1
SUCCISA	0	1	0	0	0	2	0
BIDENS TYPE	1	1	0	2	1	2	0
ASTER TYPE	0	0	0	0	0	0	1
CIRSIUM TYPE	0	0	0	1	0	0	1
ARTEMISIA	0	0	0	1	1	0	0
CENTAUREA SCABIOSA TYPE	0	0	0	0	0	0	1
C. NIGRA TYPE	0	0	0	0	0	0	0
LIGULIFLORAE	0	0	0	0	0	0	0
GRAMINEAE	3	8	12	12	44	36	32
CEREAL TYPE	6	2	0	0	2	0	2
CYPERACEAE	3	3	3	2	2	1	1
CALTHA TYPE	0	0	1	0	1	0	0
HYDROCOTYLE	0	0	0	0	0	0	1
OSMUNDA REGALIS	0	0	0	0	0	0	0
DRYOPTERIS TYPE	15	18	17	38	180	122	120
PTERIDIUM	10	11	9	18	240	45	51
POLYPODIUM	1	0	3	8	4	5	10
SPHAGNUM	0	0	0	0	0	0	0
UNIDENTIFIED	0	0	0	0	0	0	0

DEPTH	30	32	34	36	38	40	42	43	44	45	47	49	51	53	55	57
BETULA	147	150	140	141	107	102	105	206	190	117	90	111	82	89	53	31
PINUS	0	0	0	0	0	1	0	0	0	2	1	0	1	1	2	1
ULMUS	3	1	2	0	0	3	2	0	1	6	4	11	0	2	3	1
QUERCUS	210	180	192	181	161	145	197	191	169	169	197	252	150	32	76	52
TILIA	4	6	3	5	4	2	3	3	2	3	3	4	1	0	1	2
ALNUS	93	115	140	154	178	211	102	77	81	163	223	156	83	83	107	76
FRAXINUS	1	0	1	1	1	0	0	2	0	1	0	0	0	0	0	0
CORYLUS TYPE	124	150	122	155	169	162	161	102	100	49	51	85	45	35	30	27
ILEX	10	17	24	16	17	13	12	4	1	0	0	2	1	0	0	0
PRUNUS TYPE	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SORBUS TYPE	0	0	1	1	0	1	1	0	2	1	5	1	1	0	0	0
THELYCRANIA	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
MYRICA	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
VIBURNUM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
SALIX	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1	0
HEDERA	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
ERICA	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
CALLUNA	0	2	0	1	2	1	3	0	2	1	0	0	1	0	1	0
RANUNCULUS TYPE	0	0	1	1	1	0	0	0	1	1	0	0	0	1	0	0
MEDICAGO TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
ROSACEAE UNDIFF.	0	0	0	3	0	6	0	1	0	1	2	1	0	0	0	1
FILIPENDULA	0	0	0	0	0	0	0	0	0	2	0	1	1	0	5	3
POTENTILLA TYPE	0	0	0	0	0	5	0	0	0	0	0	0	1	1	0	0
UMBELLIFERAE	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0
MENTHA TYPE	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MERCURIALIS	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
RUMEX	1	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0
MELAMPYRUM	0	1	1	0	0	0	2	0	0	0	1	0	1	0	0	0
PLANTAGO LANCEOLATA	0	0	0	2	2	6	0	2	4	1	0	0	3	0	0	0
P.CORONOPUS TYPE	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
CAMPANULA TYPE	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
BIDENS TYPE	1	0	0	0	0	0	0	1	1	3	1	1	1	0	0	0
ARTEMISIA	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
CIRSIUM TYPE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
CENTAUREA SCABIOSA TYPE	0	0	0	0	0	0	0	0	0	0	1	1	0	2	1	2
LIGULIFLORAE	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
GRAMINEAE	6	22	14	17	28	47	14	6	26	35	45	20	18	27	24	19
CEREAL TYPE	0	2	0	2	4	4	0	0	1	2	14	0	0	0	3	0
CYPERACEAE	4	4	0	0	0	1	1	1	0	0	0	1	0	3	1	1
DRYOPTERIS TYPE	21	5	8	1	11	5	5	12	27	41	80	55	26	42	55	73
PTERIDIUM	9	7	12	14	20	18	16	12	19	72	92	33	39	65	190	124
POLYPODIUM	1	2	2	6	1	1	6	2	4	1	1	7	0	0	1	1
UNIDENTIFIED POLLEN	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 2; Buried Soil