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THE POST-DEVENSIAN DEVELOPMENT OF HEATHLAND SOILS AND VEGETATION

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INTRODUCTION

Information which helps to elucidate the vegetational and environmental history of the Southern English heathlands during the prehistoric period can be derived from both palynological and pedological studies. Considering the present and historical extent of the lowland heaths, data from pollen analyses of heathland soils are few. They are, however, more frequent than for soils developed on other lithologies in Southern England (e.g. chalk) by virtue of their pH values which facilitate the preservation of pollen. Dimbleby (1962a, 1976) has been largely responsible for our present knowledge of the palaeoecology of the heathlands, carrying out pollen analyses of modern and archaeologically buried soils in the Lower Greensand and Tertiary areas of the Weald and Hampshire Basin respectively.

In spite of the absence of Mesolithic archaeological structures, soil profiles of this date have apparently been preserved by blown sand. Where this has occurred in juxtaposition with scatters of Mesolithic flint implements, the sites are of substantial importance to the understanding of heathland palaeoecology. Iping Common, West Sussex (SV 84852221), produced such a site dated by analogy with Oakhanger, Selborn at 4340± 120 BC for a small encampment of these essentially hunting and gathering people. Soils of this date were buried and preserved by blown sand of Atlantic date, thereby preserving them and their contained pollen. Dimbleby (in Keef *et al* 1965) established the wooded character of the area during the late Flandrian Chronozone I, being dominantly *Pinus*, *Corylus* and *Betula* forest in the basal levels of Zones 'c' and 'd'. The importance of Iping lies in the evidence that Maglemosian peoples were able to bring about a change from woodland to heathland, at least on a local scale, by the use of fire and possibly by animal herding. At Oakhanger, Hampshire (Rankine et al 1960), bleached sand believed to have been produced by soil acidification buried Mesolithic soil levels which where radiocarbon dated at 6300± 120 BP, which therefore fall within the Atlantic phase (Flandrian Chronozone II, Godwins Pollen Zone VIIa). Here, and at Winfrith Heath, Dorset (Dimbleby 1976 and Palmer and Dimbleby 1979), the dominance of woodland on areas now supporting predominantly heathland vegetation is illustrated. Further testimony to the possible effects of Mesolithic man on certain soils comes from the deposits of the Sussex Ouse (Scaife and Burrin 1983) and the River Medina, Isle of Wight (Scaife 1980, 1982). At these sites floodplain sediments of inorganic character have been assigned to the Boreal period, resulting possibly from a greater degree of valley side forest clearance than previously envisaged. Here, it has been suggested that widespread deforestation by one or more agencies might have brought about increased surface run-off, resulting in accelerated erosion of interfluve zones.

BRONZE AGE HISTORY

From the palynological analyses it can be shown that many current heathlands were not in existence by the Neolithic period. Examples of this occur at Broome Heath, Norfolk, where a Neolithic settlement site buried brown earths of this date (Dimbleby and Evans in Wainwright 1972). Similarly at Rackham, Sussex, Neolithic flint artefacts had been incorporated into the soil profile by soil faunal (earthworm) activity (Dimbleby and Bradley 1975). At both sites, soil acidification occurred at a later date.

Human activities leading to the development of heathlands became extensive during the Bronze Age (Dimbleby 1962, 1969). A large number of Bronze Age monuments especially barrows (see

Table 1), bury both immature and well developed podzols. Recently, detailed pedological and micromorphological studies (Macphail 1981a and in Drewett 1984) and palynological investigations (Scaife 1983 and in Drewett 1984) have been carried out on the West Heath, West Sussex, Bronze Age barrow cemetery. One of the major problems in understanding the exact effects of forest clearance, soil acidification/podzolisation and development of heathlands arises from the process of podzolisation itself - which destroys most of the evidence present in the soil's past microfabric. Again recently, a site on the Lower Greensand with a long archaeological history (Mesolithic, Neolithic and Saxon and Medieval) was investigated (Macphail 1983). New data from both of these sites are presented below.

STUDIES AT SELMESTON (PROFILE 1) AND WEST HEATH (PROFILE 2)

Soils and thin sections were analysed using procedures described by Avery and Bascomb (1974) and Bullock and Murphy (1979). The pollen analysis used standard procedures for the extraction of the sub-fossil pollen and spores (Faegri and Iverson 1974, Moore and Webb 1978). Absolute frequencies of pollen were calculated using the addition of a known quantity of 'exotic' pollen (Garrya elliptica) at the outset of preparation to a known volume of sediment/soil sample. The results of the analysis of one of the barrows (VIII) are given in Figure 1 with the pollen percentages calculated as a percentage of total pollen (TP) and spores as a percentage of total pollen plus spores.

(a) Selmeston, East Sussex (TP 510070). This Mesolithic to medieval site (Rudling and Cartwright in press) is located on the narrow outcrop of the Lower Greensand (Gallois 1965). At Selmeston, because the Lower Greensand is both fine-grained and base-rich, the soil has not been podzolised and artefacts are concentrated in the Eb horizon of the typical (sandy) argillic brown earth which is present (Profile 1, Appendix and Table 2; Macphail 1983). In the microfabric of this soil successive anthropogenic effects on the site are also preserved (Micromorphology, Table 3, Figure 2). Only a few limpid argillans (Bullock et al in press) as associated with an undisturbed woodland cover were identified. These were followed by many dusty argillans - a coating which has been related elsewhere to woodland clearance episodes (Slager and Van de Wetering 1977; Courty and Federoff 1982). Coarse-grained coatings of agricutan type (Jongerious 1970) are present indicating a history of later agriculture. The limited development of limpid argillans suggests only limited clay translocation prior to Mesolithic interference - which according to the analysis of Sussex Ouse sediments may be of Middle to later Boreal date (Scaife 1983, Scaife and Burrin 1983, Burrin and Scaife 1984). The development of the dusty argillans probably relates to lengthy but minor clearance by burning. At Selmeston, localised disturbances probably continued through the Neolithic to the Saxon and Medieval periods when more intensive agricultural practices produced the final phase of coarse-grained coatings.

(b) West Heath, Harting, West Sussex (SV 786226). Nine Bronze Age barrows at West Heath were excavated prior to destruction of the area by white sand excavation. Barrows I to IV were excavated between 1973-5 (Drewett 1975 and 1976); excavation of Barrows V to IX in 1980 completed the study of the site. Pollen analysis of Barrows I to IV was carried out by Baigent (in Drewett 1976). Subsequently, more detailed palynological and pedological studies were carried out on Barrows V to IX (Scaife and Macphail in Drewett 1984). These barrows were sited on knolls on the western slopes of the Folkestone Beds (Cretaceous Lower Greensand) plateau at West Heath. The plateau top carries humo-ferric gley podzols, the poor drainage relating to the clay bands within the Folkestone Beds. On the slopes, humo-ferric podzols also occur, while the valley bottom probably contains gley podzols buried beneath at least 2 metres of bleached sand colluvium. The area has a present vegetative cover of Calluna, Pteridium and Betula scrub (Pitman and Pitman 1983).

From the interpretation of the palynological and pedological analyses undertaken, the changing ecological character of West Heath can be outlined. This is most clearly seen in Barrow VIII presented in this discussion. Pollen analysis was carried out on contiguous samples taken from the base of the Ea horizon through the in situ Ah of the old land surface and into turf No.4 of the barrow's structure. The principal changes in the soil pollen diagram (Figure 1) have been zoned from the base (Zone 1) at 40 cm upwards into the turf stack (24-0 cm - Zone 4). Initially, and not represented in the soil profile or pollen spectrum, the original vegetation may have been deciduous forest growing on sandy brown earth soils (see later). Human activity, possibly corresponding with the Mesolithic artefactual material found in the vicinity of the barrows (Drewett 1976) resulted in opening up of the forest, and subsequent soil acidification, thereby initiating pollen preservation in the increasingly more acidic soils.

Pollen Zone : (1) (37 cm to 41 cm). Below this Zone absolute pollen frequencies were too low to enable statistically adequate counts of pollen to be made. Percentages of Corylus pollen are high (60% TP) with Quercus, Tilia and some Betula and Ulmus present. Pollen of Calluna, Gramineae and spores of Pteridium may be indicative of the initial clearance of the natural forest and soil deterioration. Few herbaceous taxa are represented and it seems likely that this early phase was one of limited spatial extent. Scrub and ericaceous plant communities already present (see below) as a ground flora flowered as a consequence of greater light input.

Pollen Zone : (2) (29 cm to 37 cm). The significant changes in taxa at 37 cm are evidence for the truncation of soils represented in Zone 1. Most evident are the sharply increasing values of *Tilia* (54% TP) and *Hedera* (57%) whilst those of *Corylus* and other arboreal and shrub elements decrease. *Tilia* and *Hedera* have poor pollen dispersion characteristics, due to their entomophily, and are usually therefore under-represented in pollen spectra. Here, high values indicate that these genera must have been dominant elements in the local vegetation. The quantities of *Hedera* (reaching 720,000 grains per gramme soil weight) are exceptional, and are not generally encountered in normal circumstances of pollen deposition. These levels of Zone (2) are thought to be of late Mesolithic Atlantic age. Similarly high *Hedera* pollen counts have been made in other buried soils of the West Heath barrows (Baigent 1976, Scaife 1983, Scaife forthcoming in Drewett, 1984) and from Minstead (Dimbleby in Drewett 1973), Addington, Kent (Dimbleby 1963), Iping Common (Keef *et al* 1965) and Dimbleby in Palmer and Dimbleby 1979). From this information, Dimbleby (1976) and Dimbleby and Simmons (1974) suggested that *Hedera* might have been collected in the Autumn and used as fodder placed in clearings in order to attract red deer.

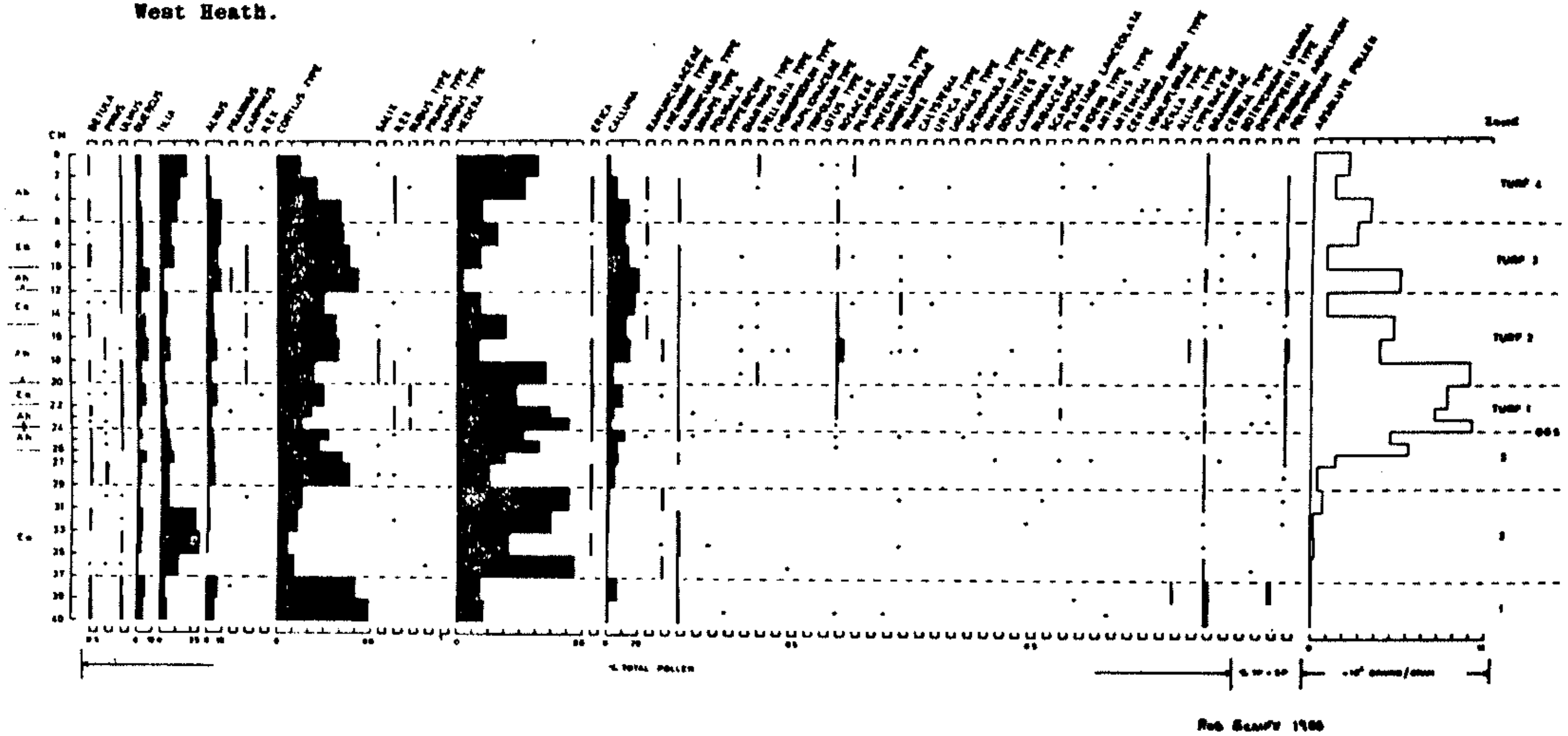
Pollen Zone : (3) (24 cm to 29 cm). A possible hiatus at 29 cm between Zones 2 and 3 is indicated by stepped pollen curves of *Alnus*, *Corylus*, *Hedera* and *Calluna* and by slightly higher pollen frequencies in the upper levels of Zone 2. This Zone spans the immediate pre-barrow *in situ* soil profile comprising the upper Ea and Ah horizons. Characteristically, in soil pollen profiles the absolute pollen frequencies rise sharply at the old lower surface (Dimbleby 1962, 1969) and this is the case here at 27 cm. The vegetation remained dominated by *Corylus* scrub but within an area comprising other deciduous woodland elements (*Quercus*, *Tilia*). Pollen frequencies of *Calluna* are less than might be expected from a pure Callunetum, and suggest it was a ground shrub under open canopy.

Pollen Zone : *(4)* (0-24 cm). The turves (1-4) lying above the *in situ* Ah at 24 cm are presumed to be coeval with the Bronze Age soils underlying the barrow but which were taken from surrounding areas. These turves therefore provide further evidence for the Bronze Age vegetation of the West Heath area. Four turves are represented in the analysis, all of which appear to have been inverted and which are separated by the white sands of the Ea horizon. The Ah horizons have high absolute pollen frequencies due to their greater organic content and compaction. Minor differences include slightly more dominant *Calluna* in turves 3 and 4 and the sporadic occurrences of *Carpinus* and *Ilex*. Analysis of a turf from barrow IX similarly exhibited differences from the *in situ* profile. Here a turf probably obtained further down the side of the knoll on a marginally better soil showed that a small amount of agricultural activity had taken place.

THE SOILS OF WEST HEATH AND THEIR DATING

The Bronze Age barrows bury a variety of podzols : at V, a type S4 (Macphail 1983) humo-ferric podzol (Avery 1980); at VI and VII humo-ferric gley podzols; at VIII a humo-ferric (gley) podzol with thin ironpan; at IX a type S2 humo-ferric podzol (Macphail 1981a). The barrows generally bury podzols with narrow eluvial horizons (23, 9, 20 and 6 cms at V, VI, VIII and IX respectively), indicating probable erosion of these soils (a fact noted in the pollen data) prior to shallow (partly relating to compression) Ah horizon development. At Barrow VIII (Profile 2, Appendix and Table 4) the clear smooth boundary between the moist b Ea and the wet b Bh horizons which overlie a thin ironpan above dry Bh/s and Bs horizons is indicative of lateral soil water flow and poor drainage in the upper soil. These conditions have probably affected the soil chemistry and microfabrics with the result that large amounts of organic carbon and mainly pyrophosphate extractable iron were measured in the turf and buried Ah horizons. Wet and acidic conditions also favoured pollen preservation, although lateral soil water flow may have affected the actual absolute quantities of pollen at depth.

Fig.1. Pollen in section through Barrow VIII,
West Heath.



At Barrow VIII the analyses of a deep sequence of soil pollen samples (see above) were correlated with the micromorphological study of the b Bh, the lower b Ea, the b Ah and the lower horizons (Ah, Ea = turves) of the turf stack barrow. The sequence identified in the microfabric above the buried soil (b Ah horizon) and old ground surface, is as follows: 1st turf aH, 1st turf Ea; 2nd turf Ah. These horizons are correlated with absolute pollen frequencies (see Table 4) present. Micromorphological analyses and pollen analyses have shown these turves to be inverted. There is a clear relationship between absolute pollen frequencies which are higher in the Ah horizons and the microfabric. High APF apparently relate to microfabrics with high percentages of organic components and low void space in horizons composed only of quartz grains, organic components and voids.

The buried Ah horizons have a very high bulk density, with the first turf having only 9% void space. As modern Ah horizons examined on Surrey heaths may have approximately 50-60% void space (Macphail 1979) it appears that the first turf may have its void spaces reduced by 6 times; the second turf and buried turf by 3 to 4 times. This can be partially explained by compression, because the buried turf on similar soils beneath the experimental earthwork at Wareham (Evans and Limbrey 1974) had only 16% void space (Macphail 1981b).

At West Heath the organic components contain very few instances of tissue residues (Bullock et al in press), the bulk being comprised of amorphous organic fine material. The latter is mainly dense and black, and may be the result of ageing by biochemical, bacteriological or fungal action on plant tissues and faunal excrements. The black colour itself may result from fungal melonotic products (Miedema, Wageningen pers. comm.). The amorphous fine organic component may also relate to fragmenting faunal excrements being welded into an amorphous fabric (Dinc et al 1976). Comparison with Ah horizon material from the modern (1964) buried soil at Wareham shows the organic components to be far more decomposed and amorphous at West Heath (Macphail 1981b; Fisher and Macphail in press). It should be noted that the lack of porosity in the b Ah horizon may be compared with a "welded" or "melted" anmoor horizon (Federoff, Grignon, Bullock, Rothamsted and Jongerious, Wageningen, pers. comm.). These again testify towards localised wetness at Barrow VIII.

The Ea horizons are characterised by more sparse, but similarly amorphous, fine organic components. At depth in the lowest Ea horizon, polymorphic amorphous organic matter may be present. However the main component of the b Bh is monomorphic (De Conninck 1980, De Conninck and Righi 1983) amorphous organic matter (Figure 3). At medium (x 125) and high (x 400) magnification, rare polymorphic elements including possible aged faunal excreta with silt inclusions and fungal hyphae were identified within the main monomorphic organic component. Microfabric, SEM and detailed chemical analyses by De Conninck and Righi (1983) of polymorphic and monomorphic amorphous organic components in Bh horizons indicate a faunal origin for the former and physico-chemical cementation for the latter.

Their interpretation was corroborated by polymorphic fabrics producing short "mean residence C^{14} dates" (e.g. 770-1440 years), compared with monomorphic material (e.g. 2,000-2,810 years) (Righi and Guillet 1977, De Conninck 1980). At Barrow VIII therefore the predominance of monomorphic amorphous organic matter in the b Bh horizon suggests that even the upper b Bh had been little affected by recent faunal action. This may be a reflection of burial beneath the turf stack (diameter c. 25 metres) and/or localised anaerobic conditions above the ironpan. One of the problems of investigating heathland is to date the initiation of podzolisation. As the Bh horizon at Barrow VIII had a microfabric apparently little affected by recent faunal turnover it was decided to attempt a C^{14} assay in order to try dating the soils antiquity and pollen assemblages present, because it was likely that a mean residence date would reflect the soils age. Approximately one kilo of soil was used by Harwell. This produced a date of mean residence of 3770± 150 years BP from which possibly it can be suggested that the initiation of illuvial humus deposition commenced in the Mesolithic. Such a finding is commensurate with the pollen data obtained from the lowest soil Zones of these barrows (at Barrow VIII the Zone 1 and 2), with the Mesolithic archaeological material and a C^{14} date of 81000± 70 bp (6150 bc) for charcoals found in a pit under Barrow I (Drewett 1976).

HISTORY OF SOILS AND VEGETATION ON SOUTHERN ENGLISH HEATHLANDS

From the corpus of information about the inception of heathlands by man and/or natural agencies of forest clearance it is apparent that replacement of woodland by heath allowed sandy brown earths to deteriorate into podzols (Dimbleby 1962). Macphail (1979) has shown that the podzols of many Surrey heaths contain relic micro-features of brown earths. With continuing evidence from pollen analysis it is suggested that a heath flora occurring in the late-glacial, i.e. Devensian, (Scaife 1980, 1982) may have persisted as isolated stands well into the subsequent post-glacial or Flandrian period (Scaife 1983 and forthcoming). Those data from the Bronze Age barrows and from the small number of Mesolithic archaeological sites certainly show that heathland was present within an open woodland context. This has normally been ascribed to human activity. It seems more realistic however to assume that ericaceous taxa remained as a woodland under storey/ground layer component or in restricted/ localised clearings brought about by tree throw or grazing herbivores, after the early Flandrian afforestation of the region, as has been suggested by continental workers (Gimingham 1972, p.17).

While the growth of such ericaceous communities is not doubted, there was a substantial gap in time from these to the open phytogeographical and plant taxonomically diverse Late-Devensian Zone III vegetation (Scaife 1980, 1982) of Southern England. However, *Pinus* woodland with changing deciduous elements was abundant in South East England and is illustrated in a substantial number of pollen analyses of peat mires (Seagrief 1959, 1960; Seagrief and Godwin 1960; Scaife and Burrin 1983; Burrin and Scaife 1984; Scaife 1980, 1982). Such vegetation is likely to have brought about significantly acid soils especially in poorer areas of low base status. Whilst *Corylus*, which was similarly abundant for a large part of this period (Godwin 1975), might have had an ameliorating effect on these acidic soils, this may not have been sufficient on certain soils (e.g. at West Heath) to preclude an acidophilous/ericaceous ground flora. This is evidenced in small part by the pollen data from West Heath where little Bronze Age agricultural activity was present (Baigent in Drewett 1976; Scaife 1983 and in Drewett forthcoming) and the predominantly Bronze Age *Corylus* scrub vegetation occurred in association with a substantial heathland vegetation element. It has been suggested therefore that Devensian dwarf shrub heathland components existing on poorer soils (Late-glacial rankers?) may have persisted as isolated pockets (Scaife 1983 and forthcoming).

The history of expansion of the heathlands as a whole relates to the opening and closing of woodland and scrub in response to phases of more and/or less intense natural and anthropogenic pressures. Climatic change (especially sub-boreal to sub-atlantic) was considered, but the overwhelming evidence of anthropogenic causes in the later-Flandrian masks any such climatic causal event relationships. It is clearly seen that such expansions and contractions of heathlands can be directly related to the differential pressues of man during his different periods of exploitation of these soils. The evidence from the Lower Greensand at Selmeston suggests that successive clearance phases and coarsening of the upper soil by cultivation may have led eventually to podzolisation on the more acidic Lower Greensands of West Sussex and Surrey. These periods of initiation and maximum extension occurred from the Middle/Late Bronze Age onwards as evidenced from Thursley Common where Bronze Age clearance and probable agriculture led to organic accumulations in Ockley Bog (Moore and Willmot 1978). Possible plough marks were also linked to the presence of cereal pollen beneath the round barrow at Ascot, Berkshire (Bradley and Keith-Lucas 1975). Such a massive extension in activity may have given rise to large-scale removal of cover loam from tracts of the Cretaceous and Tertiary lithologies (Macphail 1979). The relative absence of Neolithic archaeological material from the areas of present day heathlands might be evidence for this extensive diminution during the period c.5300-3000 BC. Evidence of such transported material has been found and examined in flood-plan alluvial situations in other areas of Sussex (Burrin 1981; Burrin and Scaife 1984, Scaife and Burrin 1983). Certainly the actual act of turf stripping for barrow construction on the slopes at West Heath - and an area of 370 sq. metres was estimated for a barrow height of 1.3 m at Ascot (Bradley and Keith-Lucas 1975) - would initiate severe erosion of the underlying Ea horizon by rain splash (Bridge and Ross, 1983; Thompson 1983). As there were nine barrows constructed at West Heath, and several are believed to overlie truncated soils, the 2 metres of bleached and colluvium in the valley bottom is easily accounted for.

CONCLUSIONS

The palaeoecological suggestions mooted in this paper are of significance to models of podzol development on heaths. In situations on particularly poor parent materials the continued presence of Calluna since the Late-Devensian would suggest a soil development sequence of - raw soil - podzolic ranker - podzol without any intermediary brown earth phase formed under an Atlantic broadleaved woodland. Commonly, podzolisation resulted from human disturbance of sandy soils as revealed at Selmeston, which may also have initiated acidification of coarse substrates by the erosion of fine cover loams.

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APPENDIX

Description of Profile 1 (Selmeston Quarry)

Slpe : 2^{o} S.W. Relief : On sand ridge.

Parent Material : Fine sandy Lower Greensand and possible Superficial silt (loess).

Soil type : Typical (sandy) argillic brown earth.

Vegetation : Old grassland.

Mull, root mat 2cm.

Ah 0-21cm	Dark brown (7.5YR3/2) moderately weak to weak loamy fine sand (see analytical data): coarse granular to fine subangular blocky; very few stones; moderately high organic matter content; abundant fine, common medium roots; common worms and ants; smooth, clear boundary.
Eb 21-51cm	Brown to dark brown (7.5YR3/2-4/2) moderately firm fine sandy loam; fine prisms; pottery and charcoal fragments; few flints; moderately low organic matter content; abundant fine roots; earthwork channels extend Eb into Bt(g); irregular, sharp boundary.

B(t g) 51-82cm	Brown (7.5YR4/4) very firm fine sandy loam with few diffuse mottles; medium to coarse prisms; few flints; few fine roots; earthwork channels; fine ped face, in-ped pore cutans; diffuse, wavy boundary.
B(t)g/C(t)g 82-104cm	Light yellowish brown (10YR6/4) moderately weak loamy fine sand; with common distinct medium mottles; poorly developed prisms; rare roots; patches of cutans; clear, smooth, boundary (soft iron pan).
C 104-120+cm	Brownish yellow (10YR6/6) weak fine sand, with ochreous soft iron pans; massive.

Micromorphology of Profile 1

Eb: 21-51 cms

Homogeneous : Mainly structureless with sand grains set in silty plasma: 19% macrovoids, compound packing voids, smoothed channels: 40% mineral grains (not including silt), mainly rounded-subrounded, few sub-angular; coarse pottery fragments present: 0.6% coarse organic matter, root fragments etc.; common fine organic matter in silasepic plasma; small amounts coarse charcoal, much fine (specks) charcoal; probable earthworm channels, earthworm casts - more organic and containing fine charcoal; dominant (35.8%) silasepic fabric comprises pale yellowish to dark brown dusty plasma containing silt, fine organic particles, fine charcoal, probable fine weathered glauconite - and commonly merges with poorly birefringent, coarse grained argillans ("argricutans") of similar composition; mainly void, some grain and within-matrix "agricutans"; few birefringent dusty ferri-argillans (include fine opaque material): rare diffuse fine nodules: silasepic; porphyroskelic.

B(tg): 51-82 cms. Upper Zone, approximately 51-66 cms.
Heterogeneous : Poorly-developed sub-angular blocky, with both areas of sepic more clayey fabric and more coarse silty

material: 15% macrovoids; compound packing voids; smoothed channels; 40% mineral grains, mainly fine-sized sand; mainly quartz, common glauconite including weathering silt-size material and "ghosts"; (mineral as above); rare coarse plant fragments, common fine organic matter; fine charcoal present; probable earthworm excrements present; decreasing (31%) silasepic fabric (see above) with increased "agricutans" (see above) - characterised by "green" weathered glauconite fragments; dusty birefringent ferri-argillans present: rare limpid argillans (clear, highly birefringent argillans); void and grain types: few diffuse nodules: mainly silasepic, with vo-skel-masepic; porphyroskelic.

B(tg): Lower Zone, approximately 67-82 cms.
Heterogeneous : Poorly developed sub-angular blocky, with both areas of sepic and silty material: 17% macrovoids (as above): 46% mineral grains (as above); mainly quartz, common glauconite, including splitting sand-sized grains, weathered silt and sand-sized grains and "ghosts": fine amorphous organic matter present; fine charcoal present; earthworm evidence present: decreased (21%) silasepic fabric (see Eb), common "agricutans" (see Eb); dusty feri-argillans present; few limpid argillans; void and grain types; generally dusty over limpid argillans-agricutans last phase; few diffuse nodules; mainly silasepic, with vo-skel-masepic; porphyroskelic.

<u>Description of Profile 2 (West Heath Barrow VIII)</u>

Soil subgroup: Humo-ferric podzol.

Altitude: 44m. O.D. Slope: 4 South West; increasing 11-12^{O} on shoulder; on spur downslope from plateau top, and barrow VI.

Horizon, depth cm.

Turf stack approx. 1.49 cm; with approx. 67 cm of lower turf stack intact.

Turf (at base of turf stack)

Ea 4-1.5	light grey (5YR6/1) loose sand; structureless; sharp, smooth boundary. pH 4.7

Ah 1.5-0	black (2.5YR2.5/0) moderately weak sand; fine to medium blocky; humose; smooth sharp boundary. pH 3.9
Old Ground Surface	
bAh 0-2(3)	black (2.5YR2.5/0) moderately weak sand; fine to medium blocky; humose; few fine roots; stone free; also merges laterally with Ah (turves) of turf stack above; smooth, sharp boundary. pH4.2.
bEa 2(3)-22(31)	grey to light grey; (5YR6/1-7/1) loose sand; structureless; rare large flints; moist; both clear and gradual, smooth boundary. pH4.5.
b Eh 22(31)-25(40)	discontinuous black (5YR2.5/1) moderately firm sand; massive humose; moderately to very stoney with medium to large flints; wt; diffuse boundary. pH3.9
b Bh2 25(40)-45(60)	dark reddish brown (2.5YR2.5/2) moderately firm sand; massive; moderately to very stoney with medium to large flints; wet; sharp, irregular boundary. pH4.2
b Bf 45(60)-46(61)	red (2.5YR4/6) moderately strong thin iron pan; sharp irregular boundary pH4.6
b Bhs 46(61)-50(62)	dark reddish brown to reddish brown (5YR3/3-4/4) moderately weak sand; massive; moderately flinty; fine Bs mottles present; gradual, irregular boundary pH4.1
bBs 50(62)-80	reddish yellow (7.5YR6/8) moderately weak sand; massive; moderately stoney with medium flints; loamy sand patches; moderately well formed prisms; gradual, irregular boundary pH4.2

bC	very pale brown (10YR7/4) sand to loamy sand
80+	pH5.1

Some additions later made

TABLE 1

Paleoenvironmental/Archaeological Sites of Heathlands of South-East England

No.	Site and Location	Feature	Age	Buried Soil	Environment	Author
1	Winfrith Heath, Dorset	Occupation	M	-	local open heath (P)	Dimbleby, 1976 Palmer and Dimbleby, 1979
2	Oakhanger, Hants	Occupation	M	-	local open heath (P)	Rankine, Rankine and Dimbleby, 1960, Dimbleby, 1962a
3	Iping Common, W. Sussex. SU 84852221	Occupation	M	-	local open heath (P)	Keef, Wymer and Dimbleby, 1965
4	Broome Heath, Norfolk TM 344912	Occupation	N	brown soil	open heath (recent woodland) (P)	Dimbleby and Evans, i Wainwright, 1972
5	Chicks Hill, Dorset SY 869859	Barrow	BA	humo-ferric podzol		Dimbleby, 1962a
6	Black Down Dorset SY 610875	Barrow	BA	podzol	primary woodland (P)	Dimbleby, in Thompson and Ashbee, 1957
7	Wallis Down, Dorset SZ 070940	Barrow	BA	podzol		Cornwall, in Case 195
8	Wallis Down, Dorset SZ 070940	Barrow	BA	"incipient podzol"		Cornwall, 1953
9	Canford Heath, Dorset SZ 020940	Barrow	BA	podzol		Cornwall, 1953
10	Turners Puddle Heath, Dorset	Barrow	BA	?		Piggott and Dimbleby, 1953

Key: M - Mesolithic
N - Neolithic
BA - Bronze Age
IA - Iron Age
Med - Medieval

No.	Site and Location	Feature	Age	Buried Soil	Environment	Author
11	Ashley Heath, Dorset	Barrow	BA	?		Piggot and Dimbleby, 1953
12	Burley, Hants. SU 212052	Barrow	BA	"immature podzol"	open heath (P)	Dimbleby, 1962
13	Moorgreen, Hants. SU 375145	Barrow	BA	"immature podzol"	not fully cleared (P)	Dimbleby, 1965
14	Ascot, Berks. SU 914687	Barrow	BA	humo-ferric podzol	arable-heath (P)	Bradley and Keith-Lucas, 1975
15	Wotton, Surrey TQ 11854805	Barrow	BA	(podzol)		Cocoran, 1963
16	St. Martha's Hill, Surrey TQ 029483	Earth circle	BA?	podzol		Wood, 1956
17	West Heath, W. Sussex SU 786226	Nine barrows	BA	humo-ferric podzols	heath-local woodland (P)	Drewert, 1976 Macphail, 1981a Scaife, 1983
18	Minstead, Sussex	Barrow	BA	humo-ferric podzol	heath (P)	Dimbleby, in Drewett, 1975
19	Tratton Common, Sussex	Barrow	BA	podzol		Keating 'unpub. PhD Thesis. Univ. of London)
20	Keston Camp, Kent TQ 421637	Fort	IA	humo-ferric podzol	primary woodland (P)	Cornwall, 1958 Dimbleby, 1962a
21	The Ridge, Hants. SU 312079	Bank	Med	humo-ferric podzol	open heath	Dimbleby, 1962a
22	Ockham Common, Surrey TQ 009590	Ridge and furrow	Med?	humo-ferric podzol		Macphail, 1982
23	Wareham, Dorset SY 911923	Experiment-al Earthwork	Mod -ern (1964)	humo-ferric podzol	heath	Evans and Limbrey, 1974

TABLE 2

Analytical Data Profile 1

Selmeston, Nr. Lewes, East Sussex

	pH	% loss on ignition	% Org. Carbon
Ah	5.7	7.0	1.58
Eb	6.0	2.4	0.72
Upper B(tg)	6.4	2.3	0.67
Lower B(tg)	6.5	2.3	0.29
B(t)g/C(t)g	6.6	1.9	-
2C	6.8	1.1	-

Grain Size	Cl	FZ	MZ	C.Z	Silt	FS	M.S	C.S	Sand	Texture
Ah	14	4	3	3	10	52	24	2	78	Loamy fine sand
Eb	14	3	6	10	19	44	22	1	67	Fine sandy loam
B(tg) (Upper)	16	4	6	6	16	53	14	1	68	Fine sandy loam
B(t(g) (Lower)	14	3	4	10	17	51	18	1	70	Loamy fine sand
Btg/Ctg	14	3	2	3	8	63	13	2	78	Loamy fine sand
2C	-	-	-	-	-	91	9	-	100	Fine sand

TABLE 3

Selmeston, Sussex

Approximate percentage of micro-features: Profile 2

Horizon	Count	Void	Mineral Grain	Glauc-onite	Pottery	Total Mineral	Coarse Org. Matter	Coarse Charcoal	Silasepic Fabric	"Agri-cutan"	Total Matrix	Argillans dusty	Argillans limpid	Nodules
Eb	1006	19.4	34.7	1.2	4.6	40.5	0.6	0.2***	35.8	2.7	38.5	0.2	-	0.1
B(tg) (Upper)	577	15.4	36.2	4.5	-	40.2	-	0.2*	30.6	5.5	36.1	2.4	0.2	1.4
B(tg) (Lower)	624	17.5	46.1	6.5	-	52.7	-	0.2*	21.5	4.5	26.0	2.2	0.8	0.6

N.B. *** - common, fine charcoal

* - rare, fine charcoal

TABLE 4

Analytical Data, West Heath

Soil	% Organic carbon	% Loss on Ignition	Pyrophosphate Extractable* Fe	Dithionite Extractable* Fe
Barrow V				
Ah (turf)	2.78	2.80		
b Ah	2.86	5.44		
Barrow VIII				
Ah (turf)	3.78	7.27	0.4	0.1
b Ah	4.73	11.11	0.5	0.0
b Bh	2.13	4.55		
Barrow IX				
Ah (turf)	4.81	7.65		
b AH	4.84	7.11		

* Carried out by Rothamsted Experimental Station

TABLE 5

Micromorphological Data and Absolute Pollen Frequencies, West Heath

Soil	Point Count	% Mineral Grain	% Void	% Organic Matter	Absolute Pollen Frequencies per gramme	Pollen Zone
3rd turf Ea					92,458	4
3rd turf Ah					546,212	4
2nd turf Ea					96,778	4
2nd turf Ah	1,100	51	15	34	515,000	4
1st turf Ea	100	(56)	(31)	(13)		
1st turf Ah	1,100	54	9	37	1,012,190	
b AH	1,100	53	17	30	493,419-610,729	3
b Ea (middle zone)	No data				c.20,000	2
b Ea (lower zone)	No data				c. 2,771	1
b Ea (lower zone)	100	(70)	(23)	(7)	too sparse to be counted	
b Bh	100	(68)	(10)	(22)		