CONTENTS

1: PALYNOLOGICAL ANALYSIS OF THE PALAEOSOL FROM RATTRAY

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SUMMARY: A palaeosol, of the later 2nd millenium BC, from beneath the Mediaeval Burgh of Rattray, Buchan was subjected to palynological analysis. Supporting evidence from soil moisture, organic matter content, soil pH and magnetic suceptability was also sought. The pollen assemblages from the palaecsol are interpreted as representing an initial period of open ground grassland conditions followed by a period of arable agriculture with evidence for cereal cultivation. Evidence of leaching (reduced pH) in the upper part of the palaeosol and in the lower part for enrichment in organic matter and enhanced magnetic susceptibility may indicate the weathering of this exposed soil surface with the resultant downwashing of organic material, including pollen. The low constant frequencies of arboreal pollen, especially pine and birch, suggest that trees were not growing at the site - but were possibly present along the inland edges of the machair. The later partial clearence of this open woodland is suggested by the reduction in the frequency of birch and heaths. The agricultural phase, associated with the creation of the plough-marks, was followed by deposition of the overlying Context following the burning of a wattle fence. The overlying context has a similar pollen assemblage but with some evidence for more unstable soil conditions possibly reflecting continuing agricultural activity. Later sands overlying both contexts record a similar picture of machair grassland with evidence for the rapid acretion of blown sand in response to poor vegetation cover. The upper assemblage is marked by the occurrence of several aquatic and marginal aquatic taxa indicating the local presence of standing water or dune marsh.

INTRODUCTION:

During excavations at the Mediaeval Burgh of Rattray (NGR: NK 088580), a number of earlier features were recorded including a series of palaeosols showing evidence of ploughing and associated with the burnt remains of a wooden wickerwork fence. On archaeological evidence these early features are of the later 2nd millenium BC (Dr. H. Murray, pers. comm.).

A total of six cuts were made through the Medieval to the prehistoric horizons. In five of these locations the buried palaeosol showed evidence interpreted by the excavator as plough marks. Three of the excavated cuts also showed evidence to suggest that two phases of ploughing were present, one contemporary with a wattle fence and a second post-dating its burning, collapse and burial by sand.

Samples for palaeoenvironmental analaysis were taken from Area 2, Cut 5, by I. D. Maté of the Scottish Development Department's Archaeological Operations and Conservation Unit. Three samples were taken: two parallel Kubiena tins were taken through the presumed soil horizon; one for micromorphological analysis the other for palynological analysis. A single bulk sample of the overlying sterile sand was taken for comparative purposes.

The author was asked to carry out the palynological analysis of one of the Kubiena tins (AOC store code 913/B1/001) together with a sub-sample of the overlying sterile sand (AOC store code 913/WH/001). The aim of the investigation was to determine the vegetation present during the formation of the palaeosol and whether patterns of change in the vegetation could be related to the archaeological record.

STRATIGRAPHY AND SEDIMENTS OF THE SAMPLE LOCATION:

The North section of the trench (Area 2, Cut 5) is illustrated in print (illus 4a). The recorded sequence of contexts, from the top of the section downwards, is as follows (all descriptions are based on those of the excavator);

TOP OF NORTH SECTION:

[2] Topsoil and modern cultivation. Overlies;

[6] Clean yellow sand, no lensing at top. Increased lensing towards base at the east end of the section (? seasonal growth ?). Overlies;

[7] Thick dark turf line. Dipping at about 30° from the horizontal from the west to the east. Overlies;

[17] Pale clean sand with lensing. Overlies;

[23] Upper plough horizon. Overlies Contexts [19], [Un-numbered], and [18].

[18] Wood charcoal or fence. Appears to laterally overlap Context [Un-numbered]. Overlies Contexts [19] and [24].

[Un-numbered] Small pocket of white sand. Apparent lateral overlap by Context [18]. Overlies Contexts [19] and [24].

[19] Plough marks. Incised upon and overlying Context [24].

[24] Lower plough horizon. Mottled sand. Overlies;

[25] Mottled sand.

BASE OF EXCAVATED SECTION.

SAMPLE LOCATION: The Kubiena tin samples were taken from across the junction of Contexts [23], [19] and [24], the majority of the sample being from Contexts [19] and [24]. A single bulk sample of the pale clean sand with lensing, Context [17], was also taken. These sampling locations are indicated in print (illus 4a).

LABORATORY SEDIMENT DESCRIPTION: In the laboratory the cleaned face of the Kubiena tin sample was drawn (shown in illus 9) and the samples were described as follows;

Bulk Sample: from Context [17]: Unconsolidated fine grained sand. Grains sub-rounded to rounded and well sorted. Colour 7.5YR 6/6 - reddish yellow. Organic matter appeared to be absent.

The Kubiena Tin: contained the base of Context [23], Context [19] and the upper part of Context [24]. This was divided into 10 mm deep spits, numbered 1 to 8 from top to bottom of the tin.

Spits 1 - 2: lower part of Context [23]: Unconsolidated fine grained sand. Grains sub-rounded to rounded and well sorted. Colour 7.5YR 6/6 - reddish yellow. Very low to absent organic matter.

Spit 3: Context [19]: Poorly consolidated fine grained sand. Grains sub-rounded to rounded and moderately well sorted. Colour 5YR 5/2 - reddish grey. Low organic matter content - abundant fine grained charcoal inclusions 1 - 2 mm diameter.

Spits 4 - 8: upper part of Context [24]: Moderately poorly consolidated silty-sand. Grains sub-rounded to rounded and moderately well sorted. Sand mottled with darker areas - base colour 7.5YR 4/2 - brown to dark brown, darker areas 7.5YR 3/2 - dark brown. Low organic matter content, further decreasing with depth - occasional fine grained charcoal inclusions 1 - 2 mm diameter.

METHODS:

In order to permit as full as possible understanding of the presumed palaeosol it was decided to undertake a series of soil-characteristic analyses in parallel with the palynological and micromorphological analyses. Given the very limited amount of sediment available it was only possible to undertake the determination of soil moisture, organic matter content, base status (pH) and magnetic susceptibility. The following procedure was adopted:

1. The kubiena tin sample was subdivided and cut into 10 mm deep horizontal spits. Each sub-sample was physically homgenised by quatering and mixing.

2. A 20 ml sub-sample of each spit (together with an equal ammount of the overlying pale sand) was taken using two 10 ml plastic containers. The residue of each spit was retained (see 6).

3. The magnetic susceptibility of each 20 ml sub-sample was then measured using a Bartington Magnetic Susceptibility Meter (model MS1, sensor type MS1B, settings - C.G.S., range 1.0). Four readings, plus background readings, were taken on each sample and the results averaged.

4. The sediment from each sub-sample was then suspended in 50 ml of distilled water and the pH measured with a Corning electronic pH Meter following the proceedure of Briggs (1980).

5. Following measurement of the soil pH the suspended sediment sample was processed to extract pollen and spores.

6. The residue of each spit sub-sample (2) was used to determine the moisture and organic matter content of the soil using the oven-drying (30°C for 24 hours) and loss-on-ignition (575°C for 8 hours) methods of Avery and Bascombe (1969) and Briggs (1980).

PALYNOLOGICAL METHODS:

The palynological samples were processed according to the methods given in Hunt (1985). This involves the disaggregation of the sediment in Potassium Hydroxide, repeated sieving on a 7 micron sieve to remove clays, and swirling on a clock glass to remove silts and sands. The palynological residues were strew mounted in glycerine jelly. Each sample was scanned at x40 magnification using an Olympus BH2 microscope until a total of 250 (or more) determinate grains had been recorded.

SOIL CHARACTERISTIC ANALYSIS RESULTS:

The results of the analyses are given in Table 1 and graphically summarised in illus 9. Note that below, the term profile refers to the stratigraphic sequence of samples submitted for analysis.

SOIL MOISTURE: Retained soil moisture shows an increase from 9.25 % of the sample weight at the base of the profile to a maximum of 13.76 % in spit 6, thereafter it declines progressively to 4.06 % by spit 1. No retained moisture was recorded in the bulk sample (BS).

ORGANIC MATTER CONTENT: Organic matter content increases from 1.92 % of the oven dry sample weight to a maximum of 3.40 % in spit 7, relatively high, but declining, percentages of organic matter are noted in spits 6 to 3 (2.56 to 1.66 %). Organic matter further declines in spits 2 and 1 (0.93 to 0.91 %). The bulk sample contained only 0.36 % organic matter.

BASE STATUS (pH): All the samples were alkaline or circum-neutral. The base of the profile was very alkaline (pH 8.68), alkalinity decreasing gradually upwards until a circum-neutral reading of pH 6.97 was recorded in spit 3, thereafter alkalinity increased again to reach pH 7.87 at the top of the Kubiena tin (spit 1). A decline in this figure to pH 6.90 was noted in the bulk sample (BS).

MAGNETIC SUSCEPTIBILITY. All the samples examined had a very poor magnetic susceptibility. At the base of the sample tin, spit 8, a reading of 0.33 C.G.S. was noted, this increases to reach a maximum susceptibility of 0.66 C.G.S. in spit 6. A marked decline in susceptibility follows reaching a more stable low of 0.15 and 0.13 in spits 2 and 1 respectively. This declines again to 0.02 C.G.S. in the bulk sample. Calculation of the packing density of the samples showed this to be uniform - the maximum variation was less than 0.12 gram per ml - which further suggest that the signal reflects genuine changes in the magnetic susceptibility of the samples rather than any artefact resulting from differential packing.

PALYNOLOGICAL RESULTS:

The palynological results are given in Table 2 and are illustrated by the pollen diagram, illus 10. The pollen sum is based on the sum of total Pollen and Spores (Σ P+S) excluding indeterminate grains. Percentage frequencies of indeterminate grains were calculated outside the sum and are given as a percentage of Σ P+S.

The pollen and spore concentrations in all the samples examined was relatively low, multiple slides were examined but in one case (spit 2) only 117 determinable grains were recovered after 100 traverses. Indeterminate grains, however, were not noteably higher in this sample than the average (8.7 %). Difficulties in achieving meaningful pollen totals from sandy machair sites have also been noted by Whittington (in Ritchie 1984) at Knap of Howar, Orkney. Nevertheless, the results appended here do appear to show meaningful patterns of variation which can be interpreted in terms of vegetational change and post-depositional history.

The palynological data can be tentatively divided into three pollen assemblage groups (delimited by shared characteristics) within the Kubiena tin sample (samples 1 to 8) with the bulk sample (BS) forming a forth outlying assemblage. The use of the term pollen zone is avoided here as it is possibly misleading in the context of soil pollen analysis - where many of the assemblages do not result from a relatively simple sequence of deposition but reflect other processes including differential pollen movement, weathering residuals, etc. (cf. Dimbleby 1985), and hence do not represent discrete sequences of vegetation change and, by inference, periods of time. Further, it is inappropriate to use the term zone when speaking of a single sample.

From the base of the profile upwards the assemblage groups are;

Pollen Assemblage Group 1: Spits 8 to 5: This assemblage group is dominated by Gramineae (Grasses, 28.5 to 25.3 %) together with moderately high frequencies of Compositae Liguliflorae type (Daisy family, 16.2 to 27.8 %). Numerous open ground herbs are sporadically present, but persistant records of Rumex acetosella (Sheeps Sorrel, 2.1 to 3.1 %), Urtica type (Nettles, 0.9 to 1.1 %), Ranunculus type (Buttercups, 2.1 to 2.8 %), Carduus Type (Thistles, 0.6 to 5.0 %) and Cirsium type (Thistles, 3.0 to 0.9 %) were noted. Arboreal pollen is present in low frequencies (see below). In general the Cryptogams, most especially the ferns (represented by Filicales, Dryopteris and Thelypteris), Sphagnum and Lycopodium show a gradual decline as one moves up the profile, although Pteridum (Bracken) after an intial increase from 2.1 % to 4.6 % remians relatively constant.

Pollen Assemblage Group 2: Spits 4 to 3: This assemblage group is delimited by increased frequencies of Compositae Liguliflorae type (48.9 to 52.7 %), Gramineae show a complimentary decline (16.2 to 16.3 %). Again numerous open ground herbs are sporadically present in low frequencies, Rumex acetosella continues to be present but in reducing frequencies (3.5 to 0.3 %). Ranunculus type, Carduus type and Cirsium type also persist, but Urtica type is absent. Arboreal pollen is again present in low frequencies. The group sees the continued declining trend of the grouped frequency of Cryptogams, although Pteridium remains constant.

Pollen Assemblage Group 3: Spits 2 to 1: This assemblage group shows a decline in the frequency of Compositae Liguliflorae type (37.6 to 40.0 %), however, this is not reflected by a rise in the Gramineae curve which remains nearly constant (16.2 to 14.4 %). Increased incidences of herb taxa, most especially Cirsium type and increased frequencies of sporadically occuring taxa such as Armeria (3 %), balance the Compositae decline. Increased frequencies of Filicales (5.1 to 3.1 %) and Pteridium (6.0 to 7.0), together with the reappearence of sporadic fern taxa, such as Thelypteris, are also noted. The frequency of Lycopodium and Sphagnum, however, further declines (to 0.9 % and 1.3 % respectively).

Pollen Assemblage Group 4: The bulk sample (Context [17]): The pollen and spore assemblage from this sample is differentiated by an increase in the frequency of Gramineae (30.4 %) and a marked decline in the frequency of Compositae Liguliflorae (10.7 %). Other herb taxa are also reduced, although low frequencies of aquatic and aquatic marginal taxa such as Polygonum amphibia and Littorella uniflora are present for the first time together with the previously sporadic Alisma type. Increased frequencies of Cryptogams including Filicales (9.1 %) and Pteridum (9.1 %), together with increased numbers of Lycopodia (3.4 %) and Sphagnum are noted.

Arboreal pollen are present in low frequencies throughout the profile, with persistent records of Pinus (Pine, 3.8 to 1.9 %), moderately persistent records of Betula (Birch, 1.6 to 0.4 %) and sporadic occurences of very low frequencies of Ulmus (Elm, 0.5 to 0.3 %), together with the persistant values observed for Coryloid type (probably Hazel, 1.2 to 3.4 %). In all cases slight fluctautions in the relative frequencies are noted but these do not reflect the changes observed elsewhere in the profile. This suggests that the arboreal pollen are derived from outside the immediate area of the site, possibly along the machair fringe where Pine, Birch and Hazel are present today, and form part of the regional pollen rain. Ericaceae pollen, however, does show some variation, decreasing during PAG1, then rising again (to 6.7 %) during PAG2. This is followed by a further decline in PAG3 and the bulk sample (PAG4).

DISCUSSION:

The soil properties are compared in illus 9. All soil properties show evidence of variation associated with the junction of Contexts [24], [19] and [23]. Both soil moisture and organic matter content show an intial increase from spit 8 through to spits 6 and 7 respectively. Both then decline gradually until spit 2 were a marked decline occurs. Since moisture content is usually related to the presence of organic matter this parallel relationship is to be expected. The bulk sample was lacking moisture and contained only a very small amount of organic matter. This may reflect relatively rapid deposition in an environment where vegetation cover was discontinous and sand blowing was relatively common. This interpretation is supported by figures for the organic matter content of immature and unstable dune soils given by Tansley (1949, 865-866).

The decline in the alkalinity of the sands in the spits immediately below the lower plough horizon suggests that some dissolution, leaching and removal of alkaline materials, in particular carbonates, from the surface of the palaeosol took place. This would agree with the archaeological interpretation of the upper surface as a plough-soil or sub-soil. Increased alkalinity in the upper samples from the Kubiena tin may indicate the subsequent downward movement of carbontes during the exposure of the upper plough horizon or more probably may reflect the deposition of relatively unweathered sand at this time. The relatively low alkalinity of the bulk sample may also have resulted from a period of leaching subsequent to deposition.

Magnetic susceptibility, although generally low, appears to parallel the results for organic matter content. The pattern of increasing and then gradually decreasing magnetic susceptibility may reflect the downwashing of organic matter and iron compounds below a weathering soil surface or it may reflect the admixture of non-susceptible sand to an existing weathered organic horizon during that horizons burial. I suspect the latter to be more probable since the base of the overlying upper-plough horizon (spits 1 and 2) has a markedly lower susceptibility suggesting that it has not been a receiving point for downwardly translocated magnetic material - the increased alkalinity and decreased organic matter content in these samples may therefore reflect the input of relatively unweathered and inorganic dune sand. Oldfield has suggested that the presence of enhanced magnetic susceptibility is indicative of weathering surfaces and soils - although the scale of change here is somewhat smaller than he has reported.

The very faint magnetic susceptibility signal in the bulk sample suggests that it has not been exposed to extended surface weathering and again indicates the relatively rapid acretion of sand.

Initial examination of the micromorphology of the parallel Kubiena tin, reveals a pattern of increasing clastic organic matter with depth which would tend to support the above observations. The presence of apparent organic coatings to some of the grains in the lower part of the slide (equivalent to spits 4 to 8) would also tend to support this. No evidence for translocated clay, in the form of clay coatings was noted, indeed clay appeared to be almost absent from the sample.

The palynological and soil characteristic analysis results are compared in illus 9. Correlations appear to exist between the behaviour of the pollen curves for the grouped taxa and those for the soil properties. This suggests a measure of interlinkage between the soil properties and the composition of the pollen and spore assemblages - in short they reflect a response, in some way, to the depositional and post-depositional history of the site.

Interpretation of variation in the pollen and spore assemblages through the sampled profile is difficult. Nevertheless, the presence of a relatively abrupt change at the boundary of the sediment contexts would suggest that the pollen and spore assemblages have not been unduely mixed between contexts (Dimbleby 1985, 11-17). Although the action of earthworms and other burrowing soil organisms in carrying soil pollen both up and down the soil profile has been demonstrated by several investigators (Ray 1959; Dimbleby 1961; Walch, Rowley and Norton 1970) it does not appear to have been a major factor in the creation of the palynological record at Rattray.

The lower plough horizon (Context [24]) contains Pollen Assemblage Groups 1 and 2, and is dominated by grasses and open ground herb taxa. Many of the pollen types represented include saline tolerent - marine marginal - species, such as Armeria type, reflecting the coastal position of the site. The presence of taxa suggesting dune pasture, such as Ranunculus, Plantago lanceolata and Cyperaceae (Tansley 1949, reports Ranunculus repens, Plantago lanceolata and Carex arenaria from cattle pasture on dune sand) together with elements indicating less stable or disturbed ground conditions such as Urtica type, many of the Compositae and cultivars such as Cereal type suggests that the lower assemblages may result from the superimposition and mixing of two pollen assemblages; the first representing a period of open grazed grassland; the second a period of arable agriculture.

The presence of decreasing frequencies of damp ground taxa such as Sphagnum and Lycopodium, together with Iris (Iris pseudacorus is reported from dune slacks by Tansley 1949) at the base of the profile suggests that the first phase of grassland vegetation may have been associated with areas of local dune slack type vegetation. The decline in damp ground taxa up the profile may reflect the local drying of the area following ploughing.

The phase of arable agriculture represented by the addition of cultivars and disturbed open ground taxa appears to have resulted in the weathering of the soil surface, reflected by the enhanced magnetic susceptibility of this horizon and possibly by the increased representation of Compositae in the upper part (spits 3 and 4). The increased representation of Compositae Liguliflorae and other Compositae taxa together with the poor preservation state of many of the taxa in these groups may reflect either the differential survival rate of these noteably resistant taxa (Havinga 1984) following weathering or the adventitious conditions offered by the disturbed open ground of arable cultivation to species of this group.

Differentiation between PAG 1 and PAG 2 may therefore be the result either of post depositional differential weathering or the superimposition of pollen derived from later arable agriculture upon an exisitng residual assemblage. The latter would accord better with the ploughing of this horizon, which presumably involved the breaking up of an existing machair turf. This my be supported by the similarity of the range of taxa present in both assemblage groups. In either case differences between the pollen assemblage groups identified in the lower plough horizon (Context [24]) should be viewed in terms of depositional processes and should not be seen as having any chronological significance.

The presence of areas of acid, dune heath, machair is suggested by the persistent presence of Rumex acetosella and Ericaceae pollen (both Erica cinerea and Calluna vulgaris are recorded from dune heath) throughout PAG 1 and PAG 2. Given the alkalinity of the samples investigated local growth appears unlikely and it is probable that Ericaceae was confined to the more established machair, possibly along the landward fringes of the area. Such heathland may have been associated with open stands of pine, birch and hazel. The low, but relatively constant, frequencies of arboreal pollen suggesting that trees were not growing at the site - but were possibly present at some distance from it along the landward edges of the machair or further inland in upland areas.

A marked decline in the frequency of Ericaceae pollen is noted in the upper sample from PAG 2 (spit 3). Low frequencies of Ericaceae continue throughout PAG 3 and PAG 4. This is mirrored by a decline in the frequency of Betula and the absence of Rumex acetosella from PAG 3 and PAG 4. This may indicate the clearence and removal of areas of Ericaceae-Betula scrub and reflect the agricultural activity suggested by increased frequencies of cereal pollen in PAG 3 and PAG 4.

The pollen assemblage from the lower part of the overlying upper plough horizon (Context [23]), PAG 3, is dominated by open ground herbs and grasses. In general terms the assemblage is not too dissimilar from that in PAG 1 and 2 and again has elements indicative of both disturbed open ground conditions (in particular cereal pollen indicating arable agriculture) and open grassland machair. The presence of relatively low organic matter content. poor magnetic susceptibility and increased alkalinity suggests the relatively rapid deposition of fresh unweathered sands across the old ground surface and it would appear probable that the pollen in part reflects the vegetation present during the accumulation of the sands and in part results from downwashing and mixing once a new, and relatively stable, surface (not sampled here) was established at a higher level. *Archaeological evidence (Murray pers. comm.)* suggests that *further* agricultural activity took place on this upper horizon - this is supported by the presence of cereal pollen (presumably downwashed into the profile).

The pollen and spore assemblage from PAG 4 is composed of similar taxa to the preceeding samples and again suggests the presence of machair grassland. That this vegetation cover may have been discontinuous at this time is suggested by the low magnetic susceptibility and organic matter content of these sands which may indicate that sand was deposited relatively rapidly. Sand movement by blowing would have been encouraged by poor or partial vegetation cover. Whether poor vegetation cover was the result of overgrazing or other agricultural activity is unknown, but it may well have played a part in destabilising the machair dune system. It is worth noting that cereal pollen was also recovered from the bulk sample suggesting that some agricultural activity was taking place during this period of sand instability. Unfortunately the limited number of grains recovered together with the poor preservation state of much of the cereal pollen from the profile preculuded its assignment as to probable species.

Most notably PAG 4 is associated with the appearence of several fresh, or at least brackish, water taxa, including Polygonum cf. amphibium, Littorella cf. uniflora and Alisma. These taxa, together with records of other possible dune marsh taxa such as Teucrium (possibly T. scordium) and the reappearence and resurgence of damp ground Cryptogam taxa such as Sphagnum and Lycopodium, may indicate the local presence of dune slack vegetation possibly with at least seasonal standing water at this time (cf. Tansley 1949, 861-862).

COMPARISON WITH OTHER SITES AND THE REGIONAL POLLEN RECORD:

Previous palynological studies of sands and sandy soils in Scotland have generally yielded poor results. Both Durno (in Coles and Taylor 1973) at Culbin Sands and Whittington (in Ritchie 1984) at Knap of Howar, recorded either the absence of pollen or pollen concentrations so low as to be uninterpretable. Nevertheless, Dimbleby (1984, 47) did record a recognisable pollen record from two buried dune soils on the Isles of Scilly and cautions against dimissing such sites out of hand - a conclusion also reached by Whittington. Certainly the comparatively high pollen concentrations recorded at Rattray Head are of interest as the sediments in the Rattray profile are as alkaline as those recorded at Knap of Howar (Whittington, in Ritchie 1984) where pollen was either absent or present as only a few isolated grains per sample. This further supports Whittington's view that pollen preservation does not appear to be directly related to the alkalinity of the sediments but must depend on other factors acting in conjunction with the base status.

The published pollen diagrams for the northeast of Scotland show little variation from the sequence seen elsewhere in the country (Gunson 1975), unfortunately no recent published sequence from lowland Buchan is known to the author, most diagrams coming from inland, upland areas such as Abernethy Forest (Birks 1970), Loch Kinord and Loch of Park (Vasari and Vasari 1968). The few lowland exceptions are the work of Durno (1956, 1957) and are insufficiently detailed to permit realistic comparison.

The problem is further complicated by the nature of the site being investigated; the very localised pollen catchment of a soil will mitigate against its correlation with sites deriving their pollen from a wider area. Further the pollen record from Rattray represents only a short time period and is clearly (at least in part) the result of small scale anthropogenic factors - factors which would not be present in that form in a site with a wider catchment. These factors have precluded the direct correlation of the Rattray results with those from other sites.

Nevertheless, it is clear that the Rattray profile differs in several respects from the detailed evidence offered by inland locations and the outline evidence offered by lowland (but not coastal) sites.

1. The Rattray profile appears to describe a series of vegetation communities similar to those of the modern machair. These are quite different in composition from those seen in other diagrams (eg. Stewart 1964) and undoubtedly reflect the sites location. This vegetation pattern is similar to that inferred by Durno (in Coles and Taylor 1973) for a dune

soil beneath an Early Bronze Age midden in the Culbin Sands on the Moray Firth coast although Durno was unable to recover sufficient grains to permit a full interpretation of the sites vegetation history.

2. The Rattray profile is remarkable for the low frequency of arboreal pollen: 15 % as against the 60 to 80 % seen at Loch Kinord in Zone VIIb. This suggests that closed woodland was absent from the Rattray area by the later 2nd millenium and may have been absent throughout the Flandrian.

3. While the dominance of pine and birch at Rattray replicates that seen elsewhere, other taxa such as oak, alder and willow are entirely absent, although hazel and elm is sporadically present. This may reflect the growth of a limited range of arboreal taxa along the margins of the machair or the long distance transport of arboreal pollen into the area.

The decline in Ericaceae pollen frequency in the Rattray profile appears to parallel that seen in other diagrams during early Zone VIIb and may reflect a regional trend, however, other evidence (above) suggests that such changes in frequency have a more local origin. Given the short time period probably represented by the samples from the Kubiena tin, and the post-depositional processes to which the assemblages have been subjected, the latter would appear more likely.

CONCLUSION:

The presence of a palaeosol at Rattray may be inferred on the grounds of lateral continuity and vertical differentiation based on the presence of clear changes in the organic matter content, base status and magnetic susceptibility through the examined profile. The Palynological data further provides limited evidence for changes in the local vegetation associated with the junction of Contexts [24], [19] and [23].

The interpretation of the palynological and soil property data presented above may be summarised as follows:

1. Deposition of sand (Context [24]), followed by development of semi-stable dune slack type vegetation dominated by grasses and Compositae

herbs, with *Sphagnum* moss and *Lycopodium* locally present. The impression of a vegetation resembling modern grazed grassland machair is reinforced by the presence of several marine marginal and salt tolerent herb taxa. This phase is associated with the initial enhancement of the organic matter content of the palaeosol and increased magnetic susceptibility.

2. Ploughing of Context [24] (Context [19] - the plough marks) followed by arable agriculture, possibly with some cereal cultivation. This is supported by the presence of a number of disturbed open ground indicators. This phase is associated with the further enhancement of the organic matter content of the soil and further increased magnetic susceptibility, together with the leaching of the upper surface of the palaeosol. The increased representation of Compositae Liguliflorae type pollen in the upper part of the palaeosol may reflect differential preservation of this pollen type following weathering of the palaeosol or it may simply reflect the preference of many Compositae species for open disturbed ground habitats synonymous with arable agriculture.

3. This agricultural phase is terminated by the deposition of the overlying sands (Context [23]). The deposition of fresh unweathered sands across this old ground surface is suggested by the presence of decreased organic matter content, decreased magnetic susceptibility and increased alkalinity. This phase is associated with disturbed open ground taxa and a decline in grasses.

4. Following further agricultural activity on this new surface (for which no samples were available) a further period of sand deposition took place. The low magnetic suceptibility and organic matter content of these sands (context [17]) suggests that sand was deposited relatively rapidly in an environment with poor or partial vegetation cover. The pollen evidence suggests a more open grass dominated vegetation similar to that observed in present dune systems. The presence of several fresh, or at least brackish, water taxa indicates the local presence of at least seasonal standing water at this time.

5. Throughout the period represented by the profile, arboreal species would appear to be entirely absent from the local area around the site. The low frequencies of pine, birch and hazel recorded suggesting that

woodland may have been confined to the landward fringes of the machair. Changes in the frequency of Ericaceae pollen may also reflect local changes - in particular the creation and destruction of acid heathlands on the edges of the machair - or they may reflect changes further inland.

The local nature of the pollen catchment of a soil of this type, together with the processes operating within it, precludes the exact correlation of the pollen spectra from the site with the few existing long pollen sequences from the area. Nevertheless, the low arboreal pollen frequencey recorded throughout the profile does accord with other similar sites and argues for the existence of a relatively treeless machair by the later 2nd millenium.

RATTRAY: RESULTS OF SOIL CHARACTERISTIC ANALYSES:

Sample Number	Percentage Moisture %	Percentage Organic Matter %	Base Status pH	Magnetic Susceptibility C.G.S.
BS.	0.0	0.36	6.90	0.02
1.	4.02	0.91	7.87	0.13
2.	5.16	0.93	7.44	0.15
3.	9.60	1.66	6.97	0.23
4.	9.49	1.89	6.99	0.38
5.	12.73	2.45	7.20	0.57
6.	13.78	2.56	7.91	0.62
7.	12.73	3.40	8.26	0.52
8.	9.25	1.92	8.66	0.33

Table 1 Results of soil characteristic analyses.

T. LE 2 PALYNOLOGICAL RESULTS

This is presented as two 'landscape' frames. The top of the Table comes first (C 7-8), followed by the lower half (C 9-10).

RATTRAY

	SAMPLE NUMBER:																	
	RH/BS		RH/1		RH/2		RH/3		RH/4		RH/5		RH/6		RH/7		RH/8	
Taxa:	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
TREES:																		
Pinus	1	0.4	7	3.0	3	2.6	7	2.3	7	1.9	6	1.9	6	3.2	14	3.8	9	2.7
Betula	1	0.4			1	0.9	3	1.0	6	1.6	2	0.6			2	0.5	1	0.3
Ulmus							1	0.3			1	0.3	1	0.5				
Sub-Total:	2	0.8	7	3.0	4	3.4	11	3.7	13	3.5	9	2.8	7	3.8	16	4.4	10	3.0
SHRUBS:																		
Coryloid	9	3.4	2	0.9	1	0.9	1	0.3	2	0.5	1	0.3	1	0.5	2	0.5	4	1.2
Ilex									1	0.3								
Hippophae	1	0.4																
Sub-Total:	10	3.8	2	0.9	1	0.9	1	0.3	3	0.8	1	0.3	1	0.5	2	0.5	4	1.2
DWARF SHRUBS:																		
Ericaceae	6	2.3	5	2.2	1	0.9	9	3.0	25	6.7	20	6.3	9	4.9	14	3.8	38	11.4
Sub-Total:	6	2.3	5	2.2	1	0.9	9	3.0	25	6.7	20	6.3	9	4.9	14	3.8	38	11.4
GRASSES:																		
Gramineae	80	30.4	33	14.4	19	16.2	49	16.3	61	16.2	81	25.3	48	26.0	86	23.4	95	28.5
Cereal Type	4	1.5	6	2.6					1	0.3					6	1.6	3	0.9
Cyperaceae	16	6.1			3	2.6	1	0.3	1	0.3	6	1.9	1	0.5	1	0.3	1	0.3
Sub-Total:	100	38.0	39	17.0	22	18.8	50	16.6	63	16.8	87	27.2	49	26.5	93	25.3	99	29.7
HERBS: (CTW order):																		
Caltha type	1	0.4							1	0.3								
Ranunculus type	15	5.7	5	2.2	2	1.7	9	3.0	4	1.1	9	2.8	2	1.1	9	2.5	7	2.1
CRUCIFERAE ('Sinapis')							1	0.3										
Viola palustris type			1	0.4														
CARYOPHYLLACEAE	2	0.8											1	0.5	4	1.1	5	1.5
CHENOPODIACEAE											1	0.3			2	0.5	2	0.6
Linum catharticum			1	0.4														
Onobrychis type	1	0.4																
ROSACEAE (undiff.)	1	0.4	2	0.9			1	0.3	1	0.3					2	0.5	1	0.3
Circeae	1	0.4																
UMBELLIFERAE			2	0.9			1	0.3	5	1.3	3	0.9			1	0.3	2	0.6
Rumex acetosella							1	0.3	13	3.5	10	3.1	5	2.7	5	1.4	7	2.1
Oxyria type									1	0.3								
Urtica type	1	0.4			1	0.9					2	0.6	2	1.1	2	0.5	3	0.9
Cannabis/Humulus	1	0.4															1	0.3
Armeria type (A+B)	1	0.4	7	3.0			3	1.0			1	0.3					4	1.2
Lamium type																	1	0.3
Teucrium	3	1.1	1	0.4														
Plantago lanceolata					5	4.3							3	1.6	1	0.3		
Campanula type	1	0.4																
COMPOSITAE *Liguliflorae*	28	10.7	92	40.0	44	37.6	158	52.7	184	48.9	89	27.8	49	26.5	71	19.4	54	16.2
COMPOSITAE Tubiflorae	5	1.9	3	1.3	1	0.9	5	1.7									2	0.6
Bidens type	1	0.4			1	0.9					1	0.3					3	0.9
Aster type	2	0.8									1	0.3						
Carduus	1	0.4	8	3.5	3	2.6	3	1.0	9	2.4	16	5.0	6	3.2	4	1.1	2	0.6
Cirsium	2	0.8	7	3.0	9	7.7	6	2.0	10	2.7	3	0.9	4	2.2	4	1.1	10	3.0
Centaurea nigra type			1	0.4														
Serratula type	3	1.1	14	6.1			8	2.7			9	2.8	1	0.5	2	0.5	2	0.6
Convallaria type	2	0.8																
Scilla type	1	0.4							1	0.3								
Allium type									1	0.3					1	0.3		
Sub-Total:	72	27.4	144	62.6	73	62.4	196	65.3	230	61.2	145	45.3	73	39.5	148	40.3	106	31.8

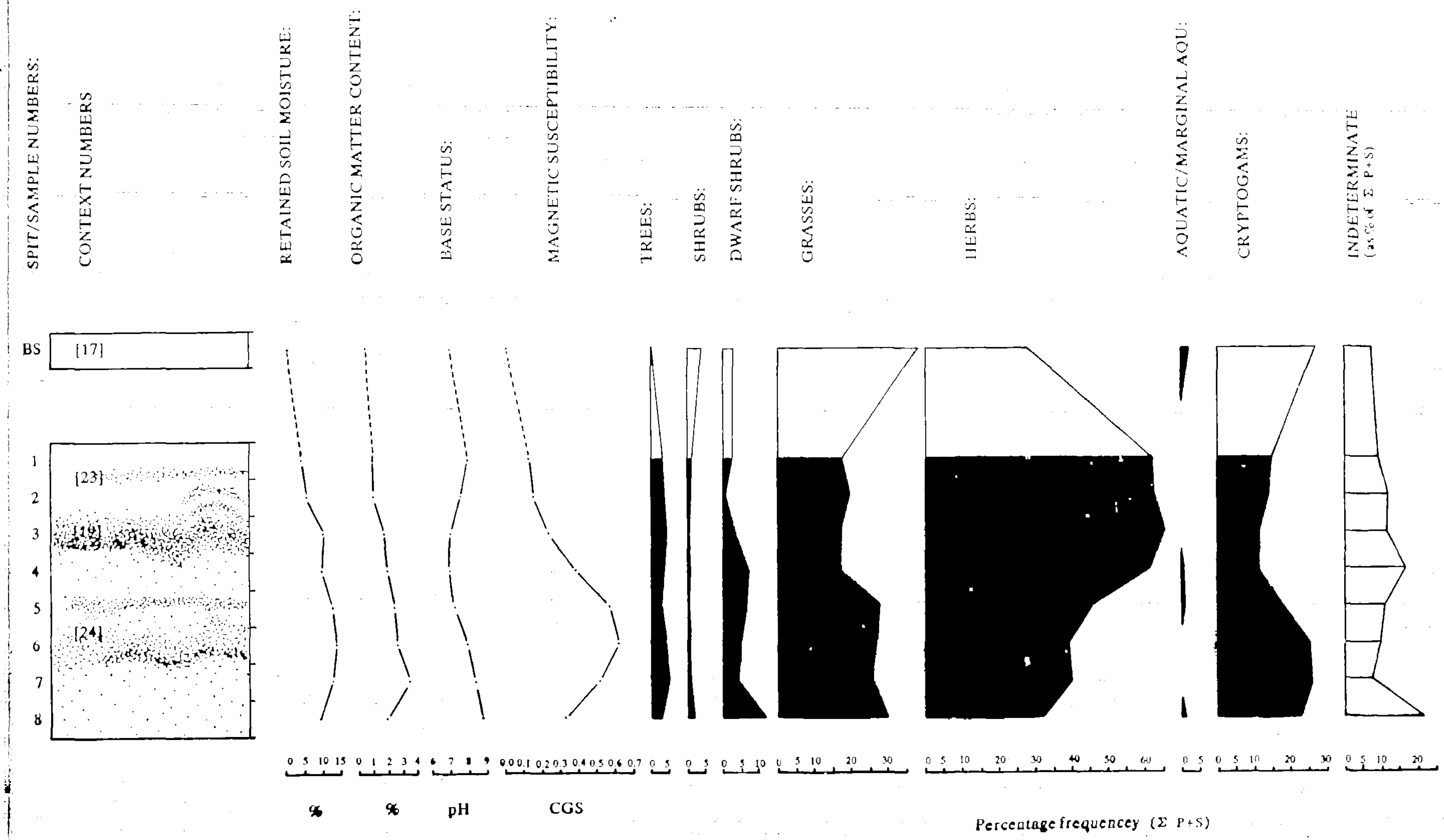
RATTRAY.

SAMPLE NUMBER:

	RH/BS		RH/1		RH/2		RH/3		RH/4		RH/5		RH/6		RH/7		RH/8	
AQUATIC/MARGINAL AQU.:																		
Polygonum cf. amphibium	1	0.4																
Littorella cf. uniflora	2	0.8																
Alisma type	1	0.4							1	0.3	1	0.3						
Iris																	1	0.3
Sub-Total:	4	1.6	0	0.0	0	0.0	0	0.0	1	0.3	1	0.3	0	0.0	0	0.0	1	0.3
CRYPTOGAMS:																		
Filicales undiff.	24	9.1	8	3.5	6	5.1	8	2.7	5	1.3	13	4.1	15	8.1	19	5.2	8	2.4
Pteridium	24	9.1	16	7.0	7	6.0	11	3.7	16	4.3	14	4.4	8	4.3	17	4.6	7	2.1
Cryptogramma crispa					1	0.9											1	0.3
Cystopteris type	2	0.8	4	1.7														
Dryopteris undiff.			1	0.4					3	0.8	1	0.3	2	1.1	3	0.8		
Thelypteris undiff.							1	0.3										
Polypodium undiff.	1	0.4	1	0.4			2	0.7	5	1.3	5	1.6	5	2.7	25	6.8	6	1.8
Ophioglossum											2	0.6			2	0.5	1	0.3
Selaginella	3	1.1					2	0.7	1	0.3					1	0.3		
Lycopodiaceae	9	3.4			1	0.9	2	0.7	2	0.5	8	2.5	1	0.5	15	4.1	46	13.8
Sphagnum	6	2.3	3	1.3	1	0.9	7	2.3	9	2.4	14	4.4	15	8.1	12	3.3	6	1.8
Sub-Total:	69	26.2	33	14.4	16	13.7	33	11.0	41	10.9	57	17.8	46	24.9	94	25.6	75	22.5
Σ POLLEN AND SPORES:	263	100.0	230	100.0	117	100.0	300	100.0	376	100.0	320	100.0	185	100.0	367	100.0	333	100.0
INDETERMINATE: (as % of Σ P+S)	19	7.2	20	8.7	14	12.0	35	11.7	63	16.8	35	10.9	18	9.7	29	7.9	70	21.0
TRAVERSES:	61		37		100		36		30		33		32		31		46	

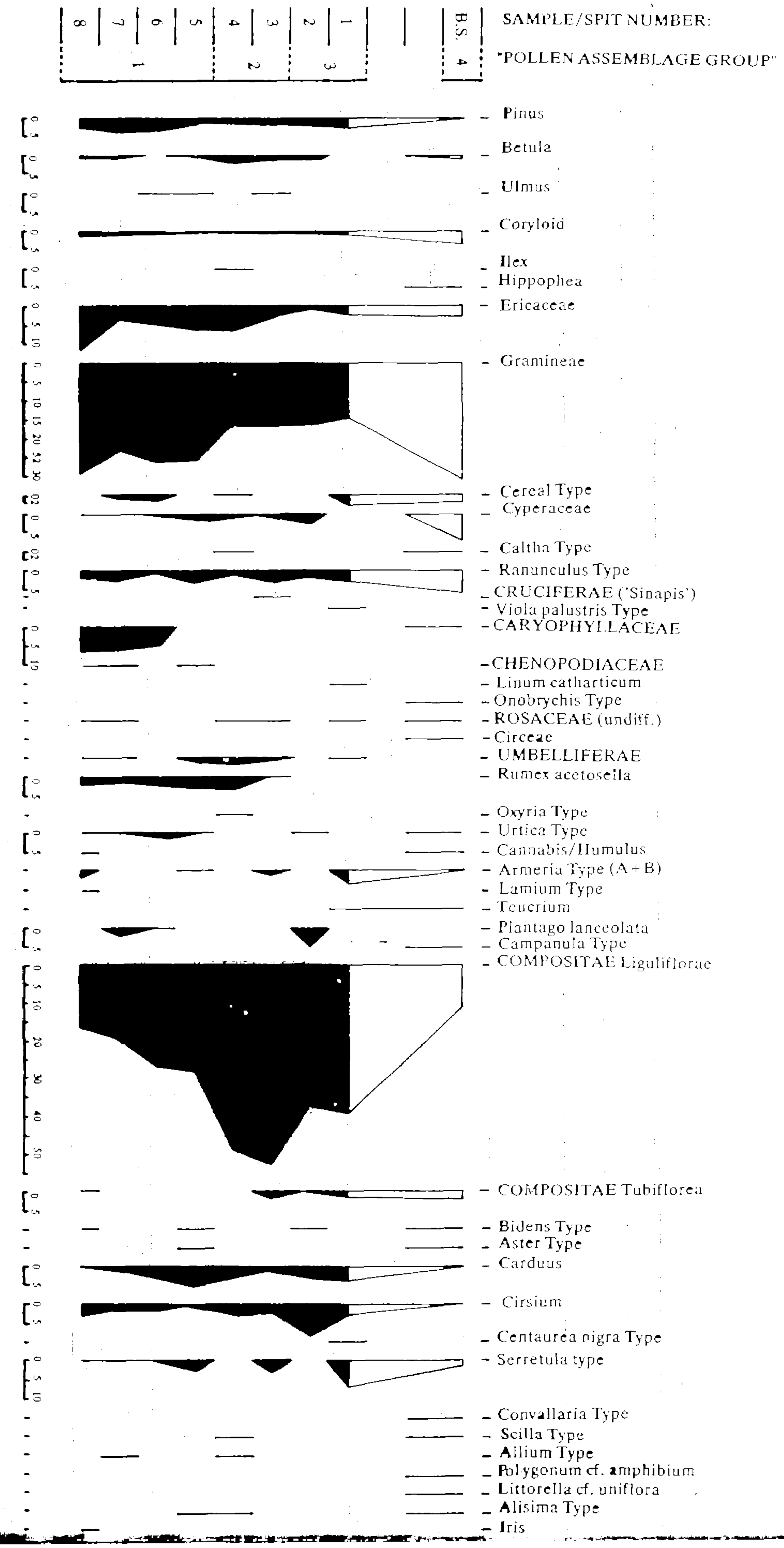
RATTRAY. SUMMARY TABLE:

Groups:	RH/BS No.	RH/BS %	RH/1 No.	RH/1 %	RH/2 No.	RH/2 %	RH/3 No.	RH/3 %	RH/4 No.	RH/4 %	RH/5 No.	RH/5 %	RH/6 No.	RH/6 %	RH/7 No.	RH/7 %	RH/8 No.	RH/8 %
	SAMPLE NUMBER:																	
TREES:	2	0.8	7	3.0	4	3.4	11	3.7	13	3.5	9	2.8	7	3.8	16	4.4	10	3.0
SHRUBS:	10	3.8	2	0.9	1	0.9	1	0.3	3	0.8	1	0.3	1	0.5	2	0.5	4	1.2
DWARF SHRUBS:	6	2.3	5	2.2	1	0.9	9	3.0	25	6.7	20	6.3	9	4.9	14	3.8	38	11.4
GRASSES:	100	38.0	39	17.0	22	18.8	50	16.6	63	16.8	87	27.2	49	26.5	93	25.3	99	29.7
HERBS:	72	27.4	144	62.6	73	62.4	196	65.3	230	61.2	145	45.3	73	39.5	148	40.3	106	31.8
AQUATIC/MARGINAL AQU.:	4	1.5	0	0.0	0	0.0	0	0.0	1	0.3	1	0.3	0	0.0	0	0.0	1	0.3
CRYPTOGAMS:	69	26.2	33	14.4	16	13.7	33	11.0	41	10.9	57	17.8	46	24.9	94	25.6	75	22.5
Σ POLLEN AND SPORES:	263	100.0	230	100.0	117	100.0	300	100.0	376	100.0	320	100.0	185	100.0	367	100.0	333	100.0
INDETERMINATE: (as % of Σ P+S)	19	7.2	20	8.7	14	12.0	35	11.7	63	16.8	35	10.9	18	9.7	29	7.9	70	21.0



Illus 9: Palynological analysis. Results of soil moisture, organic matter content, base status (pH) and magnetic susceptibility measurements, compared with the summary pollen diagram

1: C13-14

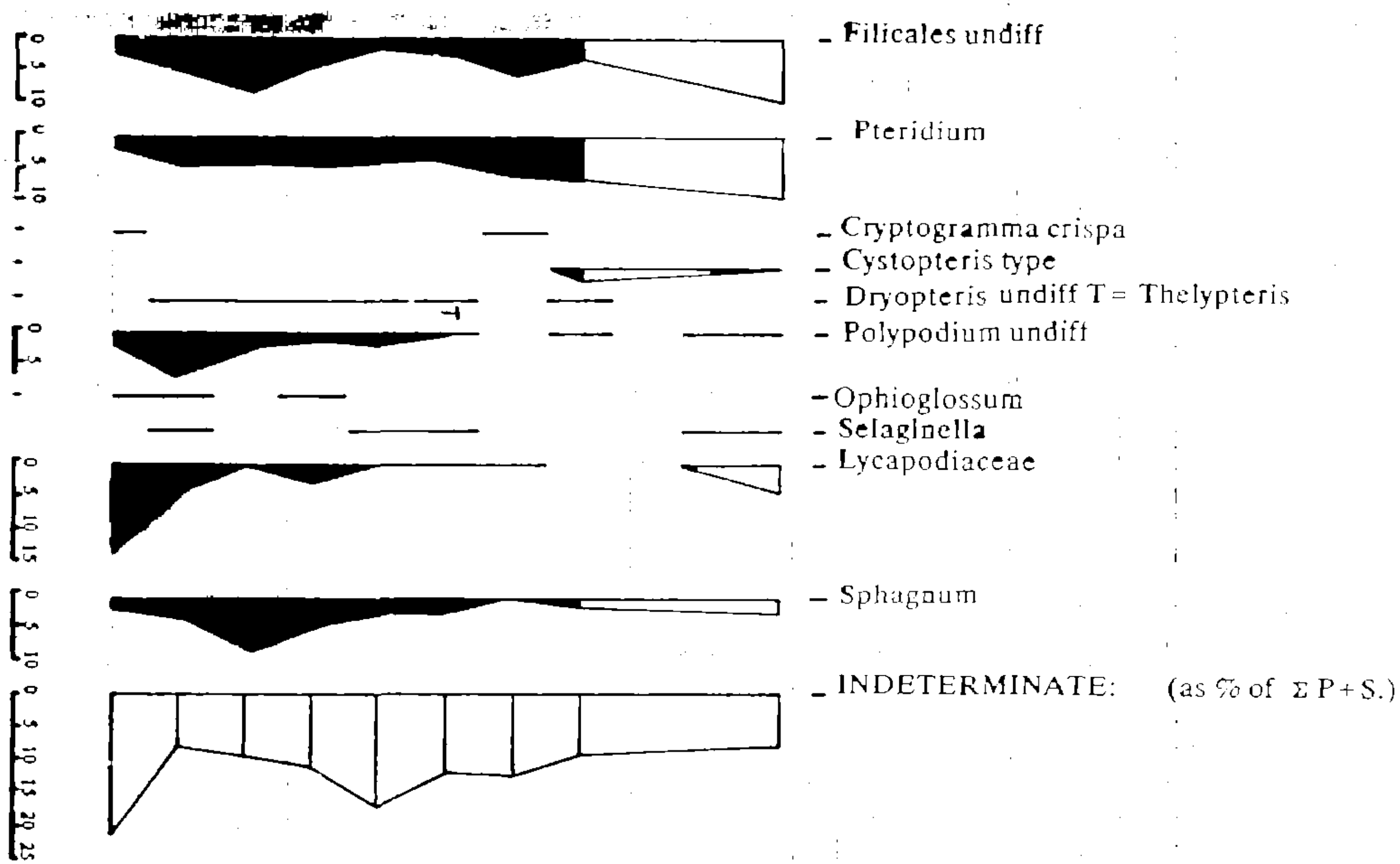


= 1% or Less

Percentage Frequency (Σ P+S.)

Illus 10: Palynological analysis. Percentage frequency of pollen and spores (Σ P+S) through the upper part of Context 24, Context 19 and the lower part of Context 23, together with the overlying (non-contiguous) sample from Context 17.

1: D1-3



Filicales undiff
Pteridium
Cryptogramma crispa
Cystopteris type
Dryopteris undiff T = Thelypteris
Polypodium undiff
Ophioglossum
Selaginella
Lycapodiaceae
Sphagnum
INDETERMINATE: (as % of Σ P+S.)

2: THIN SECTION ANALYSIS:

G. M. Coles.

A prepared vertical thin section from the second, parallel, Kubiena tin was examined by transmitted light microscopy at 40 and 100 times magnification in both cross-polarised and normal light. The position of the Kubiena tin is shown in illus 4a.

A simple visual inspection of the thin section showed it to be divided into two horizons - an upper pale brown horizon (Context [23]) and a lower darker brown horizon (Context [24]) - this division was also noted in the sampled section.

Microscopic examination of the thin section confirmed that structural (pedological) differences existed between the two horizons or contexts.

Although it was not possible to examine modern machair and dune soils by way of comparison, it may be argued that the high organic matter content of the lower horizon (context [24]), together with its varied particle size and angularity, is indicative of the formation c" a moderately mature dune soil. The low organic matter content, greater roundness and more even particle size distribution of the upper horizon (context [23]) suggests relatively immature soil development and may result from its relatively rapid deposition - probably as blown sand - in conditions of sparse or partial vegetation cover. The thin section observations are in general agreement with those from the sedimentological analysis and would tend to further support the interpretation presented in the palynological report.

INTRODUCTION:

A prepared vertical thin section from the second, parallel, Kubiena tin was examined by transmitted light microscopy at 40 and 100 times magnification in both cross-polarised and normal light. The position of the Kubiena tin is shown in illus 4a.

A simple visual inspection of the thin section showed it to be divided into two horizons - an upper pale brown horizon (Context [23]) and a lower darker brown horizon (Context [24]) - this division was also noted in the sampled section. The drawn section shown with the pollen diagram clearly shows this division.

Microscopic examination of the thin section confirmed that structural (pedological) differences existed between the two horizons or contexts. The structure of each horizon and the junction between them are described below, from the base of the sample upwards.

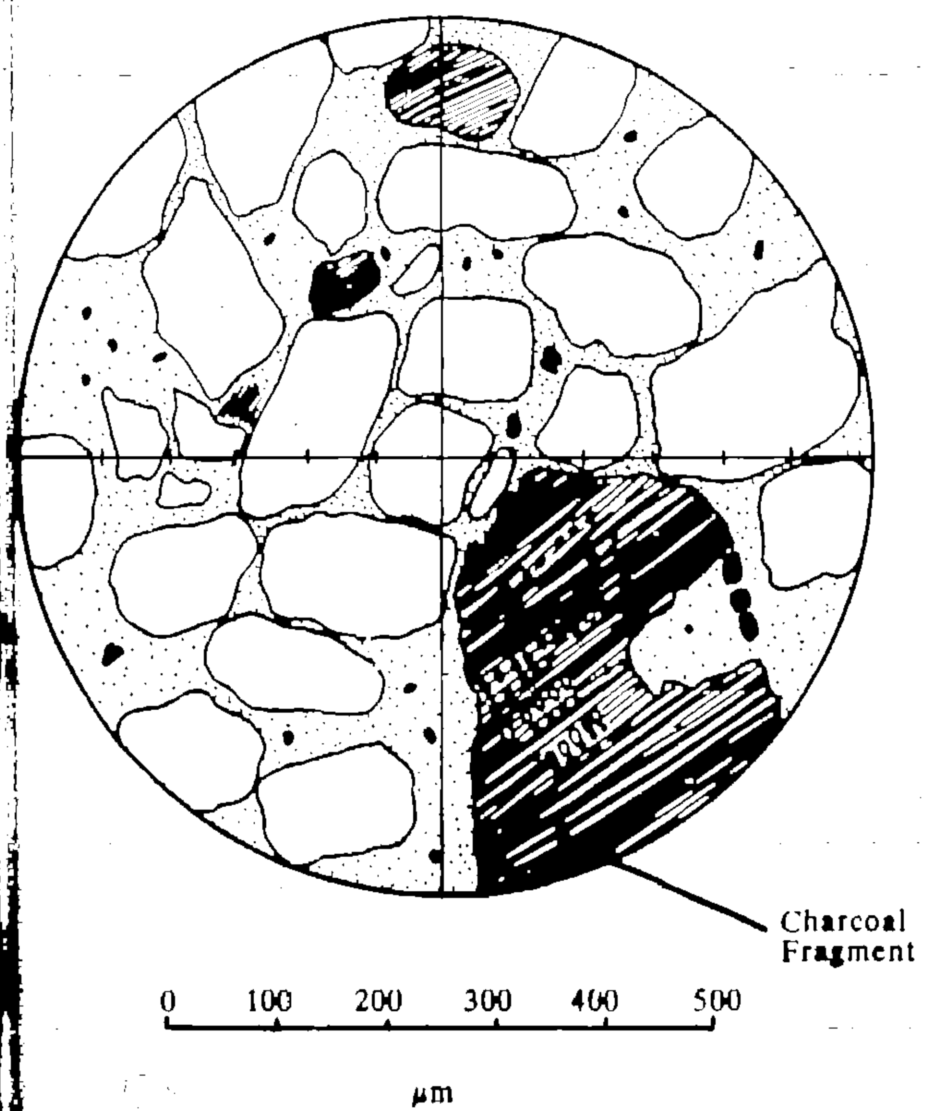
CONTEXT [24] - Lower Horizon: circa 40 to 80mm:
Shown in illus 11, 100 times magnification. A skeletal granular structure of contact supported sub-rounded to sub-angular grains - sub-angular grains appear to predominate. Grain diameter between 300μm and 50μm (mean 134μm by 86μm). Grain mineralogy is dominated by Quartz (ca.80%) with occasional grains of Mica (ca.2%), Feldspar (ca.2%), Olivine (ca.2%) and a number of other indeterminate fragmentary rock types (ca.2%). Note that no recognisable shell fragments were recorded although some Calcite (possibly degraded shell) was noted (less than 1% of clasts). Frequent clasts of structured organic material (charcoal) are present forming ca. 10% of grains. Simple packing voids are present (diameter 300μm and less) these are infilled by amorphous mid-brown (7.5YR 4/2) apparently organic matter - coats of similar material were noted on all grains. Faecal (?) pellets (ca.10μm diam.) are common within the amorphous organic material.

A vertical traverse through this horizon shows some variation in the relative abundance of organic clasts and sand. Thin lenses with increased concentrations of organic clasts standing out as slightly darker areas within the horizon.

CONTEXT [19] - Junction Between Contexts: circa 40mm:
Shown in illus 12, 100 times magnification. Transition between contexts [23] and [24] occurs over less than 1mm. Transition marked by the infilling of packing voids with amorphous apparently organic matter and increased concentrations of organic clasts (charcoal) and faecal (?) pellets.

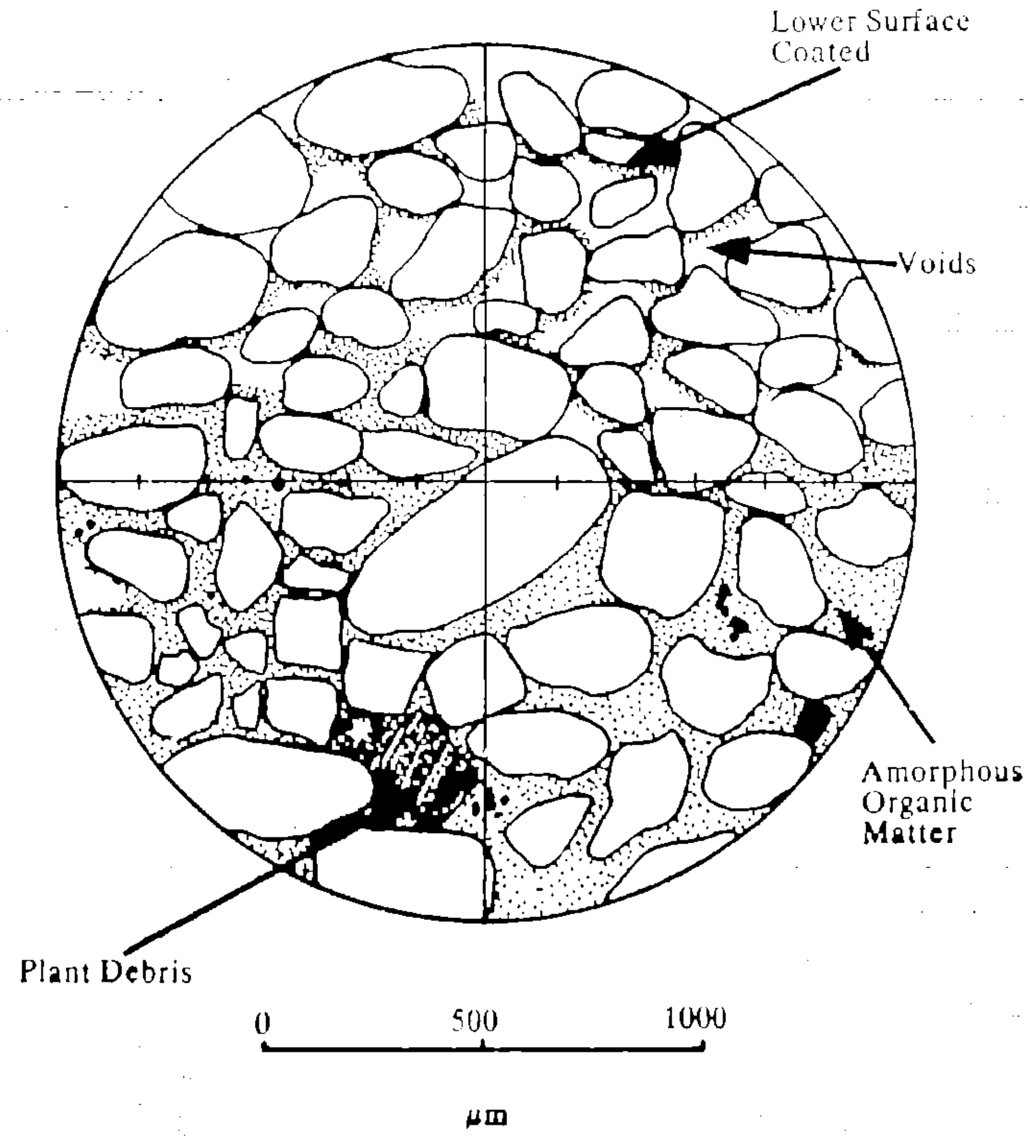
CONTEXT [23] - Upper Horizon: circa 0 to 40mm:
Shown in illus 13, 100 times magnification. A skeletal granular structure of contact supported sub-rounded to sub-angular grains - sub-rounded grains appear to predominate. Grain diameter between 400μm and 100μm (mean 192μm by 148μm) - similar to that in the Lower Horizon but larger grains appear to predomirate. Grain mineralogy is dominated by Quartz (ca.90%) with occasional grains of Mica (ca.2%), Feldspar (ca.2%), Olivine (ca.2%) and a number of other indeterminate fragmentary rock types (ca.2%). - again no recognisable shell fragments although some Calcitic fragments (degraded shell) were noted (less than 1%). Very infrequent clasts of poorly structured organic material (up to 300μm diam. - charcoal?) noted forming much less than 1% of grains. Simple packing voids are present (diameter 400μm and less). The base of many grains were coated with thin layers (5μm or less) of amorphous mid-brown (7.5YR 4/2) apparently organic matter. Infrequently the smaller packing voids are infilled by similar material.

A vertical traverse through this horizon shows it to be relatively uniform in composition.



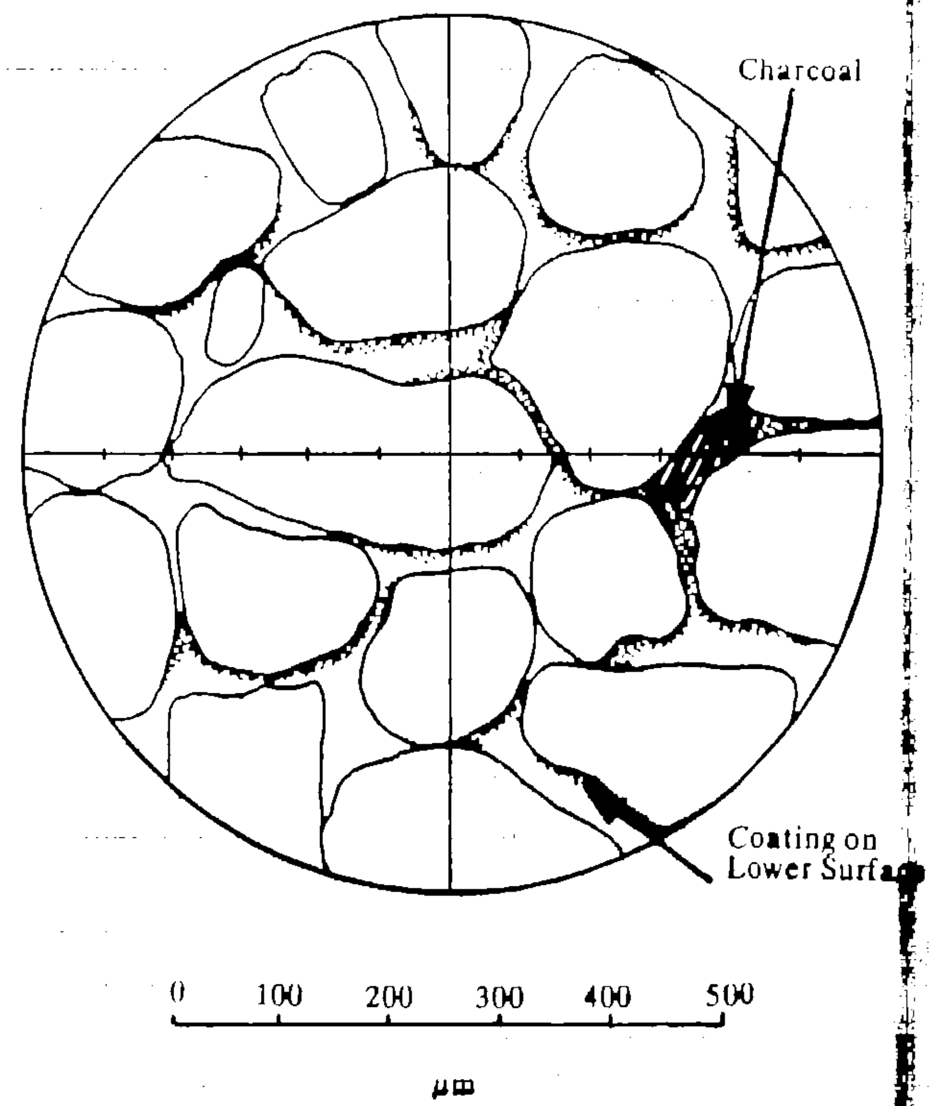
Illus 11: Thin section analysis.

Lower horizon 10 mm below junction with upper horizon.



Illus 12: Thin section analysis.

Boundary between lower and upper horizons.



Illus 13: Thin section analysis.

Upper horizon 10 mm above junction with lower horizon.

PALYNOLOGICAL NOTE: Very infrequently pollen, spores and fungal spores were noted in the thin section when higher magnifications were used (100x). Unfortunately it was not possible to determine the species present or their quantitative distribution *in situ* as most of the external detail was obscured by amorphous organic matter.

COMMENTS:

This preliminary examination of the thin section from Rattray appears to largely confirm the observation made during the processing of the palynological samples that clay minerals are rare in these contexts. The colour of each context appears to derive from the density of the apparently organic groundmass present and the presence of increased frequencies of charcoal present in the lower horizon (context [24]).

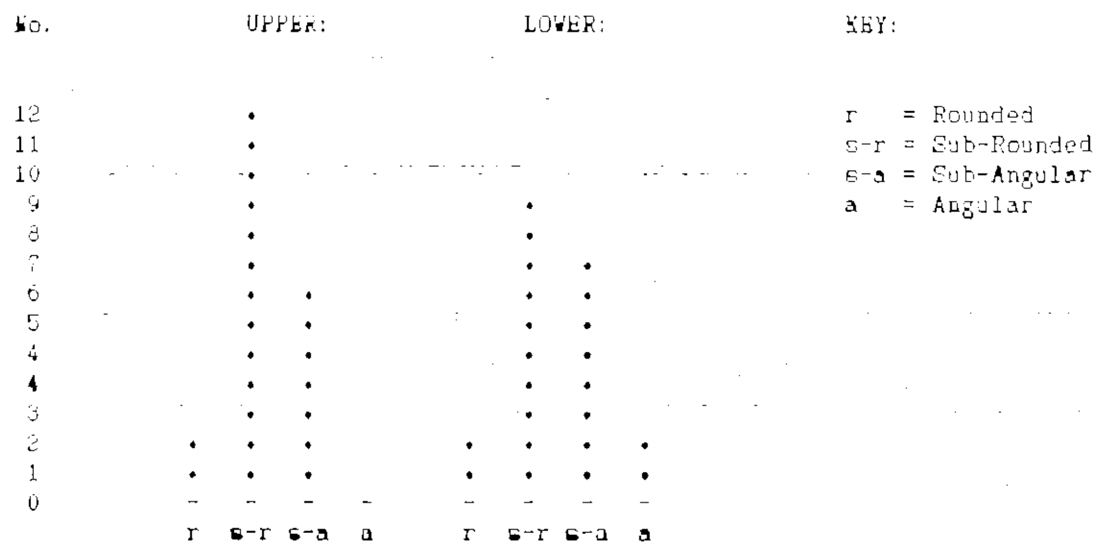
The particle size measurements tabulated below, although limited in number and hence reliablity, suggest that the mean grain diameter in the lower horizon (context [24]) is smaller than that in the upper horizon (context [23]) and that grains in the lower horizon tend to be flatter and less rounded than grains in the upper (mean length/breadth ratios of 1.40 in the upper, 1.57 in the lower). The particle sizes recorded all fell into the medium to fine sand grade (British Standard 1377).

Comparison with a Powers scale of roundness also suggested that the lower horizon contained more anglar and sub-angular grains than the upper (illus 14). It is suggested that both increased angularity and reduced mean grain size may reflect the extended weathering of the sand during soil formation. The less homogeneous composition of the lower horizon (context [24]), in conjunction with the abundance of both structured and amorphous organic matter and faecal pellets, provides further direct evidence in favour of soil formation. The paucity of such evidence in the upper horizon (context [23]) may be indicative of blown sand deposition.

The changing frequencies of organic matter would appear to confirm the results of the Loss-on-Ignition organic matter content determinations in suggesting soil formation. The increased frequencies of organic matter in context [24] appears to accord with the Magnetic Susceptibilty measurements - however the presence of burnt plant material tentatively suggests that some of the enhanced signal in this context may also be due to the episode of burning associated with the destruction of the archaeological structures (fence?).

CONCLUSION:

Although it was not possible to examine modern machair and dune soils by way of comparison, it may be argued that the high organic matter content of the lower horizon (context [24]), together with its varied particle size and angularity, is indicative of the formation of a moderately mature dune soil. The low organic matter content, greater roundness and more even particle size distribution of the upper horizon (context [23]) suggests relatively immature soil development and may result from its relatively rapid deposition - probably as blown sand - in conditions of sparse or partial vegetation cover. The thin section observations are in general agreement with those from the sedimentological analysis and would tend to further support the palynological interpretation presented in the main report.



Illus 14: Comparison of the number of occurences in each Powers scale roundness class for the Upper and Lower Horizons (contexts [23] and [24]). Results based on a sample of twenty grains from each horizon.

	UPPER HORIZON:				LOWER HORIZON:			
	a-axis µm	b-axis µm	a/b ratio	shape	a-axis µm	b-axis µm	a/b ratio	shape
01	340	160	2.13	s-r	220	100	2.20	s-r
02	240	230	1.04	s-a	190	120	1.58	s-r
03	230	160	1.44	s-a	250	150	1.67	s-a
04	160	160	1.00	s-r	110	100	1.10	s-a
05	140	80	1.75	s-r	120	100	1.20	s-a
06	90	50	1.80	r	80	80	1.00	s-r
07	180	130	1.39	s-a	150	100	1.50	s-a
08	160	150	1.07	s-r	180	110	1.64	s-r
09	150	140	1.07	s-r	70	60	1.17	s-a
10	280	170	1.65	s-r	200	100	2.00	s-a
11	190	160	1.19	s-a	200	90	2.22	s-r
12	260	160	1.63	s-r	160	100	1.6	s-r
13	290	200	1.45	s-a	170	80	2.13	s-r
14	260	130	2.00	s-r	80	50	1.60	a
15	130	120	1.08	s-a	70	40	1.75	a
16	160	140	1.14	s-r	50	30	1.67	s-a
17	210	150	1.40	s-r	80	70	1.14	s-r
18	170	150	1.13	r	110	100	1.10	s-r
19	220	150	1.46	s-r	120	100	1.20	r
20	220	170	1.29	s-r	60	30	2.00	r
Mean:	192	148	1.40	-	134	86	1.57	-

Number of Occurences in Each Roundness Class:

		UPPER:	LOWER:
r	= Rounded	2	2
s-r	= Sub-Rounded	12	9
s-a	= Sub-Angular	6	7
a	= Angular	0	2

Table 4: Thin Section Analysis - Results of Particle Size (in Microns - µm) and Shape (Powers Visual Comparison) of twenty sand grains from each of the Upper (context [23]) and Lower horizons (context [24]).

3. BOTANICAL REMAINS. S. Boardman

METHODS AND RESULTS

Three large bags of soil (total 57 litres) from a late 2nd millenium cultivation layer (RB 19) were processed using standard water separation techniques (Kenward et al 1980). The resulting fractions (1mm. & 300 microns flots, 1mm. retents) were examined in detail for charred plant remains and any other palaeoenvironmental material. The results of the botanical investigation are presented in Table 5.

DISCUSSION

There were no cereal grains or other obvious cultigens. A few hazel-nut (Corylus avellana L.) shell fragments were present. These are common in Neolithic and Bronze Age contexts; their abundance on some sites has been taken to indicate systematic harvesting of the nut (cf. Moffett et al 1990). The remains from Rattray were limited. The various herb and shrubby seeds also occurred in low numbers but the context of the assemblage should be taken into account.

The plant remains may have been charred in situ, but it is also possible that they arrived in the field or plot via recycled waste material used as a fertiliser. There were no other macroscopic remains (pottery, bone, etc.) to support this hypothesis, but some such remains were found elsewhere in the cultivation soil.

The dominant species are the knotgrasses (Polygonum spp.). From the same family comes the single seed of dock (Rumex cf. crispus L.). These plants are common today as agricultural weeds but they also thrive in grassland, particularly where there is regular disturbance, as for example by trampling and grazing. Persicaria (P. persicaria L./lapathifolium L.) suggests damp conditions and a similar case can be made for willow (Salix sp.).

Ribwort plantain (Plantago lanceolata L.) is a classic indicator of grassland/pasture on neutral and basic soils. Many of the buttercups (Ranunculus spp.) are also characteristic of grassland, particularly wet meadows and pastures. Parsley piert (Aphanes arvensis L.) is common as an agricultural weed and a grassland plant (on bare soil).

CONCLUSIONS

The range of herbs suggest damp, predominantly open conditions but shrubs or trees such as willow and hazel must have grown nearby. The herb seeds could have been derived from in and around cultivated fields. Equally possible is that they arrived via grassy material collected as animal fodder, or as a result of any number of 'accidents'. A mixture of origins seems most likely and this picture is supported by the hazel nutshells which probably constitute food refuse.

In terms of future work in the area of late 2nd millenium activity, large samples from primary deposits or areas of in situ burning, may prove very interesting, and more conclusive.

TABLE 5. THE CHARRED PLANT REMAINS FROM RATTRAY

SPECIES	BAG 1	BAG 2	BAG 3
RANUNCLUALECAE			
Ranunculus sp.	1		1
ROSACEAE			
Aphanes arvensis L.	1		
POLYGONACEAE			
Polygonum aviculare type		1	1
P. cf. *aviculare*		2	
P. persicaria L./*lapathifolium* L.	3	2	2
P. cf. *persicaria*/*lapathifolium*			1
P. sp.	1		
Rumex cf. *crispus* L.		1	
CORYLACEAE			
Corylus avellana L.		2F	5F
SALICACEAE			
Salix sp.	1	1	
PLANTAGINACEAE			
Plantago lanceolata L.			2
Weeds indet.		2F	1
Total fragments	7	11	13
Volume of soil floated (litres)	20	17	20
Fragments per litre of soil	0.3	0.65	0.65

KEY F = fragments

Charcoal samples

by BA Crone

Eleven samples of charcoal were submitted for species identification. All the samples were from a burnt hurdle (18). The samples were decayed and crumbly and it was difficult to create clean surfaces suitable for identification. It was not possible to identify four of the samples. Of those that could be identified four are hazel (Corylus avellana), two are willow (Salix sp.) and one is probably rowan (Pomoideae cf. Sorbus aucuparia).

One of the samples identified as willow was submitted for radiocarbon assay.

SAMPLES

A	Corylus avellana	
A1	Corylus avellana	
B	unidentified	
C	unidentified	
D	Corylus avellana	c. 2.0cm diameter
F	unidentified	
G	unidentified	
H	Pomoideae cf. Sorbus aucuparia	c. 9.0cm diameter
I	? Salix sp.	
J	Corylus avellana	c. 2.2cm diameter
C14	Salix sp.	

5 RATTRAY SMALL FINDS CATALOGUE

All flints examined by x 8 hand lens; terminology after Wickham-Jones (1983)

STONE

SF763 Secondary flake of mid-brown flint: c 25 mm x 25 mm x 4 mm; possible use damage on one edge.

SF765 Core of mid-brown flint: c 35 mm x 30 mm x 15 mm max (illus 8c).

SF766 Small pointed, triangular-sectioned chip of greyish flint: c 6 mm x 22 mm x 7mm max.

SF767 Chip of burnt flint: c 11 mm x 23 mm x 6 mm max; no evidence of secondary working.

SF768 Small irregular chunk of burnt flint: c 7 mm x 20 mm x 7 mm max; no evidence of secondary working.

SF769 Tiny flake of burnt flint: c 5 mm x 6 mm x 2 mm max.

SF770 Tiny chip of burnt flint: c 5 mm x 11 mm x 2 mm max.

SF809 Small broken flake of burnt flint: c 8mm x 12 mm x 3 mm max; possible further modification by fire.

SF810 Small secondary flake of brown flint: c 10 mm x 15 mm x 4 mm max; possible use damage of proximal end.

SF812 Small flint pebble: c 22 mm diam.

SF814 Small chip of brown flint: c 8 mm x 13 mm x 2 mm max.

SF851 Small chunk of honey coloured flint with coarse inclusions: c 30 mm x 24 mm x 17 mm max.

SF901 Small broken flake of burnt flint: c 10 mm x 15 mm x 2 mm max; possible further modification by fire.

SF902 Tertiary flake of grey flint: c 10 mm x 15 mm x 2 mm max; possible core rejuvenation flake.

SF903 Primary chip of red flint: c 7 mm x 12 mm x 6 mm max.

SF904 Small irregular chip of grey flint: c 12 mm x 19 mm x 4 mm max.

SF935 Secondary flake of red brown flint: c 15 mm x 25 mm x 5 mm max; no evidence of utilisation.

SF939a Small chunk of orange brown flint with cortex adhering: 18 mm x 13 mm x 6 mm max.

SF939b Small burnt chip: 10mm x 16 mm x 3 mm max.

SF939c Small broken flake of brown flint: possible further modification by fire: 10 mm x 13 mm x 3 mm max.

SF939d [Discarded stone]

POTTERY

SF808 Wall sherd of thin well-fired ware with buff pink outer surface, and dark grey-brown inner, containing small granitic inclusions; flaring of wall suggests derives from proximity of rim: 50 mm x 45 mm x 8-11 mm.

SF811 Abraded sherd of mid-brown fabric: c 27mm x 19 mm x 13 mm max.

SF905 [Discarded stone]

SF906 2 sherds of coarse crumbly thick dark brown ware with medium granitic inclusions:
i) 30 mm x 50 mm x 17 mm
ii) disintegrated

SF936 2 wall sherds of thin well-fired ware with buff pink outer surface, dark grey brown inner, containing small granitic inclusions.
i) 15 mm x 15 mm x 8-11 mm
ii) 25 mm x 25 mm x 8-12 mm; remnant of possible carination/rilling (illus 8a)

SF937 clay lump

SF938 Sherd coarse crumbly thick dark brown ware with medium granitic inclusions: 60 mm x 60 mm x 15-18 mm (illus 8b).