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INTERIM PALYNOLOGICAL REPORT FROM BIRDOSWALD ROMAN FORT AND APPLETREE TURF WALL, CUMBRIA

Patricia E. J. Wiltshire BSc.

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Summary

Turf wall sections of Hadrian's wall at Appletree and Birdoswald, as well as the Rampart, 'Desertation' layers and Morass peat at the Fort, were analysed palynologically. The Iron Age and Romano-British environments of both sites are described and compared. Details of wall construction and origin of building materials are discussed, and the character of the landscape in the environs of the wall before and during the Roman presence is inferred.

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INTRODUCTION

Birdoswald Roman Fort was built on a promontory about 60 m above and immediately to the north of the River Irthing in east Cumbria at 158 m OD. Strategically, the choice of site was wise in view of the protection afforded by the precipitous, southward slope to the river, and the deep, soligenous mire, Midgeholme Moss, immediately to the north. The turf wall at Appletree lies at 135 m OD about 1.7 Km to the west of Birdoswald where the ground leading down to the Irthing slopes more gently.

Hadrian first planned to build a wall from the Tyne to the Solway in about AD122. This involved the construction of a stone wall from the Tyne to the Irthing, and a turf wall from the Irthing (half a mile east of Birdoswald) to the Solway. Archaeological evidence suggests that the turf wall, with the ditch on its northern side, was the earliest known Roman structure on or near the site of Birdoswald, although the earliest occupation of the site seems to have been a temporary camp on the promontory.

The stone wall of the fort appears to have been built after the turf wall but still in the reign of Hadrian (before AD138). The building of the stone defences involved demolition of the turf wall which was also bisected at right angles by the western fort ditch. The stone wall had an associated earthen rampart which sealed the occupation layer beneath. (Wilmott *pers. comm.*).

It would seem, therefore, that the turf wall at Appletree and Birdoswald was built some time after AD122, and preserved the Iron Age land surface. Somewhere in the sixteen year period between AD122 and AD138 the area was occupied during which the stone defences and rampart were built, burying the early occupation layer.

After the building of the stone defences, but before the building of the internal buildings, a black layer of silty grey loam with a low organic content accumulated over a wide area within the fort. The defences, earliest internal buildings and roads were completed after the accumulation of this black layer. The horizon has been interpreted as a 'desertion' layer which formed during the temporary but prolonged abandonment of the fort during the building of Antonine Wall between AD138 and the late 160's. It is likely, therefore, that the building of the fort continued in the late second century and the granary is certainly dated to early third century (AD205-208). The fort remained in occupation until the fifth century (Wilmott *pers. comm.*).

AIMS OF THE ANALYSIS

The aims of the palynological analysis were to investigate:-

1. The nature of local vegetation before the Roman army became active in the area.
2. The nature of the local vegetation immediately before the construction of the turf wall.
3. The method of construction of the turf wall and rampart.
4. The origin of the organic material used in the turf wall construction.
5. The nature of the 'desertion' layer.
6. The vegetation which prevailed within the fort area before the building of the granary.
7. The degree of similarity between the turf wall at Appletree and Birdoswald.

Preliminary results of soil analysis carried out by M. McHugh and background information provided by A. Wilmott were used as an aid to interpretation.

METHODS

Sampling

A monolith was obtained from the exposed section of the wall at Appletree (some distance to the west of the fort), and two from the western side of Birdoswald itself (Turf Wall 1 and Turf Wall 2 - contexts 1701/1746 and 1707/4172 respectively). A monolith was also taken from the rampart, inside the the north stone wall (context 2000). In addition a single 'morass' peat sample (context 367) was obtained from beneath the granary walls. This sample was mixed and of unknown age but certainly predated AD205. Three sections of the 'desertion' layer were sampled. 'Desertion' layers 2 and 4 may be regarded as duplicates (context 3738) and were sampled as shallow blocks so that analysis could be carried out on the lower and upper parts of the layer. 'Desertion' layer 1 (context 3880) was taken as a single mixed sample so that no temporal differentiation could be established.

Pollen Analysis

Samples were subjected to standard acetolysis and hydrofluoric acid treatments (Dimbleby 1985). Pollen preparations were then stained with safranine and suspended in glycerol jelly. Preparations were examined under phase-contrast microscopy at x 400 magnification and at x 1000 magnification where necessary. Every attempt was made to count a minimum of 500 palynomorphs but this was not always possible due to low microfossil concentration. Counts ranged from as low as 113 (in Rampart dump material) to 850 (Turf Wall 1) but most were in the region of 500-600 palynomorphs.

Terminology and palynomorph taxonomy of Moore and Webb (1978) and Punt et al (1976, 1980,1981,1984, 1988) were adopted. Gramineae grains of >40 mμ with a mean annulus diameter of 8-10 mμ were referred to as 'cereal type' (Edwards 1989). The state of pollen preservation did not allow identification to morphological group for Cerealia but *Secale* (rye) was certainly not found. No attempt was made to differentiate between *Corylus* (hazel) and *Myrica* (sweet gale) pollen and the term Coryloid is used to cover these taxa. However, only *Corylus* macrofossils were recorded from Birdoswald (Huntley 1991)and it is assumed that the Coryloid pollen found was largely that of *Corylus*.

Pollen Diagram

In all pollen diagrams, palynomorphs were expressed as a percentage of the total count, excluding *Sphagnum*. Spores of other non-flowering plants were included in the sum since they were deemed to be genuine components of communities contributing to the pollen influx.

Details of lithology are given only in Figs. 3, 6, 7 and 10. The main pollen diagrams (Fig. 2, 5 and 8) show only the position of highly organic layers within the stratigraphy.

Pollen diagrams were produced by Tilia/Tilia*graph (Grimm 1991) and Apple Macintosh graphics programs. Both detailed and summary diagrams were produced. Palynomorph taxa included in the ecological groups in the summary diagrams are given Table 5 (Appendix 2).

Charcoal

Microscopic fragments of charcoal were found in every sample although it was very sparse in some. No attempt was made to quantify the fragments and subjective description is given where necessary.

Chronology

Where data from Midgeholme Moss (Innes 1988) were discussed, all dates were derived by interpolation, based on three uncalibrated radiocarbon dates of the peat. Interpolated dates were given in years BP (before present = 1950) and also bc/ad. Calender years are BC/AD.

RESULTS AND DISCUSSION

APPLETREE – The Turf Wall

A partial pollen diagram and stratigraphic profile is given in Fig.2 with pollen percentages listed in Table 1. A summary diagram containing ecological groupings (and with sampling points) is given in Fig. 3. Samples included both the organic and inorganic deposits in the areas of the three distinct, highly organic horizons. Analysis was carried out at depths of 2.5, 3.5, 4.5, 6.0, 14.0, 15.0, 16.0, 17.0, 22.5, 23.5, 25.5 and 27.5 cm. For ease of description these have been designated samples 1 - 12 respectively.

The Buried Land Surface (Samples 11 & 12): Samples 12 and 11 may be regarded as the A^1 and A^0 horizons of the original buried soil surface. Sample 11 should, therefore, indicate the nature of the vegetation immediately before the construction of the wall, while Sample 12 will give a picture of the environment prevailing in earlier, probably Iron Age, times.

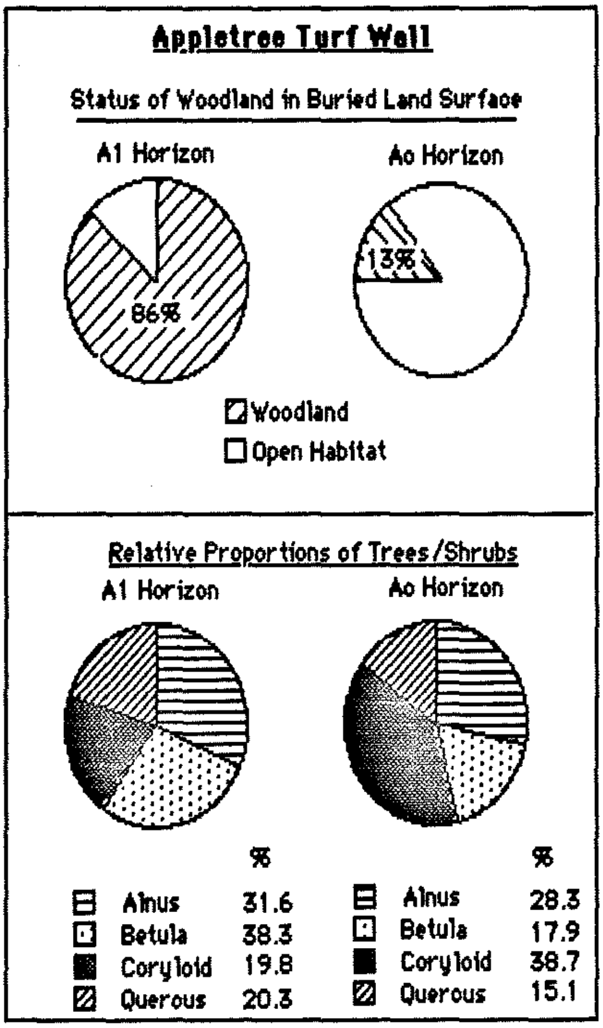

Fig.1

Fig. 1 indicates the differences between the A^1 and A^0 horizons in terms of gross landscape; it also shows the major species composition of woodland in the two horizons.

It is clear that before intensive human impact, the immediate area was heavily wooded, the local landscape being dominated by *Betula* (birch) and *Alnus* (alder) but with *Quercus* (oak) and *Corylus* also being abundant. Figs 1, 2 and 3 and Table 1 indicate the possibility that the pollen catchment included a mosaic of woodland which depended on local edaphic conditions; a birch/alder carr probably covered the wetter ground while oak might have dominated the drier slopes towards the Irthing. Hazel could have been growing in either habitat. The carr seems to have supported a tall herb community including *Filipendula* (meadowsweet) and *Rumex* (docks) while the small amount of pollen of *Vaccinium* type (c.f. bilberry) suggests that it might have been growing in more acidic and drier oak/hazel woodland. *Fraxinus* (ash), *Ulmus* (elm) and *Ilex* (holly) were also growing in the region.

The presence of ash and holly indicates that the woodland certainly had some degree of open canopy near to the pollen site and open, probably grazed, moorland areas are evidenced by low levels of Gramineae (grasses), *Plantago lanceolata* (ribwort plantain) *Pteridium* (bracken), *Rumex acetosella* (sheep sorrel)and traces of *Calluna* (ling). Human activity is indicated by sparse charcoal fragments, but the immediate site seems to have been little affected by man's hand. This is also borne out by preliminary soil analysis carried out by McHugh who found phosphate levels to be commensurate with those of native background, or pastoral husbandry.

Heim (1962) considers that a value of 50% arboreal pollen indicates 'open conditions' while Wiltshire (unpublished) has shown a background level of 25% arboreal pollen for a virtually treeless landscape for upland, central Wales (a terrain similar to that surrounding Appletree). The value for woodland plants (14.4%) in Fig. 1 shows that the ground surface (A^0 Horizon - Sample 11) buried by the turf wall had been largely cleared of trees and shrubs, and that the landscape in the pollen catchment was virtually treeless at the time of construction. Figs. 2 and 3 and Table 1 show that all tree and shrub taxa were affected so that clearance was unselective. The increase in hazel relative to other trees and shrubs might simply indicate an enhanced flowering in the small numbers of plants left after clearance; this is the plant's natural response to coppicing or removal of competition.

Soil disturbance is indicated by taxa such as *Papaver* (poppy) and Chenopodiaceae but there is overwhelming evidence that the site became dominated by wet moorland/bog. *Calluna*, *Potentilla* type (c.f. tormentil), Gramineae and *Pteridium* all increase, while *Sphagnum* moss seems to have been abundant. It is likely that moorland plants were able to exploit the open areas once trees were removed. However, the removal of the filtering effect of the tree canopy would also have resulted in a greater input of regional pollen into the site; outside the carr, the terrain probably supported *Calluna*-dominated areas which could have been the source area for much of the moorland/bog pollen.

The level of microscopic charcoal was very high indeed, indicating that the area had been burned extensively. Thin section work carried out by McHugh and the use of reflectance determinations by Jones indicate that birch, alder and oak had been burnt *in situ* and that the fires were of low temperature (McHugh *pers. comm.*). Because of the lack of resolution in both the pollen and soil work, it is difficult to ascertain whether the woodland clearance was the result of a rapid onslaught or whether it had happened more gradually. In any event, when the turf wall was constructed, open moorland prevailed at Appletree.

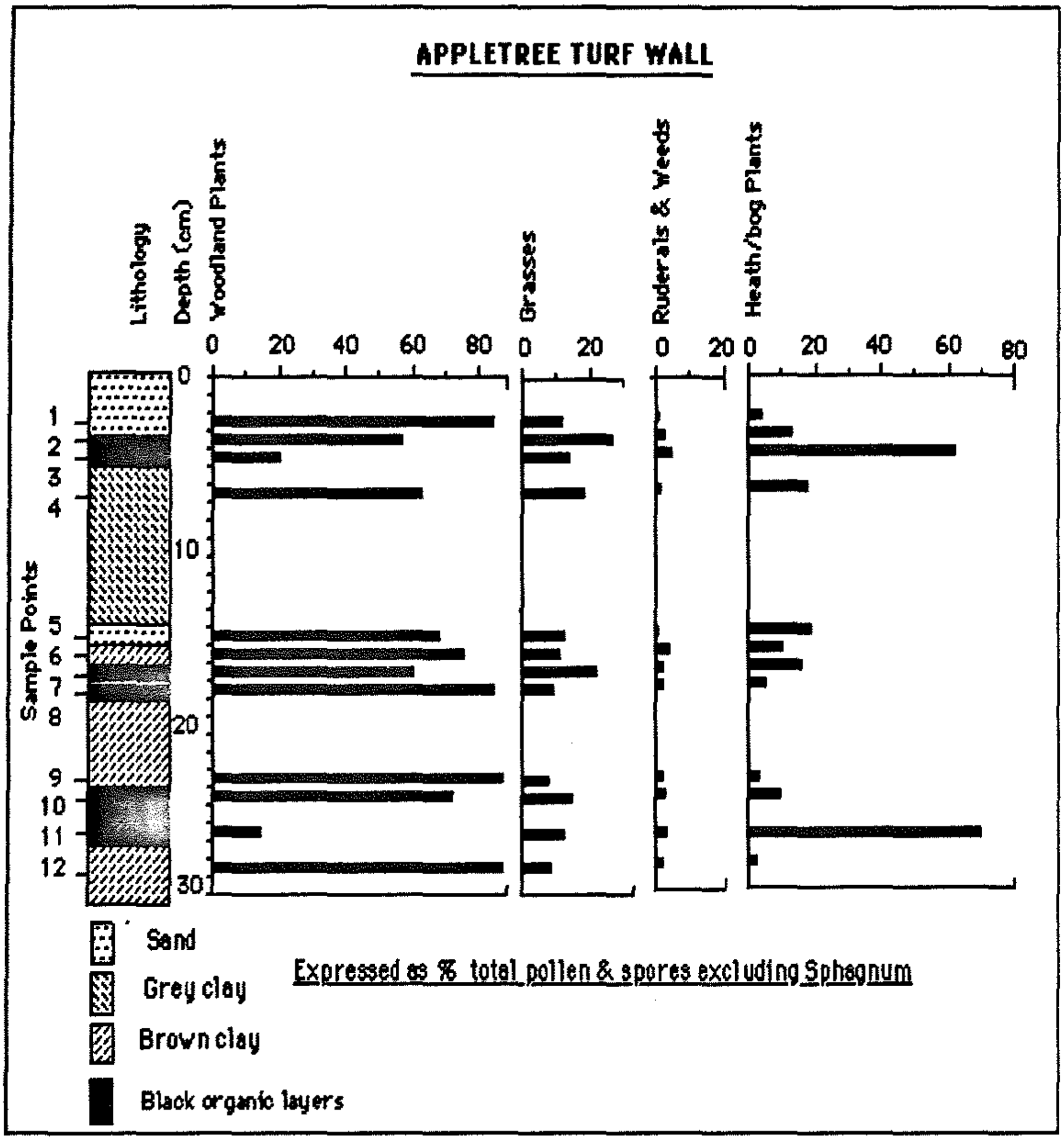

Fig. 3

What must be stressed is that pollen preservation was good in both sample 11 and 12 and there was no indication of prolonged occupation of the site before burial of the ground surface. The pollen data simply record clearance of *in situ* vegetation with burning being involved. The area seems to have been grazed moorland before wall construction.

The First Turf (Samples 9 & 10): Sample 10 was from a black organic layer which merged into the material from which sample 11 had been obtained while sample 10 was from the brown clay immediately above. It is possible, therefore, that samples 9 and 10 represent the A^1 and A^0 horizons of the ground surface from which the turf had been obtained, and that the turf was inverted.

Figs. 2 and 3 show that the turf had been obtained from an area dominated by trees, with levels of woodland plants reaching those of the A^1 horizon of the original land surface. In fact, the pollen spectra of this A^1 horizon closely resemble those in sample 12 and the two habitats must have been very similar, each supporting dense woodland but, nevertheless, with open, and possibly disturbed, areas nearby. This is evidenced by (a) the pollen *of Hedera* (ivy), an insect pollinated plant which only flowers if sufficient light and upright supports are available; it is, therefore, an indicator of disturbed woodland (b) *Melampyrum* (cow-wheat), another plant taken to indicate disturbance and burning in woodland (c) *Papaver* (poppy), an indicator of open, disturbed soils.

Charcoal levels were also very similar to those of sample 12 and the pollen data suggest that the immediate site was wooded but that the woodland was disturbed and there were areas of open, grazed ground in the vicinity.

Sample 10 shows that woodland plants diminished while open habitat taxa were more abundant. This means that the woodland canopy was being opened up and, indeed, charcoal fragments were much more abundant that in sample 9. It is interesting that *Alnus, Betula* and declined while *Quercus* increased. This might mean that carr vegetation growing on the site was cleared before oaks which might have been growing on the slopes towards the Irthing.

It is quite clear that sample 10 is not strictly comparable to sample 11, and this may be interpreted in one of two ways. Firstly, the actual surface of the inverted turn may not have been sampled so that sample 10 represents the lower part of the A^0 horizon. If so, a relatively gradual change from wooded to unwooded conditions is demonstrated and this may have been missed in the original land surface because of crude sampling. Secondly, the inverted turf might have been collected from some little distance away from the immediate site, from an area which had not been cleared so extensively. The inverted turf profile certainly contains *Pinus* (pine) pollen which was absent from the *in situ* soil profile. However, the very low levels of pine indicate that it was not growing in the vicinity - the pollen had probably been derived from a considerable distance away.

<u>The Second Set of Turves (Samples 5, 6, 7 & 8)</u>: As shown by Figs 2 and 3, the stratigraphy in the second set of turves is rather complex, with a very fine lamina of inorganic material intercalated between the upper and lower parts of the black organic layer. The pollen spectra are also more difficult to interpret than those of the first set of turves. However, all the material in this part of the section was derived from a site dominated by woodland with a fairly open canopy and with open, grazed moorland in its environs.

There are two possible interpretations of the pollen data for this part of the wall section:-

Firstly, in spite of the presence of the intercalated sand, the black layer could have been formed from a single turf which had **not** been inverted. The sand layer could conceivably represent inwashed inorganic material during the *in situ* formation of the turf. The pattern of vegetation change in samples 7 and 8 is very similar to that in the inverted 9 and 10 except for small differences in pollen percentages, notably in *Quercus*. Again samples 7 and 8 might represent a truncated A^0 horizon with the uppermost layer not having been analysed. Thus, although there was an increase in open habitat plants, very high levels of *Calluna* were not recorded (as would be have been expected if the very surface of the turf had been sampled and the turf had been obtained from the immediate vicinity - see sample 11).

Secondly, the lower part of the turf (sample 8) could represent the lower part of an A^0 horizon of turf/soil obtained from an area very similar to that of the original pre-clearance ground surface. Sample 7 could then be the A^0 horizon of an inverted turf while sample 6 (taken from the brown clay) might represent the A^1 horizon of that inverted turf. In this scenario, the thin sand between the two black organic layers night represent inorganic materials which had been deposited between the faces of the lower turf and the inverted turf before they had been placed in the wall. The relationship of sample 5 to samples 6, 7 and 8 is also difficult to interpret but the sand matrix was certainly obtained from a wooded area with open, possibly grazed, moorland nearby.

Charcoal levels were high in sample 7 (though nowhere near as high as in sample 11) whilst they were low in samples 5, 6 and 8. This indicates that sample 7 certainly represents the upper part of a turf, but its relationship with samples 6 and 8 is enigmatic in the absence of more data.

The Third Set of Turves (Samples 1, 2, 3 & 4): Although the topmost black organic layer appears to be a single horizon, again the pollen evidence may be interpreted in two ways.

Firstly, samples 3 and 4 could represent the A^0 and A^1 horizons respectively of a non-inverted turf with samples 1 and 2 reflecting the A^0 and A^1 horizons of an inverted turf lying directly above. Sample 3 had such low levels of woodland taxa and high levels of open habitat plants and charcoal that is probably represents the original ground surface from which the turf was obtained. Sample 4 had rather lower levels of woodland taxa and higher levels of *Calluna*, Gramineae and *Pteridium* than the A1 horizon of the buried ground surface (sample 12), so if it did represent an A1 horizon, the area from which it was obtained was even more open and heather-dominated than the buried ground surface under the wall.

Another possibility is that samples 1, 2 and 3 represent a single inverted turf, with high levels of woodland plants in 1, lower in 2 and lowest in 3, the woodland taxa being replaced by a heather-dominated vegetation. If this were the case, the relationship of sample 4 to 1, 2 and 3 is difficult to interpret, but it could simply represent soil collected locally and dumped into the wall structure. If this were the case, the material was obtained from open woodland with heather-dominated moorland in the near vicinity.

Appletree - Conclusion: The pollen spectra in the A^1 horizon of the original buried land surface (sample 12) showed that before human activity became intense, the site was dominated by damp alder, birch and possibly hazel carr and a tall herb community. Oak woodland with an understory of ferns and bilberry was probably growing slightly further away, but there is no evidence that pine was growing locally.

In spite of the local domination by woodland taxa, areas of disturbed soils and heather-dominated, moorland/bog (probably grazed) were in the vicinity, but the dense canopy might have filtered out much of the extra-local pollen so that it was poorly represented in the soil. Small amounts of microscopic charcoal fragments attest to a human presence but impact on the immediate site seems to have been minimal. This is also borne out by the low soil phosphate levels.

By the time the first turf of the wall was laid, the ground surface had been cleared of trees, possibly with the use of fire, and the site was grazed moorland, wet enough to support *Sphagnum* moss. Because of the lack of resolution in the pollen data, it is not possible to determine whether the woodland clearance was a rapid event or whether it occurred gradually. Nevertheless, the high proportion of *Calluna* pollen indicates that the site had been open for a considerable period before the wall was built. In spite of this, however, the excellent pollen preservation in the old ground surface indicates that the site was not subjected to prolonged occupation before construction.

The first turf of the wall appears to have been inverted onto the ground surface. The pollen spectra indicate that it had been obtained from disturbed woodland but it is possible that further sampling would have revealed the upper A^0 horizon to be dominated by open habitat taxa. It is likely that the turf had been obtained very locally.

The crude nature of the pollen sampling makes it difficult to ascertain whether the second and third sets of turves were single or multiple/non-inverted or inverted. However, the pollen spectra indicate that they were all obtained locally.

BIRDOSWALD - The Turf Wall

Turf Wall 1

A partial pollen diagram and stratigraphic profile is given in Fig. 5 with pollen percentages listed in Table 2. A summary diagram containing ecological groups (with sample points) is given in Fig.6. Analysis was carried out at 4.0, 6.0, 7.0, 17.0, 20.5, 21.5 and 22.5 cm. For ease of description these have been designated samples 1-7 respectively.

The Buried Land Surface & the First Turf (Samples 5, 6 & 7): Sample 7 (see Fig. 6) may be considered to be the A^1 horizon of the original buried land surface while it is possible that sample 6 might reflect the pollen assemblages of both the A^0 horizon of the *in situ* and that of the first inverted turf. The black organic band was narrow and a single sample was obtained for analysis from the middle of the band. It is conceivable, therefore, that the actual ground surfaces of both turves are represented in the single pollen sample so that mixed results have been obtained. Sample 5 might represent the A^1 horizon of the first turf which was inverted onto the original land surface.

Before a discussion of the Turf Wall data, it might be useful to consider the possible correlation between the two horizons of the buried soil surface with the peat of Midgeholme Moss (Innes 1988). The Midgeholme Moss pollen diagram shows that in about 2220 BP (270 bc), tree/shrub pollen accounted for about 90% of the pollen sum. There was a large clearance of woodland in about 2040 BP (90 bc) when tree/shrub pollen accounted for only 50%; this was followed by a recovery of the woodland, but never to its former extent (tree/shrub pollen accounted for 75% of the pollen sum). At about 1850 BP (ad 100), tree/shrub pollen accounted for 70% but by 1800 BP (ad 150) it was reduced to about 35%.

It must be remembered that, by virtue of its high water table, the Moss would have had rapid peat accretion compared to the higher, drier ground of the promontory; indeed, when radiocarbon years are plotted against depth, it can be seen that there was a marked increase in peat growth at about 2050 BP (100 bc). This more-or-less corresponds to the first clearance episode and, presumably, woodland removal resulted in enhanced run-off and raised water table (Moore 1988). Rapid peat accumulation gives good temporal resolution for pollen data while slow soil accretion does not. The relatively detailed vegetation history seen in Midgeholme Moss will, therefore, not be available from the Turf Wall 1 data.

Fig. 4 indicates the differences between the A^1 and A^0 horizons of the buried land surface in terms of gross landscape as well as the major species composition (in terms of relative proportion) of woodland in the two horizons. It also shows the same thing for Midgeholme Moss at about 2220 BP (270 bc) and 1850 BP (ad 100). Of course, Fig. 4 also gives a comparison of Turf Wall 1 and Midgeholme Moss.

The A^1 horizon of Turf Wall 1 shows that well before the wall was built the local landscape was heavily wooded, dominated by dense alder carr, with woodland taxa accounting for 92.5% of the

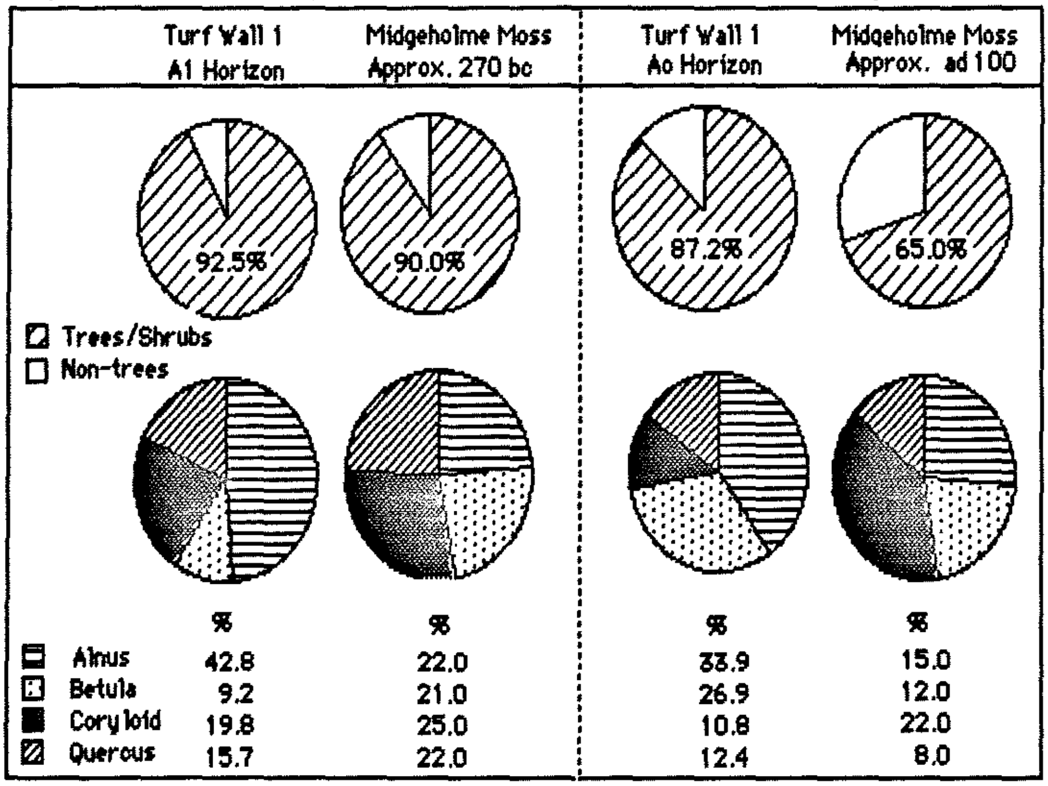

Fig. 4

pollen sum (see figs. 4 & 5). However, open grazed moorland areas were present in the vicinity as is evidenced by the low levels of Gramineae, *Plantago lanceolata*, *Calluna* and *Pteridium*. The very low levels of phosphate (McHugh *pers. comm.*) and microscopic charcoal indicate that human impact at the site was minimal.

Approximately 2220 BP (270 bc) was the last time that woodland pollen approached these levels in the north-eastern end of Midgeholme Moss and it is possible (though not totally conclusive) that the A^1 horizon of the buried land surface represents this period of the Iron Age. If this is so, there are interesting differences in the relative proportions of the five major trees and shrub. This area of the turf wall was dominated by alder, with birch being relatively unimportant. The Moss, on the other hand recorded all the major taxa as having an equal input. Further work will help clarify the proximity and extent of the various taxa on the Moss but it would certainly seem that alder was of more importance towards Birdoswald itself.

The A^0 horizon of the turf wall records the vegetation in its environs when the wall was built (i.e. after AD 122). The woodland component had been reduced by only 5.0% but there were quite marked differences in the composition of the woodland. Alder, hazel and particularly oak were considerably reduced but birch was relatively unaffected and contributed as much pollen as before, if not more. The turf wall area was considerably more wooded, again dominated by alder, and with much more birch and less hazel than the north-eastern end of Midgeholme Moss.

It cannot be stressed strongly enough that the dates quoted here are crude, but there is little doubt that by 1800 BP (ad 150), woodland had been reduced to 35%. Large scale and sustained clearance is thus indicated for the period known to cover the building of the wall.

As sample 6 might represent the junction between two turves, it is impossible to be certain as to the precise nature of the immediately local vegetation when construction of the wall started. However, Figs. 4, 5 and 6 all show that the pollen assemblage to be dominated by woodland taxa, with open habitat plants representing only 12.8% of the total pollen sum. This means, that even if the inverted turf had been obtained from a less wooded area, trees were probably still dominant in its environs. The small reduction in woodland was accompanied by a rise in non-arboreal taxa such as *Pteridium* and Cyperaceae (sedges); but these could easily have been components of the woodland understory and increased as a result of a small reduction in the woodland canopy. *Alnus*, *Corylus* and *Quercus* all declined in favour of *Betula* which increased threefold from its previous level, and it would seem that when the first turf was laid, the site was dominated by birch scrub and alder carr.

These changes in woodland composition between the A^1 and A^0 horizons of the in-situ ground surface were probably the result of pre-Roman land use. When woodland canopy is opened up, birch can colonise open ground very rapidly (especially if it has been burned) and flower within five years (Grime *et. al.* 1988). On the other hand, it is often over-represented in the pollen record by virtue of the fact that it coppices readily by cutting or burning, and flowers prolifically within a few years (Beckett & Beckett 1979). Its increase in the pollen record is thus often apparent rather than real, but usually indicates some degree of opening up of the tree canopy.

The pollen preservation in sample 6 was good, indicating the **lack** of prolonged occupation of the site before wall construction. Nevertheless, the very high levels of microscopic charcoal in the sample attest to considerable human activity at Birdoswald just before the building of the wall. The chronology is imprecise because of the lack of resolution in both the pollen sampling and the radiocarbon dating, and the extensive clearance around Midgeholme Moss interpolated at 1850 BP (ad 100) might, in fact, relate more precisely to the episode of wall building. Further radiocarbon dating and the more detailed work now being carried out on Midgeholme Moss (by P.E.J. Wiltshire) might reveal that, in fact, this clearance coincided with the critical period (sometime just after AD 122).

There is very little evidence for wholesale clearance from the promontory itself when the wall was built. It is known that the A^0 horizon **must** represent the period around AD 122 and that progressive and sustained clearance around the Moss was under way by 1850 BP (ad 100). Therefore, the promontory must have been considerably more wooded than the Moss when the wall was built.

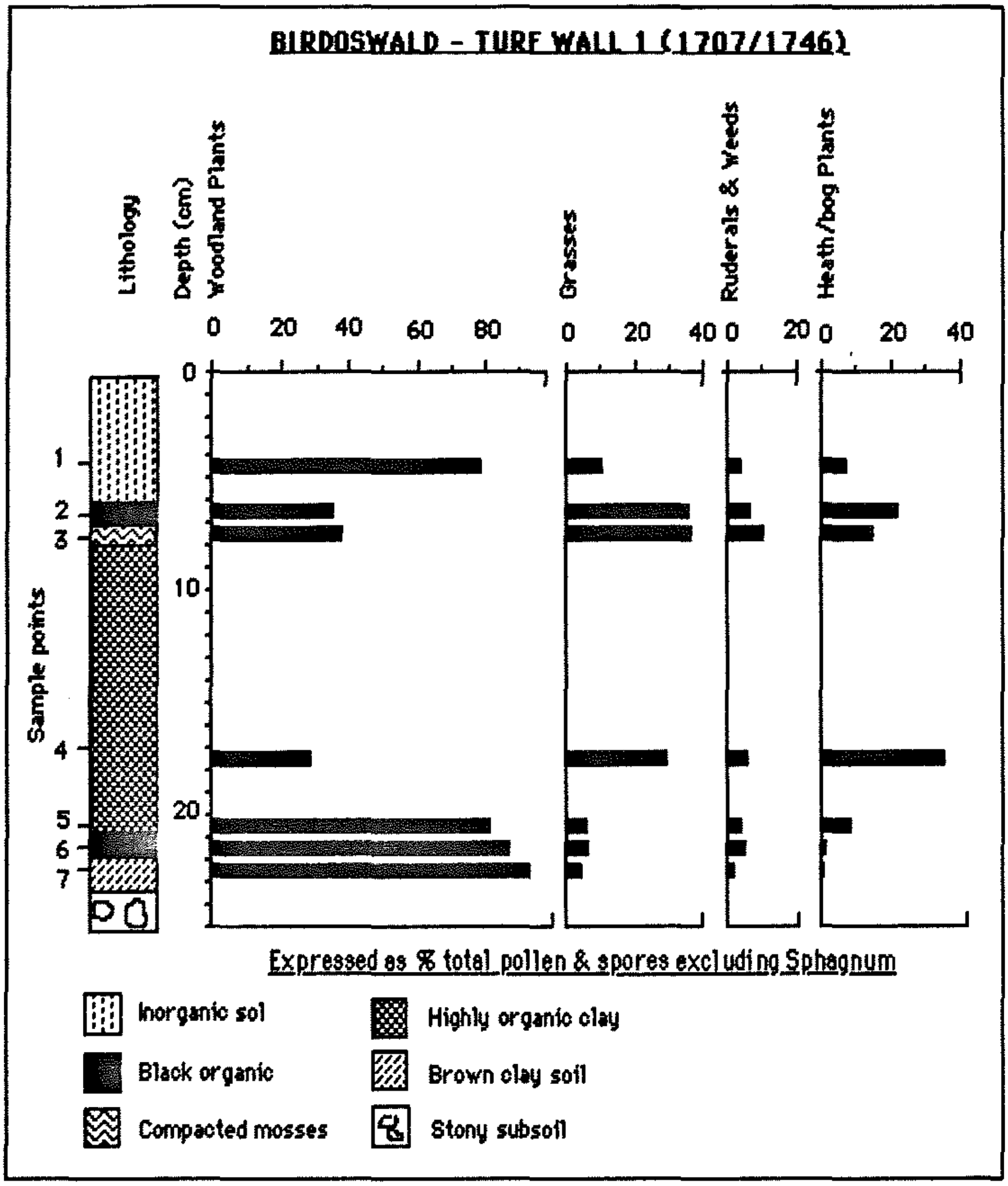

Fig.6

Two scenarios must be considered. Firstly, the building of the wall might have followed clearance of the promontory **immediately** so that the woodland pollen of the surface was preserved. Thus, it would thus appear, quite erroneously, from the pollen record that little clearance had taken place. Secondly, the Roman wall builders might have removed just enough of the woodland to allow construction. It is possible that, when there is moderate clearance, the tree pollen proportion actually increases, or remains little altered since partial removal of the canopy may allow better pollen dissemination (Perry & Moore 1987).

The pollen spectra in sample 5 reflect a more open terrain. *Alnus, Quercus* and *Corylus* were slightly lower, but *Betula* and *Calluna* were considerably higher than in sample 6 and microscopic charcoal levels were very low. It is possible, therefore, that the inverted turf was obtained a little distance away from the fort in an area dominated by more open woodland with *Betula* being an important component. If this were the case, sample 6 might indeed represent a mixed sample with the pollen record of the original land surface being 'diluted' by the inverted turf. In other words, the original land surface might have been even more densely tree covered than sample 6 would indicate. It is also possible that the inverted turf was obtained from a site nearer to Midgeholme Moss.

Dump Material (Sample 4): It is very difficult to interpret the origin of sample 4 since it was obtained from a relatively homogeneous, organic clay which might have been organic soil dumped on top of the first turf of the wall. However, the deposit was certainly obtained from a much less wooded terrain than that of the promontory. The high levels of heath/bog plants, weeds, grasses, and low charcoal levels indicate that the dumped material might have been obtained from the edge of Midgeholme Moss. In any event, it certainly does not seem to have been obtained from the immediate vicinity of the turf wall.

The Upper Turf (Samples 1, 2 & 3): These samples probably represent three horizons within an inverted turf. All contained very low levels of microscopic charcoal. Sample 3 consisted totally of unhumified remains of the following mosses: *Rhytidiadelphus squarrosus, Hypnum cupressiforme, Pleurozium schreberi and Eurhyncium sp.* Sample 3 might thus represent the A^{00} horizon, sample 2 the A^{0}, and Sample 1 the A^{1} of the inverted profile.

The mosses in sample 3 all have fairly wide ecological tolerance ranges today and are found in a range of habitats, including moorland, acid grassland and woodland. The pollen contained within the moss band shows that the area from which the turf had been obtained was open, dominated by very weedy, grazed, grassland and heathers. The similarity of sample 2 to that of 3 is rather striking although *Calluna* levels were higher in sample 2. Sample 1 has a pollen assemblage dominated by woodland, with open habitat plants being less important. However, the woodland canopy was probably fairly open with grazed, weedy, grassland and heather in the vicinity. It would seem that the upper inverted turf was probably obtained from the same area as the more minerogenic dump material represented by sample 4. In other words, it it likely that it was taken from the edge of Midgeholme Moss.

It is interesting that sample 1 reflects the much more wooded nature of the mire edge before the Roman presence in the area. Sample 2 shows the more open landscape after clearance, and it is interesting to note that a cereal-type pollen grain was found. Innes (1988) found a single cereal-type grain in Midgeholme Moss at about 2040 BP (90 bc), and no more until post-Roman times. It is possible, therefore, that sample 2 represents the cleared pre-Roman surface of the edge of the mire. Sample 3 would thus represent the land surface at the time of turf cutting, and the slightly lower levels of *Calluna* and marginally raised levels of *Corylus* might indicate a degree of encroachment of hazel onto the site by the time the Romans came to the area. Pollen data from Midgeholme Moss for 1850 BP (ad 100) (Fig. 4) confirm this apparent hazel expansion in the vicinity of the mire.

Turf Wall 2

A partial pollen diagram and stratigraphic profile is given in Fig. 5 with pollen percentages listed in Table 3. A summary diagram containing ecological groups (with samples points) is given in

Fig. 7. Analysis was carried out at 8.0, 19.0, 20.0, 32.0 and 33.0 cm. For ease of description these have been designated samples 1-5 respectively.

The Buried Land Surface (Samples 4 & 5): Samples 4 and 5 (see Fig. 7)may be considered to be the A^0 and A^1 horizons respectively of the buried land surface. The pollen evidence would suggest that mineral soil was directly dumped onto the ground surface without a cut turf being first placed into position.

Pollen was virtually absent from sample 5, with only the occasional indeterminable grain being seen. Sample 4 contained very sparse, highly corroded, indeterminable pollen but single grains of the the following were recognised: *Betula, Pinus, Quercus, Calluna*, Filicales, *Polypodium, Pteridium*, Cyperaceae, Gramineae, *Melampyrum, Plantago lanceolata* and *Sphagnum*. Three grains of *Alnus* were found. This assemblage is similar to that of the *in-situ* ground surface of Turf Wall 1.

The lack of pollen preservation, the marginally higher levels of phosphate than that seen in Turf Wall 1 (McHugh *pers. comm.*), and the very abundant charcoal all point to the surface having been highly disturbed and occupied before the building of the wall. This is very interesting in view of the short distance (about 9.0 m) which separates the site from that of Turf Wall 1. However, the part of the turf wall from which Turf Wall 2 samples were taken abutted onto the stone walls of fort, indicating a closer proximity to the site of later intensive activity. It is possible that the Turf Wall 1 site was always marginal in terms of the settlement.

The First Turf (Samples 2 & 3): These samples appear to represent the A^0 and A^1 horizons of a turf which was placed on top of the initial dump material with the surface of the turf being uppermost. Both samples have very low microscopic charcoal levels and are dominated by woodland taxa, but there are considerable differences in their pollen spectra. Fig. 5 shows that in sample 3, *Alnus* and *Corylus* were most abundant with open habitat plants such as *Calluna*, Gramineae and *Sphagnum* being at a low level. Sample 2 indicates an opening of the tree canopy with *Alnus, Quercus* and, particularly, *Corylus* being reduced, with *Betula* and open habitat indicators increasing.

This picture is very similar indeed to that shown by samples 5, 6 and 7 (original land surface and first inverted turf) of Turf Wall 1. It would seem that the area from which the turf was obtained was woodland, but that by the time it was cut for wall construction, the canopy had been reduced, allowing the pollen of more open habitats to become incorporated into the ground surface. Birch had either taken advantage of the openings or was better represented by virtue of its rapid flowering after coppicing.

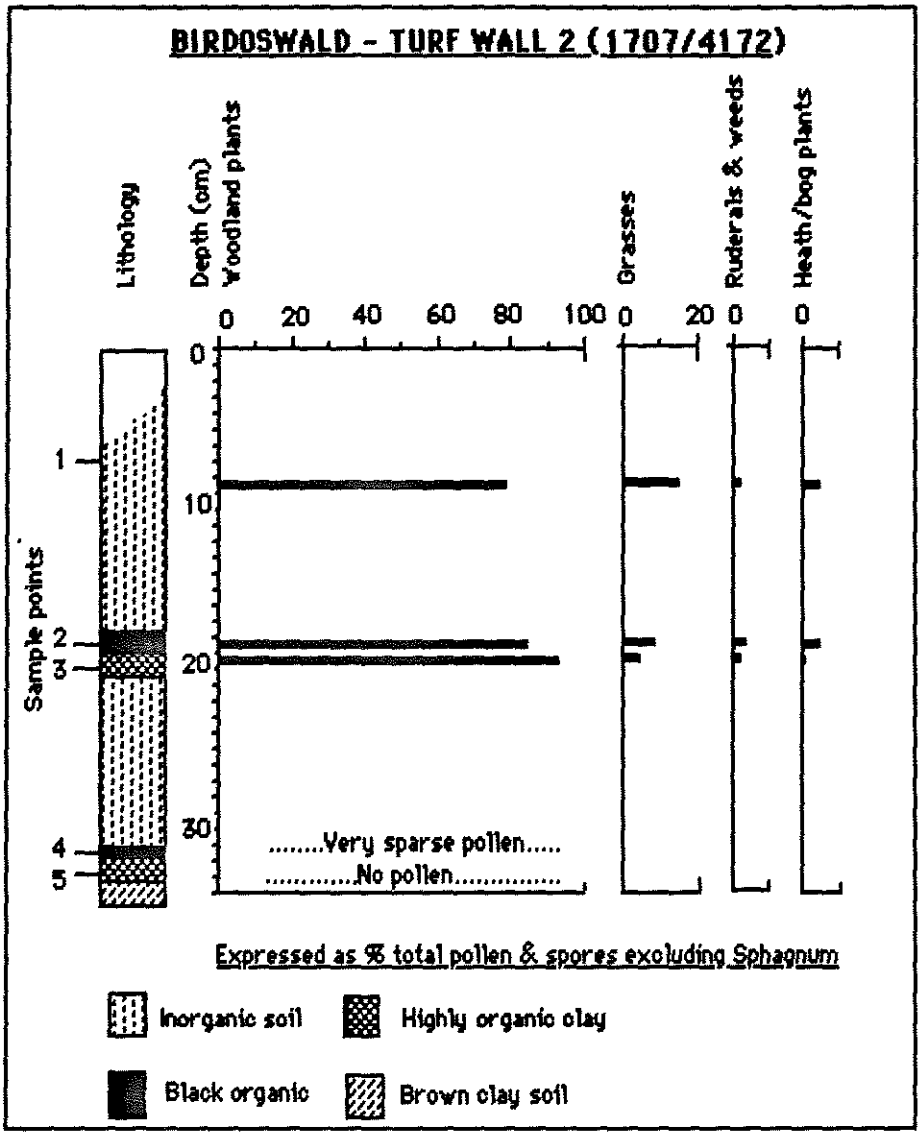

Fig.7

There is strong evidence to suppose that the turf of samples 2 and 3 was obtained very locally (from the promontory rather than from further afield) and that it had not been inverted.

Without carrying out very detailed pollen analysis of the whole profile, it is impossible to tell where the largely inorganic soil, which overlies the uppermost turf (samples 2 and 3), was obtained from. However, the pollen spectra of sample 1 are very similar to those of sample 1 of Turf Wall 1 and indicate disturbed woodland.

Turf Wall 1 & Turf Wall 2 - Conclusion:

Pre-Roman Environment: Comparison of the Birdoswald data with those of Innes (1988) for Midgeholme Moss suggest that, the A^1 horizon of Turf Wall 1 might represent a period somewhere around 2220 BP (270 bc). The pollen spectra indicate quite clearly that the site of the turf wall supported a dense cover of woodland, dominated by *Alnus*, with *Quercus*, *Corylus* and *Betula* being important. Also recorded were *Fraxinus*, *Ulmus* and *Pinus* but their very low frequencies would suggest that they were growing some distance away from the site. Indeed, considering the high pollen production and excellent pollen dispersion of *Pinus*, it is likely that it was virtually extinct in the area and that it was recorded by virtue of long distance transport. In spite of the dense woodland cover, pollen of open, grassy moorland was recorded showing that open areas were nearby. If the chronology is reasonably accurate, it would seem that the promontory was marginally more wooded than the area around Midgeholme Moss which, unlike the former site, appeared not to be dominated by any particular tree.

Iron Age clearance (which according to Innes started before 2040 BP (90 bc)) appears to have altered the nature of the woodland, with the canopy becoming opened and birch exploiting the gaps. Wet moorland also seems to have encroached up to the promontory with *Calluna* and *Sphagnum* moss increasing in frequency. It would also seem that cereal growing or processing was being carried out in the environs of Midgeholme Moss.

Romano-British Environment: Although Turf Wall 1 and 2 were only about 9.0 m apart, the ground surface on which the two parts of the wall were built differed in their history. The area of Turf Wall 1 provided little evidence of actual occupation of the ground surface before construction, while the area of Turf Wall 2 seems to have been subjected to considerable disturbance as evidenced by corrosion and oxidation of palynomorphs. The duration and intensity of this occupation cannot be ascertained but it must have been long enough or caused enough soil disturbance to enhance palynomorph degradation. It is interesting too that there is little evidence of intensive woodland removal when the wall was built and this may be due to minimal clearance, or to very rapid burial of the woodland pollen load in the surface soil.

Details of Construction and Origin of Wall Material: The ground surface of Turf Wall 1 seems to have had a turf inverted upon it in the initial phase of wall building. This turf may have been obtained a little distance away from the site, in a area of more open woodland, possibly towards Midgeholme Moss. The 'soil' subsequently dumped upon the first inverted turf may have been obtained from the edge of Midgeholme Moss. The upper turf was also probably obtained from the edge of the Moss and was inverted onto the 'soil' dump. This turf might contain evidence of Iron Age cereal-growing/processing near the Moss. In the case of Turf Wall 2, mineral soil seems to have been dumped directly onto the buried ground surface without incorporation of an initial turf. A turf was then placed on top of the mineral dump with the surface uppermost, and this appears to have been obtained from an area of disturbed woodland, possibly from the promontory itself. Further mineral soil from disturbed woodland was placed on top of the upper turf.

It is interesting, therefore, that in spite of the proximity of the two sections of wall in this study, they seem to have been built in different ways and with materials from various areas in the vicinity. It is probable that turf material was at a premium, was taken from wherever it could be obtained, and that the wall building technique was not particularly systematic.

BIRDOSWALD - The Rampart

A partial pollen diagram and stratigraphic profile is given in Fig. 8 with pollen percentages listed in Table 3. A summary diagram containing ecological groups (with sample points) is given in Fig. 10. Analysis was carried out at 6.0, 11.0, 17.0, 22.0, 27.0, 29.0, 30.0 and 32.5 cm. For ease of description these have been designated samples 1-8 respectively.

The Buried Land Surface (Samples 7 & 8): Samples 8 and 7 (see Fig. 10) may be considered to represent the A^1 and A^0 horizons of the buried soil respectively and, theoretically, should have similar pollen assemblages to the A^1 and A^0 horizons of the Turf Wall. Figs. 8, 9 and 10 show the pollen spectra in sample 8 to be dominated by woodland taxa, and even the taxa which have been interpreted as open habitat plants (Cyperaceae, Gramineae and *Pteridium*) could, in fact, have been growing on the woodland floor.

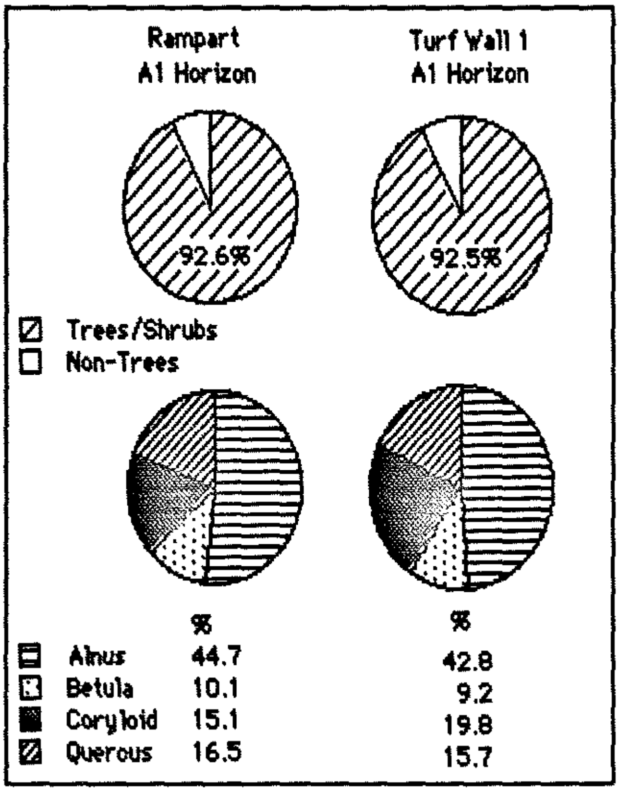

Fig. 9

Fig. 9 gives a comparison of the status of woodland between the Rampart and Turf Wall 1 for the A^1 horizon (the pre-Romano-British environment). The spectra are remarkably similar and there is little doubt that before the Roman presence, dense alder carr had covered much of the promontory, with hazel and oak growing a little further away, and birch even further, probably towards Midgeholme Moss. As with Turf Wall 1, levels of microscopic charcoal were very low and pollen preservation was good, indicating minimal disturbance and occupation of the site.

Figs. 8 and 10 show that virtually no pollen was preserved in the A^0 horizon (sample 7) of the buried soil, and microscopic charcoal levels were exceedingly high along with raised phosphate levels (McHugh *pers. comm.*). The evidence points to occupation of the site before the building of the rampart, a much more intense (or more prolonged) occupation than around the area of the turf wall. This is not surprising since the rampart was built some considerable time after the turf wall and the promontory must have been occupied in the intervening period.

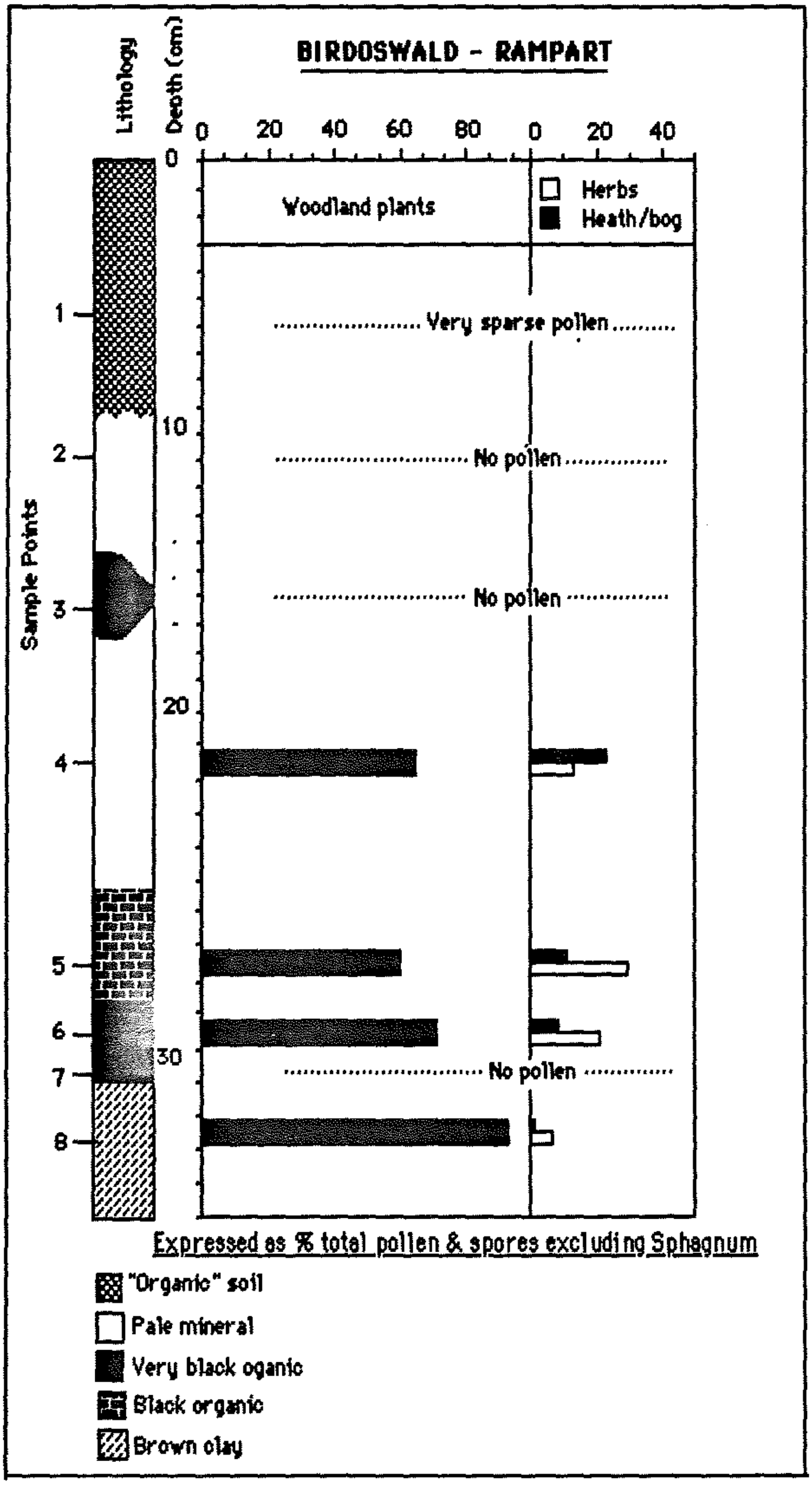

Fig. 10

The First Turf (Samples 5 &6): Although the very black organic band, from which samples 6 and 7 were taken, appeared to be homogeneous, it is obvious from the pollen spectra of sample 6 that allochthonous organic material had been lain on the original, occupied ground surface. Sample 6 thus represents an Ao horizon of a turf.

The turf was obtained from an area of open woodland, dominated by hazel and birch and with alder and oak abundant. Microscopic charcoal was moderately frequent and the relative abundance of Gramineae, *Calluna* and *Sphagnum* along with the presence of weeds such as *Plantago lanceolata, Potentilla* and *Trifolium* type attest to the proximity of grazed moorland.

It is rather difficult to ascertain whether sample 5 represents the A^1 horizon of the first turf or whether it was a mixture of unrelated organic material. Woodland taxa were lower than in sample 6 but the pollen data reflect open woodland with grassy moorland nearby. A fragment of a cereal-type pollen grain was also found. Samples 5 and 6 seem to reflect a somewhat similar picture to that of the upper inverted turf of Turf Wall 1 and it is possible that sample 5 represents the cleared pre-Roman surface of the edge of Midgeholme Moss with sample 6 thus representing the actual Romano-British surface

Mineral Dump (Sample 4): The pollen in sample 4 was exceedingly corroded, and microscopic charcoal levels were very high. This points to the material having been obtained from an area that had been subjected to considerable disturbance and oxidation. The sample was dominated by hazel, alder and birch; but *Calluna*, Gramineae and *Sphagnum* were relatively high indicating the proximity of grassy moorland. It is quite possible that the sample has no stratigraphic integrity whatsoever and that it consists of mixed material with a heterogeneous assemblage of pollen.

Subsequent Dump Material (Samples 1, 2 & 3): Sample 3 was taken from a dense, black organic band which contained sparse charcoal fragments but no discernible pollen. From such an organic deposit, a degree of pollen preservation might have been expected and it is probable that the material had been well mixed and oxidised. Sample 2 contained moderate amounts of charcoal but again no pollen while sample 1 contained very high levels of microscopic charcoal and very sparse, indeterminable pollen grains.

It would seem that the upper 20.0 cm or so of the rampart was composed of material obtained from a variety of sources but all from highly disturbed situations; it was probably taken from very local, previously occupied surfaces, or even from reused material say, for example, from the demolished turf wall.

Rampart - Conclusion: The pre-Romano-British soil showed that the site had supported dense alder carr very similar to that of the turf wall area about 150 m to the south of the site. Before construction of the rampart, the ground surface was occupied and disturbed long enough for almost a complete oxidation of the pollen to occur. The first turf of the construction might have been inverted and may have been obtained from the same area as the uppermost turf of the original turf wall, i.e. from towards the edge of Midgeholme Moss. The dump material making up the rest of the rampart seems to have been obtained from a variety of sources - probably from sites which had all been occupied and/or highly disturbed, or even from reworked material.

BIRDOSWALD - 'Desertion' Layers

Summary diagrams are given in Figs. 11, 12 & 13, and pollen percentages are shown in Table 4. The material provided for 'Desertion' Layer 1 was a single mixed sample so that no spatial or temporal differentiation was possible. However, both 'Desertion' Layers 2 and 4 were presented in Kubiena boxes so that lower (earlier) and upper (later) deposits were analysed. Pollen preservation in all the samples was poor although accurate identification was possible.

'Desertion' Layer 1 (3880): Microscopic charcoal was present, but not abundant. The pollen spectra show the area to have been dominated by open, disturbed mixed, acid woodland with areas of weedy, grazed moorland nearby. The condition of the pollen and the levels of phosphate (McHugh pers. comm.) suggest that the surface on which the layer accumulated was, or had been, occupied. However, pollen preservation and low charcoal levels would suggest that occupation was either light or short-lived.

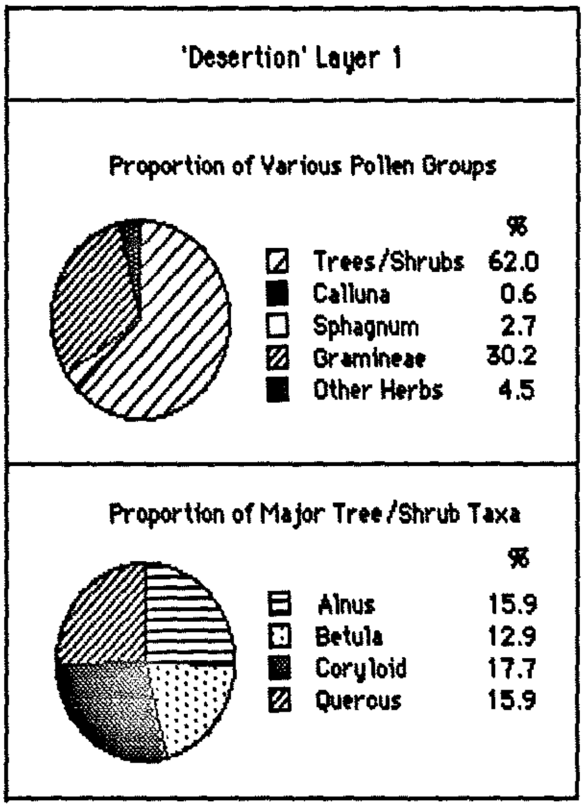

Fig. 11

'Desertion' Layers 2 & 4 (3738): Both sets of samples were obtained from the same context, although separated spatially by about 15 m. There were differences in the pollen spectra for the two locations but it is obvious that the two sets of samples reflect similar conditions and similar patterns of change through time. Fig. 12 shows the major differences between the lower (earlier) and upper (later)parts of the black layer. Both the earlier and later deposits contained microscopic charcoal but at both locations, the later one contained very much higher levels.

Both areas were dominated by damp, disturbed woodland; a wide variety of trees and shrubs were recorded, including *Salix* (willow), *Prunus* type (c.f. sloe) and *Crataegus* type (c.f. hawthorn) all of which must have been growing very nearby or been brought into the site by human agency. However, the levels of *Pteridium*, *Sphagnum*, Gramineae, *Calluna* and *Plantago lanceolata* show that there were also areas of open, grazed moorland. In both the earlier and later deposits, Layer 2 recorded more open conditions and soil disturbance than Layer 4. It is intriguing, therefore, that McHugh recorded much higher levels of phosphate from Layer 4 than Layer 2.

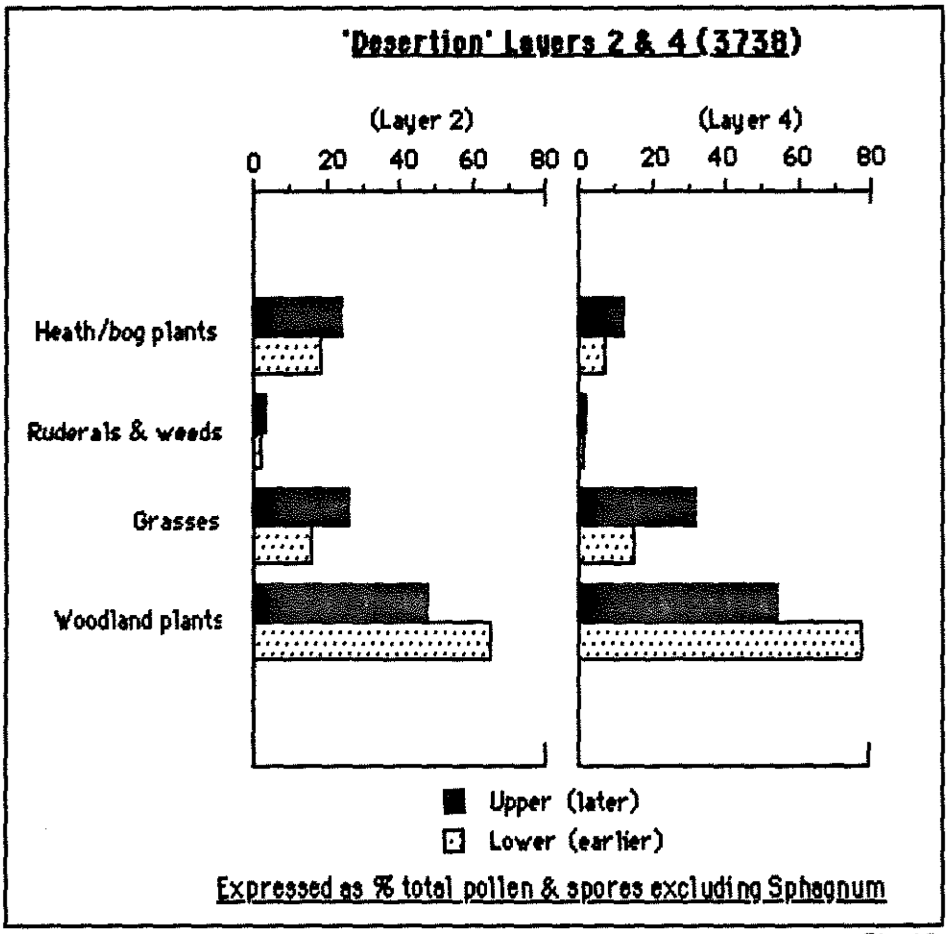

Fig. 12

What is striking is the marked reduction in woodland, and an expansion of grasses, weeds and moorland plants, which occurred at both locations. The earlier deposit could conceivably represent a desertion phase of the site, but there is little doubt that during the deposition of the upper material, its environs were subject to considerable human impact.

The degree of corrosion of the pollen and the presence of microscopic charcoal would suggest that people were active at the site during the deposition of the black layer. However, the area of the fort was certainly dominated by woodland, and it is conceivable that pollen degradation could have been due to natural decomposition in a biologically active soil. The presence of charcoal and disturbance indicators certainly point to some human activity, but not necessarily to occupation.

There is little doubt that human impact was greater during the latter phase of deposition and it is possible that what was being recorded was the resumption / acceleration of Roman activity during building of the internal buildings after the garrison's return from the Antonine Wall. The very high charcoal and reduction of woodland taxa supports this contention but, even here, if there had been very intense occupation of the soil surface (see the A^0 horizons of Turf Wall 2 and the Rampart) complete pollen degradation might have been expected. This did not occur in the 'desertion' layers. The site may have not been completely abandoned but these layers were deposited during a time when human activity was not as intense as when the turf wall and the rampart were built.

<u>Comparison of 'Desertion' Layers 1, 2 & 4</u>: Layers 2 and 4 have so many similarities in their species composition and richness (see Table 4), and in their pattern of change, that they must be considered to be more or less contemporaneous. However, they appear to be rather different from 'Desertion' Layer 1. Fig. 13 compares 'Desertion' Layers 1 and 4 and it is strikingly obvious that there are major differences in, not only woodland composition, but also open habitat indicators and minor components.

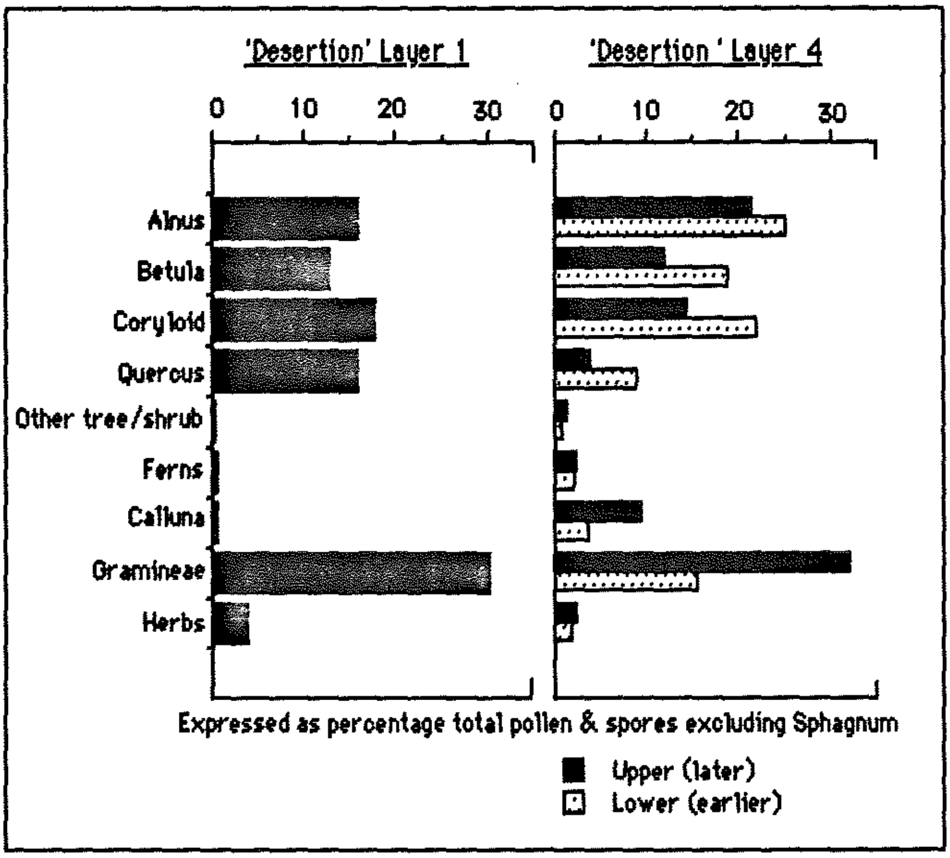

Fig. 13

Layer 4 was chosen for the comparison in view of its proximity to the sample site of Layer 1 near the west gate. It is immediately obvious that Layer 1 had higher levels of oak pollen and lower levels of alder, ferns and *Calluna*. It also had a lower species richness for trees and shrubs. The two sets of spectra are quite distinct and, either there were very drastic changes in the vegetation over the short distance between the two sample sites, or the deposits are not contemporaneous. The only other possibility is that the pollen spectra represent dumped material rather than a true picture of the vegetation at the site and, in this case, any comparison would be erroneous. However, the marked similarity between Layers 2 and 4, and the differentiation between earlier and later deposition seen in both, suggests that the differences between 'Desertion' Layer 1 and the other two are real.

'Desertion' Layers 1, 2 & 4 – Conclusion: There was microscopic charcoal present, and corrosion and degradation of palynomorphs, in all the samples. This indicates that the ground surface was either subjected to a degree disturbance, and/or that it supported a biologically active soil in which pollen was subjected to normal decomposition processes. The fact that it was possible to identify the microfossils would suggest that even if the soil were disturbed, there was certainly little evidence of intense occupation as was seen at the ground surface beneath Turf Wall 2 and the Rampart.

The pollen spectra and changes in vegetation pattern through time were so similar between Layers 2 and 4 that they may be considered to be contemporaneous. However, they were very different from Layer 1 and it would seem that the latter was deposited at a different time.

All the layers showed the fort to be dominated by open, damp woodland but Layers 2 and 4 recorded a much more diverse flora than Layer 1. Layer 2 was also gave evidence of a much more open, disturbed environment than Layer 4 which was much less influenced by grazed moorland than the area around Layer 2.

Layers 2 and 4 showed that later during deposition of the black sediment, there was considerable woodland clearance and much disturbance on the site, with evidence of more intense burning than previously. However, the degree of pollen preservation would suggest that occupation was not intense and it is possible that the black material did indeed accumulate during a period when human impact in the fort was relatively low.

BIRDOSWALD - Morass Peat

A summary diagram is given in Fig. 14 with pollen percentages in Table 4. Analysis was carried out on a single sample, possibly of mixed taphonomy. It is impossible , therefore, for a definite chronology to be assigned to the sample since the microfossil content might have been temporally heterogeneous to some extent. However, the peat must have been of pre-Roman date and the pollen data do provide information on the environment on the promontory before the wall and fort were built. Furthermore, a comparison with the pollen of the morass peat with that of the Iron Age buried ground surface of the turf wall, rampart, and of Innes's pollen diagram for Midgeholme Moss (1988)might provide a rough idea of the relative age of this deposit.

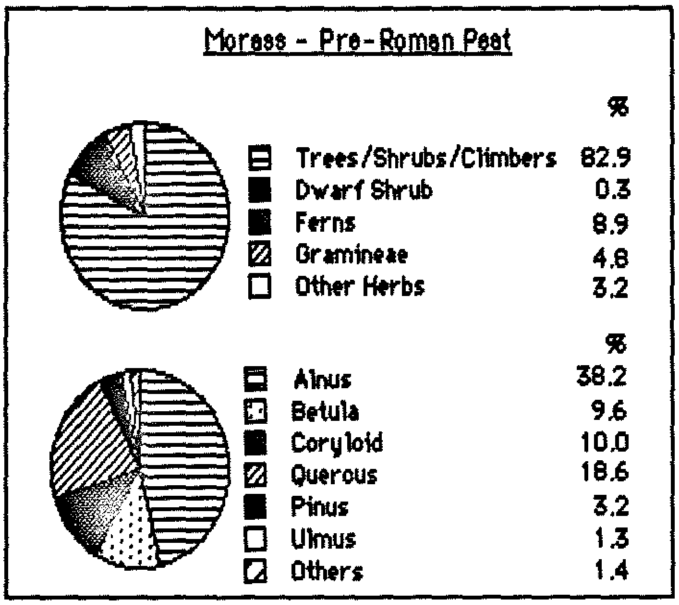

Fig. 14

Fig. 14 and Table 4 indicate that the morass peat accumulated in moist (but not water-logged) alder-dominated woodland which had an understory of ferns and tall herbs such as *Filipendula* (meadow sweet), *Valeriana* (valerian), and *Urtica* (stinging nettle). Hazel, oak and birch were abundant and the canopy was open enough to allow ash and shrubs to flower. Grasses, heathers and herbs amounted to only 8.3% although the pollen spectrum would certainly suggest that the woodland was disturbed and areas of grazed grassland were in the vicinity.

It must be remembered, of course, that if the pollen spectra were mixed because of crude sampling technique, it is conceivable that the open habitat indicators could belong to a later date. Nevertheless, overwhelmingly, the site was dominated by damp, disturbed, acid woodland.

The presence of trees on the site, and the open canopy, is supported by the presence of *Hedera* (ivy) and *Lonicera* (honeysuckle). These climbers must have been growing *in situ* since their extreme entomophily restricts their pollen dissemination. Their presence also adds weight to the contention that there were standing trees with a relatively open canopy in the immediate locality since both plants require upright support and adequate light for flowering. Both also favour acidic, moist soil and will not tolerate water-logging (Grime *et. al.* 1988).

When comparing the peat with the soils buried beneath the turf wall and the rampart, the nature of the woodland was different at the morass site. Although the relative abundances of alder, birch, oak and hazel were similar, the morass peat contained relatively high levels of pine and elm – higher levels than found in any of the other samples in the study. The disturbed nature of the canopy would mean that a certain amount of extra-local and regional pollen would find its way into the accumulating peat, but the levels found in sediments accumulating in relatively open sites, such as mires, could not be expected. Thus, it is feasible that Midgeholme Moss would have received more elm and pine pollen than the sediments on the promontory. With this in mind, it is interesting that Midgeholme Moss only recorded relatively high levels of these trees in pre-Elm Decline times i.e. before 5270 BP (3320 bc). It is possible, therefore, that the specific sample of morass peat analysed here was accumulating in Neolithic or even Mesolithic times. If this were the case then it is clear that alder woodland dominated the site of Birdoswald fort for a very long time indeed.

Morass Peat – Conclusion: The pollen spectra indicate that the site supported mixed woodland, dominated by alder and with an understory of ferns and tall herbs. Trees were growing *in situ* and the canopy was open enough to allow extra-local and regional pollen to enter the accumulating peat. The soils were acidic and moist rather than water-logged. If there is chronological integrity within the sample then areas of grazed grassland were present, probably beyond the woodland edge.

The relatively high levels of pine and elm would suggest that the morass peat sample accumulated much earlier in the history of the site, possibly in Mesolithic/Neolithic times in which case the promontory on which the fort was built supported alder-dominated woodland for a very long time indeed.

APPLETREE AND BIRDOSWALD (Turf Wall 1)
A comparison of the pollen record of the buried soils.

As already described, the ground surface buried by the turf wall at both Appletree and Birdoswald was sampled in the A^1 and A^0 horizons. Because of the impossibility of obtaining exact temporal correspondence in the samples, the comparison cannot be precise, but it has been reasoned that the A^1 and A^0 samples represent the Iron Age and Romano-British environments respectively. Fig. 15 shows the changes in the status of woodland which had occurred by the time the turf wall was built at each site, and also compares the two sections of the wall.

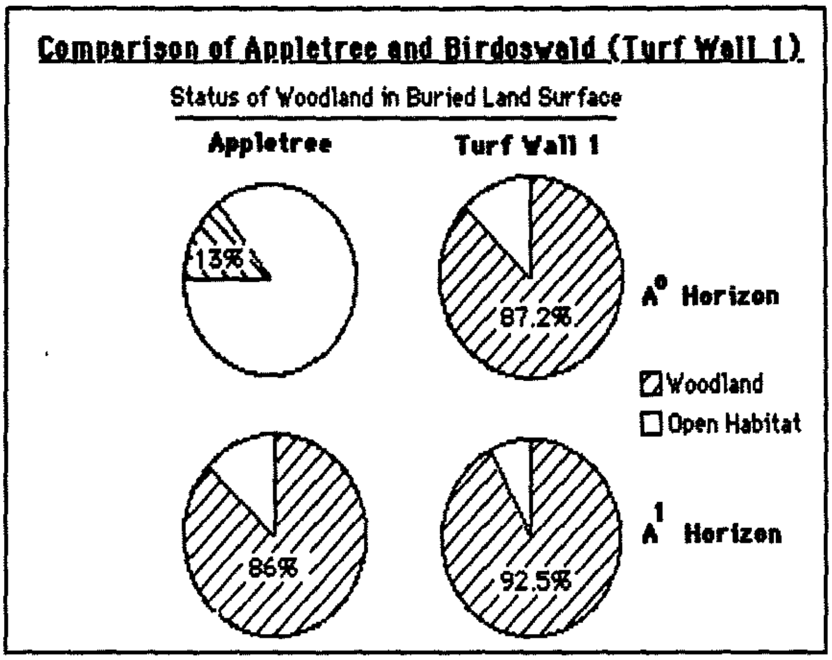

Fig. 15

It is immediately obvious that both locations were heavily wooded in the Iron Age and, if contemporaneity may be inferred for both A^1 samples, Appletree appears to have had marginally less tree cover than Birdoswald. The major and striking difference between the two sites is that the landscape around Appletree appears to have been almost cleared of trees by the time the wall was built while at Birdoswald, the site was more heavily wooded than Appletree had been even in Iron Age times.

At both sites, microscopic charcoal levels were low in the A^1 layer but high in the A^0 horizon. McHugh also reported 'native' levels of phosphate in the A horizon and high levels in the turf in each case. It is obvious then that before the Roman presence, human impact in the area was relatively minor. The apparent persistence of dense woodland in the face of the activity of Roman construction gangs at Birdoswald is enigmatic but has been discussed on page 13.

Fig. 16 shows the changing fate of the dominant woodland taxa from Iron Age to Romano-British times and also the differences between the two sites. At both sites, hazel appears to have had the same status while there seems to have been a little more oak woodland at Appletree than at Birdoswald. Birdoswald was dominated by damp alder wood with birch being a relatively small contributor to the pollen rain, this tree probably being more important just north of the site towards Midgeholme Moss (see page 11). However, birch appears to have been an important component of the Iron Age Appletree woodland.

By the time the wall was being built, the landscape at Appletree had not only been virtually cleared, but birch had been drastically reduced and hazel became the most important component in the arboreal pollen flora. At Birdoswald, the overall impact on the woodland appears to have been less but all arboreal taxa were reduced except for birch which seems to have expanded dramatically (see page 12).

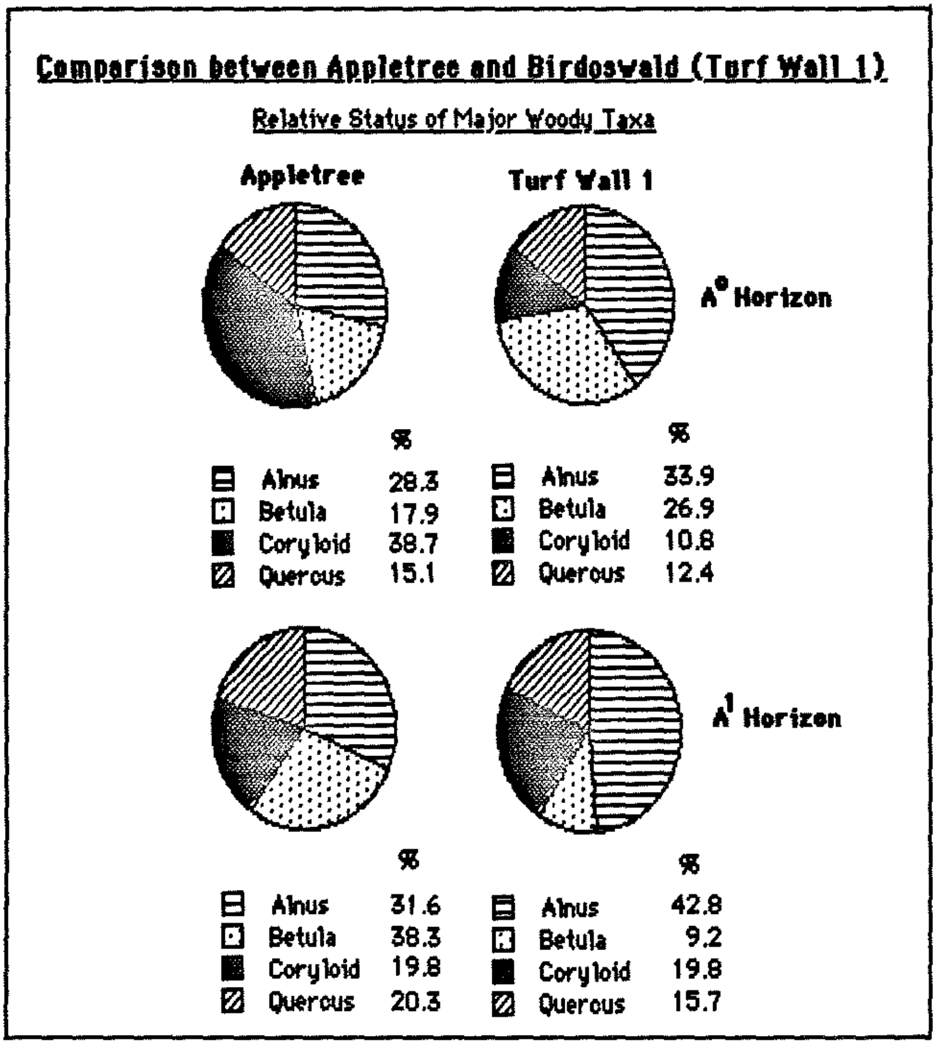

Fig. 16

Fig. 3 (page 6) shows that when the wall was being built, Appletree was dominated by rough moorland and bog, while disturbed woodland seems to have prevailed at Birdoswald. Even if either of the scenarios for Birdoswald (discussed on page 13) hold true, it seems obvious that Appletree must have been open moorland for a considerable time before the building of the wall whilst Birdoswald was not.

For *Calluna* levels to reach nearly 60% of the pollen sum at Appletree (see fig. 3), the plant must have been growing very locally and have had considerable areal cover. There is strong evidence that after clearance of a site by fire, *Calluna* may enter the succession very rapidly, but can remain grossly under-represented in the pollen rain even even after eleven years of extensive colonisation. Results vary considerably but even with a ground cover of 95%, modern pollen studies have shown that *Calluna* in its most vigorous 'building phase' (Gimingham 1972) can have a pollen representation as low as 10% of the pollen sum in peat below its canopy (Cooper 1987; Norman 1987). Data from present-day rough moorland in Northumberland have shown that *Calluna* pollen percentages can reach 60% with about 60% cover but even here, the plant blankets more than half the immediate terrain (Evans & Moore 1985). The higher pollen representation here might be a reflection of enhanced dissemination in a more open canopy of the dwarf shrub.

Of course, once woodland is removed, extra-local and regional taxa would be better represented in the turf and any surrounding moorland would be evident in the pollen data. However, within the timespan of wall building, any woodland pollen in the surface substrate would not have had time to decompose and would also be represented. It must be remembered that 1.0 cm depth of ground surface turf was taken for the pollen sample and that this must represent at least several years' pollen rain. Tree pollen was very low and moorland pollen was very high; this is strong evidence to support the contention that heather-dominated moorland had been established for a considerable period before the building of the turf wall at Appletree. It is possible that the terrain resembled that described by Evans & Moore for their present-day Northumberland site and that this had been created by late Iron Age pastoralists.

The consistently higher levels of alder at Birdoswald tentatively suggest that its section of turf wall was built on a wetter site than that at Appletree.

These data thus indicate a considerable spatial heterogeneity in the vegetation history between Appletree and Birdoswald - two points in Hadrian's Wall separated by only 1.7 Km.

FINAL COMMENTS

Until recently, there has been a relative paucity of pollen diagrams relating to the Iron Age and Romano-British period for the landscape along Hadrian's Wall, and most information has come from Donaldson & Turner 1977, Davies & Turner 1979, Turner 1979, Barber 1981, and Innes 1988. However, work is currently under way on several raised mires both along the wall and in the area up towards the Antonine Wall; details of progress are outlined in Barber, Dumayne and Stoneman (forthcoming). Furthermore, detailed analysis of Midgeholme Moss is in progress by P.E.J. Wiltshire and this should give a much clearer understanding of the regional landscape immediately prior, during, and just after the building of the wall and the Fort at Birdoswald.

Barber et. al. (forthcoming) summarise the findings of most of the accumulated research by saying that the area "was an agricultural and social backwater until the Roman occupation" and that the terrain offered many disincentives to early farming by virtue of its poor soils and large areas of raised bog. Published pollen diagrams produced by the above authors record minimal human impact on regional woodland in prehistoric times, some activity in Iron Age times, but massive and sustained woodland clearance coinciding with the Roman occupation. Furthermore, there is virtually no evidence of cereal growing in the Iron Age or Romano-British period and it is inferred that a pastoral economy dominated the area.

As discussed earlier in this report, Innes (1988) recorded some woodland clearance and a single cereal pollen grain at Midgeholme Moss in about 2040 BP (90 bc) so presumably, some arable agriculture was attempted in the Birdoswald area, albeit on a small scale. However, the pollen data point to pastoral husbandry being the most important agricultural activity. It is also interesting that although the woodland regenerated after this clearance, it did not recover to its former extent around the mire. Nevertheless, the work presented in this report shows that the woodland must have been rather patchy since the promontory on which the wall was constructed was very heavily wooded indeed until the Roman presence.

There seems little doubt from the evidence gleaned so far that at Birdoswald, dense, damp, deciduous woodland dominated the landscape until the Romans arrived. When the turf wall was built, they must have cleared enough trees away to establish an encampment and disturbed the surface soil enough for palynomorphs to decompose. However, just 9.0 m to the west of the sample site which records this disturbance (see Turf Wall 2), they either removed very few trees to build the wall (see Turf Wall 1), or carried out the operation so quickly that there was insufficient time for woodland clearance to be recorded in the pollen data. It must be stressed, however, that there certainly **were** open areas in the vicinity since some of the turves used in the construction recorded relatively low levels of arboreal pollen, higher levels of moorland and bog taxa, and indicators of grazing. But there was no convincing evidence of cereal growing.

Appletree seems to have had a rather different history. It was certainly covered by mixed, deciduous woodland in the Iron Age (although not quite as dense and wet as at Birdoswald) but the immediate terrain had been dominated by rough heather-dominated moorland for some time before the turf wall was built. The upper inverted turf (samples 1, 2 & 3) suggests a rather gradual clearance of the woodland and, presumably, this reflects sustained activity in the area by Iron Age pastoralists before the coming of the Romans. Again, there is certainly no evidence for cereal growing in vicinity.

It is, perhaps, not surprising that the turves and mineral dump material used in the wall construction at both Appletree and Birdoswald seem to have been obtained from a variety of sources However, the fact that building methods did not appear to be particularly systematic was less expected. At Birdoswald the turves were inverted in Turf Wall 1 and placed with the surface uppermost in Turf Wall 2, while at Appletree turves were both inverted and non-inverted.

The massive Romano-British woodland clearances recorded in published pollen diagrams, and the variety of sources for turf outlined in this report, are also not surprising when it is estimated that a four acre fort required 22,000 cubic feet of timber (Keppie 1986). The amount of turf needed for wall construction was also prodigious; for example, it is estimated that the forty Roman miles of the Antonine Wall needed the removal of a 50 m long strip either side of the frontier line (Keppie 1986). The Roman builders must have taken their materials from any convenient place within easy reach of the wall and, presumably, did not consider meticulous and systematic placing of turves to be of prime importance.

By the time the rampart of the stone wall of Birdoswald Fort was built, the site had been occupied for some time. The initial construction involved placing a turf upon the ground surface but the rest of the structure seems to be a mixture of mineral dump and even reused material.

It has been suggested that the black layer, which was deposited before the Fort's internal buildings were constructed, may have accumulated during the period when troops were deployed to the Antonine Wall and thus represents a 'desertion' layer. However, the evidence would suggest that activity continued and that 'Desertion' Layer 1 was not contemporaneous with Layers 2 and 4. 'Desertion' Layers 2 and 4 also record the continued opening up of the landscape during their period of deposition. However, it is suggested that occupation of the site was not intense; it is possible that a token force was kept at the Fort during the period of abandonment or even that itinerant people or grazing animals periodically used the interior of the Fort as protection from the elements.

The Morass peat which was obtained from under the granary of the Fort recorded the vegetation which prevailed on the site in much earlier times, possibly in the Neolithic or even Mesolithic. The construction of such an important building on a peat deposit is puzzling but, perhaps, is a tribute to the constructional skills of the Roman builders.

ACKNOWLEDGEMENTS

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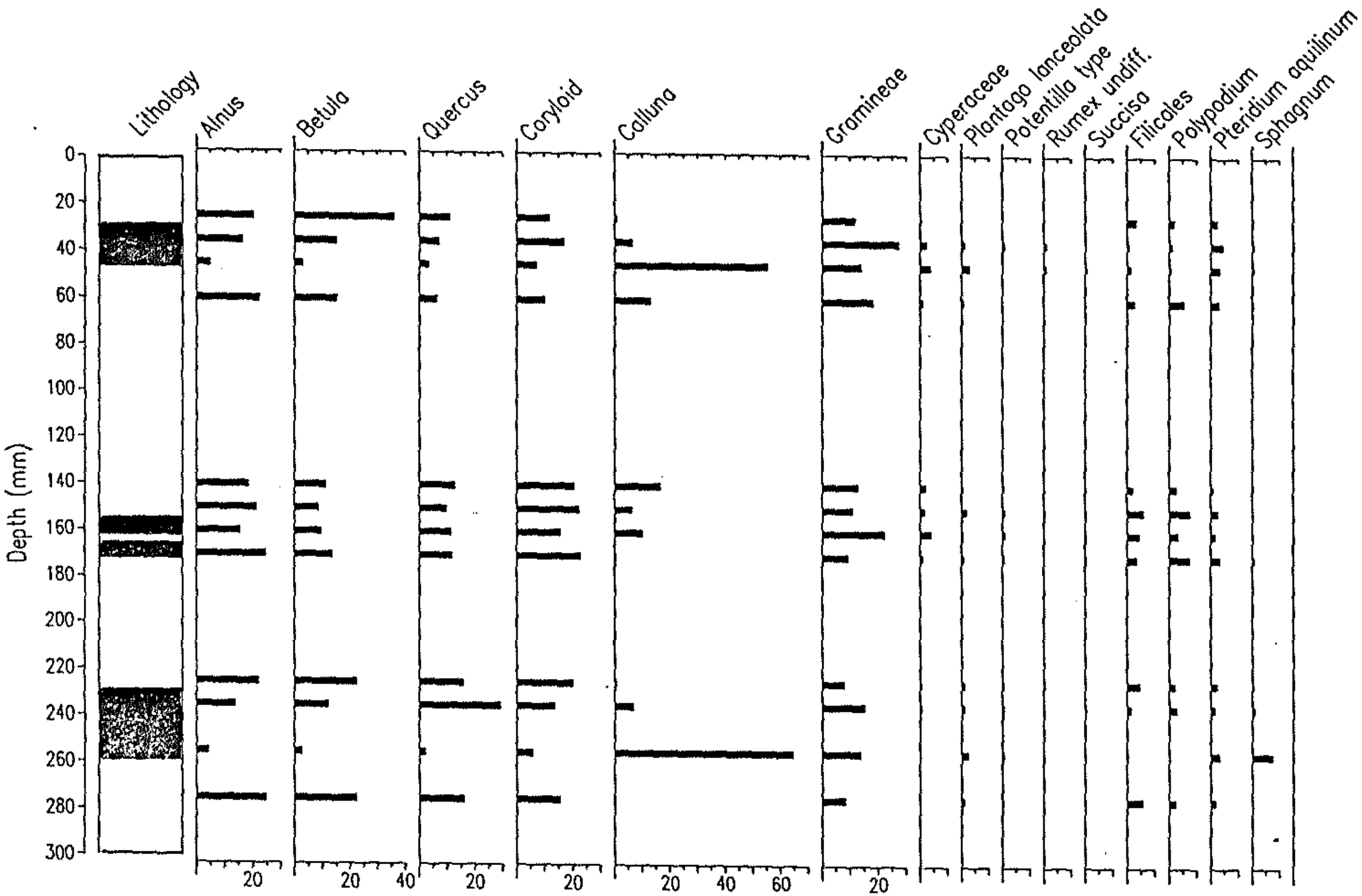
APPLETREE – TURF WALL SECTION



Expressed as % total pollen & spores excl. Sphagnum

FIG. 2

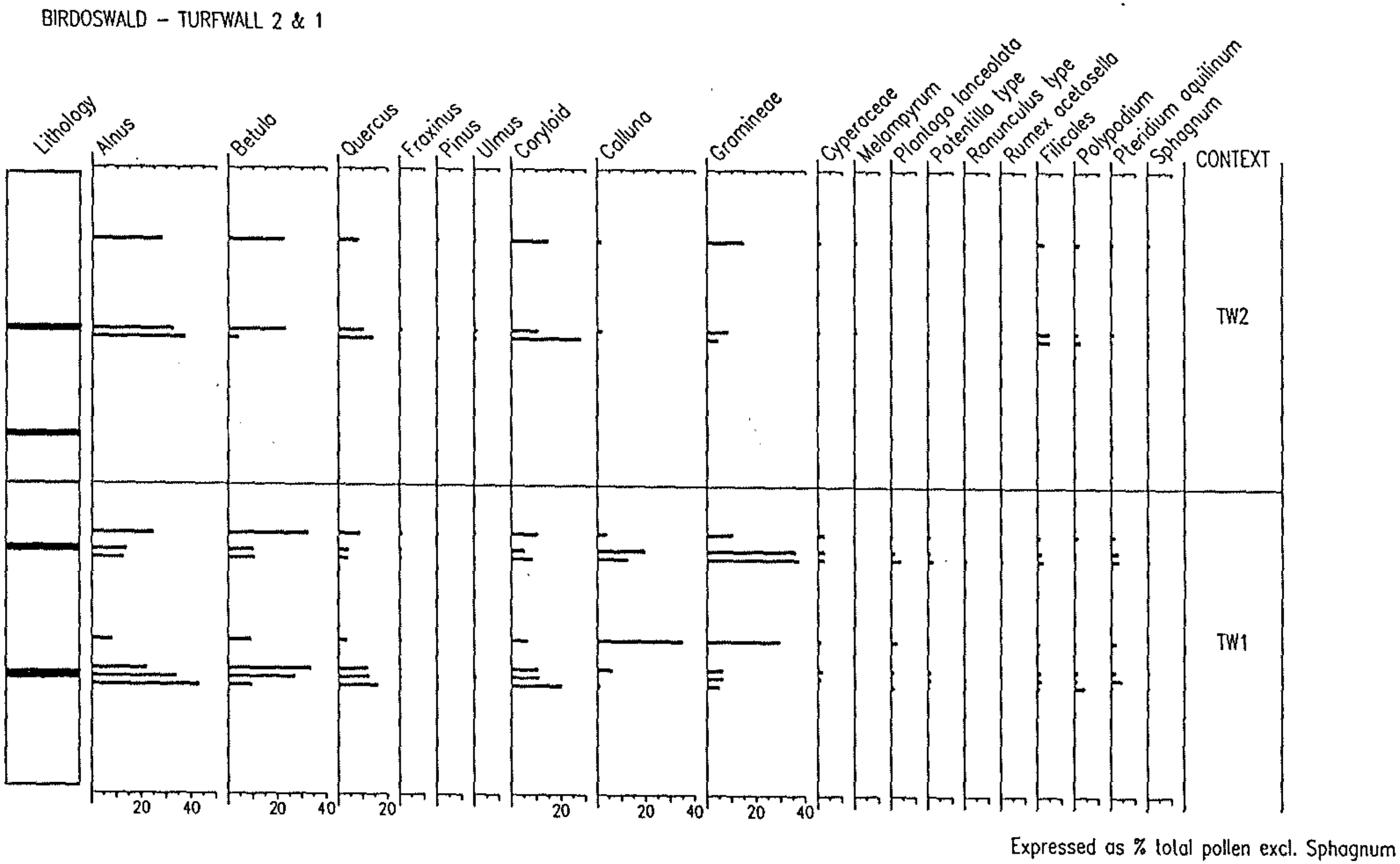
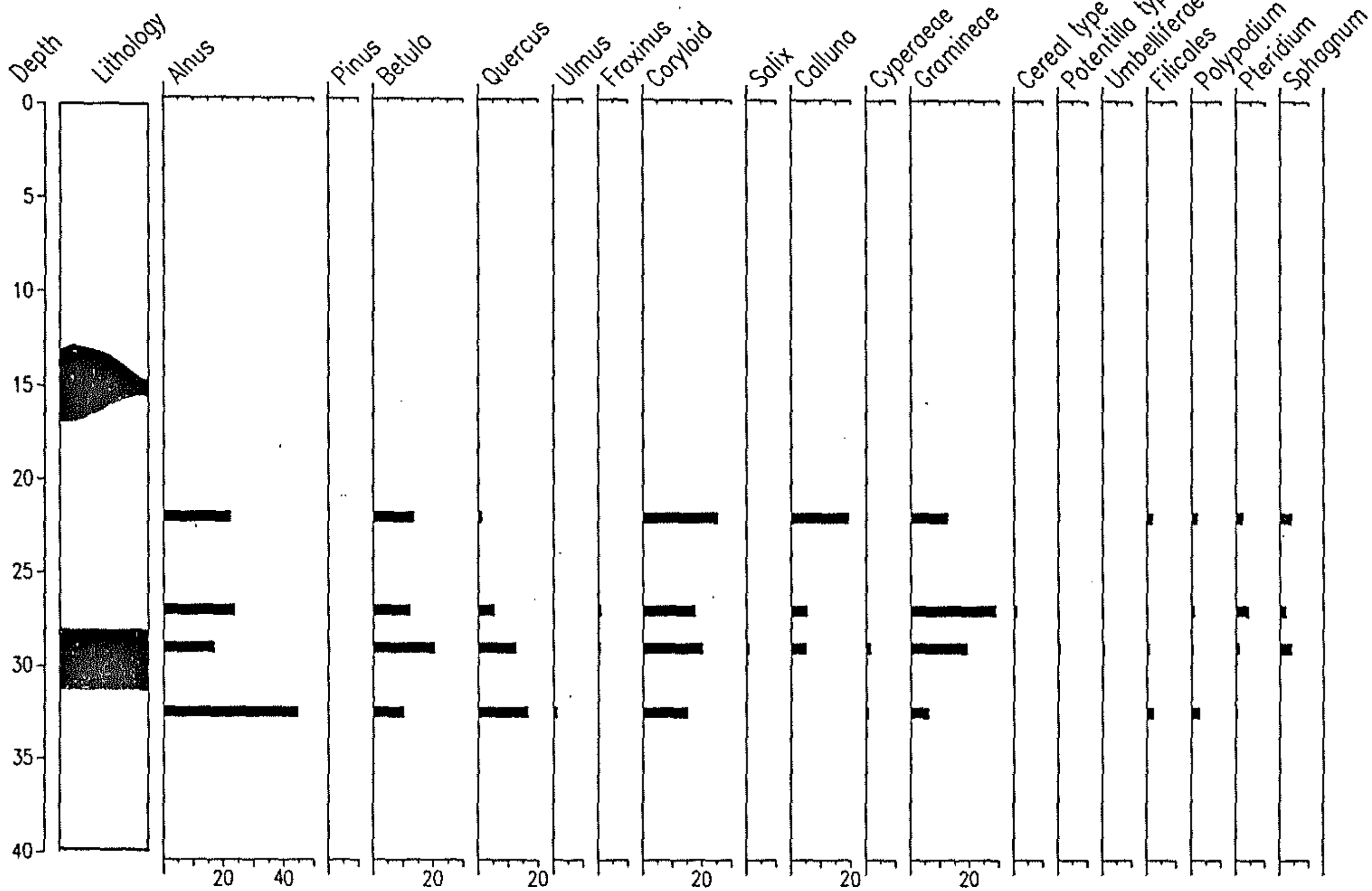

BIRDOSWALD – TURFWALL 2 & 1
Lithology
Alnus
Betula
Quercus
Fraxinus
Pinus
Ulmus
Coryloid
Calluna
Gramineae
Cyperaceae
Melampyrum
Plantago lanceolata
Potentilla type
Ranunculus type
Rumex acetosella
Filicales
Polypodium
Pteridium aquilinum
Sphagnum
CONTEXT
TW2
TW1
20
40
Expressed as % total pollen excl. Sphagnum

FIG. 5

BIRDOSWALD - RAMPART



Expressed as % total pollen & spores excl. Sphagnum

FIG. 8

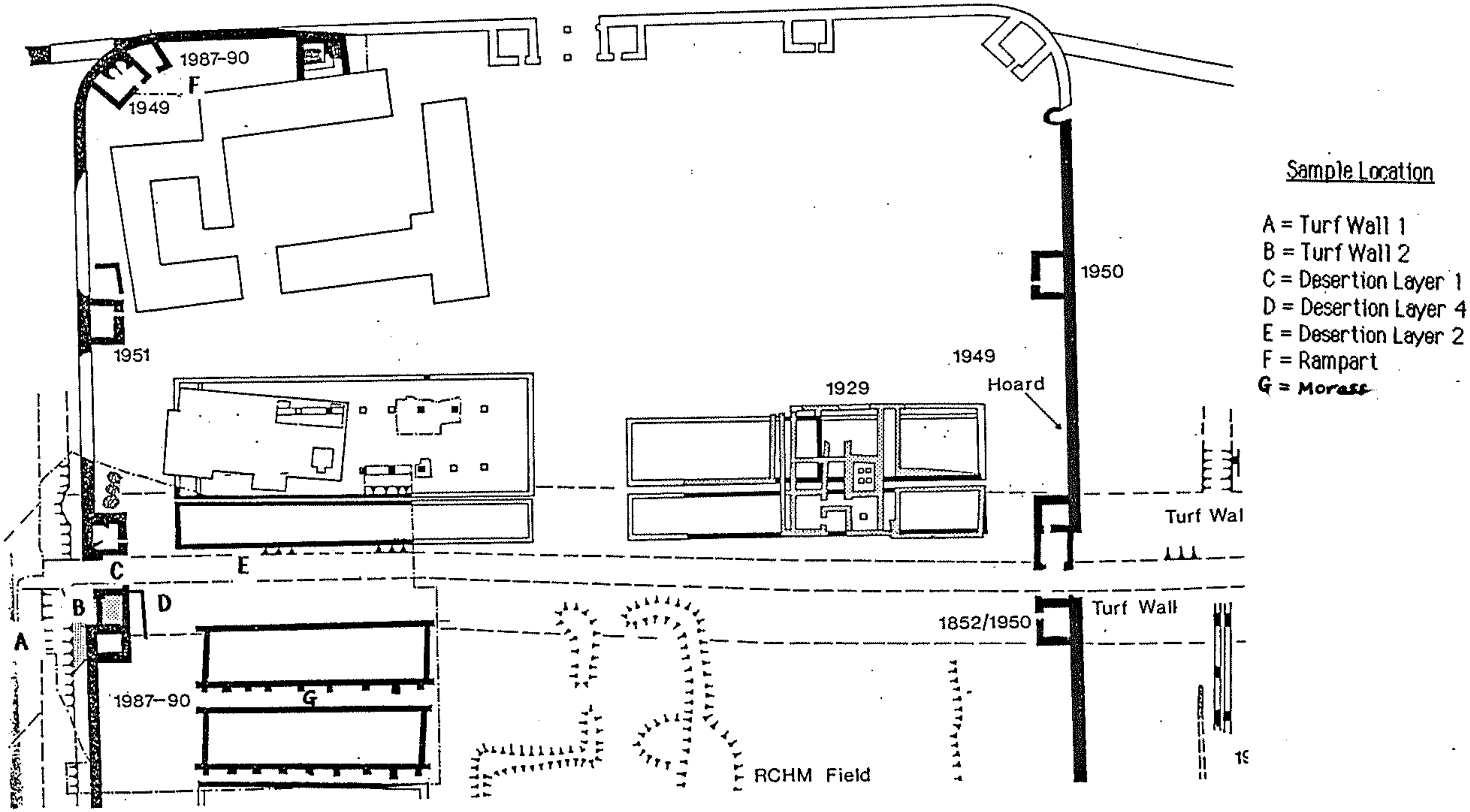

1987-90
F
1949
1950
1951
1949
Hoard
1929
Turf Wal
C
E
B
D
A
1852/1950
Turf Wall
1987-90
G
RCHM Field
Sample Location
A = Turf Wall 1
B = Turf Wall 2
C = Desertion Layer 1
D = Desertion Layer 4
E = Desertion Layer 2
F = Rampart
G = Morass

FIG. 17

APPLETREE TURF WALL - POLLEN PERCENTAGES

	Depth (cm)											
Trees & Shrubs	2.5	3.5	4.5	6	14	15	16	17	22.5	23.5	25.5	27.5
Acer				0.24								
Alnus	20.2	16.3	4.72	22.4	18.4	21.2	15.6	24.7	22	13.6	3.92	24.8
Betula	35.7	14.9	2.93	15.3	11.3	8.64	9.75	13.6	22.3	12.1	2.48	22.2
Carpinus								0.21	0.12			
Coryloid	11.5	16.8	6.99	10.1	20.4	22.2	15.6	22.6	19.9	13.4	5.36	15.5
Crataegus type						0.2						
Fraxinus		0.17	0.16		0.58		0.62	0.21	0.12			0.21
Ilex	0.19									0.16		0.11
Pinus									0.24	0.16		
Quercus	10.9	7.05	3.25	6.35	12.6	9.63	11.4	11.7	15.6	28.8	2.09	15.9
Rubus												
Salix				0.24					0.12			
Tilia												
Ulmus	0.19	0.5		0.24				0.21				0.32
Climbers												
Hedera									0.12			
Dwarf Shrubs												
Calluna	0.58	6.21	55	12.9	16.3	6.29	9.96	0.41	0.48	6.7	59.6	0.21
Vaccinium							0.21					0.11
Erica								0.21				
Pteridophytes/Bryophytes												
Filicales	3.3	0.5	1.14	2.59	1.94	5.7	4.15	3.29	4.33	1.31	0.26	5.56
Lycopodium clavatum										0.16		
Lycopodium annotinum				0.24				0.21				
Polypodium	1.94	1.01	0.49	5.41	2.52	7.47	3.11	7.2	2.05	2.78	0.26	2.35
Pteridium	2.52	4.19	3.09	3.06	0.78	2.36	1.66	3.09	2.17	1.47	2.88	1.82
Sphagnum	0.39	0.34	0.49	0.47	0.19	0.2	0.21	0.41	0.24	0.82	7.32	0.21
Herbs												
Anthemis type		0.17										
Caryophyllaceae						0.2		0.21	0.12			0.11
Chenopodiaceae			0.16			0.2				0.16	0.13	
Cirsium						0.2						
Cyperaceae	0.39	2.18	3.58	1.18	1.94	1.57	3.94	1.03	0.36	0.49	0.13	0.21
Filipendula	0.19											0.11
Gramineae	11.7	27	13.7	18.1	12.6	10.8	22.2	9.05	7.7	15	12.5	8.23
Hypericum perforatum type										0.16		
Lotus type		0.17										
Melampyrum									0.12	0.16		0.21
Papaver									0.12	0.16	0.13	
Plantago lanceolata		0.84	2.76	0.71	0.19	1.77	0.41	0.62	0.84	1.14	2.22	0.85
Potentilla type		0.5			0.19	0.59	0.83	0.62	0.24	0.33	0.39	0.21
Ranunculus		0.34		0.24		0.39	0.21	0.21		0.16	0.26	0.11
Rhinanthus type	0.19											
Rumex acetosella												0.11
Rumex obtusifolius type												0.11
Rumex undiff		0.84	0.81			0.2			0.36			0.11
Stachys type							0.21		0.12			
Succisa	0.19		0.33	0.24		0.2		0.21	0.12	0.33		0.21
Trifolium			0.33							0.33		0.11
Urtica type			0.16						0.12	0.16		

TABLE 1

BIRDOSWALD TURF WALL 1 AND 2 - POLLEN PERCENTAGES

	TURF WALL 1							TURF WALL 2				
	Depth (cm)							Depth (cm)				
Trees & Shrubs	4	6	7	17	20.5	21.5	22.5	8	18.5	19.5	31.5	32.5
Alnus	24.4	14	12.6	8.01	22.1	33.9	42.8	27.8	32.4	37.3	s	
Betula	32	10.1	10.6	8.99	33.3	26.9	9.23	22.1	22.9	4.08	p	
Carpinus								0.13	0.18	0.2	a	n
Coryloid	10.2	5.11	8.09	6.21	10.5	10.8	19.8	14.6	10.5	28	r	o
Fagus					0.31						s	
Fraxinus	0.59	0.51	0.47	0.49	0.31	0.27			0.71	0.2	e	
Ilex					0.15							
Pinus	0.12			0.16		0.13	0.2	0.53	0.35	0.82	p	p
Quercus	8.36	4.09	3.73	3.43	11.9	12.4	15.7	7.86	9.93	14.1	o	o
Rubus											l	l
Salix	0.12		0.16	0.33	0.31	0.13		0.4	0.35	0.2	l	l
Tilia				0.16							e	e
Ulmus	0.35		0.16			0.4	0.2	0.53	0.89	0.82	n	n
Dwarf Shrubs												
Calluna	3.65	19.3	12.3	34.8	5.86		0.59	1.73	1.77	0.2		
Vaccinium	0.35			0.16	0.15							
Erica		0.34			0.15							
Empetrum					0.15							
Pteridophytes/Bryophytes												
Filicales	1.06	1.53	2.02	0.65	1.08	1.46	0.59	2.66	4.79	4.9		
Polypodium	1.41	0.34		0.33	1.23	0.93	3.93	1.86	1.42	2.45		
Pteridium	1.53	2.73	2.8	1.8	1.7	4.12	0.39	0.8	1.06	0.41		
Sphagnum	0.35		0.31		0.62	0.13	0.2	0.67	0.53	0.2		
Herbs												
Angelica sylvestris (c.f.)			0.16						0.18			
Artemisia	0.12											
Bidens type			0.16									
Cereal type		0.17										
Chenopod	0.12											
Cirsium			0.16									
Cyperaceae	2.83	2.56	2.33	0.98	1.7	1.06		1.2	0.89	0.2		
Filipendula			0.16	0.16	0.15		0.2		0.35			
Gramineae	10.2	35.8	36.9	29.4	6.17	6.25	4.52	14.8	8.33	4.29		
Leguminosae			0.16									
Liguliflorae		0.51		0.49	0.15			0.13		0.2		
Melampyrum							0.2	0.93	1.06	0.2		
Plantago lanceolata	0.59	1.36	3.58	2.29	0.77		0.79	0.4	0.18	0.41		
Polygonum sp			0.16									
Potentilla type	0.94	0.85	1.87	0.16	0.93	0.93	0.2	0.27	0.53	0.41		
Ranunculus type		0.17	0.47	0.16		0.13	0.2	0.4		0.2		
Rumex acetosella			0.47		0.15				0.18	0.2		
Rumex undiff	0.12	0.68	0.16	0.49				0.13				
Sinapis type			0.16	0.16					0.18			
Succisa	0.12				0.15		0.2		0.18			
Trifolium	0.35											
Umbelliferae II				0.16		0.13						
Urtica type									0.18			

TABLE 2

BIRDOSWALD RAMPART - POLLEN PERCENTAGES

	Depth (cm)							
Trees and Shrubs	6	11	17	22	27	29	30	32.5
Alnus				21.9	23.5	16.6		44.7
Betula	s			13.3	12.2	20.1		10.1
Coryloid	p			24.8	17.4	19.8		15.1
Fraxinus	a	n	n		0.87	0.5	n	
Pinus	r	o	o			0.25	o	
Quercus	s			1.11	5.22	12.3		16.5
Salix	e					0.75		
Ulmus								1.11
Dwarf Shrubs	p	p	p				p	
Calluna	o	o	o	18.9	5.22	4.77	o	
Pteridophytes/Bryophytes	l	l	l				l	
Filicales	l	l	l	1.85		0.75	l	2.38
Polypodium	e	e	e	1.85	0.87	0.25	e	2.69
Pteridium	n	n	n	2.22	4.35	1.01	n	0.48
Sphagnum				1.48	1.74	1.01		
Herbs								
Bidens type				0.64	0.64	0.64		0.64
Cereal type					0.87			
Cyperaceae						1.51		0.79
Filipendula								0.16
Gramineae				12.2	28.7	18.8		6.02
Plantago lanceolata						0.25		
Potentilla type				0.37		0.5		
Trifolium type						0.25		
Umbelliferae II						0.5		

TABLE 3

	Morass	'Desertion' Layers				
Trees & Shrubs		1	2(L)	2(U)	4(L)	4(U)
Alnus	38.2	15.9	18.3	14.1	25.1	21.4
Betula	9.58	12.9	17.8	11.8	18.8	12
Carpinus	0.14					
Coryloid	10	17.7	19.8	17.3	22	14.5
Crataegus type			0.71	0.2	0.18	
Fraxinus	0.28			0.2	0.18	
Pinus	3.24	0.3	0.53			0.43
Prunus type	0.56			0.2		
Quercus	18.6	15.9	4.45	3.34	8.84	3.85
Rubus	0.28					
Salix	0.28		0.18	0.39	0.18	
Tilia			0.18			
Ulmus	1.27		0.18	0.2	0.18	0.85
Climbers						
Hedera	0.28					
Lonicera	0.14					
Dwarf Shrub						
Calluna	0.14	0.6	12.5	15.1	3.79	9.4
Vaccinium				0.2		
Empetrum	0.14					
Pteridophytes/Bryophytes						
Filicales	2.96	0.6	1.42		0.36	0.43
Polypodium	4.37		1.25	0.39	1.26	1.07
Pteridium	1.55		1.07	0.98	0.54	0.85
Sphagnum	0.42	2.69	4.45	6.48	1.99	1.5
Herbs						
Bidens type	0.64	0.64	0.64	0.64	0.64	0.64
Caryophyllaceae	0.14					0.21
Chrysosplenium				0.2		
Cyperaceae	0.85	1.2		0.79	0.36	
Filipendula	0.42		0.71	0.2	0.18	
Geum	0.14					
Gramineae	4.79	30.2	15.8	25.5	15.2	32.1
Hypericum perforatum type				0.2	0.18	
Melampyrum	0.14	0.6	0.36		0.36	0.43
Papaver		0.3				
Plantago lanceolata	0.14	0.3	0.36	0.79		
Potentilla type	0.14	0.9				1.07
Ranunculus type	0.42			0.59		
Rumex undiff				0.2		
Teucrium	0.14					
Trifolium				0.39		
Urtica	0.14			0.2		
Valeriana	0.14					

(L) = Lower Sample
(U) = Upper Sample

TABLE 4

ECOLOGICAL CATEGORIES OF POLLEN TAXA FOR SUMMARY DIAGRAMS

ECOLOGICAL CATEGORY	POLLEN TAXA INCLUDED
Woodland Plants	All trees and shrubs Climbers Filicales Polypodium
Grasses	Gramineae
Heath and Bog	All Ericales Pteridium Sphagnum Cyperaceae
Weeds and Ruderals	All other herbs
It must be stressed that these categories are very crude and a number of plants may occur in more than one category.	

TABLE 5