Crathes Warren Field
Assessment, analysis and interpretation of pollen contents from Pits 5, 16 and 30

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Summary
A total of 28 samples from three contexts were assessed to determine the quality and quantity of pollen surviving (7 from pit 5, 5 from Pit 16, 16 from Pit 30). Of these, the pollen surviving in the following samples was too degraded and scarce to yield meaningful results: all samples from Pit 16, two samples from the upper fill of Pit 5 (contexts 5/3 and 5/4) and four samples from Pit 30. The remaining 17 samples were fully analysed for pollen and microscopic charcoal content, five from the basal sediments of Pit 5 (context 5/14) and 12 from the fill of Pit 30 (contexts 30/12, 30/11, 30/8, 30/6, 30/5, 30/2). Post-depositional decay has affected all the pollen assemblages in these well-drained sediments, although analysis suggests that the samples are not wholly biased by differential destruction and can be interpreted with caution. Small deposition sites like the pits accumulate pollen derived from local plants, within a radius of up to *c*.50-400 m, thus reflecting pollen rain within the excavation area. The range of pollen types present in the two pits differs markedly. A relatively open birch-hazel wood was present when basal sediments were accumulating in Pit 5 around 8600-9200 cal. BP. These woods pre-dated the expansion of oak. The structure of the Mesolithic birch-hazel woods contemporaneous with the pit alignment cannot be discerned in detail, but this feature was not constructed in open ground. When Pit 30 was infilled in the early Neolithic period the local environment was a mixture of hazel, ungrazed grassland and crops. The Neolithic building, at least around the time of its destruction, was located in an open, cultivated area with no evidence for pastoral land-use and with little tree cover save for hazel scrub, in contrast with the oak-rich woodlands which dominated the region. The significance of crop-growing also contrasts with the importance attributed to livestock in the Neolithic economy.

Introduction
A total of 28 samples were obtained. Five were from the basal, Mesolithic sediments of Pit 5 (contexts 5/14/1-5/14/5) and two from sediments in that pit deposited during Neolithic recutting (Pit 5, contexts 5/3 and 5/4). Five were from Pit 16, part of the same pit alignment. Sixteen samples were from Pit 30, a pit associated with a Neolithic timber 'hall'. The samples were processed and analysed in two stages: (1) to assess whether they contained a sufficient quantity and quality of pollen to yield meaningful results and thus warranted further analysis, and (2) to analyse and interpret the pollen and microscopic charcoal assemblages from samples that passed the assessment stage.

Methods
Half a millilitre of each sample was processed using standard pollen-analytical techniques (Moore *et al*. 1991), including the addition of a known number of *Lycopodium clavatum* (clubmoss) spores to assess pollen concentrations (Stockmarr 1971). The pollen and microscopic charcoal content of each context was examined at x400 and x1000 magnification. In the assessment phase, a minimum of 100 land pollen grains (TLP, excluding spores) from each sample were identified for the samples from the basal sediments of Pit 5, from Pits 16

and 30. Pollen and spores were identified up to a total of *c*.100 *Lycopodium* marker grains during the assessment of the upper samples from Pit 5 (contexts 5/3 and 5/4). For samples which merited full analysis, a minimum of 300 land pollen grains (TLP, excluding spores) were counted from each sample, providing a statistically acceptable representation of pollen contents. The only exceptions to this are sample 5/14/5 from Pit 5 and sample 8-2 from Pit 30, which were too dilute to yield higher counts within the time available. Pollen and spore types were identified using the key in Moore *et al*. (1991) and the reference collection at the University of Stirling. Nomenclature follows Bennett (1994).

The extent and type of damage to each pollen grain and spore was recorded as this can provide valuable information regarding the existence and extent of post-depositional biasing; this is an especially important consideration in soil pollen analysis (Tipping *et al*. 1994, Bunting and Tipping 2000). During the assessment stage, the dominant preservation state of each pollen or spore (identifiable and indeterminate) was recorded in one of five classes (after Cushing 1967, Tipping 1987): well-preserved (normal), broken, crumpled, corroded, and degraded (amorphous). For analysis, this was increased to eight classes in order to further investigate the extent of potential sample biasing through taphonomic and post-depositional processes: well-preserved (normal), broken, crumpled, <25% corroded (class 1), 26-75% corroded (class 2), 76-98% corroded (class 3), >98% corroded (‘ghost’ grains, class 4) or degraded (amorphous). In addition, the indeterminate class ‘concealed’ was used where minerogenic or organic matter prevented a pollen grain from being identified. Breakage and crumpling are caused by mechanical abrasion or compression, often associated with mineral sediments or reworking (Cushing 1964, Lowe 1982, Tipping 1995). Corrosion can result from chemical and microbial (fungal or bacterial) attack on the pollen wall and is often associated with aerobic conditions (Cushing 1964, 1967, Havinga 1964, 1984). Degradation is thought to be the result of long-term deterioration, oxidation, physical abrasion or compression (Cushing 1964, Lowe 1982, Tipping *et al*. 1994, Tipping 1995). Pollen values are expressed as a percentage of the TLP sum, or TLP plus group for spores and indeterminate pollen grains.

Microscopic charcoal fragments were counted on pollen slides to provide a measure of the extent of burning. Due to the quantity of charcoal recorded in many samples, only the larger fragments (51-75 μm and >75 μm in size) were tallied. Charcoal data are expressed as a percentage of TLP.

Results

The assessment stage

The following samples did not merit further analysis due to the low quantity and/or poor preservation of pollen, and high quantities of indeterminate grains:

Pit 5: contexts 5/3 and 5/4
Pit 16: all contexts (16/1-16/5)
Pit 30: samples P4-1 (context 30/6), P5-2 (context 30/2), P6-1 (context 30/6) and P7-1 (context 30/3)

These samples cannot be used for environmental reconstruction as the low pollen quantities of pollen and poor preservation indicate that the assemblages are likely to have been significantly skewed by post-depositional decay in the well-drained sandy conditions.

Analysis of polleniferous contexts
Seventeen samples were subject to full analysis, including rigorous assessment of post-depositional deterioration. These derive from the Mesolithic-age primary infill of Pit 5 and the early Neolithic-age fill of Pit 30. The results of pollen and microscopic charcoal analyses are presented as percentages and as total land pollen concentrations in Figure 1. The extent of pollen deterioration is shown in Figure 2, with analysis of these data in Table 1.

In general terms, the pollen assemblages from the two pits differ markedly, with *Betula* (birch), *Corylus avellana*-type (cf. hazel), Ericales and *Calluna* (heaths) and *Succisa pratensis* (scabious) dominating at the base of Pit 5 (context 5/14), and cf. hazel, Poaceae (wild grasses), herbs and *Botrychium lunaria* (moonwort) predominant in all Pit 30 samples, regardless of context. Charcoal content is much higher in Pit 30.

Interpretation

1. Post-depositional biasing of pollen assemblages
Before the pollen assemblages can be used as indicators of past environment and land-use, the extent of post-depositional biasing must be assessed since the well-drained soil conditions are potentially hostile for pollen preservation and may have selectively destroyed less robust grains (Havinga 1984), thus skewing the original assemblage. A series of tests have been developed to assess the severity of post-depositional biasing in pollen assemblages from soils and archaeological sediments (see Tipping *et al*. 1994, Bunting & Tipping 2000, Tipping 2000), the *ad hoc* nature of which should be stressed. These have been applied to the Crathes Warren Field samples (Table 1). The results show that none of the samples fail more than five of the eleven tests and may therefore be considered interpretable. In particular the relative abundance of cf. hazel, a taxon known to be highly vulnerable to corrosion (Königsson 1969; Havinga 1984), suggests the samples to have integrity, but the results also indicate that a degree of caution is essential when making ecological or land-use inferences from the data. All samples but two were counted to statistically significant numbers (Test 1), because of relatively high pollen concentrations (Test 2), and yielded relatively high numbers of taxa throughout (Test 3). Most samples, however, have high proportions of indeterminate (Test 6) and damaged grains (Tests 4, 5), and resistant pollen types (*e.g*. *Tilia* (lime), Brassicaceae (mustard family), Caryophyllaceae (campion family, including *Silene vulgaris*-type and *Stellaria holostea*), *Cichorium intybus*-type (dandelions), Asteraceae (dandelion/daisy family, including *Achillea*-type and *Cirsium*-type): Tests 7, 8). Overall the samples from Pit 30 are more poorly preserved than those from the base of Pit 5. The high degree of mechanical and biochemical deterioration reflects the well-drained nature of the sediments. Samples derived from earlier-formed soils may also contain residual pollen, which had an unknown residence time in soils, although the comparatively low frequencies of fern spores (Tests 9, 11) and degraded pollen grains (Test 4) may suggest that this is a minimal component.

2. Context and pollen sources
Brief discussion of pollen taphonomy is necessary to establish what the pollen assemblage in each context may represent in regard to depicting Mesolithic and Neolithic landscapes, land-uses or site functions. The independent soil micromorphological analyses are important for understanding the processes of pit infilling and the potential origin of the sediments.

Under normal pollen dispersal and deposition conditions, small hollows like Pits 5 and 30 primarily reflect local pollen production, up to a radius of *c*.100-400 m, perhaps extending up to 1000 m (Sugita *et al*. 1999, Bunting 2002, Brostrom *et al*. 2004, 2005). Equally importantly, such small diameter sites record the ground flora more clearly than lakes or peat bogs. However, human or animal activity and disturbance associated with site change may distort these estimates. Preliminary soil analysis suggests that Pit 5 (or at least the polleniferous contexts considered here) was filled by inwashing, mainly from small-scale subaerial sediment transfer (S. Lancaster, pers. comm.). The general pollen dispersal model may thus hold true for the interpretation of the pollen in Pit 5, save that some eroding soils may have included residual pollen. By contrast, Pit 30 appears to have been rapidly and deliberately filled and this infill was derived from mixed sources rather than simply the natural sand on which the site is constructed (S. Lancaster, pers. comm.). Pollen in the fill may thus derive from several sources, including materials used or brought into the structure, such as foodstuff, artefacts, building and roofing material (the fill seems to include collapsed materials from the destruction of the structure) as well as plants growing around the site.

The polleniferous contexts in Pit 30 all contain a similar range of taxa (Figure 1), although samples from the same context do not have identical pollen assemblages, suggesting that the sediments derived from similar but not homogeneous sources. Perhaps this inhomogeneity reflects the derivation of sediments from different locations in and around the structure, but it may also reflect the effects of post-depositional biasing, as in the contrasting proportions of cf. dandelions (*Cichorium intybus*-type) in Context 30/2 (sample P4-2). Given this complexity, it is not possible to simply assume that the pollen assemblages reflect the landscape around the structure (below).

3. Environmental reconstruction

Bearing the above caveats in mind regarding complex taphonomy and post-depositional deterioration, the following inferences are made about the environments surrounding Pit 5 and Pit 30 during their infilling.

Pit 5: Early Mesolithic environment of the pit alignment

Pit 5 is located in the middle of the pit alignment, but the estimated pollen source area for this pit spans the entire length of the feature. When initially infilled, the floor of the pit may have been moist (and so protective of pollen), but it did not retain water: there are no aquatic pollen types in the analyses. The five basal samples from context 5/14 show the pit alignment to have been constructed within a birch (*Betula*)-hazel (*Corylus avellana*-type) wood. Although primarily thought of as a shrub, hazel is likely to have shared the canopy with birch. The total tree and shrub pollen sum ranges from 61-78% TLP (total land pollen), which suggests a locally extensive but not dense canopy, with good light penetration to the woodland floor (Birks 1973, Caseldine 1981). It is unclear whether the canopy was continuous or whether there were openings, but the pit alignment did not lie at a woodland edge. There was an understorey dominated by heaths and scabious (*Succisa pratensis*), with little grass (Poaceae anl-D<8 μm). The woodland predates the expansion of oak in the region at around 7200 cal. BP (Birks 1989); this evidence supports the radiocarbon dates from this context. Elm and pine were similarly absent from the local woods and probably from the region at this time. A single alder (*Alnus*) pollen grain was recorded, suggesting that the tree was rare, if not absent from the pollen source area. This probable absence accords with the accepted model of regional alder expansion (Tallantire 1992). Alder is identified as charcoal, however (Timpany 2006), very early in the regional context. If misidentification can be excluded, then evidence that alder colonisation was patchy and erratic in space and time (Bennett 1990) may account for the early presence of alder at Crathes Warren Field. The tree may have grown by the adjacent Coy Burn, outwith the pollen source area for Pit 5. There is no pollen evidence for willow or poplar, which is again present in the charcoal record (Salicaceae) within the pit (Timpany 2006).

There is no pollen evidence for a tall shrub layer, although it must be remembered that more fragile pollen types may be under-represented. While most of the heath (Ericales) pollen was too poorly preserved to identify more precisely, it suggests a ground cover including ling (*Calluna*) and bilberry (*Vaccinium*) or bell heather (*Erica*). In this context, *Vaccinium* is today a plant of woods on acid soils (McVean 1964), where it is relatively shade tolerant compared with ling. The ground cover taxa also suggest relatively dry soils around the pit alignment. There is little grass or herb pollen, with the exception of *Succisa*. This herb prefers grassy, damp soil, which is not evident from the rest of the pollen assemblage. However, *Succisa* pollen is large and relatively robust and its representation may have been inflated by the differential destruction of more fragile pollen types. Two large grass pollen grains were recorded in each of the two upper samples from this context, including *Hordeum* group, a pollen type which includes barley and some wild grasses (Andersen 1979).

There is no evidence for land-use or disturbance in the pollen record, although it is likely that the samples span a short period of time. Fire was relatively rare in this landscape, although this impression is enhanced by comparison with the high frequencies recorded in Pit 30 (see below).

Pit 30: Neolithic environment of the timber 'hall'

While the taphonomy of Pit 30 is more complex than that of Pit 5, it is estimated that the pollen source area encompasses the 'hall' and the surrounding fluvioglacial terrace on which it is constructed. In general terms, the samples are dominated by hazel (*Corylus avellana*-type), grasses (Poaceae anl-D<8 μm), cf. dandelions (*Cichorium intybus*-type), buttercups (*Ranunculus acris*-type) and moonwort (*Botrychium lunaria*, a fern), with large amounts of charcoal. With the exception of hazel and grasses, all of these prominent pollen types are resistant to decay, emphasising the need for cautious interpretation. Consequently, the difficulties of interpretation are discussed before environmental inferences.

There are no major trends through the pollen stratigraphy. This may suggest either that sources of pollen were unchanging through time, that infilling occurred very rapidly, or that originally different pollen assemblages have been reduced by post-depositional change to a uniform assemblage of resistant types. The last is rejected because samples passed the assessment stage (Table 1). There is, however, a change in the range of herb pollen types from contexts 30/12 and 30/11(samples P1-3) to contexts 30/6 (base) (sample P5-1), 30/2 (samples P4-2, 6-2), 30/6 (top) (samples P7-2, 8-2) and 30/3 (sample P8-1), with more buttercups, clovers/vetches/peas (Fabaceae) and cf. yarrow (*Achillea*-type) in earlier-deposited samples, and more consistently high hazel representation, more campions (Caryophyllaceae, *Silene vulgaris*-type), cf. daisies (*Solidago virgaurea*-type) and large grass pollen grains (*Hordeum* (barley) group, and especially Poaceae anl-D>8 µm) in upper contexts. Charcoal is also present in higher quantities in these upper contexts. This change in pollen and charcoal representation coincides with the inferred burning of the structure, seen in the charcoal-rich context 30/2. This event probably accounts for the high quantities of microscopic charcoal within one of the samples in context 30/2 (sample P4-2) and in the overlying sediment of sample P5-1 (context 30/6).

The meaning of these patterns in the pollen stratigraphy is hard to assess. The overall quality of pollen preservation is poorer in the upper samples (Table 1), which could suggest some biasing due to differential pollen destruction, caused by better drainage conditions in the upper contexts. However, the change in pollen types does not represent a simple shift to more robust taxa, indicating that changes in the source of the fill or in the pollen source area are also possible explanations, particularly before and after the main collapse of burnt material. Tentatively, it is suggested that the pollen-stratigraphic change reflects the increased representation of plants growing outside the ‘hall’ after its destruction by fire, although the rapidity of infilling may mean that the period post-burning is very short. The main inference, therefore, is that the pollen derives primarily from local sources and that the local vegetation, at a similar spatial scale to that at Pit 5, is likely to have provided the most constant source of pollen.

Defining the environment and land-uses around the structure remains complex but some interpretations can be made, beginning with the structure itself. There are no unusually high frequencies of particular pollen types in any sample to suggest that large quantities of specific, pollen-containing, plant materials were used or stored in or around the structure, or that the fill derives from discrete materials or functional areas. There is no definitive pollen evidence for roofing material.

With the exception of hazel, there were few trees within the pollen source area. The early Neolithic ^{14}C dates for the pit were obtained from charcoal identified as alder (or in one case, alder/hazel), which is poorly represented in the pollen diagram (2.8-8.9% TLP) and was probably not present on the sandy soils of the terrace, but growing on the valley sides of the incised Coy Burn to the east, on the periphery of the pollen source area. Birch, pine (*Pinus sylvestris*), oak and elm (*Ulmus*) were rare and pollen from these trees may have drifted in from elsewhere across the region, as the lime (*Tilia*) pollen must have done. Grassy ground cover was common, perhaps beneath or between hazel shrubs. Hazel may have been deliberately maintained as a useful source of seasonal food and roundwood. Heaths were also present, although less common than in the Mesolithic samples from Pit 5. There is little convincing evidence for grazing disturbance, as the main herbs, buttercups, cf. dandelions and cf. yarrow can grow in varied grass swards and only two grains of ribwort plantain (*Plantago lanceolata*), a classic grazing or mowing indicator, are recorded, both in a single sample (P1-1, context 30/11).

The records of *Hordeum* (barley) group, *Avena/Triticum* (oats/wheat) group and Poaceae anl-D>8 µm (large grass grains, too crumpled to meet all of the size criteria for *Hordeum* or *Avena/Triticum* groups) are taken to indicate the presence of cereals. *Hordeum* and *Triticum* are also present in charred seed assemblages from the structure (Hastie 2004). Cereal pollen may have originated from cereal use or storage in the structure, could have been retained in straw used for roofing, or have been derived from crop growth in the surrounding area. The consistent occurrence of such cereal-type pollen records is taken as good evidence that crops were grown around the structure. Given the limited pollen dispersal from cereal crops (Hall 1989, Vuorela 1973), it is probable that they were grown on the dry, sandy soil on the fluvioglacial terrace, immediately around the 'hall'. Many pollen types in the samples would fit into an arable context, either as crop weeds or on field edges. Many herbs would also have colonised trampled patches, as along paths or round the 'hall', but the pollen of herbs most characteristic of trampling (Plantaginaceae) is rare.

Figure 3. Photograph of the fern moonwort, *Botrychium lunaria* (from www.funet.fi).

The abundance of moonwort (*Botrychium*) (Figure 3) is unusual. It is difficult to assess whether this represents plant growth in the grassland which is thought to have surrounded the structure, whether is was collected or present in other materials used in the 'hall'. This is a small fern which grows in dry sandy grassland. This habit is in accord with the environmental reconstruction. Moonwort is disadvantaged by fertilising and high disturbance. Seen traditionally as inimical to grazing animals (Darwin 1997, 59), moonwort also has a long history of use as a vulnerary (to stem bleeding: Grieve 1931). As a relatively thick-walled spore its frequencies may also have been inflated by the preferential destruction of more fragile pollen and spore types.

Discussion

There is nothing particularly remarkable in the birch-hazel woodland which surrounded Pit 5 around 8600-9200 cal. BP. This was common across much of the British Isles at this time (Birks 1989) and the pollen assemblage from Pit 5 correlates well with other sites of this age on Deeside (Vasari & Vasari 1968; Ewan 1981; Edwards 1978, 1979; Edwards and Rowntree 1980; Tipping in press), although only the analyses of Edwards have previously been radiocarbon dated. This birch-hazel wood seems from pollen analyses to have been remarkably homogenous, and probably looked the same in every direction for hundreds of kilometres at this time in the Holocene Epoch. The composition of the woodland itself thus provides no reason why this area was selected for the construction of the pit alignment, or for its purpose. This woodland would probably not have appeared hostile to people. The spaces between trees would not have been inhibiting to movement, there seems to have been no tangle of thorns or bushes to impede walking (except for the line of pits), and there was a high amount of light reaching the woodland floor. People might have been able to see for many tens of metres, though distant views were probably not possible from the pits. At this time in the Holocene, the woodland was not the dank forbidding forest evoked by Lacaille (1954), but a very pleasant place to walk through on a nice day. The small amount of grass and relative abundance of heaths may have had adverse effects on the abundance of grazing animals, but these are hard to quantify. There is no palynological evidence that the woodland was manipulated by human communities either for occupation or to attract wild animals (cf. Simmons 1996).

The pollen data from the 'timber hall' (Pit 30) are as remarkable as the structure itself. In a comparative context, there are no regional correlatives in the early Neolithic period for the degree of open ground depicted in these analyses (e.g. Durno 1957; Vasari & Vasari 1968; Edwards & Ralston 1984; Edwards 1989; Tipping 1994, in press; Clark 2002). In no naturally wooded landscape (Bennett 1989; Tipping 1994) known to the authors in northern and central Britain is there so little evidence for woodland as around the Warren Field 'hall'. Most analyses in the region are from large diameter peat bodies or lakes, and consequently have very large pollen source areas, such that small-scale human impacts are hidden from the pollen analyst. The nearest Neolithic-age pollen sequences to Warren Field are at Loch of Park, 4 km to the north-east and the Red Moss of Candiglarich, 4.5 km to the north (Clark 2002; Clark & Edwards 2004). Loch of Park was a lake basin, very much larger than its current extent (Bremner 1935), with a correspondingly large pollen source area that probably included Warren Field, and yet the landscape appears wooded (*c*.60-80% TLP) immediately after the elm decline, when the diagram ends (Vasari & Vasari 1968). The pollen source area of the Red Moss of Candiglarich may also have included Warren Field, and here the earliest human impacts, seen in 'weed' pollen taxa and elevated levels of charcoal, are suggested to have occurred after *c*. 5250 cal. BP (Clark & Edwards 2004).

At Warren Field, the pollen analyses are from within the area cleared, and the pollen source area is small. The description of woodland clearance and land use is nested within a wider landscape still dominated by woodland. The land immediately around the 'hall' had been cleared of the oak-rich woodland that was elsewhere still abundant at this time on Deeside (Tipping 1994, in press). The agricultural activities described at Warren Field probably cannot be described as 'forest farming', that is happening beneath a tree canopy (Goransson 1989; Edwards 1993). The pollen source area for Pit 30 is thought to be small, but while it is difficult to estimate the size of the open area needed to provide so little tree pollen to Pit 30 (25-60% tree & shrub pollen, mean 41% TLP), it is possible to suggest that a quite substantial tract of land around the 'hall' may have been cleared of most trees. Some clearance may have been for the use of oak timbers in construction of the 'hall', at a time before the pollen analyses commence, but this consumption is unlikely to account for the losses of trees in the pollen source area (cf. Hanson & MacInnes (1980) in a different temporal context). Hazel persisted, and was possibly purposefully retained near the ‘hall’ to be managed and used for construction and food.

The ‘hall’ appears to have been surrounded by arable land, and so there is perhaps no reason to suppose that the building was not a form of domestic settlement, although the effects of activities like human or animal trampling are small. The level of arable agricultural activity suggested by the pollen analyses from Pit 30 is extraordinary in the British or Irish Neolithic (Richmond 1999; Fairbairn 2000). The land immediately around the Warren Field ‘hall’ may have been used in the same unusual way as suggested from charred plant remains at the early Neolithic ‘hall’ at nearby Balbridie (Fairweather & Ralston 1993). Local crop growing was not demonstrated at Balbridie (Tipping in press), despite the abundant evidence for grain, although Edwards (1989) reported that turves at Balbridie contained cereal-type pollen. Cereal remains were also reported at the comparable ‘hall’ at Claish, near Stirling (Miller & Ramsay in Barclay, Brophy & MacGregor 2002), but local growth of cereals has not yet been demonstrated here. Emphasis on crop growing and the absence of palynological evidence for stock-rearing at Warren Field is also very interesting given the recent emphasis on pastoralism in the early Neolithic (Ray & Thomas 2003), although land committed to pasture at Warren Field may have been located outwith the pollen source area. However, it may be that early Neolithic timber ‘halls’ were *foci* for the new, perhaps venerated, cultivation of cereals, special places for a special food.

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Table 1. Results of pollen preservation analysis for fully analysed pollen samples from Crathes Warren Field. Test numbers 5 and 8 are additional to those proposed by Bunting and Tipping (2000). Failure indicated in bold red font.

Test	1	2	3	4	5	6	7	8	9	10	11	
(cut-off limit) **Sample**	TLP sum (<300)	Total pollen concentration (<3000)	No. of main sum taxa (<10)	% severely deteriorated grains (degraded) (>35)	% severely deteriorated grains (>75% corroded) (>50)	% indet. pollen & spores. (%TLP+gp) (>30)	% resistant taxa (>6)	% resistant taxa (incl. more taxa than test 7) (>15)	% Pteropsida (monolete) indet. (%TLP+gp) (>40)	Spore:pollen concentration ratio (>0.66)	Spore:pollen taxa ratio (>0.66)	**No. fails**
Pit 5												
5/14/1	334.0	18577.0	19	9.9	24.6	**45.2**	0.60	9.58	18.14	0.25	0.32	**1**
5/14/2	317.0	11194.6	17	5.7	34.4	**35.3**	0.63	**11.99**	24.77	0.36	0.18	**2**
5/14/3	325.0	13421.0	14	11.4	26.2	**35.0**	0.62	8.31	16.12	0.22	0.29	**1**
5/14/4	311.0	12551.7	13	8.4	46.6	**43.5**	2.57	**16.40**	15.87	0.22	0.31	**2**
5/14/5	**126.0**	7172.5	10	9.5	36.5	**46.6**	0.00	5.56	16.23	0.22	0.20	**2**
Pit 30: Context 30/3												
P8-1	339.0	12792.2	20	5.3	**56.0**	**35.9**	**13.27**	**18.58**	27.21	**1.29**	0.30	**5**
Context 30/6 (top)												
P8-2	**141.0**	16278.3	19	7.1	20.6	**40.3**	**7.09**	**17.02**	22.57	0.58	0.26	**4**
P7-2	351.0	39664.9	24	15.1	29.1	**44.5**	**11.40**	**16.52**	23.01	**0.99**	0.21	**4**
Context 30/6 (base)												
P5-1	310.0	12082.1	20	1.9	**59.4**	**35.8**	**15.16**	**33.23**	14.03	**1.29**	0.30	**5**
Context 30/2												
P6-2	330.0	25262.2	24	2.7	46.7	**37.1**	**13.64**	**22.12**	18.43	0.57	0.25	**3**
P4-2	336.0	30026.3	21	0.9	**61.0**	**31.8**	**33.04**	**41.96**	13.38	0.35	0.29	**4**
Context 30/11												
P3-1	308.0	13762.1	20	2.9	**59.1**	**33.0**	2.60	5.84	25.12	**0.98**	0.30	**3**
P2-1	387.0	32799.8	20	2.1	28.7	27.7	**7.24**	**18.86**	11.58	0.29	0.30	**2**
P1-1	314.0	23697.6	25	4.5	17.2	**31.6**	4.78	**16.56**	14.89	0.34	0.24	**2**
Context 30/12												
P3-2	338.0	20744.3	21	2.7	30.2	**30.2**	**6.80**	**13.91**	15.38	0.46	0.29	**3**
P2-2	358.0	31082.0	20	1.1	24.3	24.3	3.91	13.13	9.36	0.31	0.20	**0**
P1-2	330.0	40046.3	20	0.6	21.8	26.7	5.15	12.12	8.89	0.23	0.25	**0**

Figure 1. Full percentage pollen data from polleniferous context from Pits 5 and 30.

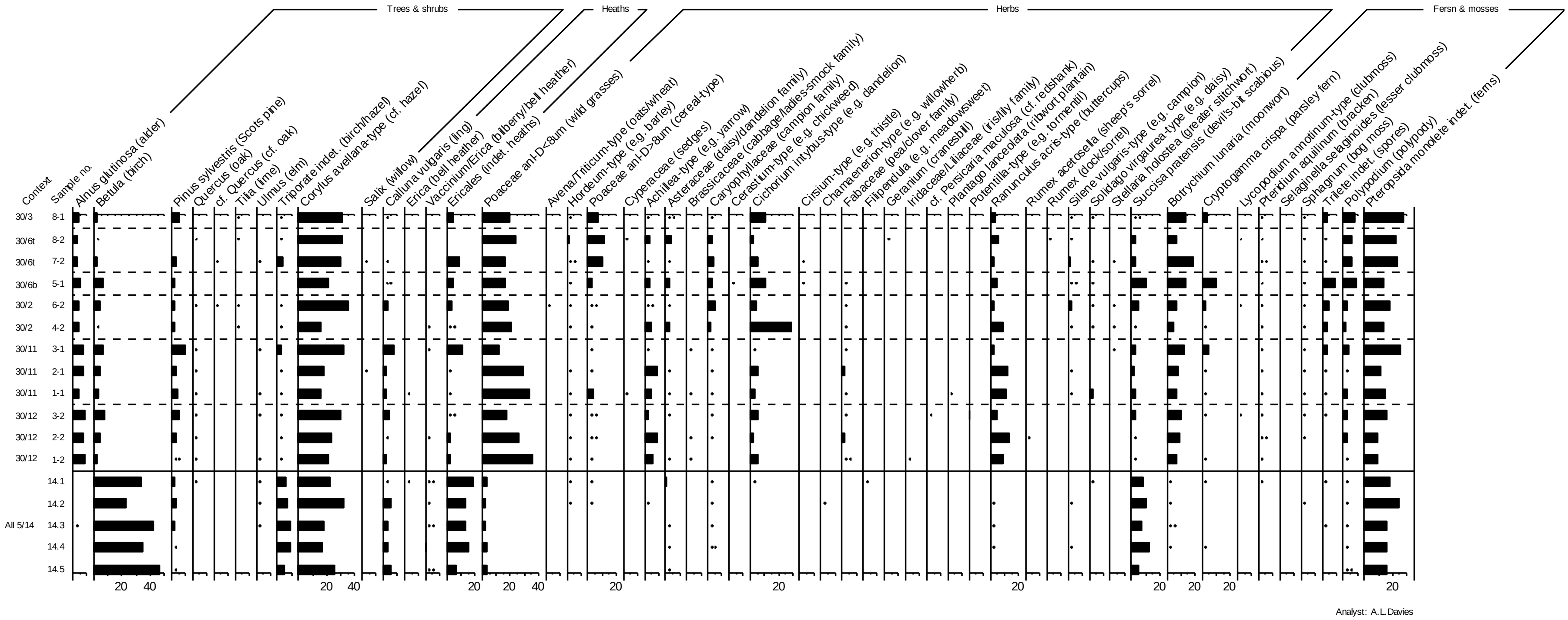

Figure 2. Pollen preservation and total land pollen (TLP) concentration data from polleniferous contexts from Pits 5 and 30.