Whitewell, Forest of Bowland, Lancashire

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CONTENTS

SUMMARY

Several pre-selected sub-samples taken from prehistoric features at New Laund Farm, Whitewell, Lancashire, Lancashire, and a monolith sample from Fairy Hole Caves, Whitewell (SD 6553 4678), were submitted by Rick Peterson (University of Central Lancashire (UCLAN) in January 2015, for pollen assessment, assessment of plant remains, and charcoal identification. The samples were taken as part of an investigation of prehistoric use of the limestone landscapes around the southern fringes of the Forest of Bowland Area of Outstanding Natural Beauty, known as the *Sheltering Memory* project, which has involved several seasons of fieldwork, commencing in 2011. The primary objective of the palaeoenvironmental study, undertaken between January and May 2015, was to assess the potential of the deposits within the features for pollen, plant remains and charcoal preservation.

The analysis demonstrates that pollen from the selected deposits is insufficient to justify further work, though potential pollen assessment from cores to be collected from an adjacent wet, boggy area during the next field season may provide a palaeoenvironmental and stratigraphical context for the cave deposits and associated archaeological finds. Although many of the small bulk samples taken during the excavations at New Laund Farm contained very little palaeoenvironmental remains, two samples, both from Site H (New Laund Timber Circle), produced sufficient charcoal fragments to warrant further study and indicate the utilisation of a range of probable locally available taxa, including alder/hazel, ash and willow/poplar. In addition, a number of the small bulk and hand-picked samples taken during the excavations would provide suitable material for radiocarbon dating.

ACKNOWLEDGEMENTS

OA North would like to thank Dr Rick Peterson (UCLAN) for commissioning the work, supplying the samples and providing background material for the project. We are grateful to Lancaster University for permission to use its laboratories for pollen preparation. Pollen samples were processed by Sandra Bonsall and assessed by Mairead Rutherford. Denise Druce assessed and analysed the plant remains and charcoal. The report was written by Mairead and Denise, and edited by Rachel Newman.

1 INTRODUCTION

1.1 Circumstances of the Project

1.1.1 The University of Central Lancashire (UCLan) requested that Oxford Archaeology North (OA North) undertake a palaeoenvironmental assessment of material collected and supplied from a site in the Forest of Bowland, Lancashire. This work formed part of the University's *Sheltering Memory* project (Peterson 2012; 2013a; 2013b; Carter and Peterson 2014), which has been ongoing since 2011.

1.1.2 The sites involved were a series of ditches/enclosures (New Laund Farm) and several small caves in the area of Whitewell. The caves have previously been explored by Musson (1947), who suggested the main cave (Fairy Cave) may have been used for settlement, and that collared urn fragments found within the cave dated this activity to the early Bronze Age (Peterson 2013a). The bulk samples were retrieved from four sites (D, H, M and P), which include the internal features (Site D) of a banked and ditched enclosure (Site C), a timber circle (Site H), and a prehistoric pit complex (Site M) associated with a ditched enclosure (Site P). Hand-picked charcoal samples retrieved during several seasons of fieldwork were also assessed for their suitability for radiocarbon dating. Although no radiocarbon dates have been submitted as yet, the features discovered at New Laund Farm are likely to date to the late Neolithic period or early Bronze Age (Peterson 2012; 2013b; Carter and Peterson 2014).

1.1.3 The primary objective of the palaeoenvironmental assessment was to investigate the potential for further study of pollen, plant remains and charcoal, in the samples supplied. The potential of any of the samples providing suitable material for radiocarbon dating was also assessed.

1.2 Location, Geology and Topography

1.2.1 One site comprises a complex of small caves (Fairy Holes) on the north side of the River Hodder at Whitewell, in the Forest of Bowland (SD 6553 4678). The prehistoric ditched enclosures and associated features, Sites C (SD 6525 4708), D (SD 6521 4707), M (SD 6538 4675/3), P (SD 6540 4673), and the timber circle, Site H (SD 6520 4708), are situated adjacent to New Laund Hill and New Laund Farm, in Whitewell. The Bowland sub-basin lies within the Craven Basin, which contains a thick carbonate sequence, including limestone reefs and bioclastic limestones of the Carboniferous period (Hughes 1986).

2 METHODOLOGY

2.1 POLLEN

2.1.1 *In-situ* cave deposits, up to 1.2m in depth, and comprising compact brown silt loam sediments, (deposit F10), were sampled as a monolith (Peterson 2013a). It is likely that F10 is the undisturbed original fill of the cave (*ibid*), whilst its upper surface (above the monolith sample) had been eroded, and redeposited in the overlying deposit, F9 (not sampled; *ibid*). Ten sub-samples for pollen assessment were taken from this monolith sample. In addition, three sub-samples at 0.05m intervals were submitted from New Laund Farm, from the lowest fill of the ditch excavated in Site C (fill C05), a light brown silty clay. Monolith P4 sampled deposit P5 (Site P), a hard, light brown clay, from which three sub-samples were taken.

2.1.2 Volumetric samples were taken from 16 sub-samples, and one tablet containing a known number of *Lycopodium* spores was added so that pollen concentrations could be calculated (Stockmarr 1972). The samples were prepared using a standard chemical procedure (method B of Berglund and Ralska-Jasiewiczowa 1986), using HCl, NaOH, sieving, HF, and Erdtman's acetolysis, to remove carbonates, humic acids, particles >170µm, silicates, and cellulose, respectively. The samples were then stained with safranin, dehydrated in tertiary butyl alcohol, and the residues mounted in 2000cs silicone oil. Slides were examined at a magnification of x400 by ten equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slides (Brooks and Thomas 1967) or at least until 100 total land pollen grains were counted. Pollen identification was made following the keys of Moore *et al* (1991), Faegri and Iversen (1989), and a small modern reference collection. Plant nomenclature follows Stace (2010). The preservation of the pollen was noted and an assessment was made of the potential for further analysis. Fungal spore nomenclature follows van Geel (1978).

2.2 PLANT REMAINS AND CHARCOAL

2.2.1 Nineteen bulk samples, taken during three seasons of excavations at New Laund Farm, were processed by students from the School of Forensic and Investigative Sciences, UCLan, under the direction of Rick Peterson. The bulk samples ranged in size from 2.5 litres to 5 litres, and were wet sieved through 1mm and 0.5mm stacked sieves. The sieved samples were wrapped in kitchen roll, bagged, and sent to the OA North offices for assessment of their palaeoenvironmental potential. The assessment was carried out using a binocular microscope on dried samples. The contents of each of the samples, such as charred plant remains (cpr), waterlogged plant remains (wpr), charcoal, snails, or bone, was recorded. In addition, the presence of modern contaminants, such as roots, insect eggs and modern seeds, was noted. Remains were quantified on a scale of 1-4, where 1 is rare (less than five items), 2 is frequent (6-25 items), 3 is common (26-100 items), and 4 is abundant (>100 items). Provisional identifications of the plant remains and charcoal were made, where possible. The potential of the samples to contain material suitable for radiocarbon dating, and for fuller analysis, was noted.

2.2.2 A further 82 hand-picked charcoal samples were also assessed for their potential to provide

suitable dating material. Positively identified charcoal fragments (some of the samples consisted of shale fragments, small stones, hardened soil, or coal) were initially observed in transverse section at up to x40 magnification, using a Leica MZ6 binocular microscope. Those fragments not identifiable at this stage (*eg* most of the short-lived taxa) were then split to reveal their radial and tangential sections, which were examined under a Meiji incident-light microscope at up to x400 magnification. Identifications were made with reference to Hather (2000), and modern reference material.

2.2.3 The results of the palaeoenvironmental assessment and charcoal identifications were tabulated (*Section 3.2*). Plant nomenclature follows Stace (2010).

2.3 ARCHIVE

2.3.1 A full professional archive has been compiled in accordance with current CIfA (2014) and Historic England (English Heritage 2006) guidelines. The project archive will be ordered and indexed and deposited with UCLan.

2.3.2 An online OASIS form (at http://www.oasis.ac.uk/) will also be completed as part of the project. This information will be made available through this website.

3 RESULTS

3.1 POLLEN

3.1.1 Pollen from 16 samples was assessed (*Appendix 1*). Although pollen is present in all but three of the sub-samples, the counts are very low, all but one sample providing less than 50 pollen grains. A count of 100 total land pollen (trees, shrubs and herbs) is usually taken as statistically representative for assessment purposes, and values less than that are not considered sufficiently large to suggest confident interpretations.

3.1.2 ***Fairy Caves monolith:*** the most abundant pollen recovery was from the topmost sub-sample from monolith F1, from which 55 total land pollen grains were counted. The plant taxa inlcuded more than 20% tree pollen, including alder (*Alnus*), oak (*Quercus*), willow (*Salix*) and hazel-type (*Corylus avellana*-type). Pollen of herbs was the most common pollen type recorded and includes pollen of plants such as grasses (Poaceae), common knapweed (*Centaurea nigra)*, pollen of the daisy family (Asteraceae: a large group comprising plants such as carline thistles, ragworts and daisy), meadowsweet (*Filipendula*), cinquefoils (*Potentilla*-type), cow-wheats (*Melampyrum*) and dandelion-type (*Taraxacum*-type). Monolete fern spores (Pteropsida) are present, and moderate quantities of microscopic charcoal were also recorded.

3.1.3 Any interpretation must be treated with caution as the pollen count is so low; however, the ecological habitats of some of the plants may suggest some useful palaeoenvironemntal data. The pollen assemblage, which must have accumulated in the cave sediments by deposition through water entering the cave, or possibly via wind transport, suggests that trees were present in the palaeoenvironment, and comprised taxa that preferentially live in wet conditions, such as alder and willow. Oak prefers drier, richer soils and hazel-type may grow as hazel-scrub on drier soils (Stace 2010). All of these arboreal taxa may have been growing locally in proximity to the cave entrance or in nearby hedgerows or more regionally, in woodlands. The herb component comprises pollen from several habitats: of waste or rough ground, for instance, dandelion-types; grassy or woodland areas, for example, common knapweed and cow-wheats; and wet areas, for example, meadowsweet. It is possible that some of these pollen types may have been brought into the cave by people or animals, perhaps on their feet. Plant taxa such as dandelion-types produce very robust pollen, which can withstand degradation.

3.1.4 Monolete fern spores are present in varying numbers throughout the deposit. Coles and Gilbertson (1994), in a study of present-day pollen taphonomy from Creswell Crags, (Derbyshire), found that pollen caught in the caves over a one-year period reflected the vegetation in the cave mouths as well as the wider area beyond, within a five-mile radius of the site. Comparatively high representation of fern spores was a persistent feature, and was attributed to the interaction of habitat, distribution and taphonomic process (for example, the number of ferns in the cave mouth; *ibid*).

3.1.5 Possibly the most interesting aspect of this assemblage is the presence of microcharcoal, which was recorded throughout the sub-samples from deposit F10. The microcharcoal suggests that burning must have taken place for the microcharcoal particles to have entered the cave sediments, although whether this was local or from a wider area cannot be

established, through a natural process (for example via water transport). Peterson (2013a) notes that, in the original excavation of the cave by Musson (1947), substantial pieces of charcoal were recorded from an area crossing the deposit sampled by the monolith. Evidence of modern fires at the entrance of the cave are unlikely to have produced microcharcoal that would have penetrated a disturbed rubble layer, approximately 0.30m thick that overlies deposit F10, and therefore it is more likely that the microcharcoal present in the monolith sample is actually *in-situ* and could have derived from fires within the cave at the time that F10 was forming.

3.1.6 ***New Laund Farm, ditch C1, fill C5:*** the three samples assessed for pollen from ditch C1 contained low pollen counts. The richest assemblage (22 pollen grains, including ferns), at 0.50m, contained a few grains of hazel-type, some grass pollen, several dandelion-type grains, a daisy-type and a single grain of ribwort plantain (*Plantago lanceolata*), several monolete fern spores and a *Sphagnum* moss spore. Fungal spores included *Glomus* (Hdv-207) and *Sporomiella* (HdV-113). Poorer pollen assemblages were recovered at 0.55m and 0.60m, in which taxa include occurrences of sedges (Cyperaceae) at 0.55m and a possible cereal-type grain at 0.60m. Microcharcoal is present within all three samples.

3.1.7 The quantity of pollen recovered from the sediments from this ditch is too low to provide any sort of vegetational reconstruction. The fungal spores, *Sporomiella* (HdV-113), are coprophilous, suggesting the presence of grazing animals nearby (van Geel 1978).

3.1.8 ***New Laund Farm, ditch P4, fill P5:*** the sediment samples from 0.45m and 0.55m were barren of palynomorphs. Only fern spores were recorded in the topmost sample, at 0.35m, although microcharcoal was also present at this depth.

3.2 Plant Remains and Charcoal

3.2.1 The assessment examined 19 small bulk samples (*Appendix 2*). None of these samples contained plant remains preserved through waterlogging, but all 19 contained at least some charcoal fragments, and six contained rare charred plant remains. Charred remains include one or two hazelnut (*Corylus avellana*) shell fragments from Site H (timber circle) and Site P, and one or two charred grass (Poaceae) stem fragments from Site D (internal enclosure features) and Site M. Two samples from these sites, samples D2 (fill D3 from curvilinear ditch D13) and M3 (posthole fill M9 from circular feature M4) also produced single indeterminate cereal grains. In addition, sample M3 was the only one to produce a charred weed seed, a single buttercup (*Ranunculus repens*-type) seed.

3.2.2 Although much of the charcoal from the samples was too comminuted or poorly preserved for species identification, eight of the samples produced at least one or two >2mm identifiable fragments, and at least two, H1 (fill H7, from shallow depression/scope H15) and H3 (fill H12, from ditch recut H39), from the timber circle, produced common >2mm fragments, which provided a reasonable dataset with which to investigate the range of wood taxa represented (*Appendix 3*). Although less than 50 identifiable fragments were recovered from each sample, given the lack of charcoal studies from the region (Huntley 2010), it was felt that further work was worthwhile. The limited dataset includes a range of taxa, including alder/hazel (*Alnus glutinosa/Corylus avellana*), with postitively identified hazel, ash (*Fraxinus excelsior*), willow/poplar (*Salix* sp/*Populus* sp), with rare hawthorn and blackthorn-type (Maloideae and *Prunus* sp), and oak (*Quercus* sp). The remaining six

samples produced only one or two fragments each, comprising a similar range of taxa as the analysed samples, namely ash, probable hawthorn-type/blackthorn-type, oak and alder/hazel.

3.2.3 Charcoal identifications were also made for hand-picked fragments from Fairy Cave (F), and sites/trenches D, H, J, M, N and Q (*Appendix 4*). Forty-six out of the 82 samples comprised >2mm or >4mm in size, identifiable charcoal fragments. A further two fragments were also charcoal, but were too small to be identified; the remainder (34 samples) consisted of small stones, shale, or compacted soil.

3.2.4 At least four taxa were identified: oak; ash; alder; and hazel. Although both alder and hazel were recorded, it should be noted that their morphological similarity means that distinguishing between them can be problematic if certain charcateristics are not observed or obscured (Hather 2000). For this reason, many of the fragments are identified as alder/hazel.

3.2.5 Given that these are both short-lived wood, alder and hazel (and alder/hazel) charcoal provide very good material for radiocarbon dating. Oak and ash, on the other hand, are not particularly suitable for radiocarbon dating, due to the 'old wood effect'.

4 DISCUSSION AND CONCLUSION

4.1 POLLEN

4.1.1 The best recovery of palynomorphs is undoubtedly from the uppermost sub-sample of deposit F10, although the pollen count is too low to recommend full analysis. It may be possible to increase the count by counting the pollen from multiple slides (as long as sufficient residue is available) but the results of such analysis would still be difficult to interpret, given the unsuitability of the sediments for dating and also the lack of a palynostratigraphic framework within which to interpret the results from this single sample (the pollen from the rest of the core is even sparser, and may not yield statistically viable counts, even if an attempt was made to count multiple slides).

4.1.2 No further pollen work is therefore recommended on the samples assessed during the current study. However, it may be possible to collect a core through a sequence of organic sediments which may be present in a low-lying boggy area adjacent to the cave system (R Petersen *pers comm*). Such a sequence may provide palaeoenvironmental information relevant to the prehistoric archaeological findings from the caves and nearby areas.

4.2 CHARRED PLANT MATERIAL AND CHARCOAL

4.2.1 Assessment of the bulk samples retrieved from four sites excavated at New Laund Farm (D, H, M and P), which include a timber circle (Site H), and prehistoric ditched enclosures and associated features (sites/trenches D, M, and P) indicates a general paucity of palaeoenvironmental material other than charcoal. This could partly be a result of the nature of the sites, where domestic activity, and therefore the deposition of occupation debris, was limited. However, the small size of the bulk samples (2.5-5 litres) may have also been a determining factor. This said, the recovery of rare cereal grains and other charred plant material suggests that there is the potential for such remains to survive.

4.2.2 The charcoal recovered from the bulk and hand-picked samples are all broadly consistent, and indicate the utilisation of several species, which were likely to have been growing nearby. The data, which are supported by the pollen evidence (*Section 3.1*), indicates local oak and hazel woodland, with alder and probable willow growing on damper soils. The presence of ash, a light-demanding tree (Rackham 2003), and hawthorn-blackthorn-type, suggests that some of the local woodland was fairly open and/or scrubby. The relatively small number of oak fragments retrieved from the two analysed samples, fill H7, from shallow depression/scope H15, and fill H12, from ditch recut H39, was notable and suggests that oak wood was not considered a priority for the activities carried out at the site. Oak, for example, makes a superb fuelwood (Edlin 1949), and is commonly recorded in archaeological assemblages. Rather, it would appear that the wood from a range of other 'shrubby' taxa was utilised, perhaps originating from woodland floors at their margins and/or hedgerows. The abundant short-lived charcoal taxa from New Laund Farm suggests that there is a great deal of scope for radiocarbon dating.

4.2.3 Although the palaeoenvironmental information gained from this phase of study is limited, the data do suggest that the sites at New Laund Farm have the potential for the recovery of plant remains and charcoal. Recommended guidelines suggest that at least 40-litre bulk

samples (or 100% of smaller features) should be taken for the retrieval of charred plant remains and charcoal (English Heritage 2011). At least one litre of material should be taken for the retrieval of waterlogged plant remains (WPR). The 40-litre bulk samples should be processed by flotation, whereby the flot is collected on a 250µm (micron) sieve, and the remaining residue on a 500µm (0.5mm) sieve. The flots are then air-dried and stored in plastic bags. The residues should be checked for plant remains/charcoal that have not floated, small mammal and fish bones, industrial residues, and small finds. Highly organic samples, or samples taken for the recovery of WPR (*eg* wells, ditches, gullies, peat bogs) should be wet-sieved by washing over a 250µm sieve, and then stored wet in plastic tubs, or double bagged.

BIBLIOGRAPHY

Berglund, B E, and Ralska-Jasiewiczowa M, 1986 Pollen analysis and pollen diagrams, in B E Berglund (ed), *Handbook of Holocene palaeoecology and palaeohydrology*, Chichester, 455-84

Brooks D, and Thomas, K W, 1967 The distribution of pollen grains on microscope slides: The non randomness of the distribution, *Pollen et Spores*, **9**, 621-9

Carter, K, and Peterson, R, 2014 *Excavations at New Laund Farm, Whitewell, Lancashire, 2014*, Draft Interim Rep, Univ Central Lancashire, unpubl rep

Chartered Institute for Archaeology (CIfA), 2014 *Standards and guidance for the creation, preparation, transfer and deposition of archaeological archives*, Reading

Coles, G M, and Gilbertson, D D, 1994 The airfall-pollen budget of archaeologically important caves: Creswell Crags, England, *J Archaeol Sci*, **21(6)**, 735-55

Edlin, H L, 1949 *Woodland crafts in Britain*, London

English Heritage, 2006 *Management of research projects in the historic environment*, London

English Heritage, 2011 *Environmental archaeology: a guide to the theory and practice from sampling and recovery to post-excavation*, 2nd edn, Swindon

Faegri, K, and Iversen, J, 1989 *Textbook of pollen analysis*, 4th edn, Chichester

Hather, J G, 2000 *The identification of the northern European woods*, London

Hughes, R A, 1986 *Geology of the Trough of Bowland Area (SD 66SW)*, Brit Geol Surv Tech Rep, **WA/87/46**, Nottingham

Huntley, J, 2010 *A review of wood and charcoal recovered from archaeological excavations in Northern England*, Engl Heritage Res Dept Rep Ser, **68-2010**, Portsmouth

Moore, P D, Webb, J A, and Collinson, M E, 1991 *Pollen analysis*, 2nd edn, Oxford

Musson, R C, 1947 A Bronze Age cave site in the Little Bolland area of Lancashire, *Trans Lancashire Cheshire Antiq Soc*, **59**, 161-70

Peterson, R, 2012 *Excavations at New Laund Farm, Whitewell, Lancashire, 2012*, Univ Central Lancashire, unpubl rep

Peterson, R, 2013a *Excavations at Fairy Holes Caves, Whitewell, Lancashire*, Univ Central Lancashire, unpubl rep

Peterson, R, 2013b *Excavations at New Laund Farm, Whitewell, Lancashire, 2013*, Univ Central

Lancashire, unpubl rep

Rackham, O, 2003 *Ancient woodland: its history, vegetation and uses in England*, Kirkcudbrightshire

Stace, C, 2010 *The new flora of the British Isles,* 3rd edn, Cambridge

Stockmarr J, 1972 Tablets with spores used in absolute pollen analysis, *Pollen et Spores*, **13**, 615-21

van Geel, B, 1978 A palaeoecological study of Holocene peat bogs sections in Germany and the Netherlands, *Rev Palaeobot Palynol*, **25**, 1-120

APPENDIX 1: POLLEN COUNTS

Sample		**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**C1**	**C1**	**C1**	**P4**	**P4**	**P4**
Feature		cave	cave	cave	cave	cave	cave	cave	cave	cave	cave	ditch	ditch	ditch	ditch	ditch	ditch
Context		*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*C5*	*C5*	*C5*	*P5*	*P5*	*P5*
Preservation		mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed
Potential		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Depth (m)		0	0.10	0.20	0.30	0.40	0.50	0.60	0.65	0.75	0.80	0.50	0.55	0.60	0.35	0.45	0.55
Trees/Shrubs																	
Alnus	Alder	3	1	4		2			1				1				
Betula	Birch										1						
Quercus	Oak	2				1		1									
Corylus avellana-type	Hazel-type	2	3			3	2	3	1		1	3					
Pinus	Pine									1	1						
Prunus-type	Cherry-type	1															
Rosaceae	Rose (shrub)	3							1		1						
Salix	Willow	6		1						1							
Calluna	Heather							1		1							
Crops																	
Cereal-type	Cereals / large grasses													1			
Herbs																	
Apiaceae	Carrot family	1															
Asteraceae	Daisy family						1					1					
Centaurea nigra	Common knapweed	1															
Cirsium-type	Thistles		1														
Cyperaceae	Sedges												2				
Fabaceae	Pea family	2			1												
Filipendula	Meadowsweet	2															
Melampyrum	Cow-wheats	2						5		2	1						
Plantago lanceolata	Ribwort plantain											1					
Plantago spp	Plantains													1			

Sample		**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**C1**	**C1**	**C1**	**P4**	**P4**	**P4**
Feature		cave	cave	cave	cave	cave	cave	cave	cave	cave	cave	ditch	ditch	ditch	ditch	ditch	ditch
Context		*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*C5*	*C5*	*C5*	*P5*	*P5*	*P5*
Preservation		mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed
Potential		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Depth (m)		0	0.10	0.20	0.30	0.40	0.50	0.60	0.65	0.75	0.80	0.50	0.55	0.60	0.35	0.45	0.55
Poaceae	Grasses	4	1	2					1			2		1			
Potentilla-type	Cinquefoils	3				1			1								
Rumex-type	Docks/Sorrels				1												
Taraxacum-type	Dandelion-type	10	1				1			1	1	4	2	2			
	Indeterminate herbs	10			1	1	1	5	3		3						
	Total land pollen	**55**	**7**	**7**	**3**	**8**	**5**	**15**	**8**	**6**	**9**	**11**	**5**	**5**	**0**	**0**	**0**
	Number of traverses	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Lycopodium	Exotic	41	56	52	90	54	100	65	140	88	120	48	17	18	30	15	15
Ferns and Mosses																	
Polypodium	Polypodies				1					1					2		
Pteridium	Bracken													1			
Pteropsida	Monolete ferns	9	5	4	11	4	2	4	10		5	11		5	5		
Sphagnum	Bog moss spores											1					
Microscopic charcoal		115	38	60	95	42	105	120	76	60	130	90	22	42	70	1	
NPP	Non-pollen palynomorphs																
Undiff NPP		9									6	10	2	1			
Glomus-HdV 207		1										11	4	1	1		
Sordaria HdV-55A/B		1															
Sporomiella HdV-113												3					
Carboniferous spores (reworked)					2					1	3			1			
Broken grains		1				1	2	3	1				2				

Sample		**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**F1**	**C1**	**C1**	**C1**	**P4**	**P4**	**P4**
Feature		cave	cave	cave	cave	cave	cave	cave	cave	cave	cave	ditch	ditch	ditch	ditch	ditch	ditch
Context		*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*F10*	*C5*	*C5*	*C5*	*P5*	*P5*	*P5*
Preservation		mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed	mixed
Potential		No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Depth (m)		0	0.10	0.20	0.30	0.40	0.50	0.60	0.65	0.75	0.80	0.50	0.55	0.60	0.35	0.45	0.55
Concealed grains		2	4	2					1			6		1	1		
Crumpled grains		6	1	3				2	1		3		1	2	2		

Figures are actual counts

APPENDIX 2: PALAEOENVIRONMENTAL ASSESSMENT RESULTS OF THE BULK SAMPLES

Site Code	Sample No	Context No	Sample vol l	Flot vol ml	Flot description	Plant remains	Charcoal	Plant remains Potential	Charcoal Potential	Material for C14 dating
NL12	D1	D8	2.5	5	Charcoal (1)			None	None	None
NL12	D2	D3	2.5	5	Charcoal (3), >2mm (1), modern roots (4), modern seeds (1)	Indeterminate cereal grains (1). Grass stem fragments (1)	Indeterminate	None	None	Yes
NL12	D3	D6	2.5	10	Charcoal (3), >2mm (1), modern roots (3)	Grass stem fragments (1)	Ash roundwood, hawthorn/ blackthorn-type	None	None	Yes
NL12	D6	D5	2.5	<5	Charcoal (1)			None	None	None
NL12	D7	D17	2.5	<5	Charcoal (1), modern roots (1)			None	None	None
NL13	H1	H7	2.5	20	Charcoal (4), >3mm (3), modern roots (3), modern seeds (1)	Hazelnut shell fragments (1)	Short-lived wood	None	Medium	Yes
NL13	H2	H16	2.5	15	Charcoal (2), modern roots (3)			None	None	None
NL13	H3	H12	2.5	10	Charcoal (4), >2mm (3)	Hazelnut shell fragments (1)	Mixed	None	Medium	Yes
NL13	H4	H18	2.5	20	Charcoal (1), modern seeds (2)			None	None	None
NL13	H5	H35	2.5	20	Charcoal (2), modern roots (3)			None	None	None
NL13	H6	H14	2.5	20	Charcoal (2), >2mm (1), modern roots (4)		Indeterminate and oak	None	None	None
NL13	H7	H33	2.5	5	Charcoal (1), modern roots (4)			None	None	None
NL14	M1	M6	5	<5	Charcoal (2), >2mm (1), modern roots (4), modern seeds (1)		Ash and alder/hazel	None	None	Yes
NL14	M2	M4	5	30	Charcoal (3), >2mm (2), modern roots (4), insects (1)		Includes alder/hazel	None	None	Yes
NL14	M3	M9	5	20	Charcoal (3), >2mm (2), modern roots (4), insects (1)	Indeterminate cereal grains (1). Weed seeds (1). Grass stem fragments (1)	Includes alder/hazel	None	None	Yes
NL14	P1	P5	5	80	Charcoal (1), modern roots (2)			None	None	None
NL14	P2	P6	5	20	Charcoal (1), modern roots (3)			None	None	None
NL14	P2	P11	5	80	Charcoal (2), modern roots (2)	Hazelnut shell fragments (1)		None	None	Yes

Site Code	Sample No	Context No	Sample vol l	Flot vol ml	Flot description	Plant remains	Charcoal	Plant remains Potential	Charcoal Potential	Material for C14 dating
NL14	P3	P2	5	10	Charcoal (2), >2mm (1), modern roots (4), modern seeds (1)		Ash and alder/hazel	None	None	Yes

Plant Remains are scored on a scale of 1-4, where 1 is rare (1-5 items/fragments), 2 is frequent (6-25 items/fragments), 3 is common (26-100 items/fragments) and 4 is abundant (>100 items/fragments)

APPENDIX 3: CHARCOAL FROM THE NEW LAUND TIMBER CIRCLE (SITE H)

Context No		H7	H12
Sample No		H1	H3
Sample Size L		2.5	2.5
Flot Size ml		20	10
% of >2mm identified		100%	100%
Comments		Charcoal quite distorted/gnarled	
Alnus glutinosa (L) Gaertn.	Alder	-	-
Corylus avellana L	Hazel	1	1
Alnus/Corylus	Alder/hazel	26	11
Fraxinus excelsior	Ash	6	17
Maloideae	Hawthorn-type	1	3
Prunus-type	Blackthorn-type	1	
Quercus sp	Oak	1	3
Salix sp/*Populus* sp	Willow/ poplar	10	
Indeterminate		3	3
Total >2mm fragments		49	38

Figures shown are actual counts

APPENDIX 4: HAND-PICKED CHARCOAL IDENTIFICATIONS

Finds No	Context	Grid Ref	East	North	Elevation	Notes	Material	Wood species	c14 potential
C025	C03	pt276	365249.617	447081.395	193.769		Charcoal	Alder/hazel	good
C026	C03	pt283	365253.520	447081.683	194.176		Stone		
C027	C03	pt284	365253.589	447082.006	194.230		Stone		
C028	C03	pt285	365253.118	447081.620	194.055		Stone		
C029	C03	pt286	365253.058	447082.168	194.074		Stone		
C048	C03	pt320	365250.431	447083.792	193.311		Charcoal	Alder/hazel	good
C050	C03	pt328	365250.175	447082.815	193.565		?not charcoal		
C051	C03	pt329	365249.604	447082.895	193.587		Shale		
C058	C02	pt292	365244.790	447083.637	194.444	renumbered post-ex (duplicated number C028)	Charcoal	Alder/hazel	good
D043	D01	pt74	365204.092	447070.538	195.674		Stone/ mineralised wood		
D059	D02	pt101	365209.429	447069.950	195.589		havm and stones		
D088	D02	pt132	365203.948	447068.709	195.728		Stone/shale		
D093	D02	pt137	365206.043	447066.823	195.697		Coal		
D096	D02	pt140	365209.921	447067.355	195.575		Coal/havm		
D099	D02	pt143	365204.961	447065.556	195.744		Stone		
D105	D02	pt149	365205.017	447065.378	195.736		Stone		
D108	D02	pt153	365206.144	447065.217	195.701	Missing			
D109	D02	pt154	365205.779	447065.612	195.698		?not charcoal		
D110	D02	pt155	365207.425	447064.529	195.693	Pt 156 on bag	Charcoal	Ash	not ideal - old wood effect
D111	D02	pt156	365204.676	447064.490	195.758	Missing			
D133	D02	pt179	365204.804	447071.541	195.627		Charcoal	Ash	not ideal - old wood effect
D138	D02	pt188	365204.005	447068.435	195.585		Stones		
D150	D03	pt239				Extra sample	Charcoal	Alder	good
D151	D06	pt240	365203.464	447070.994	195.383		Charcoal, encrusted with soil	Alder/hazel	fair
D152	D06	pt241	365203.618	447070.864	195.320		Charcoal	Alder	good
D154	D06	pt243	365203.755	447071.054	195.305	Missing			

Finds No	Context	Grid Ref	East	North	Elevation	Notes	Material	Wood species	c14 potential
D156	D06	pt245	365203.801	447071.259	195.281	Pt 255 on bag	Charcoal	Alder/hazel roundwood >7 rings	very good
D163	D05	pt252	365204.735	447069.998	195.272	Missing			
D168	D06	pt257	365203.116	447071.833	195.298		?Soil		
D169	D03	pt259	365204.385	447070.334	195.296	Missing			
D173	D07	pt263	365204.656	447069.907	195.239		Charcoal	Oak	not ideal - old wood effect
D180	D07	pt269	365206.593	447069.177	195.437		Stone		
D185	D08	pt274	365206.189	447065.073	195.130		Soil - no charcoal		
D191	D03	pt281	365205.189	447069.213	195.233		Stone		
D201	D06	pt326	365204.068	447071.580	195.110		Charcoal	Alder/hazel	good
F011	F1		499	106	49.959				
F026	F3		West Cave	West Cave	24cm	Not sent?			
F039	F5		503	103	49.4	Not sent?			
F057	F6		499	105	49.5	Not sent?			
F035	F7		West Cave	West Cave	32cm	Not sent?			
H_225	H12		365203.388	447073.348	198.571		Charcoal	Ash	not ideal - old wood effect
H_229	H10		365204.203	447077.022	198.739		Charcoal	Indeterminate-too small	
H_233	H12		365203.160	447073.180	198.492		Charcoal	Alder	good
H_235	H12		365203.350	447073.285	198.497		Charcoal	Indeterminate-too small	
H_239	H12		365203.395	447073.306	198.482		Charcoal	Alder/hazel	good
H_241	H12		365204.327	447076.558	198.679	H16 on bag	Soil - no charcoal		
H_242	H14		365201.340	447076.699	198.808		Stone		
H_243	H14		365201.473	447076.635	198.806		Small stones		
H_258	H12		365203.396	447073.515	198.388		Charcoal	Indeterminate-too small	
H_262	H03		365201.322	447076.379	198.963		Charcoal	Alder/hazel	good
H_272	H12		365203.457	447073.966	198.636		Charcoal	Alder	good
H_297	H12		365203.327	447073.874	198.354		Charcoal	Alder/hazel	good
H_298	H12		365203.502	447073.862	198.314	Missing			
H_313	H18		365203.435	447073.521	198.280		Charcoal	Alder/hazel	good
H_318	H18		365203.446	447073.775	198.185		Charcoal	Alder/hazel	good
H_325	H18		365203.566	447073.452	198.270		Charcoal	Indeterminate-too small	
H_337	H13		365203.602	447073.425	198.174		Soil - no charcoal		

Finds No	Context	Grid Ref	East	North	Elevation	Notes	Material	Wood species	c14 potential
H_377	H29		365208.138	447076.590	198.382		Charcoal	Oak	not ideal - old wood effect
H_378	H28		365209.064	447075.690	198.522		Charcoal	Oak	not ideal - old wood effect
H_394	H37		365208.794	447075.042	198.532		Charcoal	Oak	not ideal - old wood effect
H235	H12		365203.350	447203.350	198.497	Missing			
J2	J2						Stones		
J3	J2						Stones/sediment		
J4	J2						Stones		
J6	J2						Stones/sediment		
J7	J2						Havm		
J8	J2						Stone		
M059	M7						Charcoal	Oak	not ideal - old wood effect
M081	M4						Charcoal	Alder	good
M082	M4						Charcoal	Oak	not ideal - old wood effect
M089	M8					Missing			
M091	M7						Charcoal	Oak	not ideal - old wood effect
M094	M6						Soil - no charcoal		
N121	N4						Coal/havm		
N145	N2						Coal/havm		
N231	N10						Charcoal	Ash	not ideal - old wood effect
N234	N10						Charcoal	Hazel	good
N239	N10						Charcoal	Hazel	good
N245	N10						Charcoal	Oak roundwood *c* 13 rings	very good
N275	N5						Charcoal	Hazel	good
N280	N10						Charcoal	Ash	not ideal - old wood effect
N233	N14						Charcoal	Hazel	good
N243	N14						Charcoal	Oak roundwood >13 rings	very good
N244	N4						Charcoal	Hazel	good

Finds No	Context	Grid Ref	East	North	Elevation	Notes	Material	Wood species	c14 potential
N245	N18						Charcoal	Oak	not ideal - old wood effect
N246	N10						Charcoal	Alder	good
N256	N10						Charcoal	Oak roundwood > 13 rings	very good
N305	N10						Charcoal	Alder	good
N306	N10						Charcoal	Hazel	good
N307	N10						Charcoal	Hazel	good
N308	N10						Charcoal	Hazel	good
N347	N10						Charcoal	Hazel	good
N350	N10						Charcoal	Hazel	good
N351	N10						Charcoal	Hazel	good
Q009	Q2						Charcoal	Oak roundwood >11 rings	very good

Havm = heated-affected vesicular material

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