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ROMAN LODE, BURCOMBE, EXMOOR, NORTH DEVON POLLEN ANALYSIS OF BLANKET PEAT DEPOSITS

ENVIRONMENTAL STUDIES REPORT

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POLLEN ANALYSIS OF BLANKET PEAT DEPOSITS AT ROMAN LODE, BURCOMBE, EXMOOR, N. DEVON

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SUMMARY

In August 2004 field work in association with the Exmoor Iron (ExFe) project recovered a short sequence of blanket peat 100 m SE of the excavation of the large iron extraction site at Roman Lode on Exmoor. The blanket peat was sampled with the intention of using pollen analysis to generate an environmental context for the locality prior to, during and subsequent to iron extraction and undertaking geochemical analysis on the peat to identify any periods of enhanced deposition of smelting pollutants and mining dust. This report focuses on pollen analysis from the sequence, which has been radiocarbon dated. Peat accumulation began at 350-115 cal BC, with peat growth continuing until the present day. Three main pollen zones have been delimited within the section, with the basal zone characterised by heather and grass-heath in the late Iron Age, with limited woodland cover (mostly hazel scrub) in the local area. The second zone represents a local landscape dominated by more species-rich grassland, with cotton grass rather than heathers dominating local vegetation. The uppermost zone represents a more mosaic landscape, with patches of heather, cotton grass and some species-rich grassland. The analysis suggests continuous, steady peat growth at the site.

Key words: Pollen, Palaeoecology, Metal-working-Fe

CONTRIBUTORS

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ACKNOWLEDGEMENTS

The samples were collected by Vanessa Straker and David Robinson, and the work compliments the Exmoor Iron Project, directed by Gill Juleff.

ARCHIVE LOCATION

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DATE OF RESEARCH

Spring 2007

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CONTENTS

LIST OF TABLES AND FIGURES

INTRODUCTION

The site at Roman Lode formed part of Exmoor National Park's pilot survey of iron working sites in 1996, and was surveyed in 1997. This survey demonstrated a complex, multiphase set of earthworks, which were subject to two seasons of small-scale excavation in 2002 and 2003 (Juleff and Bray, 2007). The aims of these excavations were to investigate some of the earliest features on the site, the results of which have been presented by Juleff and Bray (2007).

The objectives of sampling and examining material from Roman Lode are to provide an environmental context for iron extractive activities at the site. More specifically, these are to (i) use pollen analysis to examine changes in the local environmental context for activities at Roman Lode prior to, during and subsequent to iron extraction; (ii) to provide a long-term record of atmospheric deposition of pollutants (e.g. lead, copper) associated with the iron extractive process; and (iii) determine local impacts on the landscape of the iron extractive process (e.g. peat initiation, vegetation management).

A peat section ca. 100 m to the SE of Roman Lode on Exmoor (Figure 1) was sampled in the field using 0.5 m monolith tins in August 2004 by Vanessa Straker and David Robinson (English Heritage). The section represents the deepest blanket peat located adjacent to the iron extraction site at Roman Lode (excavation location: SS75343815). The laboratory work dealt with here was undertaken during February and March 2007. Monolith tins from the sections are currently archived within the School of Geography at the University of Plymouth. Prepared samples are also retained within the same archive.

The aim of this report is to examine the pollen stratigraphy from the sampled section, to provide the environmental context for activities at the site.

Radiocarbon dating has already been undertaken from the site. This indicated that peat initiation began during the late Iron Age (350-115 cal BC) and has continued up to the present day (Table 1).

Throughout this report the results are discussed by the taxonomic names of the pollen recorded in the sequence (largely following Bennett, 1994, although see section 3.2), with common (English) names where appropriate following Stace (1991).

Table 1: Radiocarbon results from blanket peat at Roman Lode, Exmoor, RLBP 2006

Lab ID	Sample ID	Material	d13C (‰)	Radiocarbon Age (BP or %modern)	Calibrated Date (95% confidence)
OxA-15750	RLBP 2006:1	peat, humin fraction (macrofossils)	-26.8	106.5±0.3 %modern	
OxA-15825	RLBP 2006:1	peat, humic acid	-27.7	106.6±0.3 %modern	
weighted mean RLBP 2006:1	T'=0.1; v=1; T'(5%)=3.8	Ward and Wilson 1978		-509.6±16 BP	cal AD 1956–1957
OxA-15826	RLBP 2006:1	peat, humin fraction (bulk)	-27.6	101.9±0.3 %modern	cal AD 1955–1956
OxA-15827	RLBP 2006:2	peat, humin fraction	-28.2	2184±29 BP	
OxA-15865	RLBP 2006:2	peat, humic acid	-26.7	2127±26 BP	
weighted mean RLBP 2006:2	T'=2.1; v=1; T'(5%)=3.8	Ward and Wilson 1978		2153±19 BP	350–115 cal BC

METHODOLOGY

Pollen analysis

Fifteen 1.0 cm3 sub-samples were taken from the monolith tins at 4 cm intervals throughout the profile, from the mineral sub-soil, through the highly-humified blanket peat and up into the living root mat. Samples were prepared using standard procedures (see Moore *et al*., 1991). An exotic marker tablet was added to facilitate calculation of pollen concentration (Stockmarr, 1971).
Samples were screened through sieves, to retain the 10-106 micron fraction.
Silicates were dissolved using an HF wash and non-palynomorph organics were removed using an acetolysis digestion. The remaining material was mounted in silicon oil for identification.
A minimum of 500 land pollen grains (including Cyperaceae) were identified from each level (with the exception of the basal sample from the mineral subsoil, where it was only possible to counts 300 pollen grains).
Grains were identified using the keys in Moore *et al*. (1991) and Andrew (1984), and identifications were standardised to the taxonomy presented in Bennett (1994) with the exception of his *Sorbus*-type, where further taxonomic subdivision was possible.

RESULTS

The results of the analysis are given in Figure 2. Pollen data are expressed as percentage total land pollen (TLP), and sample levels expressed as depth below the surface. The pollen diagram has been zoned visually into three local pollen assemblage zones, which are described in Table 1.
Pollen was abundant in all levels counted, although in poor condition in the mineral sub-soil. The pollen concentration data suggests three phases of peat accumulation characterised by low pollen concentration at the base (more rapid accumulation), an increase in concentration between 50 and 26 cm depth (slower peat accumulation) and low levels to the surface (more rapid peat accumulation). A total of 8078 pollen and spores were identified.

Table 2: Description of pollen zones, Roman Lode, Exmoor 2007.

RL07-lpaz1 56-42 cm *Calluna vulgaris*-Poaceae
The basal zone is characterised by a predominantly open local environment, with the main pollen types *Calluna vulgaris* (~30% TLP) and Poaceae (~20-30% TLP). The herbaceous taxa are limited, but include species indicative of grazed areas, including *Plantago lanceolata*, *Geranium* and Lactuceae. High levels of *Polypodium* in the basal sample are typical of persistence of more robust spore taxa in sub-soil environments.
RL07-lpaz2 42-14 cm Poaceae-Cyperaceae-*Potentilla*-type
The lower zone boundary is marked by a significant decline in *Calluna vulgaris* with an increase in Poaceae and *Potentilla*-type. Additionally there is an increase in the number of herbaceous taxa, indicating an expansion of species-rich grassland. The middle levels include trace amounts of cereal-type pollen taxa (*Avena*/*Triticum*-type).
RL07-lpaz3 14-0 cm Poaceae-Cyperaceae-*Calluna vulgaris*
The top zone is marked by a re-expansion of *Calluna vulgaris* with a continued dominance of Poaceae with Cyperaceae. The number of herbaceous taxa decline, suggesting a different type of grassland community represented in this zone.

DISCUSSION

Vegetation development

The pollen data detail the development of vegetation in the vicinity of Roman Lode. At the time of peat inception (the late Iron Age) the local environment was predominantly open with a mosaic of heather and grass heath. It is not possible to further resolve the grasses to below genus level; however, the associated herbaceous taxa suggest a grass heath which is not particularly improved. Although there are woodland taxa present in the pollen diagram they are limited, and dominated by hazel which is most likely to be located in and around the coombes on Exmoor at this time. This picture of a predominantly open late Iron Age environment supports the conclusions of previous work on Exmoor (Francis and Slater, 1990; 1992; Fyfe, 2000; Fyfe *et al*., 2003b).
The subsequent pollen zone indicates changes in the character of the vegetation on this part of Exmoor (at between 400 and 450 m OD), with a notable increase in species-rich grassland during zone RL07- lpaz2. On this part of Exmoor there is a mosaic of dry heath and blanket peat; the increase in Cyperaceae through the zone probably represent a shift towards *Eriophorum* (cottongrass) and/or *Trichophorum* (deergrass) on the blanket peat whilst the improved grassland is located on the drier areas on the local upland. The records of cereal types are most likely to represent an expansion of cultivation into the upland fringes, distant from this site, as identified by Fyfe *et al*. (2003b) on the southern Exmoor edge and Fyfe *et al*. (2004) in the mid-Devon lowlands to the south of Exmoor.

The upper-most zone is marked by a shift to species-poor grassland, probably dominated by *Molinia caerulea* (purple moor grass), with a re-expansion of some heather and continued Cyperaceae, which implies a more mosaic character to the local blanket mire vegetation, with cottongrass, deergrass, heathers and purple moor grass across the upland.

Integrity of the section

There is no evidence of any hiatus within the sequence from the pollen analysis, which suggests continuous peat growth over the last c.2300 years at the site. This implies that further work on the sequence, including geochemical analyses and tephrochronology, should not be compounded by complex stratigraphy and dating issues. Further, there is no evidence of reworked pollen in the samples (which would be reflected by levels with a mixed assemblage or differential pollen preservation, typically represented in unidentifiable grains) which suggests that both geochemical and tephra analyses will not be complicated by erosive events or reworked of soils from around the site.

Impacts of iron extraction on the local landscape

There is no clear evidence of any impact of iron extraction from the site at Roman Lode in this sequence. The level of woodland cover is low throughout the sequence, following a general pattern of a predominantly open upland with continuity of landuse through the last two millennia (Figure 3; Appendix 1). As a supply of fuel (charcoal) is an important factor in the location of smelting sites, it is unlikely that extensive smelting activities would have taken place in the local area.

Further analysis

Geochemical analysis (using ICP-MS) is on-going from the section presented in this report at the University of Plymouth. Geochemical analysis on the peat is being undertaken to identify any periods of enhanced deposition of smelting pollutants and mining dust which may provide evidence for the chronology of iron extraction and working in proximity to the site, in the absence of archaeological evidence for furnaces. In addition, work at Royal Holloway (by Ian Matthews and Nick Branch) has identified tephra sherds within the sequence, and this palynological study, combined with the geochemical analyses, will augment this important discovery.

CONCLUSIONS

The pollen evidence from Roman Lode dates from the late Iron Age and describes a predominantly open heath upland landscape, similar to that identified in previous research. The major changes in the pollen data indicate: (i) a shift at 42 cm to more species-rich grassland, with evidence for some cereal cultivation in the lowland fringes of Exmoor; and (ii) at 12 cm a shift to species-poor grassland in a mosaic of dry heath and blanket mire, similar to that which is seen in the modern Exmoor landscape. This broad pattern of landscape openness through the last two millennia follows the established vegetation sequence on Exmoor.

There is no evidence of human activity relating directly to iron extraction in the vegetation history.

There is no evidence either of a hiatus in the pollen sequence or of reworking of palynomorphs. This suggests a complete sequence which is suitable for further geochemical analysis.

REFERENCES

Andersen, S T 1978 'Identification of wild grass and cereal pollen'. *Danmarks Geologiske Undersøgelse Årbog* 1978, 69-92.

Andrew, R 1984 *A practical pollen guide to the British flora.* QRA technical guide no. 1: Quaternary Research Association.

Badger, J 2000 *A Palaeoenvironmental Reconstruction of the River Barle Valley, Landacre Bridge, Exmoor.* Unpublished Undergraduate Dissertation, University of Exeter.

Bennett, K D 1994 *Annotated catalogue of pollen and pteridophyte spore types.* Unpublished report, Department of Plant Sciences, University of Cambridge.

Carter, V 2002 *Pollen analysis from Halscombe Allotment, Exmoor.* Unpublished Undergraduate Dissertation, University of Exeter.

Francis, P D & Slater, D S 1990 'A record of vegetation and land use change from upland peat deposits on Exmoor. Part 2: Hoar Moor'. *Somerset Archaeology and Natural History Society Proceedings* 134, 1-25.

Francis, P D & Slater, D S 1992 'A record of vegetation and land use change from upland peat deposits on Exmoor. Part 3: Codsend Moor'. *Somerset Archaeology and Natural History Society Proceedings* 136, 9-28.

Fyfe, R M 2000 *Palaeochannels of the Exe Catchment: their age and an assessment of their archaeological and palaeoecological potential.* Unpublished PhD thesis, University of Exeter.

Fyfe, R M, Brown, A & Coles, B J 2003a 'Mesolithic to Bronze Age vegetation change and human activity in the Exe Valley, Devon, UK'. *Proceedings of the Prehistoric Society* 69, 161-181.

Fyfe, R M, Brown, A G & Rippon, S J 2003b 'Mid- to late-Holocene vegetation history of Greater Exmoor, UK: estimating the spatial extent of human-induced vegetation change'. *Vegetation History and Archaeobotany* 12, 215-232.

Fyfe, R M, Brown, A G & Rippon, S J 2004 'Characterising the late prehistoric, "Romano-British" and medieval landscape, and dating the emergence of a regionally distinct agricultural system in South West Britain'. *Journal of Archaeological Science* 31, 1699-1714.

Jennings, S, Orford, J D, Canti, M, Devoy, R J N & Straker, V 1998 'The role of relative sea-level rise and changing sediment supply on Holocene gravel barrier development: the example of Porlock, Somerset, UK' *The Holocene* 8, 165-181.

Juleff, G & Bray, L 2007 'Minerals, metal, colours and landscape: Exmoor's Roman Lode in the Early Bronze Age' *Cambridge Journal of Archaeology* 17, 285-296.

Maltby, E & Crabtree, K 1976 'Soil organic matter and peat accumulation on Exmoor: a contemporary and palaeoenvironmental evaluation' *Transactions of the Institute of British*

Geographers 1, 259-278.

Merryfield, D L 1977 *Palynological and stratigraphical studies on Exmoor.* Unpublished PhD Thesis, Kings College London.

Merryfield, D L & Moore, P D 1974 'Prehistoric human activity and blanket peat initiation on Exmoor' *Nature* 250, 439-441.

Moore, P D, Webb, J A & Collinson, M E 1991 *Pollen analysis.* Oxford: Blackwell.

Stace, C 1991 *New flora of the British Isles.* Cambridge: Cambridge University Press.

Stockmarr, J. 1971 'Tablets with spores used in absolute pollen analysis'. *Pollen et Spores* 13, 615-621.

Straker, V & Crabtree, K 1995 'Palaeoenvironmental studies on Exmoor: past research and future potential'. In: Binding, H (ed.) *The changing face of Exmoor.* Exmoor Books, Tiverton, 43-51.

Ward, G K & Wilson, S R. 1978. 'Procedures for comparing and combining radiocarbon age determinations: a critique.' *Archaeometry* 20 (1), 19-31.

Wessely, H 2002 *Pollen analysis from Hoccombe Combe, Brendon Common, Exmoor.* Unpublished Undergraduate Dissertation, University of Exeter.

Table 3: Details of pollen sequences from Exmoor (for locations see Figure 1)

	site	grid ref (SS)	height	14C dates	site type	reference
1	Halscombe Allotment	81903347	350	yes	spring mire	Carter (2002)
2	Hoccombe Combe	77304440	380	no	spring mire	Wessely (2002)
3	Landacre Bridge	81653617	270	no	floodplain mire	Badger (2000)
4	Moles Chamber	71853937	420	yes	spring mire	Fyfe (2000)
5	Brightworthy	83333596	260	yes	floodplain mire	Fyfe *et al* (2003a)
6	Exebridge	93602527	120	yes	floodplain mire	Fyfe *et al* (2003a)
7	Pinkery Canal	72424146	435	no	buried soil	Maltby and Crabtree (1976)
8	Porlock Marsh	87774768	0	yes	marsh	Jennings *et al* (1998)
9	Hoar Moor	86264074	430	yes	blanket peat	Francis and Slater (1990)
10	Codsend Moor	87014106	455	yes	blanket peat	Francis and Slater (1992)
11	The Chains	73454200	480	no	blanket peat	Merryfield and Moore (1974); Straker and Crabtree (1995)
12	Hoar Tor	76344298	430	no	blanket peat	Merryfield (1977)
13	Alderman's Barrow	83684231	440	no	blanket peat	Merryfield (1977)
14	Brendon Common	77004500	410	no	blanket peat	Merryfield (1977)
15	Gourte Mires	82472969	300	yes	spring mire	Fyfe *et al* (2003b)
16	Long Breach	81863097	340	yes	spring mire	Fyfe *et al* (2003b)

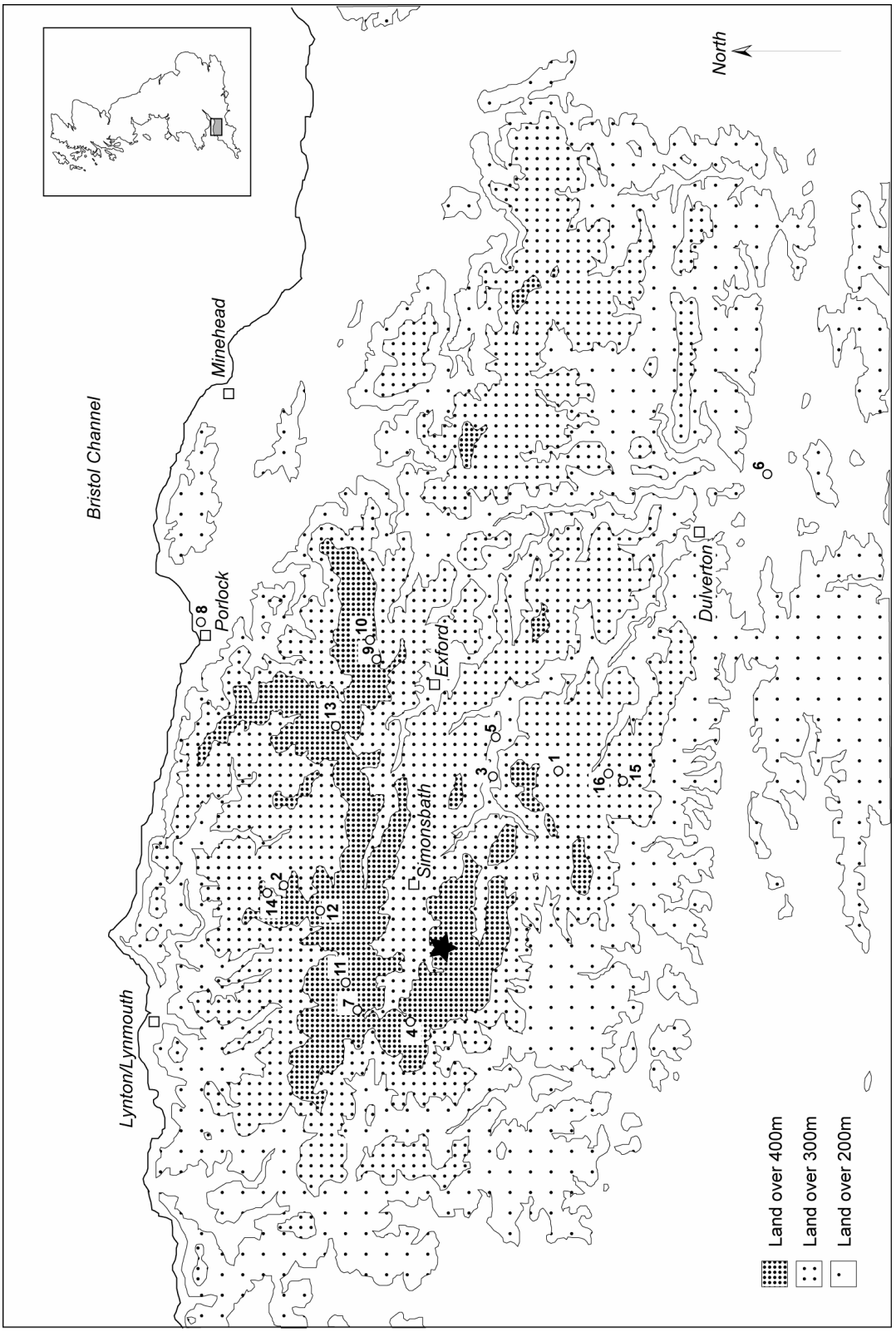


Figure 1 Location of Roman Lode on Exmoor (star) and sequences detailed in Figure 3 and Table 3.

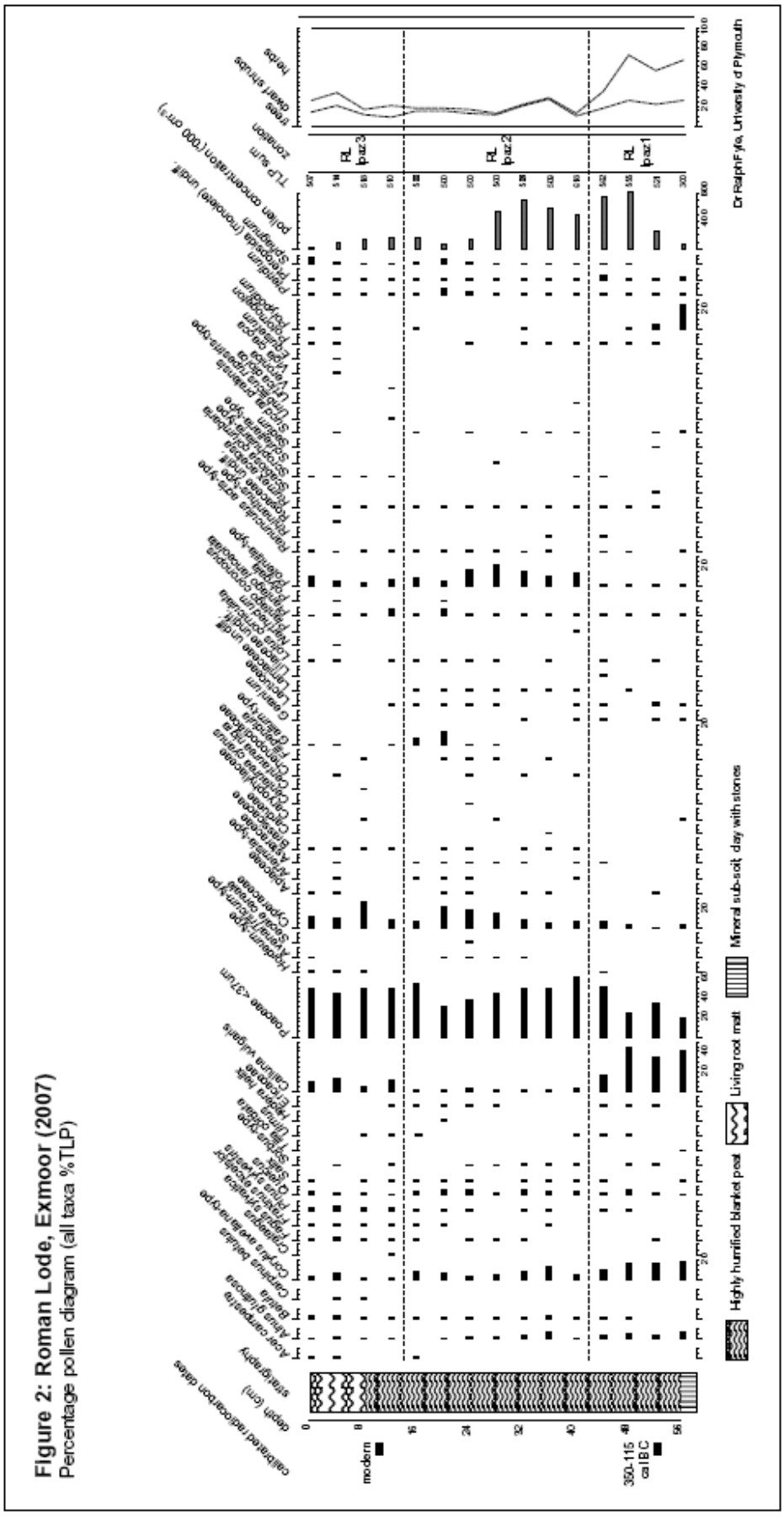


Figure 2: Roman Lode, Exmoor (2007)
Percentage pollen diagram (all taxa %TLP)

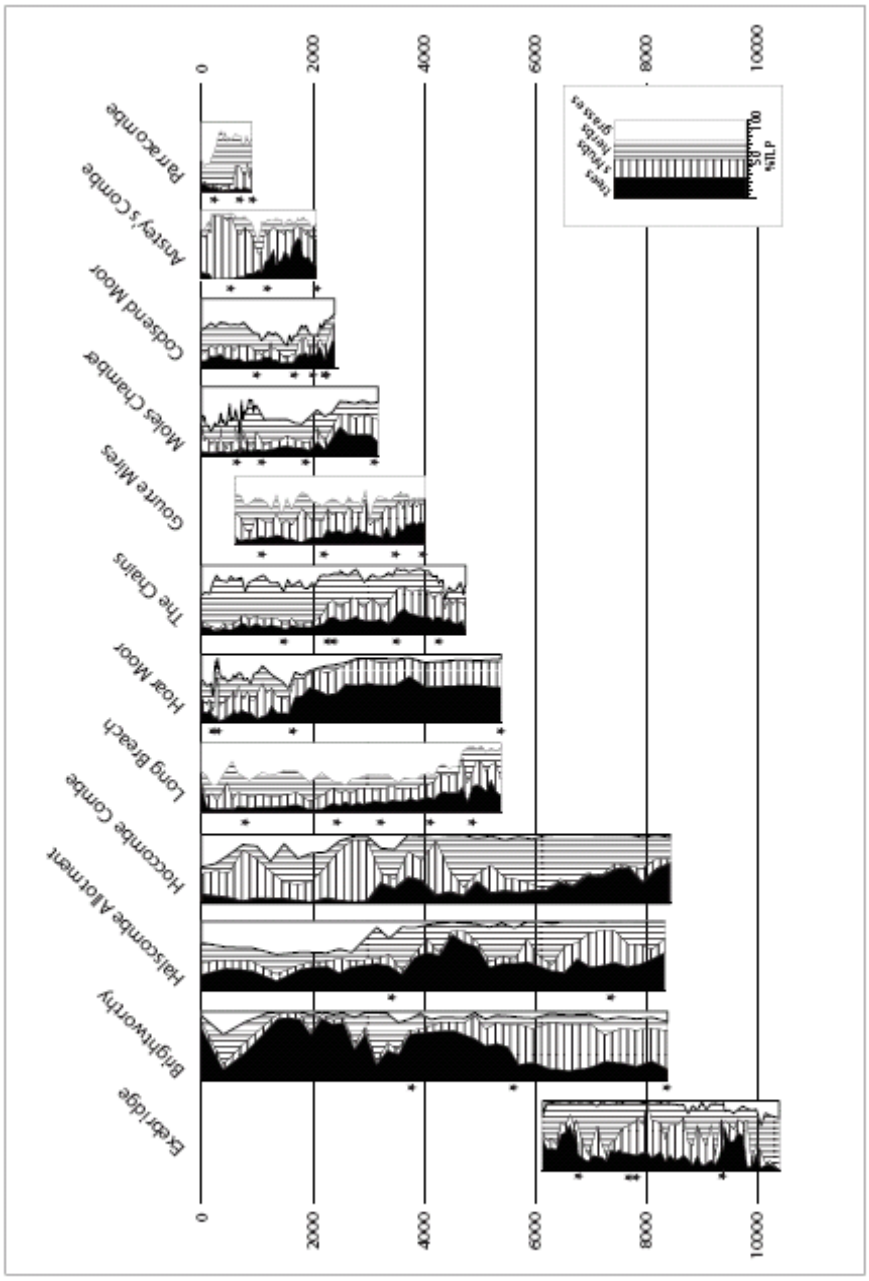
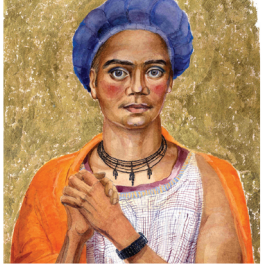


Figure 3: Summaries from dated Exmoor pollen diagrams



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