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HIGHWAYS AGENCY

Archaeology on the A303 Stonehenge Improvement

Appendix 2: Pollen

by Sylvia Peglar

Wessex Archaeology

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By Matt Leivers and Chris Moore

With contributions from

Michael J. Allen, Catherine Barnett, Philippa Bradley, Nicholas Cooke, John Crowther, Michael Grant, Jessica M. Grimm, Phil Harding, Richard I. Macphail, Jacqueline I. McKinley, David Norcott, Sylvia Peglar, Chris J. Stevens, and Sarah F. Wyles

and illustrations by

Rob Goller, S. E. James and Elaine Wakefield

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Appendix 2: Pollen

Sylvia Peglar

Summary

Ten samples from two non-feature sequences identified in evaluation trenches placed along a proposed change to the A303 near Stonehenge were assessed for their potential for pollen analysis. Pollen was found to be at very low concentrations and poorly preserved in all samples. Full analysis was not feasible, but 'extended assessments' were made on four samples from sample 15000 and one from samples 30/31.

Herb pollen accounts for *c*. 65% total land pollen and spores, but with *c*. 15% tree and shrub pollen, and 20% Pteridophytes (ferns and fern allies). The pollen assemblages are dominated by grasses (Poaceae undifferentiated), dandelion-type (*Taraxacum*-type), and bracken (*Pteridium aquilinum*), together with other herbs characteristic of chalk grassland – evidence of the land having been cleared. However, some woodland, particularly of oak (*Quercus*) and hazel (*Corylus avellana*), was still extant in the area. There is evidence of probable cereal cultivation and open, disturbed ground/footpaths nearby.

The pollen assemblages show that the sediments from both sequences were laid down post the 'elm decline' (ie, after *c*. 5000 BP) and post the 'lime decline', possibly dated to *c*. 3600 BP nearby, suggesting a Late Neolithic/Early Bronze Age date for the buried soils.

Introduction

Circumstances of the project

Wessex Archaeology (hereafter the client) undertook evaluations, ahead of proposed changes to the A303 near Stonehenge. During this work they identified and sampled two non-feature sequences, which were interpreted in the field as palaeo-argillic brown earths. One sequence was identified in a trial trench (54379, samples 30/31) and the other in a test-pit (48067, sample 15000).

Eighteen samples from these two non-feature sequences, 15000 and 30/31, were submitted for pollen assessment. The client supplied detailed sediment descriptions of the sequences in hard copy.

The aim of the pollen assessment was to include assessment level counts, range of taxa observed and state of preservation using a total of ten sub-samples, four from monolith sample 15000 and six from samples 30/31. Depending on these results, as many of the eighteen samples submitted by the client as were judged suitable were to be taken to analysis.

Location of the samples

Monolith sample 15000 from test-pit 121 was taken 350 m due south of Stonehenge itself, at *c*. NGR 412200 141800, through a probable palaeo-argillic brown earth (*Main Report*, Chapter 4). The second samples, 30/31, were taken from Trench 3 just to the north-west of Amesbury, at NGR 415073 142108, with two overlapping Kubiena tins from a suspected palaeo-argillic brown earth, associated with a spread of Late Mesolithic/Early Neolithic flints (*Main Report*, Chapter 2).

Methods

Laboratory methods

Volumetric samples were taken from the 10 samples, selected by the client for the initial assessment, and two tablets containing a known number of *Lycopodium* spores were added so that pollen concentrations could be calculated (Stockmarr 1971). 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 > 170 microns, 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 400x (1000x for critical examination) by 10 equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slides (Brooks and Thomas 1967). Pollen identification was made following the keys of Moore *et al*. (1991), Faegri and Iversen (1989), and a small modern reference collection. Andersen (1979) was followed for the identification of cereal grains. Indeterminable pollen was also recorded as an indication of the state of pollen preservation. Plant nomenclature follows Stace (1997).

Presentation of the results

The results from sample 15000 are shown in *Main Report*, Figure 1 as a pollen diagram depicting the pollen as percentages of the total terrestrial pollen and spore sum (sumP). Indeterminable pollen and spores and Sphagnum (bog moss) spores are percentages of sumP + sum indeterminable, and sumP + sum Sphagnum respectively. At the left of the figure is a composite diagram of the proportions of trees and shrubs, herbs and Pteridophytes (ferns and fern allies). The calculations and drafting of the diagram were achieved using TILIA and TILIA.GRAPH in TG View 2.02 (Grimm 1990).

The results from Samples 30/31 are shown in Table 1. It was only feasible to calculate percentages from sub-sample 0.04–0.05m. The data for the remaining sub-samples are expressed as the actual counts recorded

Results and interpretation

Unfortunately, pollen was present in extremely low concentrations and was generally poorly preserved. After assessment of the ten samples, it was judged that none of the samples were suitable for full pollen analysis. However, in order to gain some idea of the vegetation, land-use and chronology of the sites at the time of deposition, 'extended assessments' of the best of the samples were made. It was deemed that no further samples were worth analysing.

Sample 15000

Four sub-samples were assessed from this sequence. The concentration and preservation of the pollen from 15000 was slightly better than from 30/31, and the four sub-samples were given an 'extended assessment'. The results are shown in *Main Report*, Figure 1.

Indeterminable values were high (up to 50%) and pollen preservation was variable. Many of the grains were corroded and crumpled. The resulting pollen percentages must therefore be seen as biased: robust pollen grain types may survive and be recognised at the expense of more fragile grains. The sequence shows little change throughout and the very low concentrations of pollen suggest that the sediment probably accumulated rapidly. Microscopic particles of charcoal were abundant in all samples and were not quantified.

The pollen assemblages are dominated by the pollen of herbs (>60%) especially *Taraxacum*-type pollen: an extremely robust type which is recognisable even when very crumpled or corroded and including all the ligulate composite taxa such as *Taraxacum* (dandelion), *Leontodon* (hawkbits) and *Hieracium* (hawkweeds). Grass pollen (Poaceae undifferentiated) is also well represented, together with other pollen taxa associated with grassland, particularly chalk grassland, eg, Aster-type (*daisies*), Ranunculus (*buttercups*), Caryophyllaceae (pink family), *Helianthemum* (rock-rose), *Plantago lanceolata* (ribwort plantain), *Rumex acetosa*-type (sorrels), *Succisa pratensis* (devil's bit scabious), *Sanguisorba minor* ssp. *minor* (salad burnet), *Campanula*-type (bellflowers), Rubiaceae (bedstraws), and *Lotus*-type (bird's-foot trefoil).

The assemblages also contain some tree and shrub pollen – averaging *c.* 15% sumP. They include *Quercus* (oak), *Corylus avellana* (hazel) and *Alnus glutinosa* (alder). Ferns are also well represented, especially *Pteridium aquilinum* (bracken).

These assemblages may be interpreted as grasslands existing on the site but with some woodland still extant in the area, either as scattered trees/shrubs or small copses locally, or as woodland at some distance from the site. Most herbaceous taxa are entomophilous (pollinated by insects) and produce small amounts of pollen. Most trees and shrubs, including oak and hazel, are anemophilous, wind pollinated, and produce copious amounts of pollen. The abundant occurrence of more than 60% herb pollen therefore suggests that the site was not in a clearing in woodland but was a large open area with woodland at some distance. The high bracken values may be from bracken surviving in the grassland after woodland has been removed, or as a result of grazing.

However, there are a few grains of cereals present including *Hordeum*-type (barley-type) and *Triticum* (emmer or spelt), probable evidence for cereal growth nearby, as cereal grains are large and heavy and do not travel far from their origin. Some weeds that may be associated with arable fields and open waste ground are also present in the assemblages: including again dandelion-type, Brassicaceae (cabbage family), *Urtica* (nettles), and Apiaceae (cow parsley family).

In the early Holocene, Salisbury Plain was within the 'Lime province' and would have been covered with deciduous woodland, probably dominated by lime (*Tilia*) and including woodland with oak, hazel, and elm (*Ulmus*). Sequence 15000 appears to have accumulated after the elm decline as elm is virtually absent. This event appears to be more or less synchronous across North West Europe at *c*. 5000 BP and was probably caused by a mixture of human impact disturbing the forest and allowing in beetles carrying a form of disease similar to 'Dutch elm disease' (Peglar 1993).

The absence of lime pollen, a robust grain which survives very well and can be recognised even when very corroded, suggests that this sequence post-dates the lime decline. This event is not synchronous across England but is thought to be due to human impact (Turner 1962). At Sidlings Copse, Oxfordshire (Day 1991) this decline has been dated to *c.* 3600 BP and a similar date, of *c.* 3700 BP, has been recorded at Brede Bridge, East Sussex Weald (Waller and Marlow 1994). It is possible that clearance took place in the Stonehenge area at a similar time.

However, although the odd cereal grain is found during Neolithic times, more consistent finds of cereal grains and their accompanying weed floras, and large reductions in tree and shrub pollen evidencing woodland clearance, are not usually found until the later Neolithic or Early Bronze Age. At Winchester (Waton 1982; Greig 1996) evidence for cereal growth is present from *c.* 3500 BP – at about the same time as at Sidlings Copse. The evidence for cereals may suggest that the palaeo-argillic brown earth in sample 15000 was formed in the Late Neolithic or Early Bronze Age.

Sample 30/31

Six sub-samples were assessed from this sequence but only one (0.04–0.05 m) had a sufficient concentration and was well enough preserved to be assessed further. Some further analysis was made on sub-samples 0.12–0.13 m and 0.20–0.21 m. The results are shown in Table 1. It was only feasible to calculate percentages from sub-sample 0.04–0.05m. Charcoal particles were present in large quantities in all these samples.

The pollen assemblages found are similar to those above from 15000. It is very difficult to interpret anything from the limited data, bearing in mind the problems associated with the very low concentrations of pollen and the poor preservation which was worse than in 15000. Again, tree and shrub pollen values are low suggesting widespread clearance of the woodland had already taken place. Herb pollen, particularly dandelion-type, dominates the assemblages, and grassland seems to have prevailed. One cereal grain was found. This sequence appears to be of a similar age to 15000.

Table 1. Pollen counts from 30/31

Depth (m) *Context*	*0.04-0.05* *302*	*0.12-0.13* *303*	*0.20-0.21* *303*	*0.28-0.29* *303*	*0.36-0.37* *304*	*0.44-0.45* *304*
Trees & shrubs						
Pinus sylvestris	4 (4.2)	2	3	1		
Ulmus	1					
Corylus avellana	2 (1.7)	1	2			
Salix	1	2	2			
Quercus		2	1		1	
Tilia			1			
Alnus glutinosa			1			
Total	8 (6.8)	7	10	1	1	
Herbs						
Poaceae undiff.	19 (16.2)	6	11	3	4	2
Cerealia-type undiff.					1	
Hordeum-type	1					
Cyperaceae	5 (4.3)		1			
Aster-type	1	1				
Taraxacum-type	45 (39.4)	10	14	6	8	4
Chenopodiaceae	2 (1.7)	2	2	1		
Brassicaceae	14 (12.0)	16	4	2		2
Plantago lanceolata	3 (2.6)		1			
Ranunculus	1					
Rumex acetosa-type	1					
Apiaceae	1					
Matricaria-type			1			
Plantago undiff.					1	
Centaurea nigra-type						1
Total	93 (76.9)	35	34	12	14	9
Pteridophytes						
Monolete spores und.	3 (2.6)	2	1			
Pteridium aquilinum	13 (11.1)	3	5			1
Total	16 (13.7)		6			1
Total pollen & spores	117	47	50	13	15	10
Indeterminable	31 (20.9)	15	13	6	8	5

Numbers in brackets in 0.04-0.05m column are percentages of the total land terrestrial pollen & spores (sumP), except for 'indeterminable' which is percentage sumP + sum indeterminable.

Conclusions

The two sequences from A303 Stonehenge both appear to date from after the *Tilia* decline, and show that widespread woodland clearance had already taken place in the vicinity, although some trees and shrubs, either as scattered trees or copses locally, or woodland further away (with oak and hazel particularly), were still extant in the area. The vegetation on both sites seems to have been chalk grassland with a wide variety of herbs growing in the sward. Arable fields and waste ground/footpaths were probably close by. The pollen assemblages suggest that the two sequences may be of Late Neolithic or Early Bronze Age date.

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This volume reports on the archaeological works undertaken between 1998 and 2003 as part of the A303 Stonehenge Improvement highway scheme promoted by the Highways Agency.

The A303 trunk road and the A344 which pass Stonehenge are widely agreed to have a detrimental effect on its setting and on other archaeological features within the World Heritage Site. Around Stonehenge there is noise and visual intrusion from traffic and also air pollution. Each year nearly one million people visit the World Heritage Site and surroundings, using visitor facilities intended to cater for a much smaller number.

Many plans that might improve this situation have been examined, involving partnership working across many organisations. Common to all these has been the aim of removing traffic from the area of Stonehenge and at the same time addressing highways issues with regard to road capacity and safety.

This volume sets out the objectives of the extensive programme of archaeological work that was undertaken to inform the planning of the highway scheme, the methods used, the results obtained, and to explain something of the significance of works which provided a 12 km transect across the WHS and beyond: the first of its kind ever undertaken.

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