

The Archaeology of the A30 Bodmin to Indian Queens Road Scheme Specialist Report Archive

Pollen Analysis

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Introduction

Following the pollen assessment by Allen and Brown (OA client Report 2007) and discussions with the client, a decision was made to carry out full pollen analysis on the lower palaeochannel sequence identified in the stream valley south-west of Belowda Lane (chainage 3000-3200), and on the fill of one of the hengiform monument's pits (Site E). The Royalton Hengiform monument, situated c 1km south-west of the palaeochannel, was the earliest feature identified during the excavations, and the pollen record provided by the pit sequence may provide a detailed record of the immediate landscape surrounding the site during and after its use. The palaeochannel sequence, which spans the period between the middle Bronze Age and the modern period, is sufficiently close to the archaeological sites identified during the excavations, and may provide information on contemporary vegetation and land-use in the later prehistory and Roman periods.

Sediment Sampling

The palaeochannel sequence was sampled with two monoliths (samples 20005 and 20006), which overlapped by c 0.22m; monolith 20005 being the lower of the two and containing c 0.02m of the basal sandy gravel (context 2006) (see Figure **). The fill of the hengiform monument pit (1064) was sampled with a single monolith (sample 1053).

Laboratory Procedures

Sub-Sampling

The monoliths taken from the two sites were cleaned, described and sub-sampled for pollen. A total of 22 sub-samples were counted from the palaeochannel sequence (samples 20005 and 20006) and ten from the hengiform monument pit fill (sample 1053). The monoliths were initially sub-sampled at regular intervals or at discrete boundaries within the sediment sequence; subsequent sub-samples were then taken at observed changes in the pollen curve. In order to correlate the results from the two monoliths taken from the palaeochannel, depths from the top of the upper monolith (20006) are used in the pollen diagrams and discussion. Similarly, depths from the top of the single monolith taken from the hengiform monument pit are used in the pollen diagram and text.

Palynological Methodology

All samples were prepared for pollen analysis using a standard chemical procedure (method B of Berglund & 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 2000 cs silicone oil. Slides were examined at a magnification of 400x (1000x for critical examination) by equally-spaced traverses across at least two slides to reduce the possible effects of differential dispersal on the slide (Brooks & Thomas, 1967). Tablets with a known concentration of *Lycopodium* spores (Stockmarr, 1971) were added to a known volume of sediment at the beginning of the preparation so that pollen concentrations could be calculated if necessary. Counting continued until a sum of at least 500 land pollen grains was reached. Pollen identification was carried out using the standard keys of Faegri *et al* (1989) and Moore *et al* (1991), and the limited reference collection held at OA North. Cereal-type grains

were defined using the criteria of Andersen (1979). Microscopic charcoal fragments >5µm were counted where present. Plant nomenclature follows Stace (1997).

The results of the analyses were entered into the TILIA and TILIA.VIEW software packages (Grimm 1991, 2004) and the data are presented as percentage diagrams (Figures *, ** and ***). The percentage values are based on a pollen sum of all land pollen and fern spores but excludes aquatic taxa and indeterminate grains. All palynomorphs excluded from the pollen sum and charcoal values are expressed as a percentage of the pollen sum plus the group sum. The pollen taxa are listed alphabetically, however species of the same family are grouped together. The palaeochannel pollen diagrams are divided into local pollen assemblage zones (LPAZ) by visual changes in the pollen curves to aid the interpretation of the data.

Interpreting pollen data from palaeochannels and archaeological features has to be carried out with some degree of caution. Such features are likely to contain pollen from a variety of different sources in addition to the contemporary pollen rain. Although the pollen within the palaeochannel is likely to be from local sources, pollen may also be carried down by streams or originate from material eroding into the channel from its sides. Similarly, pollen within archaeological features is just as likely to originate from its eroding sides and from dumped material as it is from the contemporary vegetation.

Radiocarbon Dates

The Palaeochannel Sequence

Five radiocarbon dates were submitted from the palaeochannel sequence (see Section**), which are shown in Table *. Four of the dates came from the lower monolith (20005), however, in order to correlate the results with the pollen sequence and with the upper monolith (20006) the depths from the top of the upper monolith (20006) and equivalent OD heights are given. The results are discussed in relation to the depths from the top of the upper monolith.

The dates suggest that the surface of the palaeochannel is relatively young, which means, potentially, the sediments may contain a pollen sequence spanning c 3500 years, and record changes in the landscape surrounding the site from the middle Bronze Age through to the medieval/modern period; thus covering the time period of many of the settlement sites discovered during the excavations.

Monolith/depth from top (m)	Depth from top of 20006 (upper monolith) (m)	OD Height (m)	Laboratory number	Radiocarbon age (BP)	Calibrated date range (95% confidence)
20005/0.03-0.04	0.25-0.26	130.30-130.29	SUERC 10872	250 ± 35	AD 1510-1960
20006/0.30-0.32	0.30-0.32	130.25-130.23	SUERC 16075 (GU-15876)	200 ± 35	AD 1640-1960 (51.1% AD 1720-1820)
20005/0.20-0.22	0.42-0.44	130.13-130.11	SUERC 16074 (GU-15875)	995 ± 35	AD 980-1160
20005/0.31-0.33	0.53-0.55	130.02-130.00	SUERC 16076 (GU-15877)	2220 ± 35	390-200 cal BC

20005/ 0.42-0.43	0.64-0.65	129.91- 129.90	SUERC 10873	3115 ± 35	1500-1290 cal BC
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Table*: Summary of the radiocarbon dates from the palaeochannel

The Royalton Hengiform Monument (Site E), Pit 1064

Although a sheep/goat tooth from one of the pit fills of the henge provided an early medieval date, which suggests some level of contamination of the features. Charcoal from two pits (1128 and 1154) situated either side of pit 1064 provided dates of 2888-2623 cal BC (4175±45 BP; NZA 29340) and 2901-2665BC (4208±40 BP; NZA 29302). Thus placing the henge pits, or the charcoal from them at least, firmly in the Neolithic.

Results and Discussion

The Palaeochannel Sequence (Figures* and **)

The lower channel, approximately 10m wide and 0.5m in depth, consisted of horizontally bedded sandy silts and peats (context 2005) overlying natural sandy gravel (context 2006), and sealed by a deposit of sand with pockets of redeposited organics (context 2004), followed by *c* 3m of sand and gravel. Although closer examination of the sequence in the field showed that a possible break might have occurred during the accumulation of context 2005 in parts of the palaeochannel (OA Report 2007), this feature was very ephemeral at the sampling site (C. Champness pers com). Indeed, the dates (see above) and the pollen evidence do not indicate any form of substantial break in the record. The laminated sandy silts and peats represent changes in flow conditions, which are likely to have developed under relatively stable conditions.

LPAZ P1 (0.56-0.69m)

The pollen diagrams (Figures* and **) show that the relative abundance of arboreal pollen and herbaceous taxa is fairly consistent from 0.56m to 0.69m. Although a very slight increase in herbaceous pollen is recorded between 0.64m and 0.68m the percentages of arboreal and herbaceous pollen are more or less equal, with *Pteridophytes* representing *c* 10% of the pollen sum. *Alnus glutinosa* (alder) and *Corylus avellana*-type (hazel/myrica gale) dominate the tree and shrub assemblage, together with some *Betula* (birch). Low numbers of *Quercus* (oak) and *Calluna vulgaris* (heather) pollen are also recorded.

Poaceae (grass) and Cyperaceae (sedge) pollen dominate the herbaceous assemblage throughout this zone and the remainder of the pollen diagram. A fairly wide range of herbaceous taxa is recorded, which includes the disturbance indicator *Plantago lanceolata* (ribwort plantain) and common ruderals such as Lactutaceae (dandelion family), *Rumex acetosa/acetosella* (docks), *Solidago virgaurea*-type (daisy family), and *Ranunculus*-type (buttercups), which, together, may indicate the presence of wet meadows or pastures (Behre 1981). Other notable taxa include *Lotus* (bird's-foot trefoil), *Polygala* (milkworts) and *Succisa pratensis* (devil's-bit scabious), which are typical components of grassland. These, and many of the other herbaceous taxa present are represented by no more than a few grains. Cereal pollen grains, including *Hordeum*-type (includes cultivated barley and some wild grasses) and *Avena/Triticum*-type (wild or cultivated oat/wheat) pollen are recorded throughout the diagram, which may suggest some small-scale cultivation nearby; a very slight reduction in the cereal pollen signal takes place between 0.50 and 0.63m depth.

A number of aquatic taxa including *Potamogeton* (pondweed) and *Typha angustifolia*-type (lesser bulrush/bur-reed) are present throughout the whole of the diagram, and *Lemna* (duckweed), and *Myriophyllum alterniflorum* (alternate water-milfoil) are also recorded in LPAZ

P4. These taxa, perhaps unsurprisingly, indicate wet conditions and the presence of standing or slow flowing water within the palaeochannel during its infilling.

LPAZ P2 (0.325-0.56m)

Although the chief pollen types recorded in LPAZ P1 continue to dominate the assemblage in LPAZ P2, this zone appears to record a period of minor fluctuations in the relative abundance of arboreal pollen and herbaceous taxa. Perhaps caused by subtle changes in the flow conditions of the river during this time.

LPAZ P3 (0.25-0.325m)

The most significant change in the diagram occurs in this zone, in which arboreal pollen decreases to 20% and herbaceous pollen increases to *c* 75%. In addition, the arboreal assemblage shows a decline in *Alnus glutinosa* and *Corylus avellana*-type pollen with a corresponding increase in heathland taxa such as *Calluna avellana*, *Erica tetralix* (cross-leaved heath), Cyperaceae and *Pteridium aquilinum* (bracken). However, indeterminate pollen grains increase slightly during this zone, which may indicate a slightly more skewed dataset. Microscopic charcoal levels are slightly lower towards the base of this zone, which may indicate slightly less burning activity during this period.

LPAZ P4 (0.15-0.25m)

The arboreal pollen assemblage returns to its former values in this zone, which shows a recovery in *Alnus glutinosa* and *Corylus avellana*-type and a corresponding decline in *Calluna vulgaris* and Cyperaceae pollen. This may suggest a recovery in the woodland surrounding the site during this period, however, the stratigraphy at this level changes from sandy silt to sand and gravel, which, in the field, was seen to contain pockets of redeposited organic material. It is possible therefore, that this zone represents both contemporary and older pollen grains

The Royalton Hengiform Monument (Site E), Pit 1064 (Figure ***)

Pit 1064 was one of ten pits forming the circular segmented ditch of the henge feature and two of the pits provided material dated to the Neolithic. Pit 1064 contained a fairly complex sequence of clayey, sandy and organic silts, which were sampled with a single monolith (sample 1053).

Pollen preservation in the lower half of the pit fill was very poor, consisting of the occasional grains of Poaceae pollen and *Pteridophyte* spores. The lowermost sample containing sufficient pollen for a meaningful count was at 0.24-0.25m depth, and although pollen was sufficiently abundant in the upper 0.25m, the number of crumpled and corrosion grains was relatively high (reaching 30% in some cases), which may suggest some degree of reworking and/or post-depositional decay. In addition, the very high levels of *Pteridium aquilinum* (bracken) and *Pteropsida* (monolete) (fern) spores, which, being particularly resistant to decay, may indicate preferential pollen preservation.

Tree and shrub pollen represents less than 40% of the total sum and is generally slightly higher in the lower half of the sequence. *Corylus avellana*-type pollen dominates the arboreal assemblage and its values remain relatively constant throughout the profile, at between 10 to 20%. Low values of *Alnus glutinosa* pollen are also recorded and *Quercus* shows a steady decline from *c* 15% in the lower half of the profile to just the occasional grain in the upper half.

The diversity of herbaceous pollen taxa is generally fairly poor but includes some indicator species such as *Plantago lanceolata*, *Plantago major/media* (greater/hoary plantain), *Rumex cf acetosa* (common sorrel). These species, together with *Centaurea nigra* (common knapweed) and *Gentianella campestris*-type (gentians) indicate the presence of disturbed grassland or pasture.

The presence of *Drosera intermedia* (sundew) is interesting and, together with the occasional *Sphagnum* moss and *Lycopodium/Diphasiastrum* (clubmosses) spore, could suggest the local development of acid peaty conditions in or surrounding the pit during its final stages of infilling (E.Huckerby pers comm). The soil micromorphological study (Macphail and Crowther this report) also identified the development of an in-situ humic (and acidic) soil in the upper fill from this feature.

Levels of microscopic charcoal were consistently recorded at more than 80% of the pollen sum in the analysed part of the pit fill, and are therefore not included in the pollen diagram. In addition, >1mm charcoal fragments were recorded in the pollen sievings from 0.125m to 0.185m depth. Relatively large fragments of *Quercus* charcoal were recorded in many of the henge features (D. Challinor this report), which, along with the abundant charred lignified and monocotyledonous material (Macphail and Crowther this report) suggests on-site burning activity.

Interpretation

The Palaeochannel Sequence

The pollen evidence suggests that the landscape surrounding the palaeochannel from 1460-1290 cal BC (3115±35 BP; SUERC 10873) through to the post medieval/modern period consisted of primarily open grassland with some areas of hazel and oak woodland. Small-scale cereal production of barley, wheat and/or oat may have been taking place nearby from the early/middle Bronze Age onwards. The floodplain adjoining the channel was likely to have consisted of wet meadow or pasture with alder and birch carr; minor fluctuations in their relative abundance caused by subtle changes in the flow conditions of the river after 390-200 cal BC (2220±35 BP; SUERC 16076). It is possible that cereal cultivation decreased or ceased during this period, however this is very tentative from the available data. Interestingly, the charred macrofossil record from the nearby Belowda Roundhouse (Site B), which has been dated to 360-40 cal BC (2131±35BP; NZA 25410), indicates an environment of disturbed/waste ground and possible neglected arable land (Druce this report).

A significant change in conditions occurred just prior to AD 1640-1960 (200±35 BP; SUERC 16075/GU-15876) (with a 51.1% probability of being AD 1720-1820), which sees a substantial decline in the alder and birch carr growing on the floodplain and evidence of increased wetness and disturbance alongside the expansion of heathland. A subsequent recovery in the carr woodland and a return to former conditions may have occurred at AD 1510-1960 (250±35 BP; SUERC-10872), however, this interpretation is tentative given the evidence for reworked organic material at this level.

The Royalton Hengiform Monument (Site E), Pit 1064

The high level of possible reworked pollen and fern spores in the samples means that any interpretations from this feature remain tentative. With this caveat the data themselves are informative and the pollen record does appear to reflect some changes in surrounding environment. The evidence indicates that the environment surrounding the pit during the middle stages of its infilling during the late Neolithic/early Bronze Age? was primarily grassland/pasture with some hazel, birch and oak woodland nearby. A decline in oak pollen suggests increased disturbance during the later stages of infilling. The dominance of bracken spores, a plant typical of open/grazed woodland and heath/moorland may indicate some degree of soil acidification, possibly corroborating the evidence for the development of a podzolic soil at the site (see Macphail and Crowther this report). Indeed, evidence from this site and on Bodmin Moor indicates that podsolisation was taking place prior to the Bronze Age in many places (Gearey et al 2000b). Similarly, bracken is also very indicative of burning (E. Huckerby pers comm) and

burning activity in and around the site is certainly indicated by the charcoal and soil micromorphological evidence (D.Challinor and Macphail and Crowther this report).

Regional Context and Conclusions

A detailed study on the uplands of Bodmin Moor by Brown (1977) concentrated on much earlier deposits to those in this study. The results, however, along with early Holocene evidence produced by Gearey *et al* (2000a) can provide a regional context with which the Henge monument, in particular, can be discussed. Although there has been dispute over the extent of woodland cover on the very high and exposed areas of Bodmin moor, studies agree that hazel was the dominant species on the hillsides and may have formed a closed canopy during the early-Holocene. Alder became a component of the valleys and damper areas following its expansion at c 6500 BP, and more exposed sites on valley sides and higher ground contained openings dominated by ferns, grasses and a species-poor herb assemblage including *Succisa pratensis* (Geary *et al* 2000b). Although the pollen evidence suggests that very temporary and small-scale woodland clearance occurred during the earlier Holocene, studies agree that the first real signs of anthropogenic activity occur during the mid Neolithic on the high moors and during the late Neolithic in the lower valleys and slopes. An example of a later clearance episode has been dated to after 2880-2460 cal BC (4080±80 BP; Beta-84828) at Tresellern Marsh (c 240m OD) (Geary *et al* 2000b). Geary *et al* (2000b) interpreted these Neolithic clearances as seasonal or intermittent use of Bodmin Moor primarily for a pastoral economy. The pollen evidence from the Royalton Hengiform site indicates a very open and disturbed landscape of grassland/pasture with limited hazel dominated woodland by the time the pit feature was filling up. The very high level of bracken and the herbaceous assemblage do suggest grazing activity, however, the act of the monument building itself in terms of both wood use for the inner palisade and possible woodland clearance for site visibility must have had some affect on the immediate landscape surrounding it.

Evidence from previous studies indicates a fundamental change in the subsistence economy on Bodmin Moor during the early to middle Bronze Age (Brown 1977, Fowler 1983 cited in Wilkinson and Straker ****, Gearey *et al* 2000b), which sees a shift from an economy based primarily on pastoralism to a mixed farming regime. Although a period of late Bronze Age abandonment has been suggested by many workers, which is based on the archaeological evidence, there is no obvious change in the environment surrounding the palaeochannel from this site until much later. A slight reduction in cereal cultivation may have occurred during the Iron Age/ Romano British period, which matches a period of reduced land-use pressure suggested by Geary *et al* (2000b). However this pattern is very tentative based on the existing data and as Geary *et al* (2000b) suggest, it is highly likely that the economic basis of settlements in and around Bodmin in the later periods was likely to be very varied and piecemeal. The pollen evidence from the palaeochannel deposits suggest a relatively long period of settlement or farming activity from the early/middle Bronze Age, with a mixed economy of relatively non-intensive pastoralism and possible small-scale arable cultivation. A significant change took place during the post-medieval period, when land-use appears to have intensified dramatically, creating the heathland typical of Bodmin Moor today. A possible regeneration in woodland may have occurred after AD 1510-1960 (250±35 BP; SUERC-10872), however, unless a very local change, this is not in keeping with other records or, indeed, with the current vegetation surrounding the site.

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Bibliography

Allen, P, and Brown, 2007, Pollen Assessment, *A30 Bodmin to Indian Queens Road Improvement Scheme*. OA client Report

Andersen, S T, 1979, Identification of wild grass and cereal pollen, *Danm. Geol. Unders. Årbog 1978*, 69-92

Behre, K-E, 1981, The interpretation of anthropogenic indicators in pollen diagrams, *Pollen et Spores*, 23, 225-245

Brown, A P, 1977, Late Devensian and Flandrian History of Bodmin Moor, Cornwall, *Philosophical Proceedings of the Royal Society of London*, **B267**, 251-320

Faegri, K, and Iversen, J, 1989, *Textbook of modern pollen analysis*, 4th edn (Revised by K Faegri, P E Kaaland and K Krzywinski) Chichester

Geary, B R, Charman, D J, and Kent, M, 2000a, Palaeoecological Evidence for the Prehistoric Settlement of Bodmin Moor, Cornwall, southwest England. Part I: The Status of Woodland and Early Human Impacts, *Journal of Archaeological Science*, **27**, 423-438

Geary, B R, Charman, D J, and Kent, M, 2000b, Palaeoecological Evidence for the Prehistoric Settlement of Bodmin Moor, Cornwall, southwest England. Part II: Land Use Changes from the Neolithic to the Present, *Journal of Archaeological Science*, **27**, 493-508

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

Stace, C, 1997, *The New Flora of the British Isles*, Cambridge

Wilkinson, K, and Straker, V, 20/12/10 **** Neolithic and Early Bronze Age environments in south-west England