BIRMINGHAM ARCHAEO-ENVIRONMENTAL

BAE

Palaeoenvironmental Assessment of Samples from Bayston Hill Quarry, Shropshire

By

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1. INTRODUCTION

Birmingham Archaeo-Environmental (BA-E) was subcontracted by SLR Ltd to assess the palaeoenvironmental potential of deposits from an archaeological excavation at Bayston Hill quarry, Shropshire. The main aims of the assessment were to:

- Assess this material for the preservation of sub-fossil plant, pollen and coleoptera (beetles);
- Assess the preservation of charred plant remains;
- Determine the potential of this material to provide information regarding the environment and the possible role of human activity in landscape change;
- Provide recommendations for further analyses.

In addition, three samples of worked wood from a layer of brushwood at the site were sampled and submitted for radiocarbon dating (BHQ 9, 410, samples 005, 006 and 012). These wood samples were thin sectioned and submitted for species identification.

2. METHODS

The waterlogged plant, beetle and pollen assessments focussed on samples from a trench excavated through a Roman road. This included context 428, a grey, slightly organic silt deposit sealed by a layer of brushwood (410). A single bulk sample (Sample 19, 10l) was processed. In addition, a continuous monolith sequence (samples 16 and 17) through the clay road core beneath the brushwood layer was collected. Four sub-samples from this monolith (0, 0.08, 0.16 and 0.20m) were taken for pollen assessments.

2.1 Plant macrofossil assessment (waterlogged)

The bulk sample was processed at the University of Birmingham Archaeology using the standard method of paraffin flotation outlined in Kenward *et al.* (1980). The insect remains were then sorted from the paraffin flot. The resultant flot remainders together with the paraffin residue were then washed through a sieve with 300µm mesh using a mixture of detergent and water in order to remove the paraffin from the remaining organic material. The samples were then sorted in order to retrieve waterlogged plant-macrofossils

Plant material was identified under a low power binocular microscope at magnifications of x10 and x40. Identification was aided by use of a modern comparative collection and by using various seed identification manuals (Anderberg, 1994; Beijerinck 1947 and Berggren 1969 & 1981 and Cappers *et al* 2006). Nomenclature and habitat information follows Stace (1997).

2.2 Beetle assessment

The insect remains were sorted from the paraffin flot as described above and the sclerites identified under a low power binocular microscope at x10 magnification. The system for "scanning" faunas as outlined by Kenward *et al.* (1985) was followed. This assessment was undertaken to answer the following questions:

i. Are any insect remains of interpretative value preserved?

ii. Do any of the insects present suggest the nature of the surrounding environment at the time of deposit formation?

iii. Do any of the insects indicate the nature of human activity at and around the site?

2.3 Pollen assessments

Pollen preparation followed standard techniques including potassium hydroxide (KOH) digestion, hydrofluoric acid (HF) treatment and acetylation (Moore *et al.*, 1991). At least 125 total land pollen grains (TLP) excluding aquatics and spores were counted for each sample.

2.4 Plant macrofossils (charred)

Fifteen sub-samples (10 litres) of raw sediment were processed (Table 1). The samples were examined in the laboratory, where they were described using a pro forma and were processed using standard water flotation methods. Additional samples submitted for assessment were regarded as unsuitable for further work. These included sample 13 (very small poorly preserved wood fragments, unsuitable for identification or radiocarbon dating), 23, 24 and 25 (Dry silts and ?fire cracked stone, unsuitable for floatation).

The flot (the material from each sample that floats) was sieved to 0.5 mm and air dried. The heavy residue (the material which does not float) was examined and consisted mainly of heat shattered stone and other inorganic remains.

The flot was examined under a low-power binocular microscope at magnifications between x12 and x40. A four point semi quantitative scale was used, from '1' – one or a few specimens (less than an estimated six per kg of raw sediment) to '4' – abundant remains (many specimens per kg or a major component of the matrix). Data were recorded on a personal computer using a Microsoft Access database.

The flot was then sieved into convenient fractions (4, 2, 1 and 0.3 mm) for sorting and identification of charcoal fragments. Identifiable material was only present within the 4 and 2 mm fractions. A random selection of c. 100 fragments of charcoal of varying sizes was made for identification. Where samples did not contain 100 identifiable fragments, all fragments were recorded. This information is recorded with the results of the assessment in Table 2 below. Identification was made using a reference collection and the wood identification guides of Schweingruber (1978) and Hather (2000). Taxa were identified only to genus due to a lack of defining characteristics in charcoal material.

2.5 Radiocarbon dating and wood species identification

The three samples of worked roundwood (410) submitted for radiocarbon dating were all identified as *Sambucus* spp. (elder). In addition, three samples of wood charcoal (Samples 22, 30 and 31 – see Table 1) were submitted for radiocarbon dating. The samples were all sent to Beta Analytic Inc., Miami, Florida, for dating using the AMS method.

3. RESULTS

3.1 Plant macrofossils (waterlogged)

The flot was rich in identifiable waterlogged plant remains. Those seeds are from a range of species likely to be growing in the area around the sampling site. The species present included stinging nettle, buttercups, sedges, bramble, docks, goosefoots, (*Urtica dioica*, *Ranunculus* spp., *Carex* spp., *Rubus fructicosus*, *Rumex* spp., *Chenopodium* spp.). These species suggest damp grassland, with taxa such as brambles, goosefoots, docks and nettles suggesting somewhat disturbed soils. There is no indication of woodland in this sample.

3.2 Beetles

The insect fauna recovered was very small, eroded and fragmented suggesting poor preservation. Only two taxa were recovered in significant numbers (Table 1). This included species of the *Aphodius* ('dung beetles'). this probably indicates that herbivores, possibly cattle, were grazing in the area since they are commonly associated with animal dung lying in pasture. The other species recorded was *Notaris acridulus* is a weevil which is normally associated with reed-sweet grass (*Glyceria maxima* (Hartm.) Holmb., a tall reed-like herb that grows in or at the margins of wetlands.

The presence of dung beetles would seem to confirm the results of the plant assessment. The area around the sampling site was open grassland that was probably created and/or maintained by grazing. It would seem probable that this reflects the pastoral farming activities of local human communities, although the dung beetle may derive in whole or part from wild animal populations.

3.3 Pollen

No palynomorphs were present in any of the samples. It is likely that this reflects the preservation of low concentrations of microfossils in the largely inorganic silt deposit.

3.4 Plant macrofossils (charred)

Table 2 shows the components recorded from each of the samples. No charred seeds were identified in any of the samples. Root/rootlet fragments were ubiquitous which may indicate disturbance of the archaeological features by bioturbation. Such disturbance is further confirmed by the presence of probable modern insect remains in nine of the samples and earthworm egg capsules in five of the samples. Seeds similar in appearance to waterlogged plant macrofossils were present in small numbers in three of the samples. The preservation of these was excellent and those recorded (*Chenopodium* spp./ *Atriplex* spp. and *Carex* spp.) are species often found in varying abundance in archaeological samples as modern contaminants.

Charcoal was recorded in all the samples, although the preservation of the fragments was variable both within and between the samples. Some of the charcoal was firm and crisp permitting clean surfaces where identifiable characteristics were visible. However, a lot of the fragments were very brittle, and the material tended to crumble or break in uneven patterns making the identifying characteristics harder to distinguish. The results of the assessment of identifiable charcoal on nine of the samples are given in Table 2.

The range of taxa identified (Table 3) includes *Quercus* (oak), *Alnus* (alder), *Corylus* (hazel), *Fraxinus* (ash), hawthorn/apple/*Sorbus*-group, Pomoideae), *Salix*/*Populus* (willow/ populus) and *Betula* (birch). These taxa belong to the groups of species represented in the native British flora. The wood was therefore derived from a range of slightly different habitats including woodland (*Quercus*), wetland or damper soils (*Alnus*, *Salix*), and scrub/woodland edge (*Fraxinus*, *Corylus* and species of the Pomoideae).

However, *Quercus* is the most abundant of the identified charcoal fragments, with *Fraxinus* and *Corylus* also relatively well represented. It can be noted that *Quercus, Fraxinus* and *Corylus* are regarded as producing excellent firewood (Stuijts 2005). *Alnus* was also well represented in Sample 26 (614 – pit feature). This wood is a relatively poor firewood, but makes excellent charcoal, raising the possibility that production of charcoal was being carried out at the site.

There are a number of variables that affect the representation of species in samples of archaeological charcoal, which range from environmental as and/or social factors in the selection of different materials in antiquity, as well as the various factors of taphonomy and preservation (Thery-Parisot 2002). The relative proportions of taxa should not be considered proportionately representative of the abundance of wood resources in the local environment, and are more likely to reflect particular choices of fuel. The presence of bark on some of the charcoal indicates that the material is more likely to have been burnt in an unworked state, rather than derived from waste structural timber for example.

3.5 Radiocarbon dating

The results of the radiocarbon dating of the roundwood samples are summarised in Table 4. Radiocarbon dates were calibrated using Intcal04 (Reimer *et al*., 2004). All analyses are reported as having proceeded normally.

The samples date to the late Iron Age/early Romano-British period. The implications of this for the age of the construction of the road are unclear, but one of the dates 2120±40 BP (Beta-265657; BC 350-300 and 210-40) would appear to fall clearly within the Iron Age, whilst the other two 1980±40 BP (Beta-265656; BC 50-90 AD) and 2050±40 BP (Beta-265658; BC 170-50 AD) span the later Iron Age and early Romano-British period. This may indicate that the material used in the brushwood layer was of different ages. The charred wood from Samples 22, 30 and 31 dates to the Bronze Age (Table 4).

4. DISCUSSION AND CONCLUSIONS

Poor preservation of relatively low concentrations of waterlogged plants and beetles in the sample from Context 428 prevents detailed discussion, but the presence of dung beetles would seem to confirm the results of the plant assessment. The area around the sampling site was apparently open grassland that was probably created and/or maintained by grazing. It would seem probable that this reflects the pastoral farming activities of local human communities, although the dung beetle may derive in whole or part from wild animal populations. The indications of dung is paralleled by the results of soil micromorphological analyses of the underlying Context 430 which produced evidence of faecal sphelurites and dung residue (Macphail 2010). The combined datasets would thus suggest the movement of animal traffic along the road as well as possible grazing in the areas adjacent.

The use of *Sambucus* in the brushwood layer 410 is somewhat unusual as it is a taxa not often encountered in archaeological contexts. There are two native species of the genus, *S. nigra* (elder/ elderberry) and *S. ebulus* (danewort/ dwarf elder), both of which are typical of moist loamy soils, and grow in a range of habitats including wasteground, woodland edge and scrub. Presumably the choice of this wood reflects its local availability, but it can also be observed that much folklore surrounds the elder tree. Whether this has any relevance in terms of the archaeological record must remain a moot point.

The bulk samples produced no plant macrofossil remains of interpretable value, other than charcoal remains from nine of the samples. The difference in preservation between these deposits and the sample from 428 can be explained by the fact that the latter was originally deposited in a fluvial context and appears to have remained at least partially waterlogged, hence the preservation of some organic material. The samples from the other contexts represent relatively dry pits fills, spreads etc. which have clearly been free draining and hence without the potential for preservation of any uncharred material.

The three samples of wood from the pit fills 22, 30 and 31 have been dated to the Bronze Age. This would suggest that these pits represent an earlier phase of activity, predating the construction of the road. However, the residence of charcoal in archaeological contexts and the possibility of re-working and re-deposition must also be considered. It is possible that the dated samples represents residual material. This may also indicate that other undated features on the site also pre-date the construction of the trackway/road in the Iron Age/Romano-British period.

The charcoal itself reflects the burning of several wood/shrub species native to Britain, including *Quercus, Fraxinus*, *Alnus* and *Corylus*. The absence of other plant remains such as seeds, may reflect selective preservation in the samples. However, the presence of charcoal fragments, including those less than 1 mm in size, can be regarded as a good indication that the lack of other plant remains is a broadly accurate reflection of the original contents of the sampled features. It seems likely that no plant remains other than charcoal were deposited in these features in antiquity.

It could be tentatively suggested that the range of wood represented might suggest burning of felling debris rather than activity associated with a domestic context. The relative abundance of charcoal in the context identified as road covering (Sample 3), for example, may be further evidence that this material was derived from burning associated with the construction of the road, perhaps the clearance of areas of scrubby vegetation. However, the Bronze Age date for charcoal samples from the pit fills may suggest a lengthy chronology of human activity at the site and somewhat complicated relationships between the different features.

5. ARCHIVE

The samples, sub-samples and all electronic and paper records pertaining to the work are held at BA-E. These samples will be retained until further notice.

6. REFERENCES

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Context number	**428**
Sample no.	**19**
COLEOPTERA	
Carabidae	
Bembidion spp.	+
Staphylinidae	
Stenus spp.	+
Scarabaeidae	
Geotrupes spp.	
Aphodius spp.	+++
Curculionidae	
Apion spp.	+
Notaris acridulus (L.)	++

Table 1: Results of the Bayston Hill insect assessment.
Key: + = 1-2 individuals ++ = 2-5 individuals +++ = 5-10 individuals ++++ = 10+ individuals +++++ = 20+ individuals.

Sample No. **Context No.** **Sample volume (L)**	**1** **002** **10**	**2** **512** **10**	**3** **516** **10**	**4** **400** **10**	**15** **430** **10**	**20** **11** **10**	**21** **21** **10**	**22** **19** **10**	**26** **614** **10**	**27** **619** **10**	**28** **624** **10**	**29** **27** **10**	**30** **24** **10**	**31** **29** **10**	**32** **625** **10**
Charcoal fgts.	4	3	4	3	3	4	3	4	4	3	4	3	4	4	4
Earthworm egg capsules	1	-	-	1	1	-	-	1	1	-	-	-	-	-	-
Herbaceous detritus	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
Insect fgts.	1	1	-	1	1	1	1	2	1	1	-	-	-	-	-
Plant macros.	-	-	-	-	1	-	1	-	-	1	-	-	-	-	-
Root/rootlet fgts.	2	4	2	3	3	2	4	3	3	3	3	2	3	2	2
Sand	-	-	2	3	2	-	4	4	3	2	3	4	3	4	4
Stones	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-

Table 2: Components of the subsamples from Bayston Hill Quarry, Shropshire. Semi quantitative score of the components of the samples is based on a four point scale, from '1' – one or a few remains (less than an estimated six per kg of raw sediment) to '4' – abundant remains (many per kg or a major component of the matrix). Earthworm capsules and roots/rootlets are likely to be modern contaminants.

Name	**Vernacular**	**Sample 1 (002)** **300+ fgts** **30mm** **Pit fill**	**Sample 3 (516)** **500+ fgts** **43mm** **Charcoal spread/ road covering**	**Sample 20 (11)** **300+ fgts.** **50mm** **Pit fill**	**Sample 22 (19)** **150+ fgts.** **23mm** **Pit fill**	**Sample 26 (614)** **200+ fgts.** **30mm** **Pit fill**	**Sample 28 (624)** **55 fgts.** **17mm** **Pit fill**	**Sample 30 (24)** **10 fgts.** **6mm** **Pit fill**	**Sample 31 (29)** **10 fgts.** **8mm** **Pit fill**	**Sample 32 (625)** **100+ fgts.** **26mm** **Pit fill**
Alnus glutinosa	Alder	-	-	-	13	32	-	-	-	-
Alnus/*Corylus*	Alder/Hazel	7	-	-	-	18	10	-	-	-
Betula spp.	Birch	-	-	-	6	10	-	2	1	-
Corylus avellana	Hazel	-	4	-	25	-	19	1	-	14
Fraxinus excelsior	Ash	9	6	-	-	-	-	1	2	16
Quercus	Oak	68	64	62	7	43	5	4	4	25
Pomoideae	Hawthorn/apple/*Sorbus* Group	-	11	-	14	-	10	-	-	-
?Salix/Poplar	?Willow/Poplar	-	-	-	-	-	-	-	-	35
	Indeterminate	16	15	38	35	4	11	2	3	2

Table 3: Complete list of taxa recovered from deposits at Bayston Hill Quarry, Shropshire
Taxonomy and nomenclature follow Schweingruber (1978). Numbers are identified charcoal fragments per sample.

Sample	Lab Code	Material	Conventional Age BP	13C/12C o/oo	2 sigma calibration
BHQ5	Beta-265656	Wood (*Sambucus* sp.)	1980±40	-25.8	BC 50-90 AD
BHQ6	Beta-265657	Wood (*Sambucus* sp.)	2120±40	-26.4	BC 350-300 and 210-40
BHQ12	Beta-265658	Wood (*Sambucus* sp.)	2040±40	-25.9	BC 170-50 AD
BHQ22	Beta-273087	Charred wood (*Corylus*)	3340±40	-24.2	BC 1740-1520
BHQ30	Beta-273088	Charred wood (*Quercus*)	3300±40	-23.7	BC 1680-1500
BHQ31	Beta-273089	Charred wood (*Quercus*)	3050±40	-27.4	BC 1390-1120

Table 4: Results of Bayston Hill radiocarbon dating

Appendix 1

Radiocarbon Dating Certificates

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.8:lab. mult=1)

Laboratory number: **Beta-265656**

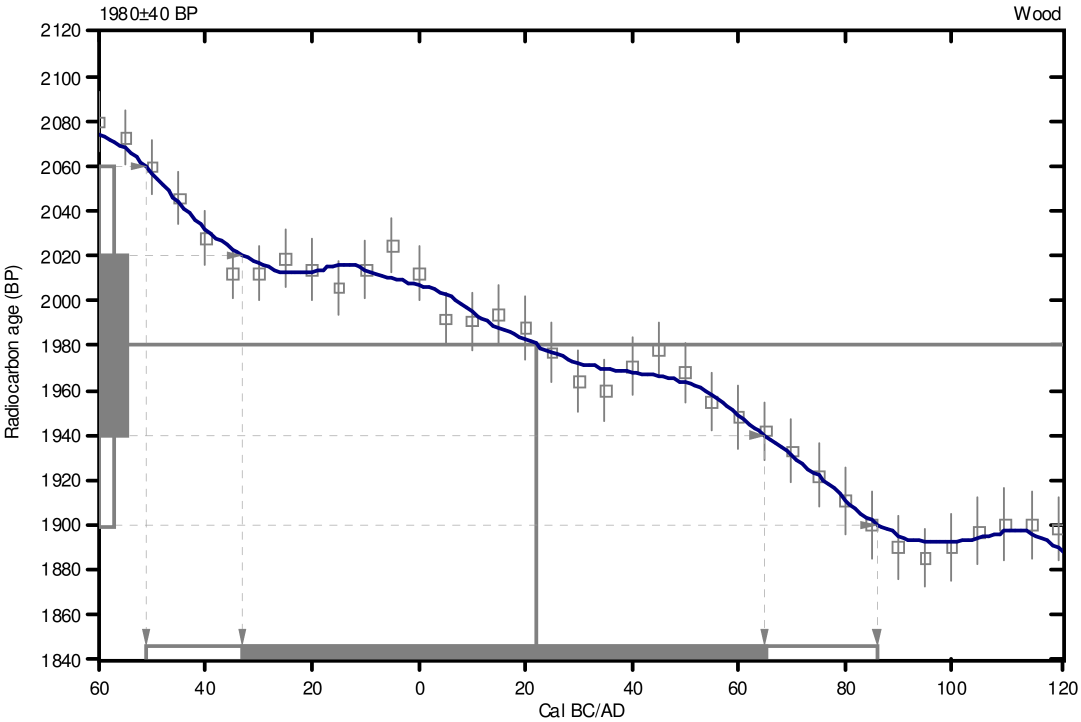
Conventional radiocarbon age: **1980±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 50 to Cal AD 90 (Cal BP 2000 to 1860)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 20 (Cal BP 1930)

1 Sigma calibrated result: (68% probability) Cal BC 30 to Cal AD 60 (Cal BP 1980 to 1880)



References:
Database used
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Calibration Database
INTCAL04 Radiocarbon Age Calibration
IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-26.4:lab. mult=1)

Laboratory number: **Beta-265657**

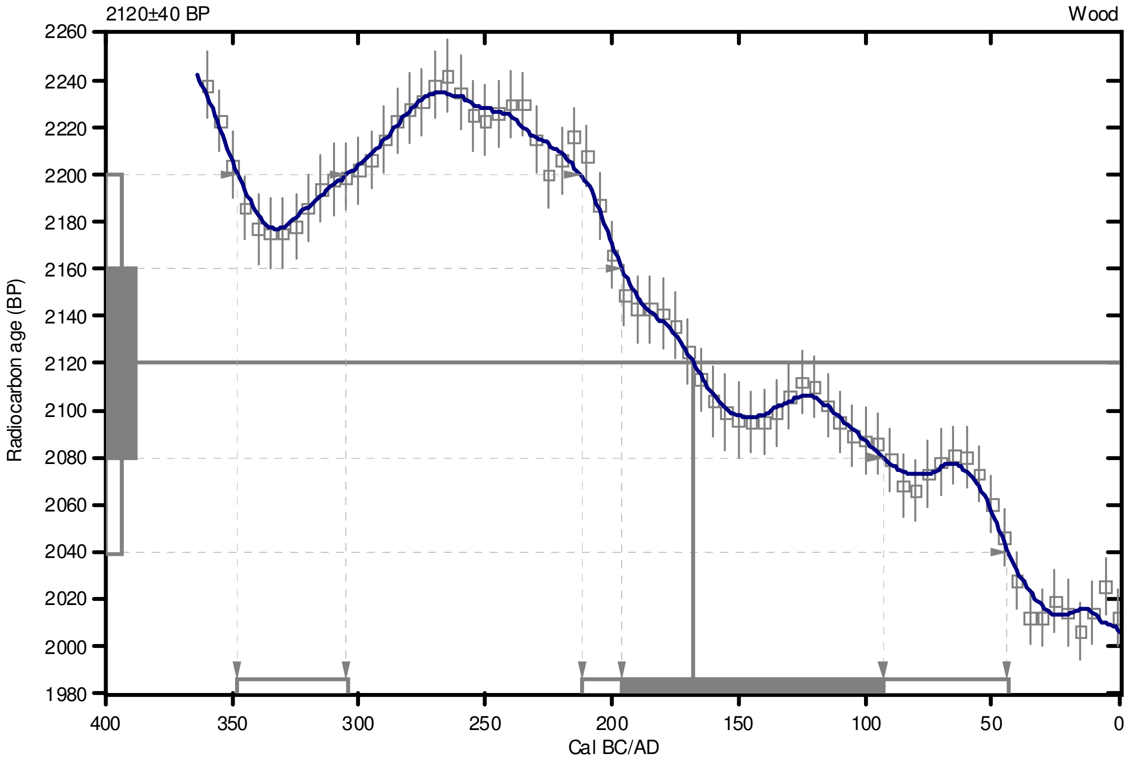
Conventional radiocarbon age: **2120±40 BP**

2 Sigma calibrated results: **Cal BC 350 to 300 (Cal BP 2300 to 2260) and**
(95% probability) **Cal BC 210 to 40 (Cal BP 2160 to 1990)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 170 (Cal BP 2120)

1 Sigma calibrated result: Cal BC 200 to 90 (Cal BP 2150 to 2040)
(68% probability)



References:

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.9:lab. mult=1)

Laboratory number: **Beta-265658**

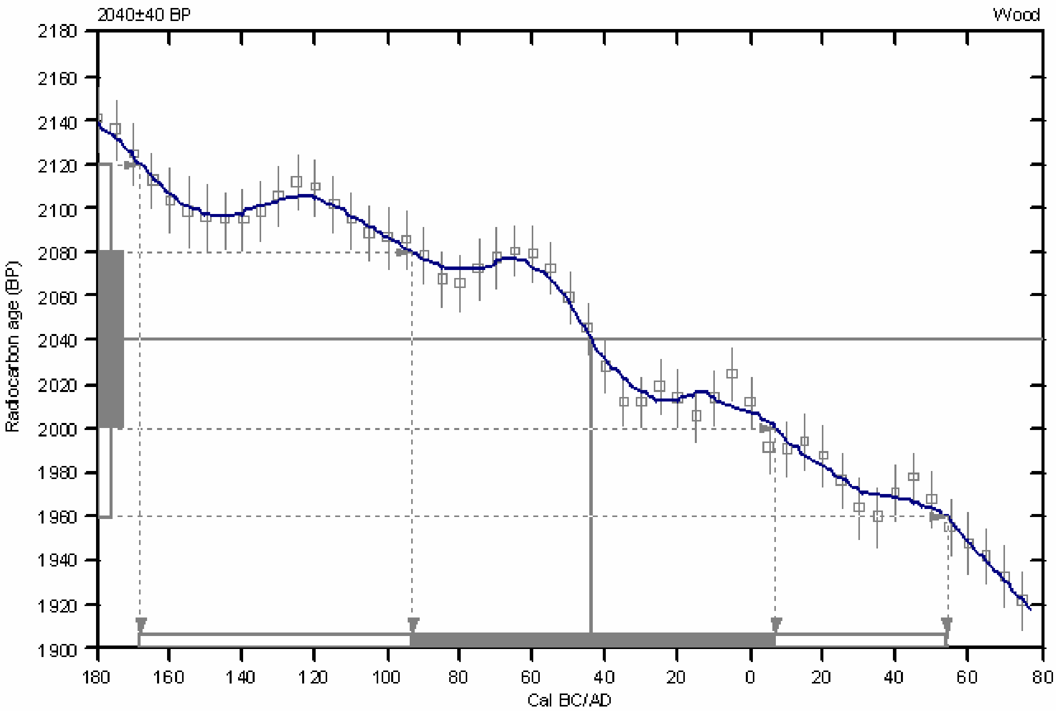
Conventional radiocarbon age: **2040±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 170 to Cal AD50 (Cal BP 2120 to 1900)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 40 (Cal BP 1990)

1 Sigma calibrated result: (68% probability) Cal BC 90 to Cal AD 10 (Cal BP 2040 to 1940)



References:

Database used

INTCAL04

Calibration Database

INTCAL04 Radiocarbon Age Calibration

IntCal04: Calibration Issue of Radiocarbon (Volume 46, nr 3, 2004).

Mathematics

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.2:lab. mult=1)

Laboratory number: **Beta-273087**

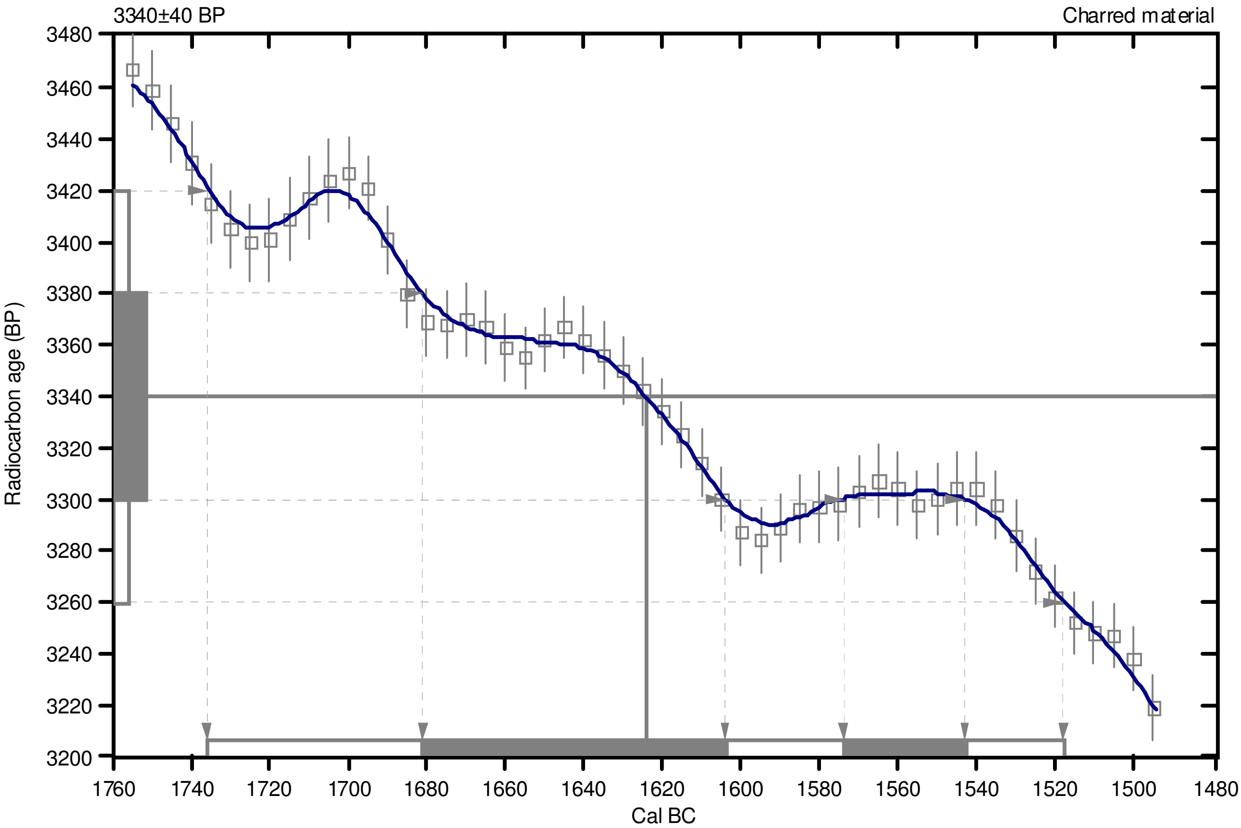
Conventional radiocarbon age: **3340±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 1740 to 1520 (Cal BP 3690 to 3470)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 1620 (Cal BP 3570)

1 Sigma calibrated results: (68% probability) Cal BC 1680 to 1600 (Cal BP 3630 to 3550) and Cal BC 1570 to 1540 (Cal BP 3520 to 3490)



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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.7:lab. mult=1)

Laboratory number: **Beta-273088**

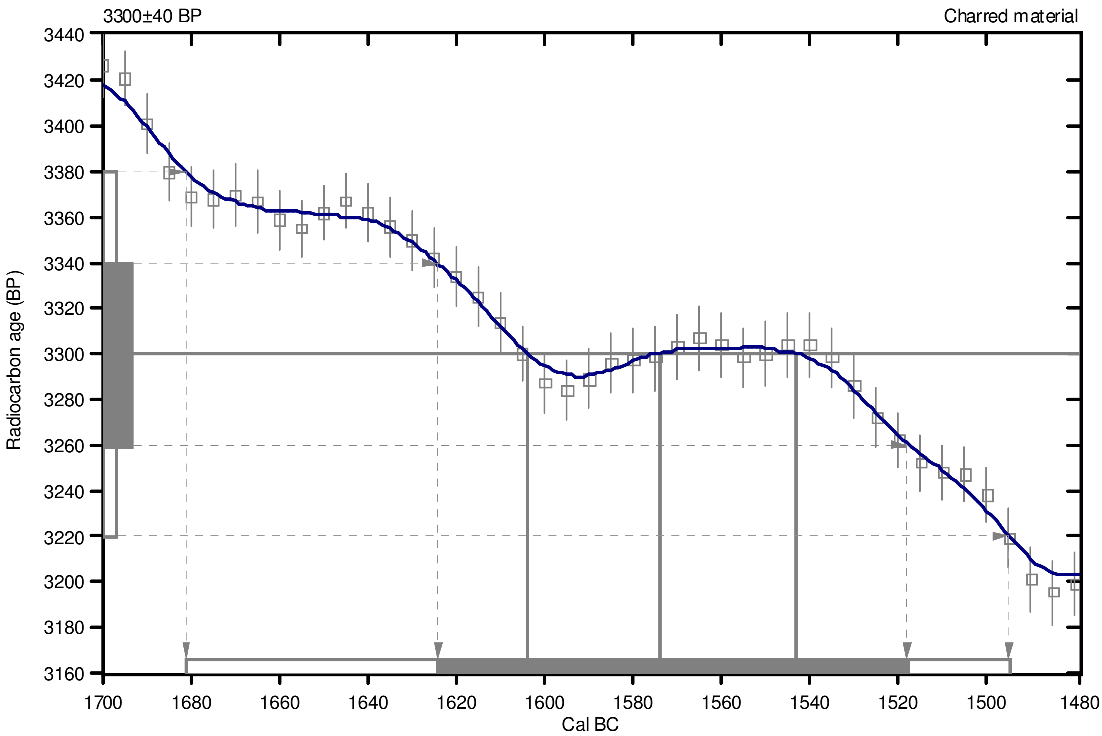
Conventional radiocarbon age: **3300±40 BP**

2 Sigma calibrated result: **Cal BC 1680 to 1500 (Cal BP 3630 to 3440)**
(95% probability)

Intercept data

Intercepts of radiocarbon age
with calibration curve: Cal BC 1600 (Cal BP 3550) and
Cal BC 1570 (Cal BP 3520) and
Cal BC 1540 (Cal BP 3490)

1 Sigma calibrated result: Cal BC 1620 to 1520 (Cal BP 3570 to 3470)
(68% probability)



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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-27.4:lab. mult=1)

Laboratory number: **Beta-273089**

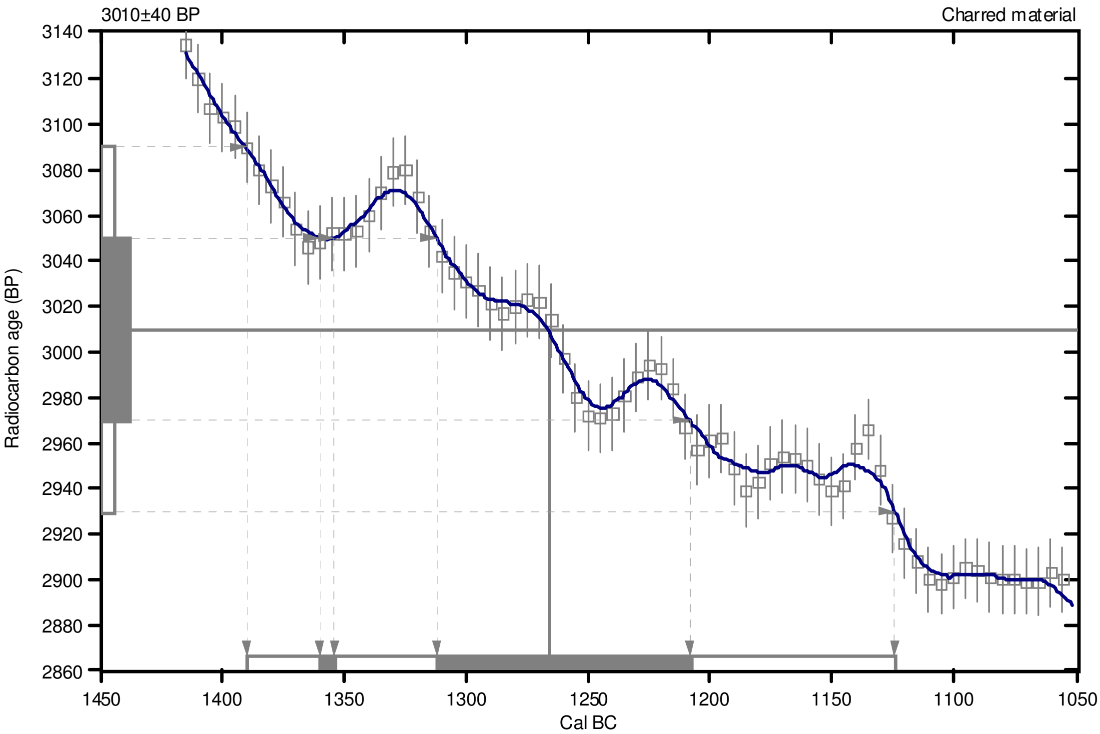
Conventional radiocarbon age: **3010±40 BP**

2 Sigma calibrated result: **Cal BC 1390 to 1120 (Cal BP 3340 to 3070)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 1270 (Cal BP 3220)

1 Sigma calibrated results: Cal BC 1360 to 1350 (Cal BP 3310 to 3300) and
(68% probability) Cal BC 1310 to 1210 (Cal BP 3260 to 3160)



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