Wearmouth-Jarrow geoarchaeological evaluation (Phase 3 of 3):
Palynological assessment of a site near the A195 Washington Expressway, Washington, Tyne and Wear

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Wearmouth-Jarrow geoarchaeological evaluation (Phase 3 of 3): Palynological assessment of a site near the A195 Washington Expressway, Washington, Tyne and Wear

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1. Introduction

This report summarises the results of a palaeoecological assessment of a sediment core recovered from a channel-like depression in the grounds of the John F. Kennedy Primary School, located to the west of the A195 Washington expressway between the Barmston and Columbia districts of Washington, Tyne and Wear (Fig. 1). The site lies in the shallow valley of a small unnamed tributary stream of the River Wear, located 1.2 km upstream from the confluence with the Wear and 8.5 km from St Peter's Monastery (Fig. 1), and was chosen for detailed analysis on the strength of desk-based assessment (Passmore, 2009) and field evaluation (Passmore, 2009; ARS, 2011) that aimed to identify organic-rich sedimentary sequences in the hinterland of the candidate dual World Heritage site of Wearmouth-Jarrow.

Although presently urbanised, the 1862 and 1899 OS maps show the area as poorly drained open fields that lie upstream of the Washington Chemical Works reservoir (Fig. 2), and the local valley fill is mapped by the BGS Superficial Geology coverage as Quaternary peat deposits that are surrounded by glaciofluvial sand and gravel spreads (Fig. 1). Much of the area has been urbanised during the twentieth century and has been bisected by the A195, but areas of open ground survive to either side of the expressway and were available for sediment coring (Fig. 3). Evaluation of 7 coring sites in the valley floor to the east and west of the A195 revealed the greatest thickness of organic-rich sediment (136 cm) to be preserved in the grounds of the John F. Kennedy Primary School (ARS, 2011; Core 2; Fig. 4). Accordingly, this site was re-cored in order to recover material for palaeoecological and ^{14}C analysis.

2. Sedimentary sequence at Core 2

Organic-rich sediments at Core 2 lie beneath 104 cm of topsoil and made ground and reach a thickness of 136 cm (Table 1). These comprise compact silty peats between 104-170 cm (including occasional sandy silt lenses and abundant plant macrofossils and wood fragments) that overlie 70 cm of organic-rich silts and calcareous precipitate. Basal sediments in the sequence comprise calcareous silts with organic inclusions between 240-269 cm. Coring was terminated at an impenetrable level at 269 cm. Three samples were submitted to SUERC for ^{14}C dating at 110 cm (MW110: peat, humic acid fraction), 140 cm (MW140: wood, Salix s.p.) and 164 cm (MW164; wood, Salix s.p.) (Appendix 1), and thirteen samples (spanning 104-166 cm) were analysed for pollen content.

3. Methods

Pollen samples were prepared using standard techniques (Moore *et al*. 1991) including HF treatment and acetylation. Counting was carried out using a Meiji Microscope at a magnification of x 500. Usually, assessment level counts would be made of at least 125 total land pollen grains (TLP). However, pollen concentrations were very low in all the samples and hence one complete slide was counted for each sample. Pollen nomenclature follows Bennett *et al.* (1994).

4. Results

The results of pollen analysis are provided in Table 2 and show little variation in the general range of taxa recorded in the sequence; these include trees/shrubs *Alnus glutinosa* (alder), *Quercus* (oak), *Ulmus* (elm), *Pinus sylvestris* (Scots pine)*, Betula* (birch) and *Corylus avellana*-type (hazel), with herbs Poaceae (grasses), Cyperaceae (sedges), Lactuceae undiff. (dandelions etc.) and *Plantago lanceolata* (ribwort plantain). Spores Pteropsida (monolete) indet. (ferns) and *Pteridium aquilinum* (bracken) are also recorded in most of the samples. It can be observed that counts for Cyperaceae tend to be slightly higher than other taxa, presumably reflecting the presence of sedges on the sampling site. In general, however, very low pollen concentrations significantly restrict palaeoenvironmental interpretation.

Preservation of those palynomorphs that were present was generally good, with few unidentifiable pollen grains recorded. This may imply that the low concentrations of pollen are not a result of post-depositional destruction, but perhaps more probably reflect rapid sediment accumulation rates and/or low influx of pollen into the sampling site during sediment accumulation. Furthermore, the record of calcareous precipitate below 170 cm suggests the influence of base-rich ground water conditions during sediment accumulation and this may also explain the low concentrations of pollen.

Radiocarbon assays yielded dates of c.1880-1682 cal. BC at 110 cm (SUERC-38617), c. 1889-1747 cal. BC at 140 cm (SUERC-38612) and c.2204-2032 cal. BC at 164 cm (SUERC-38616) (Appendix 1). Given the significant overlap in calibrated age ranges in the upper two ^{14}C determinations and the possibility of hard water error, the dating controls on Core 2 are best regarded as provisional; they do, however, strongly suggest that peaty sediments were accumulating at this site during the Bronze Age, and certainly well before the early medieval period forming the focus of the project.

5. Discussion and conclusions

The combination of low pollen concentrations and a provisional radiocarbon chronology permit only a limited and tentative palaeoenvironmental interpretation of Core 2. Nevertheless, the available data implies the presence of mixed deciduous woodland close to the sampling site during localised peaty sediment accumulation in the valley floor in the vicinity of the present J.F.K. Primary School which, on the basis of the radiocarbon dates, appears to correspond to the Bronze Age. The presence of herbs including *P. lanceolata* and Lactuceae might also reflect the local occurrence of more open, possibly ruderal environments, but these cannot be ascribed to human activity with any confidence. Whilst it would be possible to obtain higher pollen counts from some of the samples, it is considered that in the context of this particular project the value of such effort would probably not be worth the time required. Accordingly, no further work is recommended at this site.

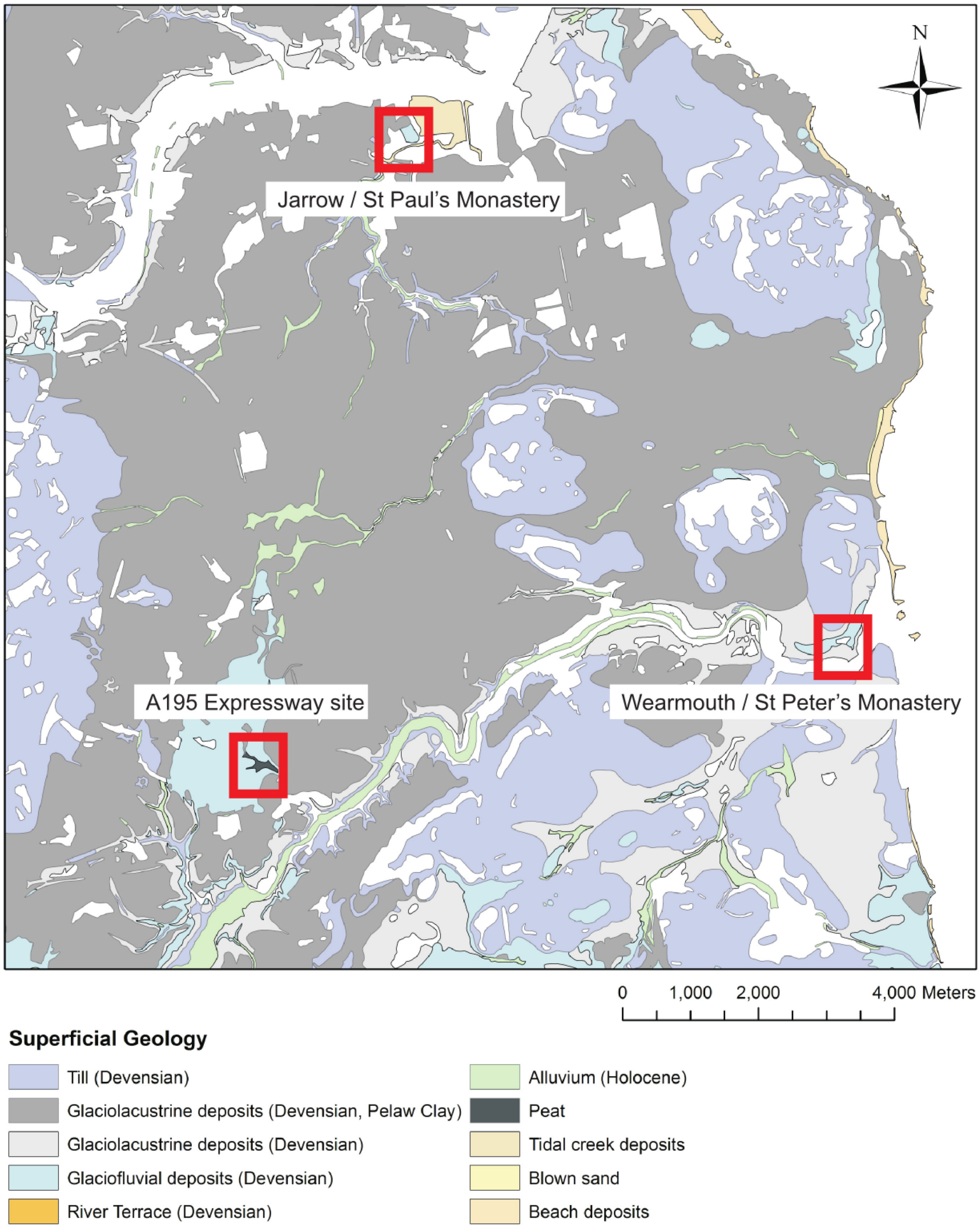

Figure 1. Superficial geology of the Wearmouth-Jarrow-Washington area showing the three study sites forming the focus for detailed Phase 1 geoarchaeological evaluation.
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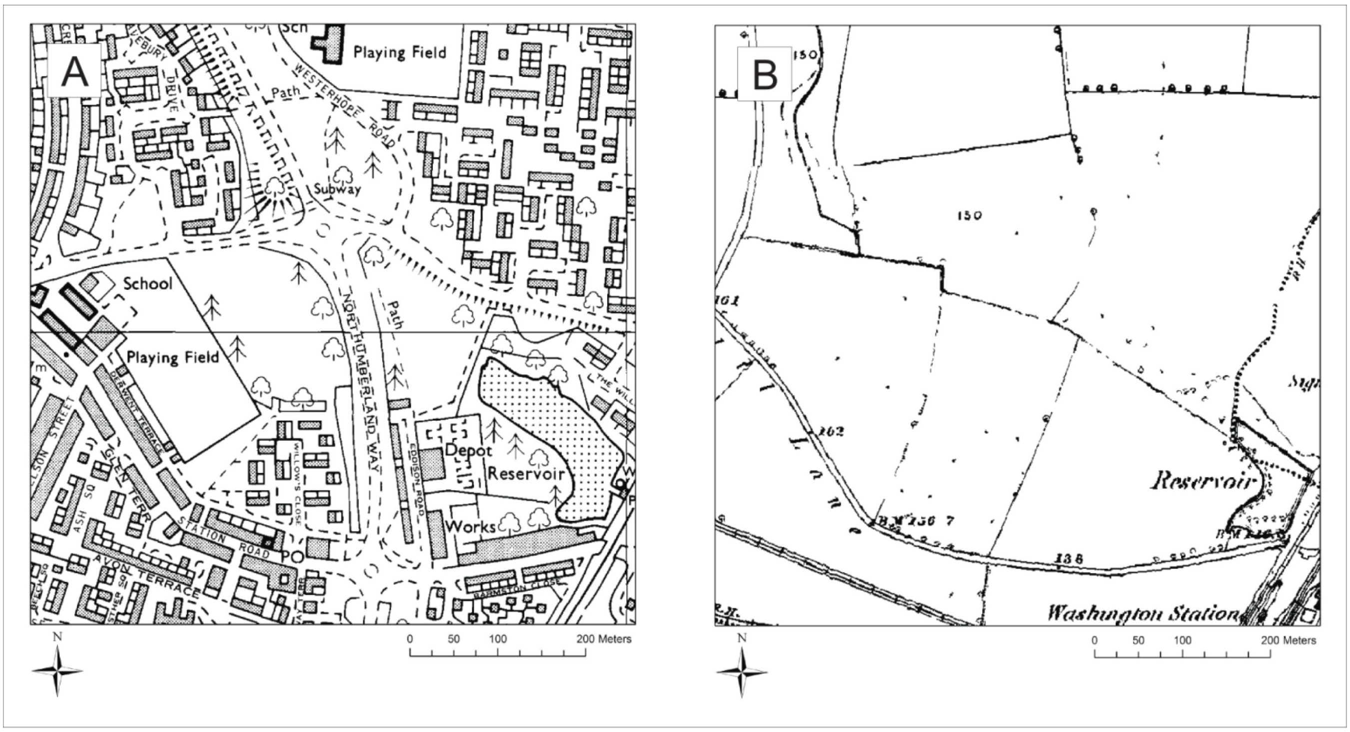

Figure 2. Ordnance Survey (County Series) maps showing (a) the A195 between the Barmston and Columbia districts of Washington, Tyne and Wear in c.1987 and (b) the pre-urbanised landscape of the same area in 1862 (1st Edition Ordnance Survey). © Crown Copyright / database right 2008. An EDINA supplied service.

Figure 3. Aerial image of the A195 Expressway site showing extent of BGS-mapped peat deposits – note open areas to west (school playing fields) and east of the A195 (source http://multimap.co.uk).

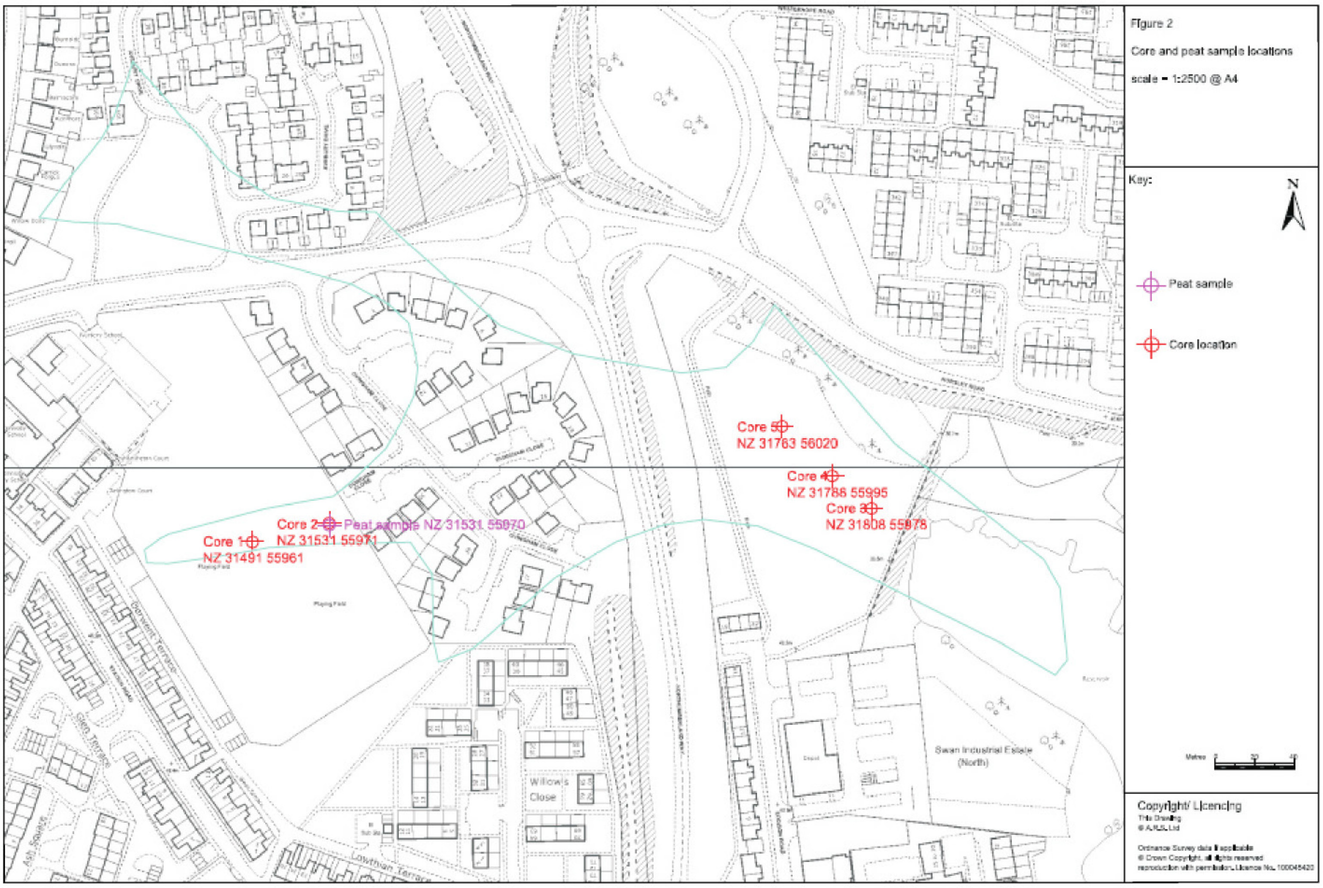

Figure 4. Location of sediment cores (see ARS, 2011 for original)

References

ARS Ltd. 2011. Geoarchaeological Coring in Monkwearmouth. ARS Ltd Report No 2011/22.

Bennett, K.D., Whittington, G. & Edwards, K.J. 1994. Recent plant nomenclature changes and pollen morphology in the British Isles. *Quaternary Newsletter* 73, 1-6.

Moore, P. D., Webb, J. A. & Collinson, M. E. 1991. *Pollen Analysis*, 2nd Edition. Blackwell Scientific Publications, Oxford.

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Table 1. Description of the Core 2 sedimentary sequence (J.F.K. Primary School, Washington).

Depth (cm)	Description	Comments
0-80	Topsoil / dark brown inorganic silty sand, occasional fine gravel, tile fragments	
80-104	Dark grey organic-rich sandy silt, occasional fragments of wood, red tile, iron slag and fine gravel	Disturbed / made ground
104-120	Black compact silty peat, frequent plant macrofossils (inc. seeds and wood fragments)	^{14}C sample at 110cm (SUERC-38617); c.1880-1682 cal BC
120-137	As above, but some thin lenses of inorganic sandy silt	
137-170	Black compact silty peat, frequent plant macrofossils, becoming wood-rich downprofile	^{14}C sample at 140cm (SUERC-38612); c.1889-1747 cal BC ^{14}C sample at 164cm (SUERC-38616); c.2204-2032 cal BC
170-240	Dark grey organic-rich silt with frequent beige calcareous precipitate	
240-269	Beige tufa / calcareous silt, frequent wood fragments and plant macrofossils	

Table 2: Results of the pollen assessment of Core 2 (figures in parentheses are the number of grains identified for each pollen type per slide). Analysis by Dr Ben Gearey.

Sample	Taxa Recorded (Raw counts per slide)
MW 104cm	Abundant organic detritis Cyperaceae (4) *Alnus glutinosa* (1) Poaceae (1) *Plantago lanceolata* (1) Lactuceae (1) Pteropsia (monolete) indet.(3) *Pteridium aquilinium* (3)
MW 108cm	Pteropsida (monolete) indet.(1)
MW 112cm	*Corylus avellana*-type (2) Cyperaceae (2) *Pteridium aquilinium* (18) Unidentified (2)
MW 116cm	*Alnus glutinosa* (1) Pteropsida (monolete)indet. (6), *Pteridium aquilinium* (1) *Polypodium vulgare* (2)
MW 120cm	*Betula* (3) *Alnus glutinosa* (1) *Rumex*-type (1) *Cirsium*-type (1) Apiaceae (1) Cyperaceae (3) Pteropsida (monolete)indet. (6), *Pteridium aquilinium* (3)
MW 138cm	*Betula* (1) *Alnus glutinosa* (4) *Quercus* (3) *Corylus avellana*-type (2) *Fraxinus excelsior* (1) *Tilia* (1) Cyperaceae (21) Rosaceae (1) *Cirsuim*-type (1) Pteropsia (monolete) indet.(8) Unidentified (2)
MW 142cm	Poaceae (1) Pteropsida (monolete) indet. (2)
MW 146cm	*Alnus glutoinosa* (1) Cyperaceae (13) Poaceae (2) *Valariana*-type (1) *Cirsium*-type (1) *Pteridium aquilinium*-type (4) Pteropsida (monolete) indet. (3)
MW 150cm	*Alnus glutinosa* (10) *Corylus avellana*-type (4) *Quercus* (1) Cyperaceae (17) *Plantago lanceolata* (1) *Pteridium aquilinium* (11) Pteropsida (monolete) indet. (1) Undientified (1)
MW 154cm	*Alnus glutinosa* (4*) Corylus avellana*-type (3) *Ulmus* (1) Cyperaceae (10) *Plantago lanceolata* (2) Lactuceae (2) Poaceae (3) *Pteridium aquilinium* (9) Unidentified (2)
MW 158cm	*Corylus avellana*-type (1) *Ulmus* (1) *Pteridium aquilinium* (2)
MW 162cm	*Alnus glutinosa* (3) *Pinus sylvestris* (1) *Ulmus* (1) Lactuceae (1) *Pteridium aquilinium* (7)
MW166cm	*Corylus avellana*-type (2) *Betula* (1) *Alnus glutinosa* (6) *Quercus* (3) Cyperaceae (12) *Plantago lanceolata* (1) Poaceae (3) Pteropsida (monolete) indet. (1,) Unidentified (4)

Appendix 1 – Radiocarbon dates

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RADIOCARBON DATING CERTIFICATE

06 March 2012

Laboratory Code	SUERC-38612 (GU26693)
Submitter	Paul Flintoft ARS LTD Angel House Portland Square Bakewell, Derbyshire, DE45 1HB
Site Reference	Jarrow
Sample Reference	MW140
Material	Wood : Salix s.p
$\delta^{13}C$ relative to VPDB	-28.4 ‰
Radiocarbon Age BP	3495 ± 25

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standards, background standards and the random machine error.

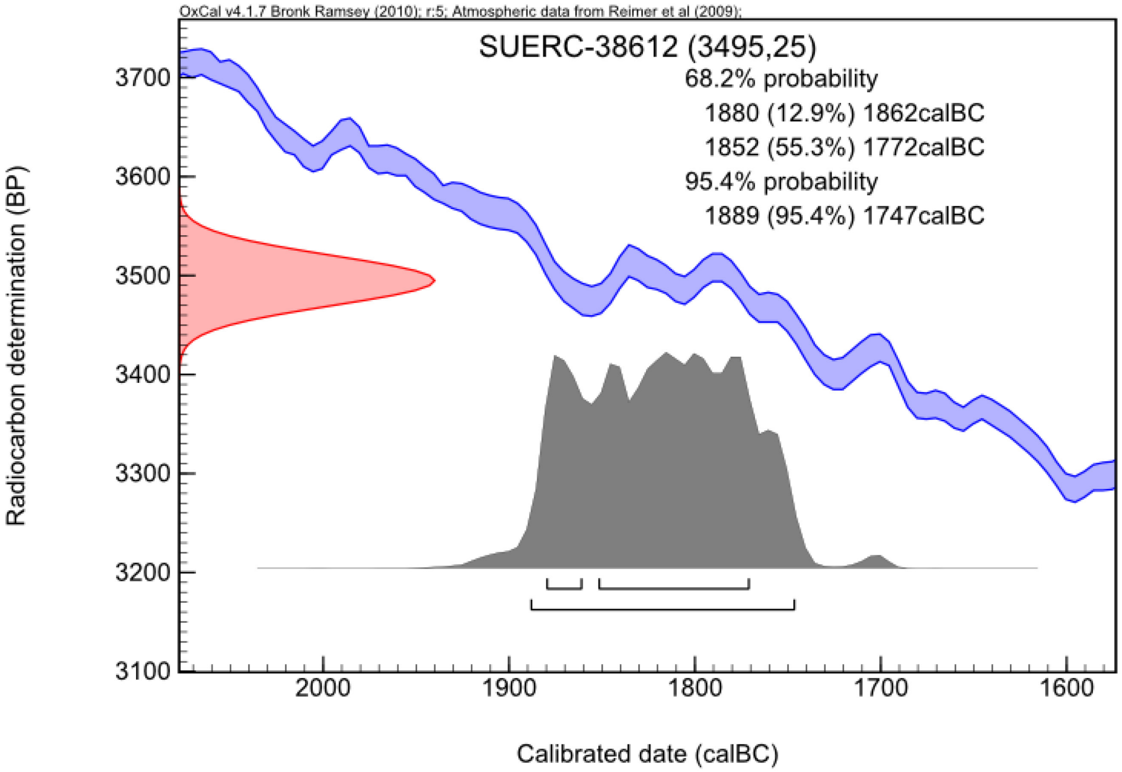
The calibrated age ranges are determined using the University of Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.1 (Bronk Ramsey 2009). Terrestrial samples are calibrated using the IntCal09 curve while marine samples are calibrated using the Marine09 curve.

Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



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RADIOCARBON DATING CERTIFICATE

06 March 2012

Laboratory Code	SUERC-38616 (GU26694)
Submitter	Paul Flintoft ARS LTD Angel House Portland Square Bakewell, Derbyshire, DE45 1HB
Site Reference	Jarrow
Sample Reference	MW164
Material	Wood : Tilia s.p?
$\delta^{13}C$ relative to VPDB	-30.7 ‰
Radiocarbon Age BP	3725 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standards, background standards and the random machine error.

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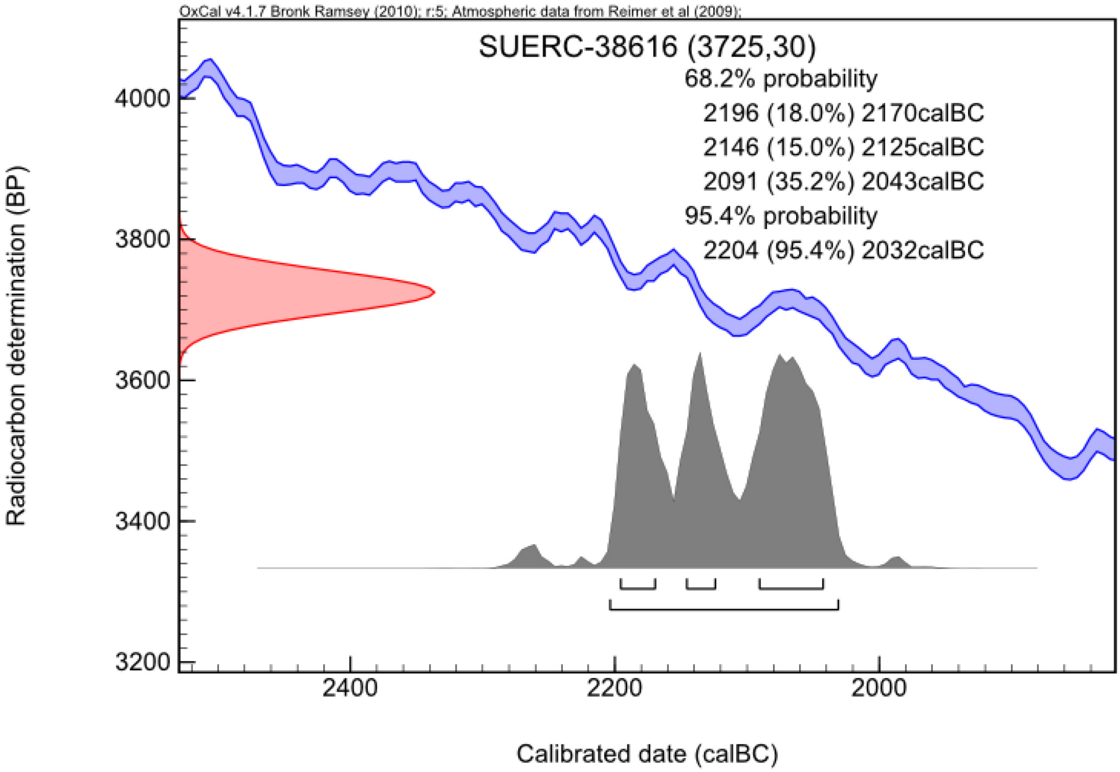
Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



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RADIOCARBON DATING CERTIFICATE

06 March 2012

Laboratory Code	SUERC-38617 (GU26695)
Submitter	Paul Flintoft ARS LTD Angel House Portland Square Bakewell, Derbyshire, DE45 1HB
Site Reference	Jarrow
Sample Reference	MW110
Material	Peat : Humic Acid Dated
$\delta^{13}C$ relative to VPDB	-28.1 ‰
Radiocarbon Age BP	3440 ± 30

N.B. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standards, background standards and the random machine error.

The calibrated age ranges are determined using the University of Oxford Radiocarbon Accelerator Unit calibration program OxCal 4.1 (Bronk Ramsey 2009). Terrestrial samples are calibrated using the IntCal09 curve while marine samples are calibrated using the Marine09 curve.

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