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**Darden Hood**  
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Deputy Directors

July 07, 2017

Dr. Roderick Bale  
University of Wales  
Trinity Saint David  
Department of Archaeology, History and Anthropology  
Lampeter, Ceredigion SA48 7ED  
United Kingdom

RE: Radiocarbon Dating Results

Dear Dr. Bale,

Enclosed is the radiocarbon dating result for one sample recently sent to us. As usual, specifics of the analysis are listed on the report with the result and calibration data is provided where applicable. The Conventional Radiocarbon Age has been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

The reported result is accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all pretreatments and chemistry were performed here in our laboratories and counted in our own accelerators here in Miami. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analysis.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C was measured separately in an IRMS (isotope ratio mass spectrometer). It is NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the result, please consider any communications you may have had with us regarding the sample. As always, your inquiries are most welcome. If you have any questions or would like further details of the analysis, please do not hesitate to contact us.

Our invoice has been sent separately. Thank you for your prior efforts in arranging payment. As always, if you have any questions or would like to discuss the results, don't hesitate to contact us.

Sincerely ,



Darden Hood  
Digital signature on file



## REPORT OF RADIOCARBON DATING ANALYSES

Dr. Roderick Bale

Report Date: July 07, 2017

University of Wales

Material Received: June 30, 2017

Sample Information and Data	Sample Code Number	Conventional Radiocarbon Age (BP) or Percent Modern Carbon (pMC) & Stable Isotopes	Calendar Calibrated Results: 95.4 % Probability High Probability Density Range Method (HPD)
<b>Beta - 468411</b>	<b>LG1127 ring 80</b>	<b>510 +/- 30 BP</b>	<b>IRMS <math>\delta^{13}C</math>: -25.1 o/oo</b>
Submitter Material: Woody material		<b>(90.9%) 1396 - 1445 cal AD</b>	<b>(554 - 505 cal BP)</b>
Analyzed Material: Wood		<b>( 4.5%) 1328 - 1341 cal AD</b>	<b>(622 - 609 cal BP)</b>
Pretreatment: (wood) acid/alkali/acid			
Analysis Service: AMS-PRIORITY delivery			
Percent Modern Carbon: 93.85 +/- 0.35 pMC			
Fraction Modern Carbon: 0.9385 +/- 0.0035			
D14C: -61.52 +/- 3.50 o/oo			
$\Delta^{14}C$ : -69.09 +/- 3.50 o/oo(1950:2017)			
Measured Radiocarbon Age: (without $\delta^{13}C$ correction): 510 +/- 30 BP			
Calibration: BetaCal3.21: HPD method: INTCAL13			

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" was calculated using the Libby half-life (5568 years), is corrected for total isotopic fraction and was used for calendar calibration where applicable. The Age is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the  $^{14}C$  signature of NIST SRM-4990C (oxalic acid). Quoted errors are 1 sigma counting statistics. Calculated sigmas less than 30 BP on the Conventional Radiocarbon Age are conservatively rounded up to 30.  $\delta^{13}C$  values are on the material itself (not the AMS  $\delta^{13}C$ ).  $\delta^{13}C$  and  $\delta^{15}N$  values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.

# Calibration of Radiocarbon Age to Calendar Years

(High Probability Density Range Method (HPD): INTCAL13)

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(Variables:  $\delta^{13}C = -25.1$  o/oo)

**Laboratory number**     **Beta-468411**

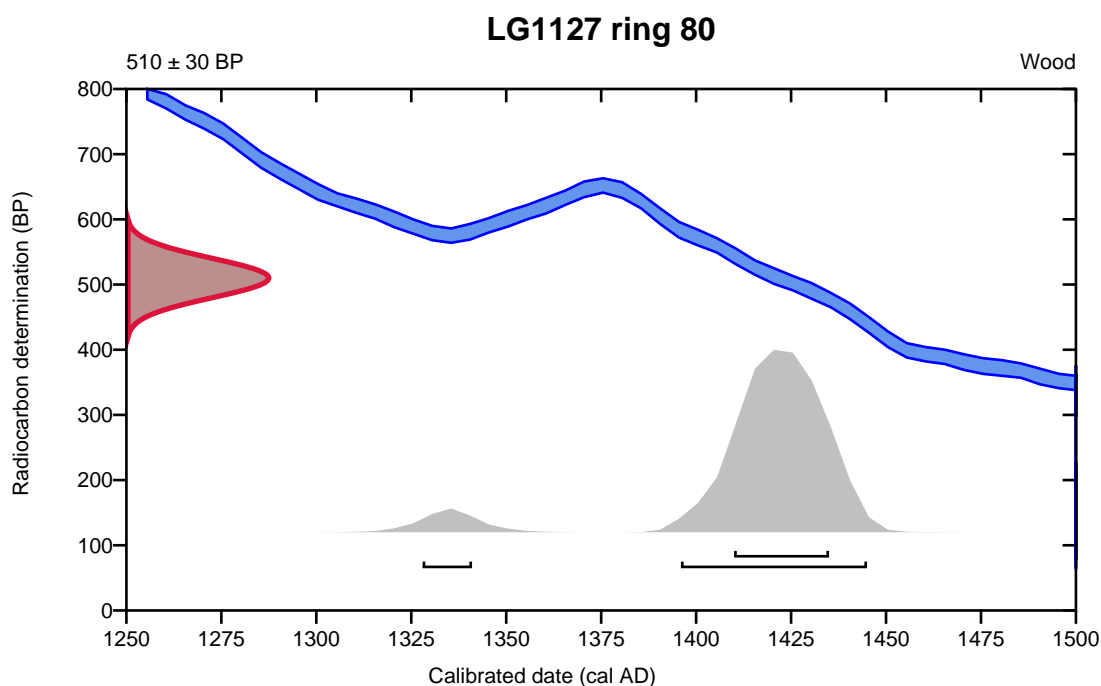
**Conventional radiocarbon age**     **510 ± 30 BP**

95.4% probability

(90.9%)	1396 - 1445 cal AD	(554 - 505 cal BP)
(4.5%)	1328 - 1341 cal AD	(622 - 609 cal BP)

68.2% probability

(68.2%)	1410 - 1435 cal AD	(540 - 515 cal BP)
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**Database used**  
INTCAL13

## References

### References to Probability Method

Bronk Ramsey, C. (2009). Bayesian analysis of radiocarbon dates. *Radiocarbon*, 51(1), 337-360.

### References to Database INTCAL13

Reimer, et al., 2013, *Radiocarbon* 55(4).



Radiocarbon Dating

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The Radiocarbon Laboratory Accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423

## Quality Assurance Report

This report provides the results of reference materials used to validate radiocarbon analyses prior to reporting. Known-value reference materials were analyzed quasi-simultaneously with the unknowns. Results are reported as expected values vs measured values. Reported values are calculated relative to NIST SRM-4990B and corrected for isotopic fractionation. Results are reported using the direct analytical measure percent modern carbon (pMC) with one relative standard deviation. Agreement between expected and measured values is taken as being within 2 sigma agreement (error x 2) to account for total laboratory error.

**Report Date:** July 07, 2017  
**Submitter:** Dr. Roderick Bale

### QA MEASUREMENTS

#### Reference 1

Expected Value: 0.44 +/- 0.10 pMC

Measured Value: 0.45 +/- 0.03 pMC

Agreement: Accepted

#### Reference 2

Expected Value: 129.41 +/- 0.06 pMC

Measured Value: 129.51 +/- 0.39 pMC

Agreement: Accepted

#### Reference 3

Expected Value: 96.69 +/- 0.50 pMC

Measured Value: 96.60 +/- 0.30 pMC

Agreement: Accepted

**COMMENT:** All measurements passed acceptance tests.

Validation:

Date: July 07, 2017