



Consistent accuracy
delivered on time

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

August 17, 2017

Kalle Luoto
Kulttuuriympristpalvelut Heiskanen & Luoto Oy LLC
Pyhajarvenkatu 1
Tampere, Finland 33200
Finland

RE: Radiocarbon Dating Results

Mr. Luoto,

Enclosed are the radiocarbon dating results for two samples recently sent to us. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable. The Conventional Radiocarbon Ages have all 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.

Reported results are accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all chemistry was performed here in our laboratory and counted in our own accelerators here. 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 analyses.

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 values were measured separately in an IRMS (isotope ratio mass spectrometer). They are NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the results, please consider any communications you may have had with us regarding the samples.

The cost of the analysis was charged to the credit card provided. Thank you. 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

Mr. Kalle Luoto

Report Date: August 17, 2017

Kulttuuriympristpalvelut Heiskanen & Luoto Oy LLC

Material Received: July 26, 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)
Beta - 470630	41212:124	1510 +/- 30 BP	IRMS δ13C: -24.8 o/oo IRMS δ18O: -19.5 o/oo
Submitter Material: Bone (Cremated)		(74.8%) 528 - 622 cal AD	(1422 - 1328 cal BP)
Analyzed Material: Cremated bone carbonate		(19.7%) 430 - 494 cal AD	(1520 - 1456 cal BP)
Pretreatment: (cremated bone carbonate) bone carbonate extraction (acid wash prior to AMS standard delivery)		(0.9%) 510 - 517 cal AD	(1440 - 1433 cal BP)
Analysis Service: AMS standard delivery			
Percent Modern Carbon: 82.86 +/- 0.31 pMC			
Fraction Modern Carbon: 0.8286 +/- 0.0031			
D14C: -171.37 +/- 3.09 o/oo			
Δ14C: -178.05 +/- 3.09 o/oo(1950:2017)			
Measured Radiocarbon Age: (without d13C correction): 1510 +/- 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 14C 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. d13C values are on the material itself (not the AMS d13C). d13C and d15N values are relative to VPDB-1. References for calendar calibrations are cited at the bottom of calibration graph pages.



REPORT OF RADIOCARBON DATING ANALYSES

Mr. Kalle Luoto

Report Date: August 17, 2017

Kulttuuriympristpalvelut Heiskanen & Luoto Oy LLC

Material Received: July 26, 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)
Beta - 470631	41212:161	1500 +/- 30 BP	IRMS δ13C: -17.9 o/oo IRMS δ18O: -17.8 o/oo
Submitter Material: Bone (Cremated)		(84.8%) 532 - 638 cal AD	(1418 - 1312 cal BP)
Analyzed Material: Cremated bone carbonate		(10.6%) 432 - 489 cal AD	(1518 - 1461 cal BP)
Pretreatment: (cremated bone carbonate) bone carbonate extraction (acid wash prior to AMS standard delivery)			
Analysis Service: AMS standard delivery			
Percent Modern Carbon: 82.97 +/- 0.31 pMC			
Fraction Modern Carbon: 0.8297 +/- 0.0031			
D14C: -170.33 +/- 3.10 o/oo			
Δ14C: -177.03 +/- 3.10 o/oo(1950:2017)			
Measured Radiocarbon Age: (without d13C correction): 1380 +/- 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 14C 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. d13C values are on the material itself (not the AMS d13C). d13C and d15N 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)

(Variables: $\delta^{13}C = -24.8$ o/oo)

Laboratory number **Beta-470630**

Conventional radiocarbon age **1510 \pm 30 BP**

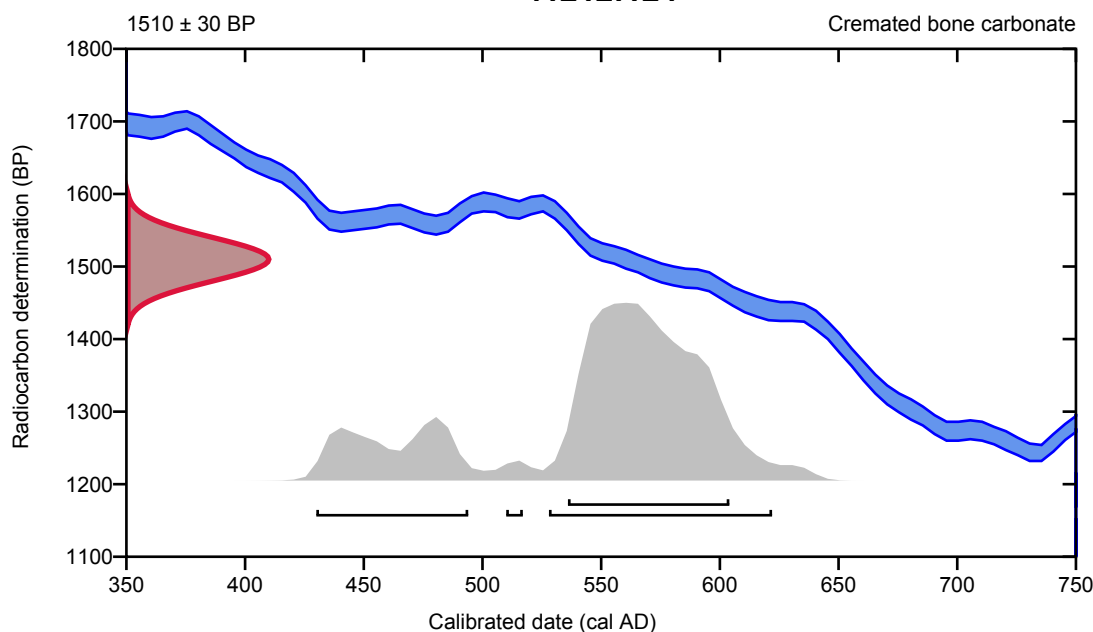
95.4% probability

(74.8%)	528 - 622 cal AD	(1422 - 1328 cal BP)
(19.7%)	430 - 494 cal AD	(1520 - 1456 cal BP)
(0.9%)	510 - 517 cal AD	(1440 - 1433 cal BP)

68.2% probability

(68.2%)	536 - 604 cal AD	(1414 - 1346 cal BP)
---------	------------------	----------------------

41212:124



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).

Calibration of Radiocarbon Age to Calendar Years

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

(Variables: d13C = -17.9 ‰)

Laboratory number **Beta-470631**

Conventional radiocarbon age **1500 ± 30 BP**

95.4% probability

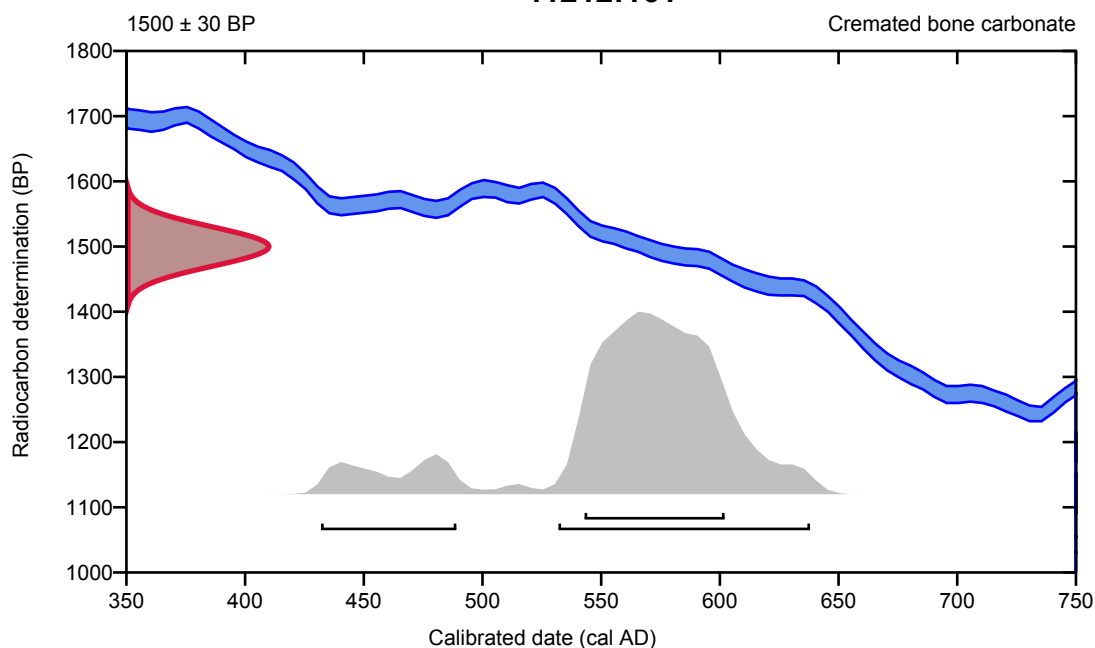
(84.8%) 532 - 638 cal AD (1418 - 1312 cal BP)

(10.6%) 432 - 489 cal AD (1518 - 1461 cal BP)

68.2% probability

(68.2%) 543 - 602 cal AD (1407 - 1348 cal BP)

41212:161



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

Consistent Accuracy
Delivered On-Time

Beta Analytic Inc.
4985 SW 74 Court
Miami, Florida 33155 USA
Tel: 305-667-5167
Fax: 305-663-0964
info@betalabservices.com
www.betalabservices.com

Mr. Darden Hood
President

Mr. Ronald Hatfield
Mr. Christopher Patrick
Deputy Directors

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: August 17, 2017
Submitter: Mr. Kalle Luoto

QA MEASUREMENTS

Reference 1

Expected Value: 96.69 +/- 0.50 pMC

Measured Value: 96.78 +/- 0.30 pMC

Agreement: Accepted

Reference 2

Expected Value: 0.44 +/- 0.10 pMC

Measured Value: 0.45 +/- 0.04 pMC

Agreement: Accepted

Reference 3

Expected Value: 129.41 +/- 0.06 pMC

Measured Value: 129.70 +/- 0.39 pMC

Agreement: Accepted

COMMENT: All measurements passed acceptance tests.

Validation:

Date: August 17, 2017