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delivered on time

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Darden Hood
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Ronald Hatfield
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June 23, 2017

Mrs. Kiersten Medvedich
Gaia
833 S Boulder Road
Louisville, CO 80027
United States

RE: Radiocarbon Dating Results

Dear Mrs. Medvedich,

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.

The cost of the analysis was charged to the American Express 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 ,



Digital signature on file



REPORT OF RADIOCARBON DATING ANALYSES

Mrs. Kiersten Medvedich

Report Date: June 23, 2017

Gaia

Material Received: June 20, 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 - 467660	BTM2	1740 +/- 30 BP	IRMS $\delta^{13}C$: -18.0 o/oo	
Submitter Material: Tissue		(60.2%) 320 - 411 cal AD	(1630 - 1539 cal BP)	
Analyzed Material: Tissue		(35.2%) 249 - 308 cal AD	(1701 - 1642 cal BP)	
Pretreatment: (tissue) acid/alkali/acid				
Analysis Service: AMS-TIMEGUIDE delivery				
Percent Modern Carbon: 80.52 +/- 0.30 pMC				
Fraction Modern Carbon: 0.8052 +/- 0.0030				
D14C: -194.75 +/- 3.01 o/oo				
$\Delta^{14}C$: -201.25 +/- 3.01 o/oo(1950:2017)				
Measured Radiocarbon Age: (without $\delta^{13}C$ correction): 1630 +/- 30 BP				
Calibration: BetaCal3.21: HPD method: SHCAL13				

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): SHCAL13)

(Variables: $\delta^{13}\text{C} = -18.0$ o/oo)

Laboratory number **Beta-467660**

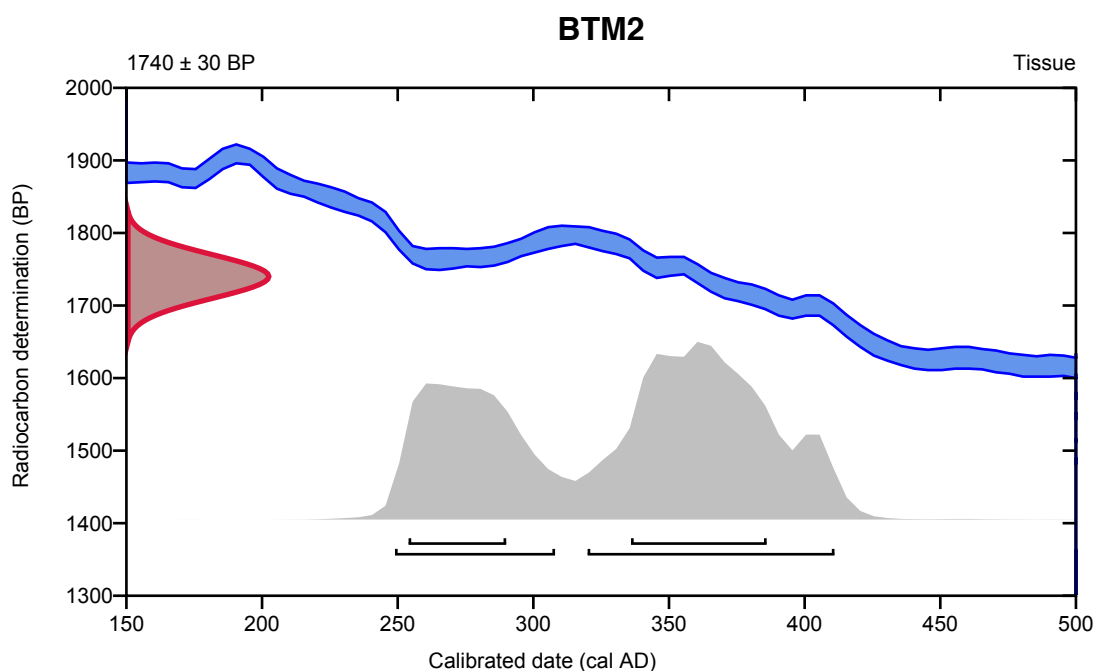
Conventional radiocarbon age **1740 \pm 30 BP**

95.4% probability

(60.2%)	320 - 411 cal AD	(1630 - 1539 cal BP)
(35.2%)	249 - 308 cal AD	(1701 - 1642 cal BP)

68.2% probability

(42.7%)	336 - 386 cal AD	(1614 - 1564 cal BP)
(25.5%)	254 - 290 cal AD	(1696 - 1660 cal BP)



Database used
SHCAL13

References

References to Probability Method

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

References to Database SHCAL13

Hogg, 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: June 23, 2017
Submitter: Mrs. Kiersten Medvedich

QA MEASUREMENTS

Reference 1

Expected Value: 129.41 +/- 0.06 pMC

Measured Value: 129.44 +/- 0.37 pMC

Agreement: Accepted

Reference 2

Expected Value: 0.44 +/- 0.10 pMC

Measured Value: 0.44 +/- 0.03 pMC

Agreement: Accepted

Reference 3

Expected Value: 41.14 +/- 0.10 pMC

Measured Value: 41.40 +/- 0.16 pMC

Agreement: Accepted

COMMENT: All measurements passed acceptance tests.

Validation:

Date: June 23, 2017