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November 20, 2012

Ms. Sofia Tereso
Camara Municipal de Braganca
Forte de São João de Deus
Braganca, 5300-263
Portugal

RE: Radiocarbon Dating Results For Samples Sample 1: UE [15]-R9/S9, Sample 2:UE [43]-W3/2,
Sample 3:UE [43]-O0/O1, Sample 4:UE [50]-O0/O1, Sample 5:UE [19]-R9, Sample 6:UE [17]-W3/2

Dear Ms. Tereso:

Enclosed are the radiocarbon dating results for six samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses proceeded normally. The report sheet contains the dating result, method used, material type, applied pretreatment and two-sigma calendar calibration result (where applicable) for each sample.

This report has been both mailed and sent electronically, along with a separate publication quality calendar calibration page. This is useful for incorporating directly into your reports. It is also digitally available in Windows metafile (.wmf) format upon request. Calibrations are calculated using the newest (2004) calibration database. References are quoted on the bottom of each calibration page. Multiple probability ranges may appear in some cases, due to short-term variations in the atmospheric ¹⁴C contents at certain time periods. Examining the calibration graphs will help you understand this phenomenon. Calibrations may not be included with all analyses. The upper limit is about 20,000 years, the lower limit is about 250 years and some material types are not suitable for calibration (e.g. water).

We analyzed these samples on a sole priority basis. No students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

Information pages are enclosed with the mailed copy of this report. They should answer most of questions you may have. If they do not, or if you have specific questions about the analyses, please do not hesitate to contact us. Someone is always available to answer your questions.

Thank you for prepaying the analyses. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,



Darden Hood
Digital signature on file



REPORT OF RADIOCARBON DATING ANALYSES

Ms. Sofia Tereso

Report Date: 11/20/2012

Camara Municipal de Braganca

Material Received: 11/2/2012

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 334443 SAMPLE : Sample 1: UE [15]-R9/S9 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (bone collagen): collagen extraction: with alkali 2 SIGMA CALIBRATION : Cal AD 1020 to 1160 (Cal BP 930 to 800)	870 +/- 30 BP	-19.0 o/oo	970 +/- 30 BP
Beta - 334444 SAMPLE : Sample 2:UE [43]-W3/2 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (bone collagen): collagen extraction: with alkali 2 SIGMA CALIBRATION : Cal AD 1020 to 1160 (Cal BP 930 to 790)	860 +/- 30 BP	-19.2 o/oo	960 +/- 30 BP
Beta - 334445 SAMPLE : Sample 3:UE [43]-O0/O1 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (bone collagen): collagen extraction: with alkali 2 SIGMA CALIBRATION : Cal AD 1020 to 1170 (Cal BP 930 to 780)	830 +/- 30 BP	-18.7 o/oo	930 +/- 30 BP
Beta - 334446 SAMPLE : Sample 4:UE [50]-O0/O1 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (bone collagen): collagen extraction: with alkali 2 SIGMA CALIBRATION : Cal AD 1020 to 1170 (Cal BP 930 to 780)	840 +/- 30 BP	-19.5 o/oo	930 +/- 30 BP

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "**". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.



REPORT OF RADIOCARBON DATING ANALYSES

Ms. Sofia Tereso

Report Date: 11/20/2012

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 334447 SAMPLE : Sample 5:UE [19]-R9 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (bone collagen): collagen extraction: with alkali 2 SIGMA CALIBRATION : Cal AD 650 to 690 (Cal BP 1300 to 1260)	1260 +/- 30 BP	-19.3 o/oo	1350 +/- 30 BP
Beta - 334448 SAMPLE : Sample 6:UE [17]-W3/2 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (bone collagen): collagen extraction: with alkali 2 SIGMA CALIBRATION : Cal AD 1030 to 1220 (Cal BP 920 to 740)	800 +/- 30 BP	-19.2 o/oo	900 +/- 30 BP

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "**". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-19:lab. mult=1)

Laboratory number: Beta-334443

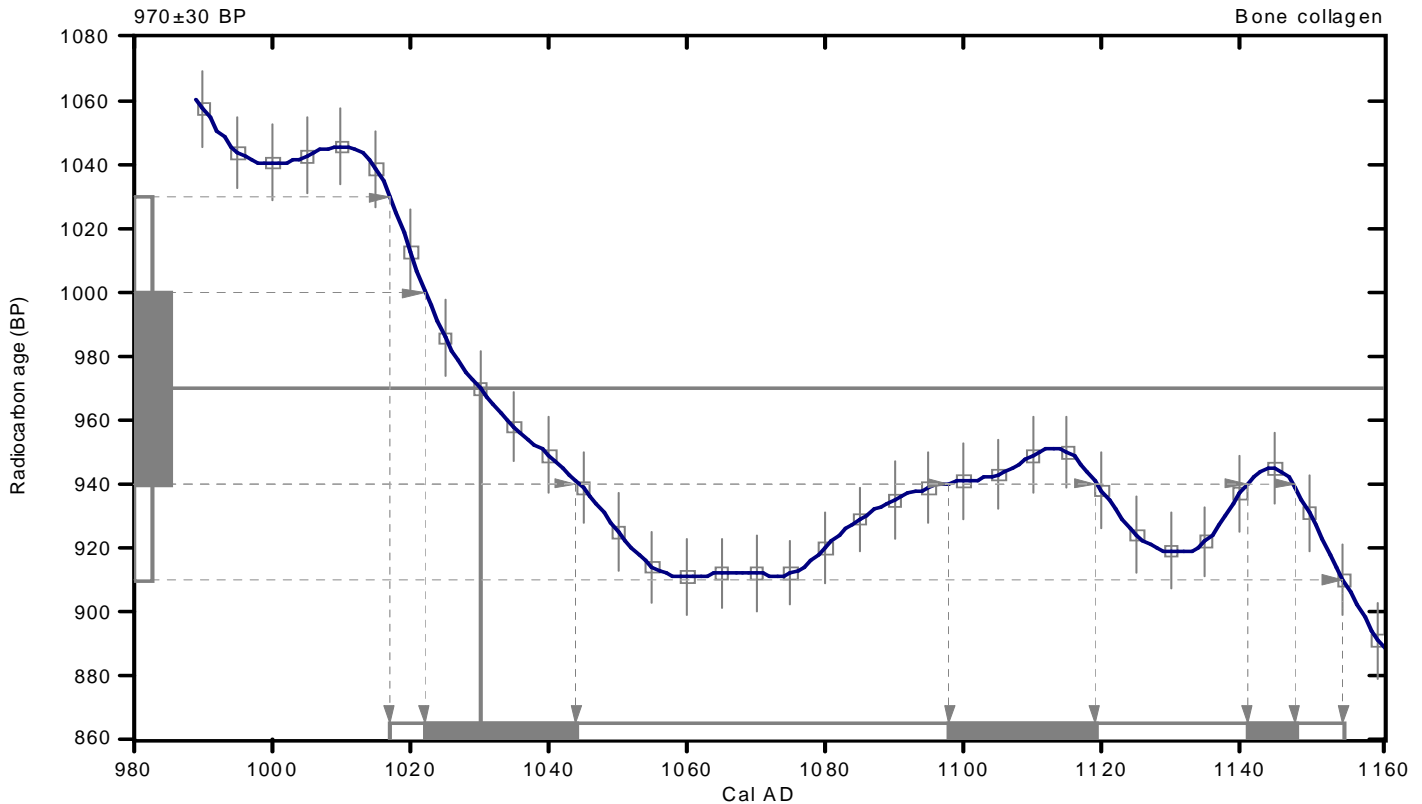
Conventional radiocarbon age: 970±30 BP

**2 Sigma calibrated result: Cal AD 1020 to 1160 (Cal BP 930 to 800)
(95% probability)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1030 (Cal BP 920)

1 Sigma calibrated results: Cal AD 1020 to 1040 (Cal BP 930 to 910) and
(68% probability) Cal AD 1100 to 1120 (Cal BP 850 to 830) and
Cal AD 1140 to 1150 (Cal BP 810 to 800)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton, et al., 2009, Radiocarbon 51(4):1151-1164, Reimer, et al., 2009, Radiocarbon 51(4):1111-1150, Stuiver, et al., 1993, Radiocarbon 35(1):137-189, Oeschger, et al., 1975, Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-19.2:lab. mult=1)

Laboratory number: Beta-334444

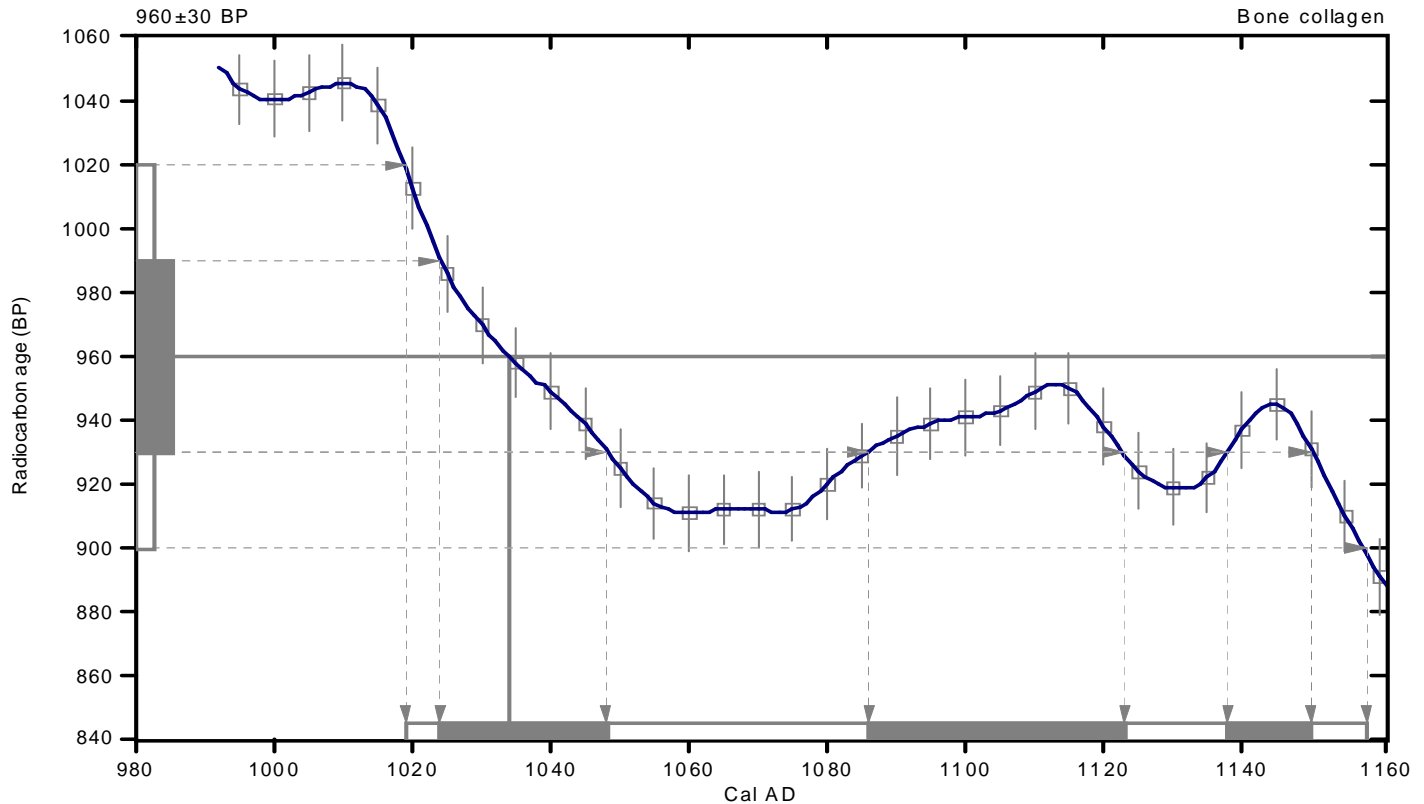
Conventional radiocarbon age: 960±30 BP

**2 Sigma calibrated result: Cal AD 1020 to 1160 (Cal BP 930 to 790)
(95% probability)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1030 (Cal BP 920)

1 Sigma calibrated results: Cal AD 1020 to 1050 (Cal BP 930 to 900) and
(68% probability) Cal AD 1090 to 1120 (Cal BP 860 to 830) and
Cal AD 1140 to 1150 (Cal BP 810 to 800)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton, et al., 2009, Radiocarbon 51(4):1151-1164, Reimer, et al., 2009, Radiocarbon 51(4):1111-1150, Stuiver, et al., 1993, Radiocarbon 35(1):137-189, Oeschger, et al., 1975, Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-18.7:lab. mult=1)

Laboratory number: Beta-334445

Conventional radiocarbon age: 930±30 BP

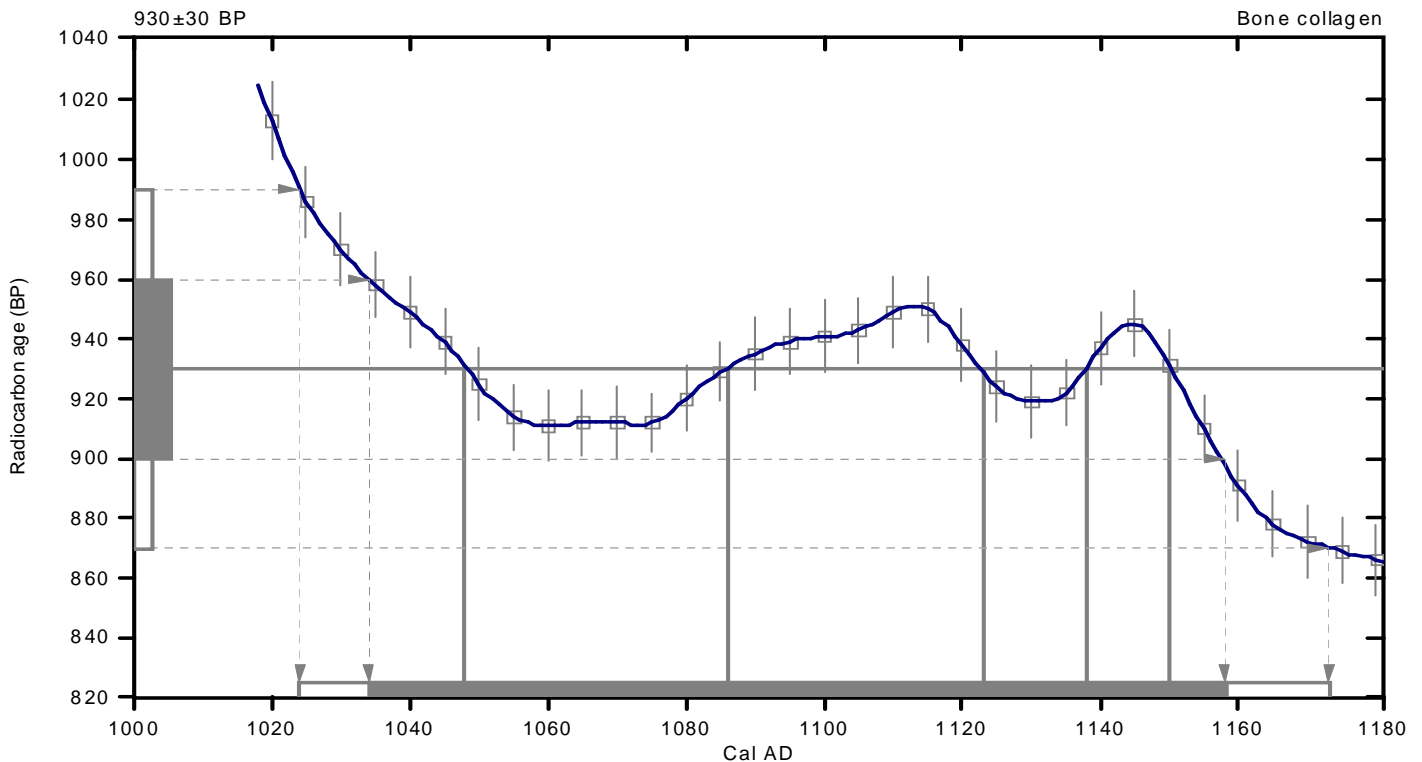
**2 Sigma calibrated result: Cal AD 1020 to 1170 (Cal BP 930 to 780)
(95% probability)**

Intercept data

Intercepts of radiocarbon age
with calibration curve:

Cal AD 1050 (Cal BP 900) and
Cal AD 1090 (Cal BP 860) and
Cal AD 1120 (Cal BP 830) and
Cal AD 1140 (Cal BP 810) and
Cal AD 1150 (Cal BP 800)

**1 Sigma calibrated result: Cal AD 1030 to 1160 (Cal BP 920 to 790)
(68% probability)**



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton, et.al., 2009, Radiocarbon 51(4):1151-1164, Reimer, et.al., 2009, Radiocarbon 51(4):1111-1150, Stuiver, et.al., 1993, Radiocarbon 35(1):137-189, Oeschger, et.al., 1975, Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-19.5:lab. mult=1)

Laboratory number: Beta-334446

Conventional radiocarbon age: 930±30 BP

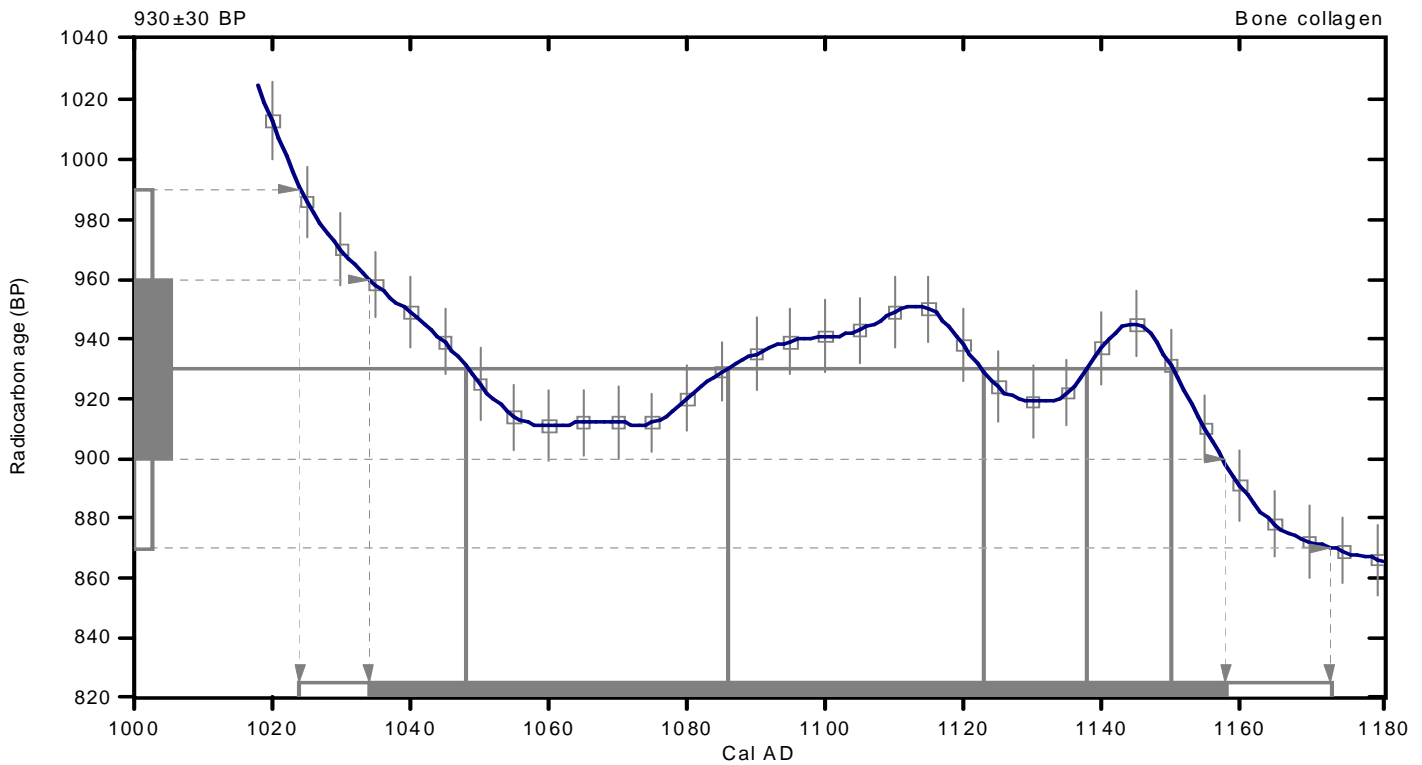
**2 Sigma calibrated result: Cal AD 1020 to 1170 (Cal BP 930 to 780)
(95% probability)**

Intercept data

Intercepts of radiocarbon age
with calibration curve:

Cal AD 1050 (Cal BP 900) and
Cal AD 1090 (Cal BP 860) and
Cal AD 1120 (Cal BP 830) and
Cal AD 1140 (Cal BP 810) and
Cal AD 1150 (Cal BP 800)

**1 Sigma calibrated result: Cal AD 1030 to 1160 (Cal BP 920 to 790)
(68% probability)**



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton, et al., 2009, *Radiocarbon* 51(4):1151-1164, Reimer, et al., 2009, *Radiocarbon* 51(4):1111-1150, Stuiver, et al., 1993, *Radiocarbon* 35(1):137-189, Oeschger, et al., 1975, *Tellus* 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, *Radiocarbon* 35(2):317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-19.3:lab. mult=1)

Laboratory number: Beta-334447

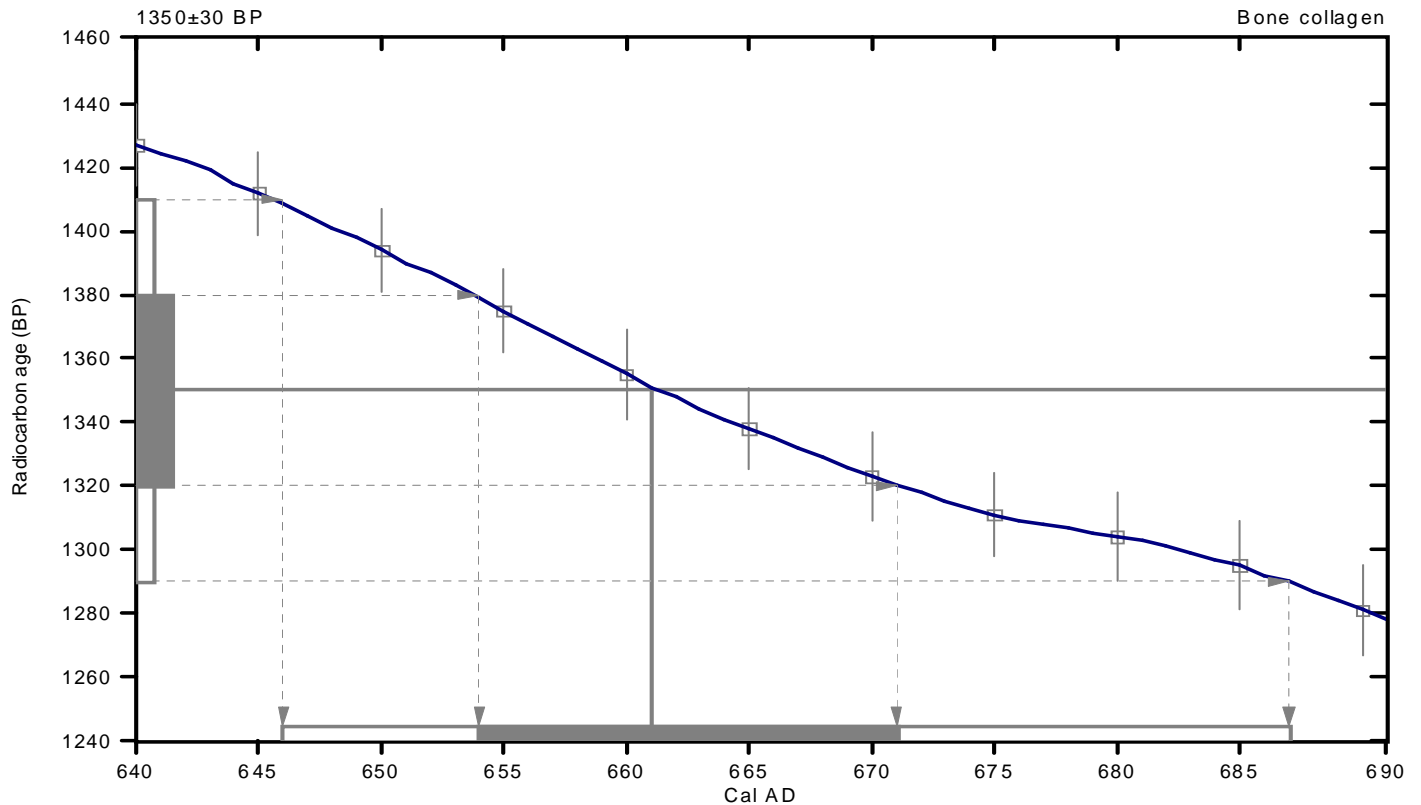
Conventional radiocarbon age: 1350±30 BP

**2 Sigma calibrated result: Cal AD 650 to 690 (Cal BP 1300 to 1260)
(95% probability)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 660 (Cal BP 1290)

**1 Sigma calibrated result: Cal AD 650 to 670 (Cal BP 1300 to 1280)
(68% probability)**



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton, et al., 2009, *Radiocarbon* 51(4):1151-1164, Reimer, et al., 2009, *Radiocarbon* 51(4):1111-1150, Stuiver, et al., 1993, *Radiocarbon* 35(1):137-189, Oeschger, et al., 1975, *Tellus* 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, *Radiocarbon* 35(2):317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-19.2:lab. mult=1)

Laboratory number: Beta-334448

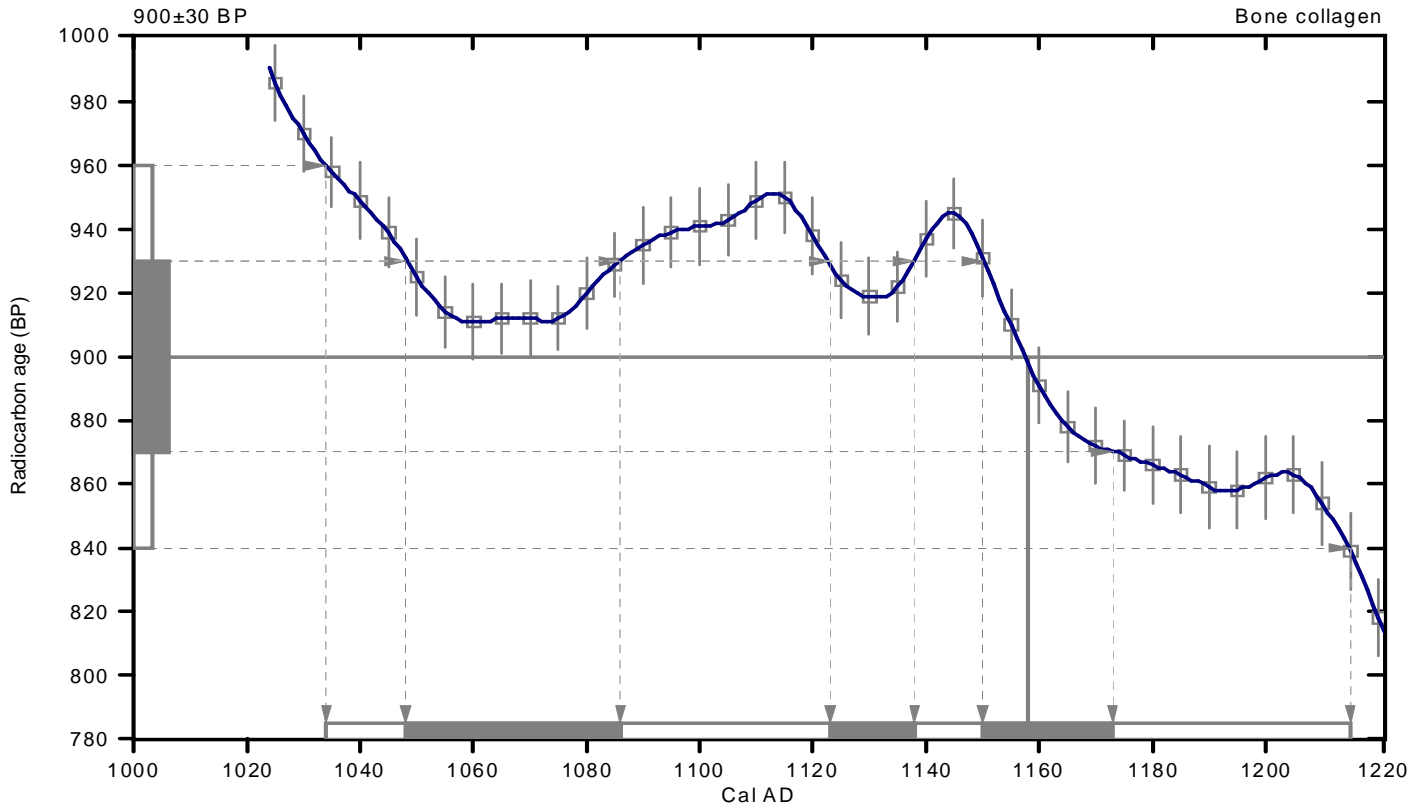
Conventional radiocarbon age: 900±30 BP

**2 Sigma calibrated result: Cal AD 1030 to 1220 (Cal BP 920 to 740)
(95% probability)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1160 (Cal BP 790)

1 Sigma calibrated results: Cal AD 1050 to 1090 (Cal BP 900 to 860) and
(68% probability) Cal AD 1120 to 1140 (Cal BP 830 to 810) and
Cal AD 1150 to 1170 (Cal BP 800 to 780)



References:

Database used
INTCAL09

References to INTCAL09 database

Heaton, et al., 2009, *Radiocarbon* 51(4):1151-1164, Reimer, et al., 2009, *Radiocarbon* 51(4):1111-1150, Stuiver, et al., 1993, *Radiocarbon* 35(1):137-189, Oeschger, et al., 1975, *Tellus* 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

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