

**Resultados datación Muestra M1-3 Cueva de Las Grajas. Material fémur de bóvido.** Envío correo electrónico de Beta Analytic.

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Reply-To: beta@analytic.win.net (Beta Analytic Inc.) To:  
moralesm@ccaix3.unican.es

Date: Mon, 20 Mar 1995 16:41:05

Subject: C14 Dating Results for Mr. Cobo From: beta@analytic.win.net (Beta Analytic Inc.)

Sending E-mail beta@analytic.win.net

Receiving E mail moralesm@ccaix3.unican.es

The following report contains the results on the material recently submitted for radiocarbon dating. Along with the result, the analysis method, delivery basis, material type and pretreatment, and any comments are included. The original mailed copy contains a covering letter outlining our analytical and reporting procedures, a glossary of pretreatment terms, and applicable calendar calibrations. The invoice (where applicable) contains balance/credit information and discount "count" to date.

As always, if you have any specific questions, please do not hesitate to fax, e-mail, or call us.

Darden Hood

#### DATING RESULTS:

Sample Data Measured C13/C12

Conventional

C14 Age Ratio

C14 Age (\*)

Beta-80370 3710 +/- 60 BP -25.0\* o/oo 3710  
+/- 60\* BP

SAMPLE #: GRAJAS M1-3

ANALYSIS: radiometric-standard

MATERIAL/PRETREATMENT:(bone collagen): collagen extraction with alkali

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NOTE: It is important to read the calendar calibration information and to use the calendar calibrated results (reported separately) when interpreting these results in AD/BC terms.





**BETA ANALYTIC INC.**

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## REPORT OF RADIOCARBON DATING ANALYSES

FOR: Dr. Eduardo Lejardi/E. Fernandez  
Ayuntamiento de Camargo

DATE RECEIVED: October 31, 1994

DATE REPORTED: December 2, 1994

Sample Data	Measured C14 Age	C13/C12 Ratio	Conventional C14 Age (*)
Beta-77484	850 +/- 70 BP	-25.0* o/oo	850 +/- 70* BP

SAMPLE #: MT-GAT-2

ANALYSIS: radiometric-standard

MATERIAL/PRETREATMENT:(charred material): acid/alkali/acid

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (\*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.



# CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: estimated C13/C12=-25; lab mult.=1)

Laboratory Number: Beta-77484

Conventional radiocarbon age\*: 850 +/- 70 BP

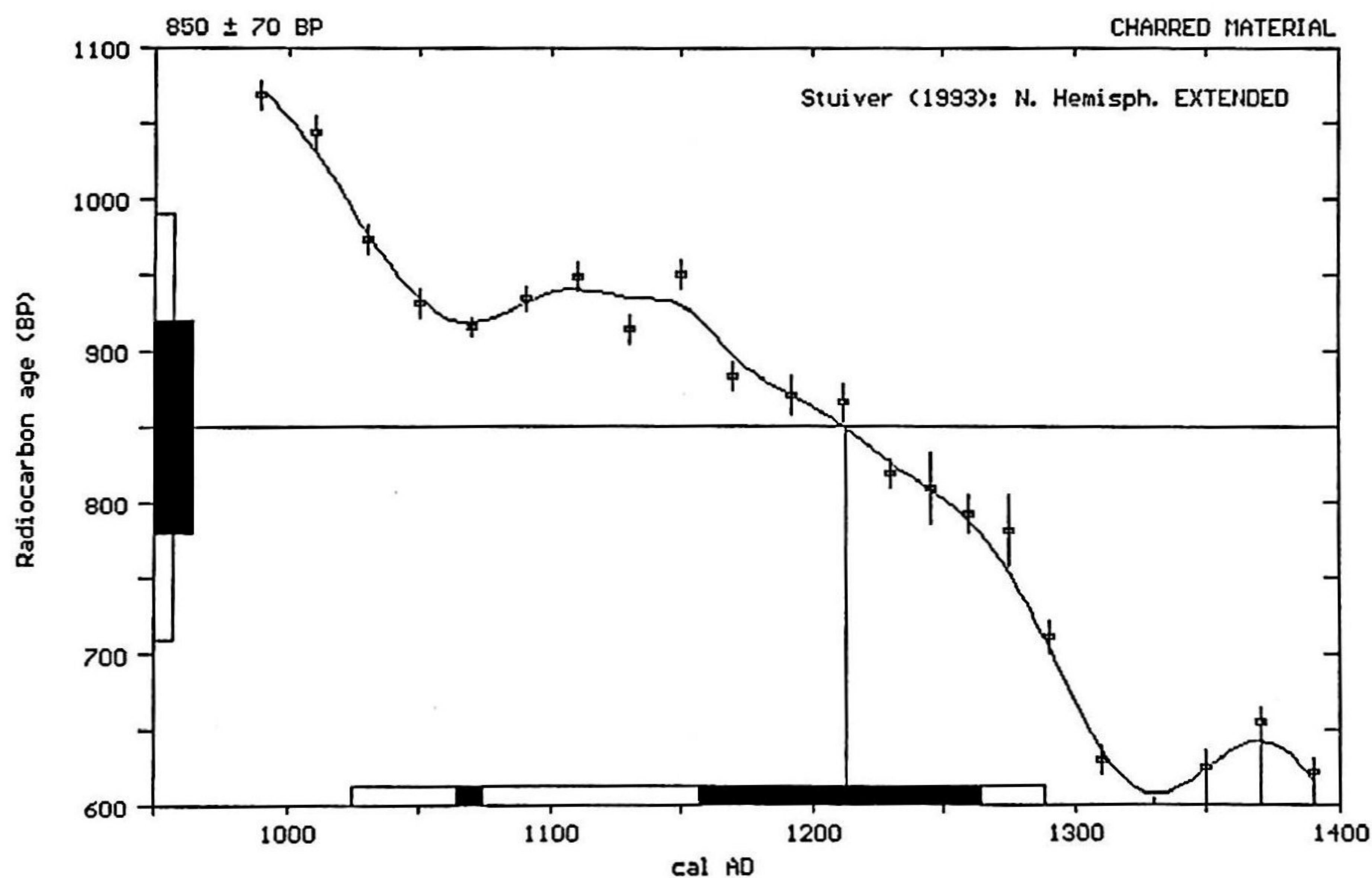
Calibrated results:  
(2 sigma, 95% probability) cal AD 1025 to 1290

\* C13/C12 ratio estimated

Intercept data:

Intercept of radiocarbon age  
with calibration curve: cal AD 1215

1 sigma calibrated results:  
(68% probability) cal AD 1065 to 1075 and  
cal AD 1155 to 1265



## References:

- Vogel, J. C., Fuls, A., Visser, E. and Becker, B., 1993, *Radiocarbon* 35(1), p73-86  
Talma, A. S. and Vogel, J. C., 1993, *Radiocarbon* 35(2), p317-322  
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., *Radiocarbon* 35(1)

## Results prepared by:

Beta Analytic, Inc. 4985 S.W. 74th Court, Miami, Florida 33155



# EXPLANATION OF THE PRETORIA/BETA ANALYTIC DENDRO-CALIBRATION PRINTOUT

## CALIBRATION OF RADICARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -24.8; lab mult. = 1)

Variables used in the calculation

Laboratory Number: Beta-12345

Conventional radiocarbon age:

2400 +/- 60 BP

The uncalibrated radiocarbon age ( $\pm 1$  sigma)

The recommended calibration age range to be used for interpretation

Calibrated result:

cal BC 770 to 380

(2 sigma, 95% probability)

Intercept data:

Intercept of radiocarbon age with calibration curve:

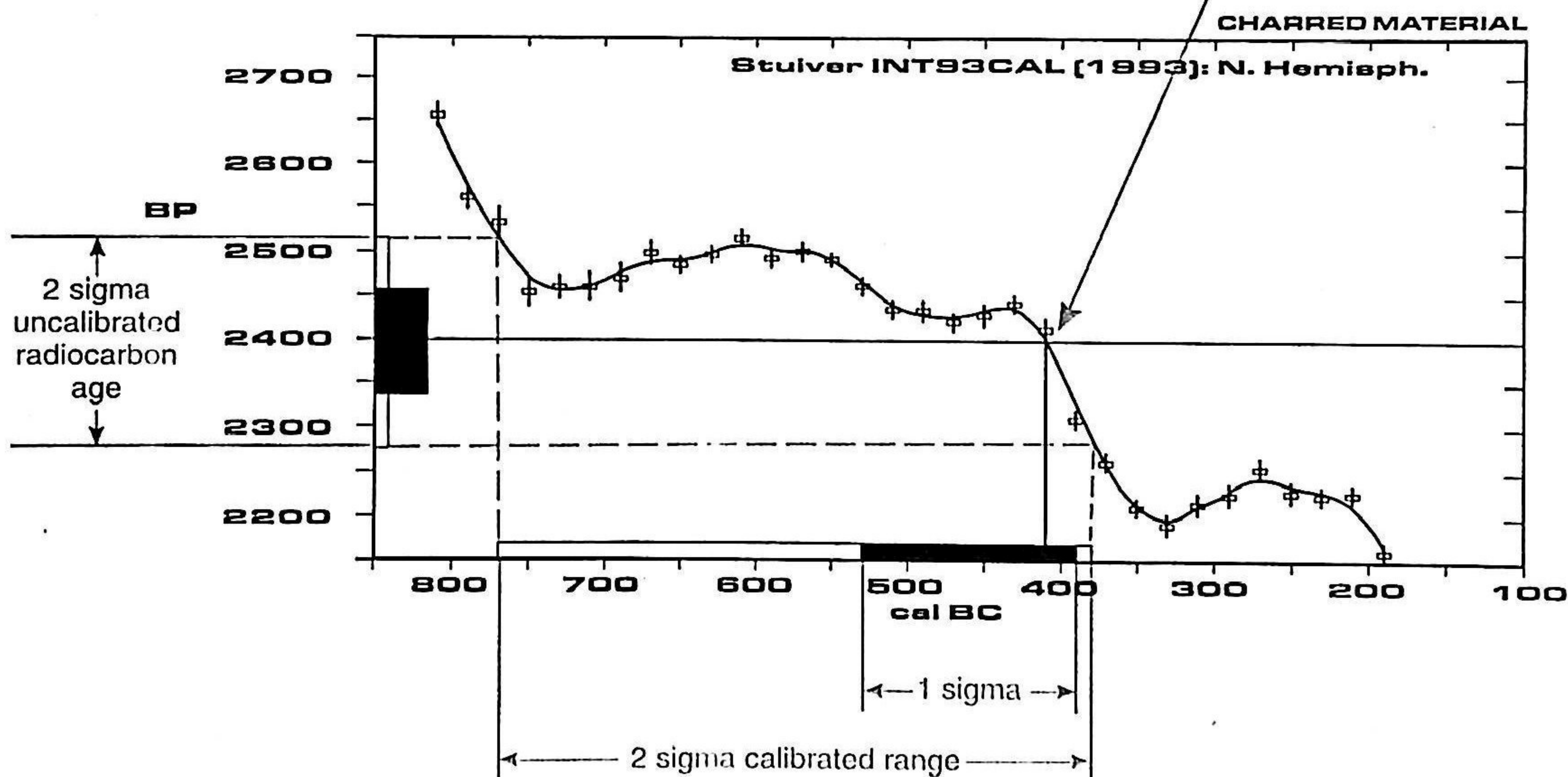
cal BC 410

The intercept between the radiocarbon age & the calibrated calendar time scale curve

The calibration result of the radiocarbon age  $\pm 1$  sigma

1 sigma calibrated result: (68% probability)

cal BC 530 to 390



### References:

- Vogel, J. C., Fuls, A., Visser, E. and Becker, B., 1993, *Radiocarbon* 33(1), p73-86  
Talma, A. S. and Vogel, J. C., 1993, *Radiocarbon* 35(2), p317-322  
Stuiver, M., Long, A., Kra, R. S. and Devine, J. M., 1993, *Radiocarbon* 35(1)

Results prepared by:

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### Reporting results (recommended):

1. List the radiocarbon age with its associated 1 sigma standard deviation in a table and designate it as such.
2. Discussion of ages in the text should focus on the 2 sigma calibrated range.



BETA ANALYTIC INC.  
RADIOCARBON DATING LABORATORY  
CALIBRATED C-14 DATING RESULTS

Calibrations of radiocarbon age determinations are applied to convert BP results to calendar years. The short term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of longer term differences.

The parameters used for the corrections have been obtained through precise analyses of hundreds of samples taken from known-age tree rings of oak, sequoia, and fir up to 7,200 BP. The parameters for older samples, up to 22,000 BP, as well as for all marine samples, have been inferred from other evidence. Calibrations are presently provided for terrestrial samples to about 10,000 BP and marine samples to about 8,300 BP.

The Pretoria Calibration Procedure program has been chosen for these dendrocalibrations. It uses splines through the tree-ring data as calibration curves, which eliminates a large part of the statistical scatter of the actual data points. The spline calibration allows adjustment of the average curve by a quantified closeness-of-fit parameter to the measured data points. On the following calibration curves, the solid bars represent one sigma statistics (68% probability) and the hollow bars represent two sigma statistics (95% probability). Marine carbonate samples that have been corrected for  $\delta^{13/12}\text{C}$ , have also been corrected for both global and local geographic reservoir effects (as published in Radiocarbon, Volume 35, Number 1, 1993) prior to the calibration. Marine carbonates that have not been corrected for  $\delta^{13/12}\text{C}$ , have been adjusted by an assumed value of 0 ‰ in addition to the reservoir corrections. Reservoir corrections for fresh water carbonates are usually unknown and are generally not accounted for in those calibrations. In the absence of measured  $\delta^{13/12}\text{C}$  ratios, a typical value of -5 ‰ was assumed for freshwater carbonates. There are separate calibration data for the Northern and Southern Hemisphere. Variables used in each calibration are listed below the title of each calibration page.

(Caveat: the calibrations assume that the material dated was living for exactly ten or twenty years (e.g. a collection of 10 or 20 individual tree rings taken from the outer portion of a tree that was cut down to produce the sample in the feature dated). For other materials, the maximum and minimum calibrated age ranges given by the computer program are uncertain. The possibility of an "old wood effect" must also be considered, as well as the potential inclusion of some younger material in the total sample. Since the vast majority of samples dated probably will not fulfill the ten/twenty-year-criterium and, in addition, an old wood effect or young carbon inclusion might not be excludable, these dendrocalibration results should be used only for illustrative purposes. In the case of carbonates, reservoir correction is theoretical and the local variations are real, highly variable and dependant on provenience. The age ranges and, especially, the intercept ages generated by the program must be considered as approximations.)



## PRETREATMENT GLOSSARY

Pretreatment of submitted materials is required to eliminate secondary carbon components. These components, if not eliminated, could result in a radiocarbon date which is too young or too old. Pretreatment does not ensure that the radiocarbon date will represent the time event of interest. This is determined by the sample integrity. The old wood effect, burned intrusive roots, bioturbation, secondary deposition, secondary biogenic activity incorporating recent carbon (bacteria) and the analysis of multiple components of differing age are just some examples of potential problems. The pretreatment philosophy is to reduce the sample to a single component, where possible, to minimize the added subjectivity associated with these types of problems.

### "acid/alkali/acid"

The sample was first gently crushed/dispersed in deionized water. It was then given hot HCl acid washes to eliminate carbonates and alkali washes (NaOH) to remove secondary organic acids. The alkali washes were followed by a final acid rinse to neutralize the solution prior to drying. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of the sample. Each chemical solution was neutralized prior to application of the next. During these serial rinses, mechanical contaminants such as associated sediments and rootlets were eliminated. This type of pretreatment is considered a "full pretreatment".

Typically applied to: charcoal, wood, some peats, some sediments, textiles

### "acid washes"

Surface area was increased as much as possible. Solid chunks were crushed, fibrous materials were shredded, and sediments were dispersed. Acid (HCl) was applied repeatedly to ensure the absence of carbonates. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of each sample. The sample, for a number of reasons, could not be subjected to alkali washes to ensure the absence of secondary organic acids. The most common reason is that the primary carbon is soluble in the alkali. Dating results reflect the total organic content of the analyzed material. Their accuracy depends on the researcher's ability to subjectively eliminate potential contaminants based on contextual facts.

Typically applied to: organic sediments, some peats, small wood or charcoal, special cases



#### "collagen extraction"

The material was first tested for friability ("softness"). Very soft bone material is an indication of the potential absence of the collagen fraction (basal bone protein acting as a "reinforcing agent" within the crystalline apatite structure). It was then washed in de-ionized water and gently crushed. Dilute, cold HCl acid was repeatedly applied and replenished until the mineral fraction (bone apatite) was eliminated. The collagen was then dissected and inspected for rootlets. Any rootlets present were also removed when replenishing the acid solutions. Where possible, usually dependant on the amount of collagen available, alkali (NaOH) was also applied to ensure the absence of secondary organic acids.

Typically applied to: bones

#### "acid etch"

The calcareous material was first washed in de-ionized water, removing associated organic sediments and debris (where present). The material was then crushed/dispersed and repeatedly subjected to HCl etches to eliminate secondary carbonate components. In the case of thick shells, the surfaces were physically abraded prior to etching down to a hard, primary core remained. In the case of porous carbonate nodules and caliche, very long exposure times were applied to allow infiltration of the acid. Acid exposure times, concentrations, and number of repetitions, were applied accordingly with the uniqueness of the sample.

Typically applied to: shells, caliche, calcareous nodules

#### "neutralized"

Carbonates precipitated from ground water are usually submitted in an alkaline condition (ammonium hydroxide or sodium hydroxide solution). Typically this solution is neutralized in the original sample container, using deionized water. If larger volume dilution was required, the precipitate and solution were transferred to a sealed separatory flask and rinsed to neutrality. Exposure to atmosphere was minimal.

Typically applied to: Strontium carbonate, Barium carbonate  
(i.e. precipitated ground water samples)

#### "none"

No laboratory pretreatments were applied. Special requests and pre-laboratory pretreatment usually accounts for this. This would never be the circumstance without the knowledge of the submitter.