BETA ANALYTIC INC.

RADIOCARBON Dating Services

Beta Analytic Inc. was founded in 1979 and is now the world's leading Radiocarbon Dating Service.

Chairman Dr. Murry Tamers, Ph.D. (Yale University), D.Sc. (Université de Paris Sorbonne) has been active in radiocarbon dating development and research since 1959 and was among the originators of benzene radiometric dating.

Director Mr. Darden Hood, has been active in radiocarbon dating since 1979 and has personally analyzed over 25,000 samples of archaeological and geological materials.

Together, they have developed and refined radiocarbon dating techniques which efficiently analyze samples while maintaining analytical research quality. Over 5000 scientists world wide have entrusted Beta Analytic with the accurate and timely delivery of over 110,000 radiocarbon dates.

Larger samples (those containing greater than 0.5 grams of final carbon) are analyzed using decay counting. These "radiometric" results are provided within 30 business days using the standard service, within 20 business days using the ADVANCE service and within 6-8 business days using the PRIORITY service.

Very small samples (those containing 0.001 to 0.5 grams of final carbon) are analyzed using direct, atomic counting. These "AMS" results are provided within 30 business days using the standard service or within 6-14 business days using the ADVANCE service.

DELIVERY TIMES ARE FIXED AND INDEPENDENT OF VOLUME.

Publication quality calendar calibration print-outs are provided with all appropriate radiometric and AMS results.

How to contact us - check out the Beta Analytic Inc. MAIL ROOM

- What's NEW at Beta Analytic Inc.
- Radiocarbon Dating services
- Scanning Electron Microscopy (SEM)

Site design and maintenance Netquest Communications

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What's NEW at this web site

We have upgraded! You'll now find extensive information on our full range of services, available for online viewing or download. You can also check out our MAIL ROOM. There, you'll find help on requesting additional information from Beta Analytic Inc. and on submitting material for analysis.

Scanning Electron Microscopy (SEM) is a valuable tool in the interpretation of radiocarbon dates. SEM images, magnified up to 10,000 times, are especially useful for AMS samples.

We now accept VISA and American Express cards in addition to checks (in US dollars payable on a bank with an address in the U.S.A.), International money orders and wire transfers. Foreign submitters will get the best international exchange rates using credit cards.

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SCANNING ELECTRON MICROSCOPY (SEM) of materials submitted for radiocarbon dating

Scanning Electron Microscopy (SEM) can be used to magnify objects up to 10,000 times.

SEM photographs showing microscopic details provide very useful information in the interpretation of radiocarbon dates. For instance, SEM can be used to distinguish primary vs. secondary shell structure and to identify very small wood, charcoal and carbonate samples. SEM micrographs are also an excellent addition to reports and theses.

Click here to view SAMPLE SEM IMAGES from Beta Analytic Inc. (151 KB)

APPROPRIATE MATERIALS:
SEM is especially useful for AMS samples. It is recommended for: very small carbonates which cannot be pretreated (forams, ostracods, coccoliths), or unidentified macro-fossils concentrated from sediments (wood or charcoal for which some taxon identification is useful).

THE SERVICE:
Three (3) micrographs of various angles and/or magnifications are provided for each sample. Micrographs are obtained on a representative portion of the material submitted for radiocarbon dating, not on the dated material itself. The technician will usually be able to choose the angles and magnifications which are most appropriate. The service does not include identification or characterization, but wherever possible, some will be provided.

COST:
The cost is $60 per sample when performed with C14 dating (call for prices when not performed with C14 dating.) Additional micrographs are available for $20 per photo per sample (minimum of 2).

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RADIOCARBON DATING SERVICES

Beta Analytic is the largest radiocarbon dating facility in the world. Currently, over 10,000 samples are analyzed each year for researchers worldwide. Beta's SOLE mission is to provide research quality radiocarbon analyses, delivered ON TIME. Our standard 30 business day delivery schedule for both radiometric and AMS analysis is independent of volume. ADVANCE and PRIORITY services are equally dependable. Full-time professional staff scientists devote 100% their working time to your samples, without the distractions of personal research or other career objectives.

An online version of our brochure is available through the menu below. For current prices or if you have specific questions, please e-mail us at beta@radiocarbon.com. We are always available to answer your questions.

About Beta Analytic Inc.

- Facilities, Equipment and Analysis Services
- Our Assurance of Quality
- Sending samples and visiting our laboratories

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About our COMPANY

Since 1979, BETA ANALYTIC INC. has analyzed over 110,000 radiocarbon samples for 5000 researchers worldwide. This has been accomplished by using methods developed and proven by Drs. Tamers and Stipp in their university research laboratories and by using a professional technical staff who are not distracted with classes or other career objectives. Clients and colleagues represent universities, government and private research institutes and private archaeological and geological consultants from around the world.

FULL TIME PROFESSIONAL STAFF

The laboratory is directed by Mr. Darden Hood and managed by Mr. Ronald Hatfield, each of whom has personally analyzed over 25,000 radiocarbon samples. In their 30 years experience with Beta Analytic Inc., they have refined and proven routine analysis techniques in both the benzene and AMS methods. The professional staff employed are dedicated, full-time technicians whose livelihoods depends upon the accuracy of your results. All are university graduates with degrees in the sciences of geology, chemistry, marine science and biology.

AMS CONSORTIUM LABORATORIES

Routine AMS measurements have been performed since 1983 when Beta Analytic formed a consortium with one of the oldest and most prestigious accelerator laboratories in the world, ETH (Eidgenossiche Technische Hochschule) in Zurich, Switzerland. This consortium now includes five additional accelerator facilities, giving Beta 6 AMS counters to depend upon for rapid, dependable delivery of your AMS dates. Immediately upon receipt of your samples, Beta performs the critical age determining steps of sample assessment, pretreatment and conversion of sample carbon to pure graphite. The AMS facilities are responsible for proper instrument operation and accurate counting of your sample graphite. When they have completed the measurements, the raw results are sent back to Beta for verification, interpretation, and calendar calibration. This "International AMS Collaboration" built by Beta represents the most accurate source of radiocarbon dates available. The collaborating laboratories (seven total including Beta's radiometric laboratory) are intercalibrated daily through the intercomparison of standards and blinds. Beta measures a sample radiometrically and then converts the same sample to graphite for measurement as a blind at two of its collaborating AMS facilities. This ensures accurate results from each laboratory and gives AMS results which are systematically the same as the 80,000 radiometric dates provided by Beta over the last 2 decades.

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Facilities, Equipment and Analysis Services

Radiometric and AMS laboratories are located in a building specifically designed for efficient radiocarbon dating analyses. The RADIOMETRIC division presently has seventeen chemical synthesis lines and 63 state of the art Liquid Scintillation Counters. The AMS division has 18 chemical combustion and graphitization lines, which supply Beta Analytic's AMS Consortium, consisting of 6 AMS counters, with sample graphite.

CONVENTIONAL RADIOMETRIC TECHNIQUE

Beta Analytic employs the benzene method of analysis which was pioneered by Dr.(s) Tamers and Stipp. This technique has a practical dating range of a few hundred years to as much as 45,000 years B.P. (before present, 1950 A.D.).
Standard service is for samples containing at least 1.0 to 4.0 grams of final carbon (carbon remaining after all necessary pretreatments and chemical syntheses have been performed).
Complex/Non-Standard Services are for samples containing 0.3 to 1.0 grams of final carbon or those which require extensive specialized handling.
Quoted precision (the '+/- value' reported with the age of the sample) for recommended size samples generally ranges from 40 to 80 years for samples less than 10,000 years and typically about 1% to 3% for ages beyond 10,000 years. Less than recommended or minimum size samples will produce larger than normal associated standard deviations that will vary with sample size and antiquity. In many cases precision may be enhanced by using the Extended Counting Service. This service may be authorized any sample where enhanced precision is required.

ACCELERATOR MASS SPECTROMETRY (AMS)

This technique has a practical dating range similar to that of conventional radiometric dating; however, much less material is necessary for the analysis. The AMS technique is uniquely suited for very small samples containing 0.001 to 0.3 grams of final carbon.
Quoted precision generally ranges typically from 30 to 80 years for samples less than 10,000 BP and typically 1%-2% for samples older than 10,000 years.

THE RESULTS FROM THE TWO METHODS (RADIOMETRIC AND AMS) ARE IDENTICAL IN ACCURACY. THE PRECISION CAPABILITIES OF AMS IS SLIGHTLY BETTER DUE TO HIGHER COUNTING EFFICIENCY, BUT THE RADIOMETRIC METHOD COSTS ABOUT ½ OF AMS DATING.

STABLE ISOTOPE RATIOS (C13/12)

Measurement of the C13/12 ratio allows for correction of the measured C14 age based on the amount of isotopic fractionation (enrichment or depletion) in the individual sample as compared to the modern standard. This measurement is particularly important for marine or freshwater shells where the correction could result in as much as a 300 to 500 year adjustment to the measured C14 age. In terrestrial samples that may contain C4 or a mixture of C3 and C4 pathway plants, it is also important as the adjustment could range from as little as a few tens of years to over 280 years.

RADIOMETRIC RESULTS WITHIN 30 BUSINESS DAYS

Delivery times are maintained while upholding research standards of analytical quality. Analyses of samples are completed within 30 business days using the STANDARD service, within 20 business days using the ADVANCE service and within 6 business days using the PRIORITY service. The TIME GUIDE Service is capable of results within 2-3 days for special sample types with close laboratory and field coordination. These delivery schedules are independent of sample volume.

AMS RESULTS WITHIN 30 BUSINESS DAYS

Accelerator Mass Spectrometry (AMS) is performed through the Beta Analytic Consortium of Accelerator Laboratories. We perform the critical age determining steps of sample suitability assessment, pretreatment, and conversion of carbon to pure graphite. Your graphite is then sent to one of 6 AMS research facilities for counting. The raw data is sent back to us for verification, interpretation, calibration, and reporting. Completed analyses are generally available within 30 business days using the STANDARD service and within 6 to 14 business days using the ADVANCE service. Our unique consortium design provides the most dependable AMS delivery available. Besides having a large excess of available machine time, down time by any one instrument is not a delivery factor. A laboratory operating independently of our consortium ceases operation entirely during a malfunction, imposing unknown delay problems.

BEST METHOD ANALYSIS

Compromising your research based on sample type or size is not necessary. This complementary service allows maximum flexibility and cost effectiveness, while keeping your research on schedule. Submit the most important samples for your research and we will examine and advise you of the Best Method of analysis (Radiometric or AMS). Samples can be converted from one technique to another or additional services authorized, without delay of results. This is possible due to our large over-capacity with regards to both equipment and personnel.

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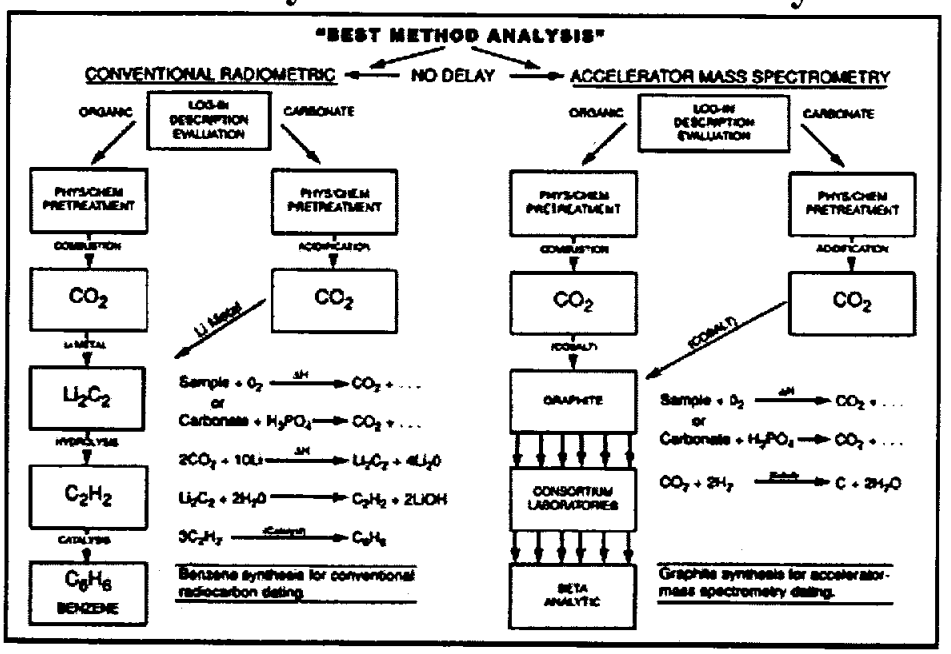
The Analysis Process at Beta Analytic



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Our Assurance of Quality

Beta Analytic is unequalled in its commitment to the quality of the results reported to our clients and colleagues.

Our Experience Factor, with over 80,000 dates reported, on samples of all types from around the world, cannot be duplicated. All accepted international conventions for radiocarbon dating are carefully followed.

The modern reference used is the NBS Oxalic Acid Carbon-14 Standard. Extensive routine inter-calibrations between the Radiometric and Consortium Accelerator Laboratories as well as participation in ongoing International Radiocarbon Intercalibrations such as IAEA (International Atomic Energy Agency) and TIRI (Third International Radiocarbon Intercalibrations) assures reliable results.

Daily monitoring of instrumentation and chemical purity is performed in addition to extensive computer cross checks of statistical analyses and final age calibrations. (Results of International Radiocarbon Intercalibrations and QA/QC documents are available upon request.

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Sending Samples and Visiting our Laboratories

Please click here for "General Sample Size Requirements". Please note that these sizes are estimates. Normal pretreatment procedures can remove 30 to 70 percent of the original material sent. Water, adhering mineral matter and carbon losses from essential chemical pretreatments are basic factors to consider and to allow for when determining the amount of material required.

HOW TO SEND SAMPLES

We recommend either First Class Air Mail or an express courier service such as FedEx, UPS, DHL or TNT. The package should be labelled CARBON SAMPLES FOR SCIENTIFIC STUDY - NO COMMERCIAL VALUE. Each sample should arrive wrapped in an aluminum foil packet placed inside a zip-lock plastic bag. Both should be clearly marked with the sample code number in indelible ink.

NOTE: Please be sure to indicate the hemispheric (north or south) and geographic location of any sample(s). Additionally, if the sample(s) is shell or carbonate, please indicate if the origin is marine or fresh water. This information is essential in determining the necessary hemispheric and

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General Sample Size Requirements

The quantities listed below assume the material is dry and free from associated matrix. Wet and/or dirty samples require sending as much as is available.

RADIOMETRIC TECHNIQUE:

CHARCOAL:
Recommended: 30 gms
Minimum: 1.7 gms

SHELL:
Recommended: 100 gms
Minimum: 7 gms

WOOD:
Recommended: 100 gms
Minimum: 7 gms

PEAT:
Recommended: 100 gms
Minimum: 15 gms

ORGANIC SEDIMENT:
Recommended: 2 kilograms
Minimum: Variable, requires examination

BONE:
Recommended: 500 gms
Minimum: 200 gms

DUNG:
Recommended: 30 gms
Minimum: 7 gms

WATER ($BaCO_3$, $SrCO_3$):
Recommended: 50 gms
Minimum: 7 gms

WATER (AS LIQUID):
Recommended: Call the laboratory

Extended Counting required/recommended for minimum sizes

ACCELERATOR MASS SPECROMETRY TECHNIQUE (AMS):

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CHARCOAL:
Recommended: 50 mgs
Minimum: 5 mgs

SHELL:
Recommended: 100 mgs
Minimum: 30 mgs

FORAMS:
Recommended: 100 mgs
Minimum: 15 mgs

WOOD, SEEDS:
Recommended: 100 mgs
Minimum: 10 mgs

PEAT:
Recommended: 100 mgs
Minimum: 15 mgs

ORGANIC SEDIMENT:
Recommended: 10 gms
Minimum: Variable, requires examination

BONE:
Recommended: 30 gms
Minimum: 2 gms

PLANT MATERIAL:
Recommended: 50 mgs
Minimum: 10 mgs

WATER ($BaCO_3$, $SrCO_3$):
Recommended: 50 mgs
Minimum: 15 mgs

WATER (AS LIQUID):
Recommended: 1 liter
Minimum: 1 liter

SEDIMENT SAMPLE SIZE LIMIT
The laboratory cannot accept extremely low carbon sediments weighing more than about 2 kilograms. Handling requirements and increasing environmental constraints regarding disposal of excess material have imposed this limitation.
AMS analysis can be performed on just a few grams of the same material. Although more expensive, it allows for complete pretreatments, isolation and analysis of fewer sediment components, provides better precision for older materials, and may give less subjective results.

NOTE: Final Carbon is the amount of carbon remaining after all pretreatments and chemical syntheses have been performed. This is typically much less than the material submitted for analysis. As an example, 25% of the amount of submitted charcoal weight is usually available as final carbon. For charcoal, if you multiply the weight by 0.25 and the result is greater than 1, the result can probably be analyzed on a standard basis. If it is between 0.3 and 1.0, the Extended Counting Service is recommended. If is less than 0.3, AMS analysis is required.

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EXTENDED COUNTING SERVICE
Samples containing 0.3 to 1.0 grams of final carbon will give low precision results (large "+/-" values). Use this optional service to enhance precision for small samples, low carbon sediments and special cases where optimal precision is required. Delivery of results is not delayed.

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Calibration of Radiocarbon Age to Calendar Years

EXPLANATION OF THE BETA ANALYTIC DENDRO-CALIBRATION PRINTOUT

CALIBRATION OF RADICARBON AGE TO CALENDAR YEARS

Laboratory Number: Beta-12345

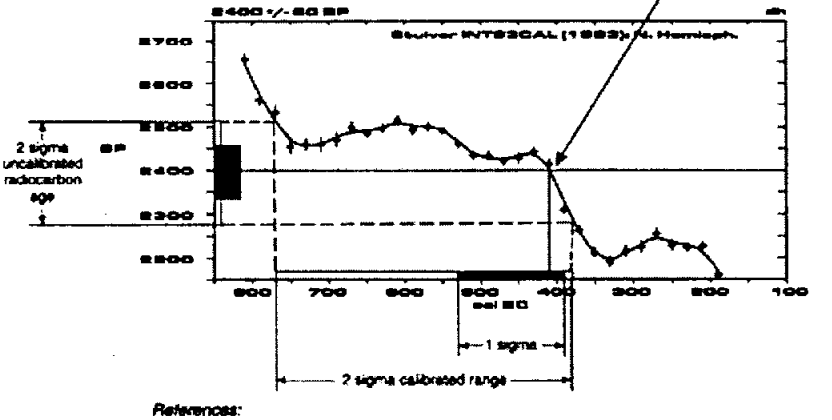
Radiocarbon age: 2400 +/- 60 BP ← The uncalibrated radiocarbon age (± 1 sigma)

The recommended calibration age range to be used for interpretation → Calibrated result: (2 sigma, 95% probability) cal BC 770 to 380

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 ± 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:

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

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

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The BETA ANALYTIC INC. mail room - how to contact us!

If you have any comments, requests or would like more information on submitting samples for analysis, you can e-mail us directly from this site.

PHONE:
(01) 305-667-5167

FAX:
(01) 305-663-0964

MAILING ADDRESS:
Beta Analytic Inc.
University Branch
4985 S.W. 74th Court
Miami, Florida
USA 33155

And while you're here, if you wish to save our URL to your browser's hotlist, it's:
http://www.radiocarbon.com

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