

# Radiocarbon

Published by THE AMERICAN JOURNAL OF SCIENCE

---

**Editor**

MINZE STUIVER

**Associate Editors**

*To serve until January 1, 1984*

STEPHEN C PORTER *Seattle, Washington*

*To serve until January 1, 1985*

W G MOOK *Groningen, The Netherlands*

HANS OESCHGER *Bern, Switzerland*

*To serve until January 1, 1987*

RONALD B DAVIS *Orono, Maine*

**Editor at Large**

IRVING ROUSE *New Haven, Connecticut*

**Managing Editor**

RENEE S KRA

QC  
798  
D3  
A48  
pr

Kilne Geology Laboratory  
Yale University  
New Haven, Connecticut 06511



ISSN: 0033-8222

## NOTICE TO READERS AND CONTRIBUTORS

Since its inception, the basic purpose of Radiocarbon has been the publication of compilations of  $^{14}\text{C}$  dates produced by various laboratories. These lists are extremely useful for the dissemination of basic  $^{14}\text{C}$  information.

In recent years, Radiocarbon has also been publishing technical and interpretative articles on all aspects of  $^{14}\text{C}$ . The editors and readers agree that this expansion is broadening the scope of the Journal. Next year we will publish the Proceedings of the Eleventh International Radiocarbon Conference which was held in Seattle, Washington, June 20-26, 1982. We also published the Proceedings of the Tenth International Radiocarbon Conference in 1980.

Another section is added to our regular issues, "Notes and Comments". Authors are invited to extend discussions or raise pertinent questions to the results of scientific investigations that have appeared on our pages. The section will include short, technical notes to relay information concerning innovative sample preparation procedures. Laboratories may also seek assistance in technical aspects of radiocarbon dating. Book reviews will also be included for special editions.

Manuscripts of radiocarbon papers should follow the recommendations in *Suggestions to Authors*. \* All copy (including the bibliography) must be typewritten in *double space*. Our deadline schedule is:

<i>For</i>	<i>Date</i>
Vol 25, No. 2, 1983	Jan. 1, 1983
Vol 25, No. 3, 1983	May 1, 1983
Vol 26, No. 1, 1984	Sept. 1, 1983

General or technical articles should follow the recommendations above and the editorial style of the *American Journal of Science* or the Proceedings of the Tenth International Radiocarbon Conference. Date lists should follow the format shown in the most recent issue of RADIOCARBON. More detailed instructions are available upon request. Separate mailings have been discontinued.

*Half life of  $^{14}\text{C}$* . In accordance with the decision of the Fifth Radiocarbon Dating Conference, Cambridge, 1962, all dates published in this volume (as in previous volumes) are based on the Libby value,  $5570 \pm 30$  yr, for the half life. This decision was reaffirmed at the 9th International Conference on Radiocarbon Dating, Los Angeles/La Jolla, 1976. Because of various uncertainties, when  $^{14}\text{C}$  measurements are expressed as dates in years BP the accuracy of the dates is limited, and refinements that take some but not all uncertainties into account may be misleading. The mean of three recent determinations of the half life,  $5730 \pm 40$  yr, (Nature, v 195, no. 4845, p 984, 1962), is regarded as the best value presently available. Published dates in years BP, can be converted to this basis by multiplying them by 1.03.

*AD/BC Dates*. In accordance with the decision of the Ninth International Radiocarbon Conference, Los Angeles and San Diego, 1976, the designation of AD/BC, obtained by subtracting AD 1950 from conventional BP determinations is discontinued in Radiocarbon. Authors or submitters may include calendar estimates as a comment, and report these estimates as AD/BC, citing the specific calibration curve used to obtain the estimate.

*Meaning of  $\delta^{14}\text{C}$* . In Volume 3, 1961, we endorsed the notation  $\Delta$  (Lamont VIII, 1961) for geochemical measurements of  $^{14}\text{C}$  activity, corrected for isotopic fractionation in samples and in the NBS oxalic-acid standard. The value of  $\delta^{14}\text{C}$  that entered the calculation of  $\Delta$  was defined by reference to Lamont VI, 1959, and was corrected for age. This fact has been lost sight of, by editors as well as by authors, and recent papers have used  $\delta^{14}\text{C}$  as the observed deviation from the standard. At the New Zealand Radiocarbon Dating Conference it was recommended to use  $\delta^{14}\text{C}$  only for age-corrected samples. Without an age correction, the value should then be reported as percent of modern relative to 0.95 NBS oxalic acid (Proceedings 8th Conference on Radiocarbon Dating, Wellington, New Zealand, 1972). The Ninth International Radiocarbon Conference, Los Angeles and San Diego, 1976, recommended that the reference standard, 0.95 times NBS oxalic acid activity, be normalized to  $\delta^{13}\text{C} = -19\text{‰}$ .

In several fields, however, age corrections are not possible.  $\delta^{14}\text{C}$  and  $\Delta$ , uncorrected for age, have been used extensively in oceanography, and are an integral part of models and theories. For the present, therefore, we continue the editorial policy of using  $\Delta$  notations for samples not corrected for age.

\* Suggestions to Authors of the Reports of the United States Geological Survey, 6th ed, 1978, Supt of Documents, U S Govt Printing Office, Washington, DC 20402.

# RADIOCARBON

Editor: MINZE STUIVER

Managing Editor: RENEE S KRA

Published by

## THE AMERICAN JOURNAL OF SCIENCE

Editors: JOHN RODGERS, JOHN H OSTROM, ROBERT A BERNER

Managing Editor: MARIE C CASEY

Published three times a year, in Winter, Spring, and Summer, at Yale University, New Haven, Connecticut 06511.

Subscription rate \$75.00 (for institutions), \$50.00 (for individuals), available only in whole volumes. The Proceedings of the Tenth International Radiocarbon Conference, vol 22, nos. 2 and 3, are available for \$60.00. The Proceedings of the Eleventh International Radiocarbon Conference will be \$50.00. The price of the full volume 22, nos. 1-4, is \$60.00 for individuals and \$80.00 for institutions.

All correspondence and manuscripts should be addressed to the Managing Editor, RADIOCARBON, Kline Geology Laboratory, Yale University, 210 Whitney Ave, PO Box 6666, New Haven, Connecticut 06511.

*Reprints.* The minimum reprint order for each article will be 50 copies without cover. No reprints will be furnished free of charge unless page charges are paid. The cost of additional copies will, of course, be greater if the article is accompanied by plates involving unusual expense. Copies will be furnished with a printed cover giving the title, author, volume, page, and year, when specially ordered.

*Page charges.* Each institution sponsoring research reported in a technical paper or a date list, will be asked to pay a charge of \$80.00 per printed page, due when galley proof is returned. Institutions or authors paying such charges will be entitled to 100 free reprints without covers. No charge will be made if the author indicates that his institution is unable to pay them, and payment of page charges on an article will *not* in any case be a condition for its acceptance.

*Back issues* and price lists may be obtained from the office of RADIOCARBON.

*Missing issues* will be replaced without charge only if claim is made within three months (six months for India and Australia) after the publication date. Claim for missing issues will not be honored if absence results from failure by the subscriber to notify the Journal of an address change.

*Illustrations* should include explanation of symbols used. Copy that cannot be reproduced cannot be accepted; it should be capable of reduction to not more than 10 by 17.5, all lettering being at least 1/6 inch high after reduction. When necessary, one large map or table can be accepted, if it will not exceed 17.5 inches in width after reduction. Line drawings should be in black India ink on white drawing board, tracing cloth, or coordinate paper printed in blue and should be accompanied by clear ozalids or reduced photographs for use by the reviewers. Photographs should be positive prints. Photostatic and typewritten material cannot be accepted as copy for illustrations. *Plates* (photographs) and *figures* (line drawings) should each be numbered consecutively through each article, using arabic numerals. If two photographs form one plate, they are figures A and B of that plate. **All measurements should be given in SI (metric units).**

*Citations.* A number of radiocarbon dates appear in publications without laboratory citation or reference to published date lists. We ask that laboratories remind submitters and users of radiocarbon dates to include proper citation (laboratory number and date-list citation) in all publications in which radiocarbon dates appear.

*Radiocarbon Measurements: Comprehensive Index, 1950-1965.* This index, covering all published <sup>14</sup>C measurements through Volume 7 of RADIOCARBON, and incorporating revisions made by all laboratories has been published. It is available to all subscribers to RADIOCARBON at \$20.00 US per copy.

*List of laboratories.* The comprehensive list of laboratories at the end of each volume appears in the third number of each volume. Changes in names or addresses should be reported to the Managing Editor by May 1.

*Index.* All dates appear in index form at the end of the third number of each volume.

## CONTENTS

<b>BM</b>	<i>Richard Burleigh, Keith Matthews, and Janet Ambers</i> British Museum Natural Radiocarbon Measurements XIV .....	229
<b>BM</b>	<i>Richard Burleigh, Janet Ambers, and Keith Matthews</i> British Museum Natural Radiocarbon Measurements XV .....	262
<b>Gif</b>	<i>Georgette Delibrias, M T Guillier, and Jacques Labeyrie</i> Gif Natural Radiocarbon Measurements IX .....	291
<b>SFU</b>	<i>D E Nelson and K A Hobson</i> Simon Fraser University Radiocarbon Dates I .....	344
<b>Z</b>	<i>Dušan Srdoč, Nada Horvatinčić, Bogomil Obelic, and Adela Sliepčević</i> Rudjer Bošković Institute Radiocarbon Measurements VII .....	352
	List of Laboratories .....	372
	Index to Volume 24 .....	384