

# Radiocarbon

An International Journal of Cosmogenic Isotope Research

VOLUME 66 • NUMBER 5 • 2024

14  24<sup>th</sup> Radiocarbon  
10<sup>th</sup> <sup>14</sup>C & Archaeology

Zurich, Sept. 11–16, 2022  
Proceedings Part 1 of 2

Guest edited by  
Elisabetta Boaretto, Irka Hajdas,  
and Hans-Arno Synal

14



Editor  
A.J.T. Jull

CAMBRIDGE  
UNIVERSITY PRESS

## Radiocarbon

*An International Journal of Cosmogenic Isotope Research*

### EDITOR

A. J. T. Jull · University of Arizona

### MANAGING EDITOR

Kimberley Tanner Elliott · University of Arizona

### ASSOCIATE EDITORS

Edouard Bard · Collège de France  
Nancy Beavan · ESR, New Zealand  
Warren Beck · University of Arizona  
Ravi Bhushan · PRL, Gujarat, India  
Elisabetta Boaretto · Weizmann Institute  
Christopher Bronk Ramsey · Oxford University  
George S. Burr · University of Arizona  
Lucio Calcagnile · University of Salento, Lecce, Italy  
Alexander Cherkinsky · University of Georgia  
Owen K. Davis · University of Arizona  
Ellen R. M. Druffel · University of California-Irvine  
Pieter Grootes · Christian-Albrechts University  
Carla S. Hadden · University of Georgia  
Irka Hajdas · ETH Zurich  
Derek Hamilton · University of Glasgow  
Christine Hatté · LSCE, Gif-sur-Yvette  
Gregory Hodgins · University of Arizona  
Quan Hua · ANSTO, Australia  
Yaroslav Kuzmin · Russian Academy of Sciences  
Steven W. Leavitt · University of Arizona

Susanne Lindauer · CEZA, Mannheim  
Kita Macario · UFF, Rio de Janeiro  
Ann P. McNichol · WHOI, USA  
Mihály Molnár · Lab. of Envir. Studies, Hungary  
Toshio Nakamura · Nagoya University  
Jesper Olsen · Aarhus AMS Center  
Charlotte Pearson · University of Arizona  
Pavel Povinec · Comenius University, Slovakia  
Gianluca Quarta · University of Salento, Lecce, Italy  
Andrzej Rakowski · Silesian Univ. of Tech., Gliwice  
Paula J. Reimer · Queen's University Belfast  
E. Marian Scott · University of Glasgow  
Corina Solis · UNAM, Mexico City  
John R. Southon · University of California-Irvine  
Jocelyn Turnbull · GNS Science, New Zealand  
Johannes van der Plicht · Groningen University  
Ryan Venturelli, Colorado School of Mines  
Rachel Wood · Oxford University, UK  
Antoine Zazzo · Mus. Nat. d'Histoire naturelle  
Weijian Zhou · Inst. of Earth Environ., Chinese Acad. of Sci.

*Radiocarbon* (ISSN 0033-8222) is published six times per year by Cambridge University Press, One Liberty Plaza 20th Floor New York, NY 10006. © 2024 by the Arizona Board of Regents on behalf of the University of Arizona. All rights reserved.

### Editorial Office

Communications should be addressed to the Managing Editor, *Radiocarbon*, Department of Geosciences, The University of Arizona, 1040 E. 4th St., Rm. 208, Tucson, AZ 85721 USA. Tel.: +1 (520) 621-0641; Email: kimelliott@arizona.edu. Contributors should consult the Instructions for Contributors, which is available on the journal's Web site: [cambridge.org/rdc](http://cambridge.org/rdc).

### Subscriptions

Annual subscription rates for Volume 66, 2024: Institutional rate is (print and electronic) \$710 in the USA, Canada, and Mexico, £458 + VAT elsewhere. Institutional rate (electronic only) \$399 in the USA, Canada, and Mexico, £285 + VAT elsewhere. Individual rate is (print and electronic) \$216 in the USA, Canada, and Mexico, £139 + VAT elsewhere. Individual rate (electronic only) \$138 in the USA, Canada, and Mexico, £90 + VAT elsewhere. Please direct subscription inquiries and requests for back issues to Customer Services at Cambridge University Press, email: [subscriptions\\_newyork@cambridge.org](mailto:subscriptions_newyork@cambridge.org) (USA, Canada, and Mexico) or [journals@cambridge.org](mailto:journals@cambridge.org) (outside of USA, Canada, and Mexico).

### Advertising

To advertise in the journal email [advertising@cambridge.org](mailto:advertising@cambridge.org) or telephone +1 (212) 337 5062 in the USA, Canada, or Mexico; email [ad\\_sales@cambridge.org](mailto:ad_sales@cambridge.org) or telephone +44 (0)1223 325898 in the rest of the world.

### Abstracting and indexing

*Radiocarbon* is indexed and/or abstracted by the following sources: *Anthropological Index*; *Anthropological Literature*; *Art and Archaeology Technical Abstracts*; *Bibliography and Index of Geology* (GeoRef); *British Archaeological Bibliography*; *Chemical Abstracts*; *Chemistry Citation Index*; *Current Advances in Ecological and Environmental Sciences*; *Current Contents* (ISI); FRANCIS (Institut de l'Information Scientifique et Technique – CNRS); *Geographical Abstracts*; *Geological Abstracts*; *Oceanographic Literature Review*; *Science Citation Index*; *Social Sciences Citation Index*.

### List of laboratories

Our current list of laboratories is at [www.radiocarbon.org](http://www.radiocarbon.org). Listings are self-reported. We ask all directors to provide their lab code designation, telephone and fax numbers, and email addresses. Changes should be reported to the managing editor. Labs are arranged in alphabetical order by country, and we include a list of current and past lab codes.

### Permissions

No part of this publication may be reproduced, in any form or by any means, electronic, photocopying or otherwise, without permission in writing from Cambridge University Press. Policies, request forms and contacts are available at: <http://journals.cambridge.org/action/rightsAndPermissions>. Permission to copy (for users in the USA) is available from Copyright Clearance Center: <http://www.copyright.com>, email: [info@copyright.com](mailto:info@copyright.com).

**Postmaster:** Send address changes to *Radiocarbon*, Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA.

# Proceedings of the 24th Radiocarbon and 10th Radiocarbon & Archaeology International Conferences

## **Radiocarbon**

Vol 66, Nr 5, 2024

Part 1 of 2

### **CONTENTS**

#### **EDITORIAL**

Introduction

*Elisabetta Boaretto, Irka Hajdas, Hans-Arno Synal, A J Timothy Jull*..... 825

#### **REGIONAL AND GLOBAL CARBON CYCLE**

Changes in fossil CO<sub>2</sub> emissions in Mexico City during the COVID-19 lockdown deduced from atmospheric radiocarbon concentrations

*Laura E Beramendi-Orosco, Galia González-Hernández, Edith Cienfuegos, Francisco Otero*..... 843

Radiocarbon analysis of soil microbial biomass via direct chloroform extraction

*Kari M Finstad, Erin E Nuccio, Katherine E Grant, Taylor A B Broek, Jennifer Pett-Ridge, Karis J McFarlane*..... 854

Time series of surface water dissolved inorganic carbon isotopes from the Southern California bight

*Niels E Hauksson, Xiaomei Xu, Shawn Pedron, Hector A Martinez, Christian B Lewis, Danielle S Glynn, Christopher Glynn, Noreen Garcia, Alessandra Flaherty, Katherine Thomas, Sheila Griffin, Ellen R M Druffel*..... 863

Radiocarbon ages of plant remains in massive ground ice and underlying sediments of the Barrow Permafrost Tunnel, Alaska

*Go Iwahana, Masao Uchida, Kazuho Horiuchi, Jody Deming, Hajo Eicken, Hiroshi Ohno, Kanako Mantoku, Toshiyuki Kobayashi, Kazuyuki Saito*..... 879

Source apportionment of atmospheric and sedimentary PAHs from Kolkata, India using compound-class-specific radiocarbon analysis (CCSRA)

*Hidetoshi Kumata, Masao Uchida, Mahua Saha, Shoichi Saitoh, Kanako Mantoku, Toshiyuki Kobayashi, Tomoaki Okuda, Fumiyuki Nakajima, Shiro Hatakeyama, Yasuyuki Shibata, Hideshige Takada*..... 892

AMS <sup>14</sup>C dating and stable isotope analysis on an 8-kyr oyster shell from Taipei Basin: Sea level and SST changes

*Hong-Chun Li, Horng-Sheng Mii, Tsung-Kwei Liu, Wen-Shan Chen, Su-Chen Kang, Chun-Yen Chou, Satabdi Misra, Tzu-Tsen Shen, Meixun Zhao*..... 904

Soil carbon stocks not linked to aboveground litter input and chemistry of old-growth forest and adjacent prairie

*Karis J McFarlane, Stefania Mambelli, Rachel C Porras, Daniel B Wiedemeier, Michael W I Schmidt, Todd E Dawson, Margaret S Torn*..... 919

The influence of plant species and pretreatment on the <sup>14</sup> C age of Carex-dominated peat plants of a peat core from Jinchuan Mire, NE China <i>Satabdi Misra, Sneha Kashyap, Chun-Yen Chou, Tingyi Chang, Hong-Chun Li, Xiaoyan Ning, Jing-Jing Sun, Jie Wang, Meixun Zhao</i> .....	937
Characterization of fine carbonaceous aerosols from the Eastern Mediterranean: Contributions of fossil and non-fossil carbon sources <i>Chandra Mouli Pavuluri, Nikolaos Mihalopoulos, Masao Uchida, Kanako Mantoku, Toshiyuki Kobayashi, Pingqing Fu, Kimitaka Kawamura</i> .....	958
Radiocarbon variations in annual tree rings with 11-year solar cycles during 1800–1950 <i>Pavel P Povinec, Ivan Kontul', Ivo Svetlik</i> .....	973
Atmospheric CO <sub>2</sub> carbon isotope composition in urban and clean areas of the Northern Adriatic coast of Croatia <i>Andreja Sironić, Emma Hess, Jadranka Barešić, Tjaša Kanduč, Damir Borković, Ines Krajcar Bronić</i> .....	989
The size inherited age effect on radiocarbon dates of alluvial deposits: Redating charcoal fragments in a sand-bed stream, Macdonald River, NSW, Australia <i>Rachel Wood, Fleur King, Rebecca Esmay, Qianyang Chen, Larissa Schneider, Emilie Dotte-Sarout, Stewart Fallon, Kirstie Fryirs, Richard Gillespie, Russell Blong</i> .....	1006

## TECHNICAL

<sup>14</sup> C Measurement of samples for environmental science applications at the National Environmental Isotope Facility (NEIF) radiocarbon laboratory, SUERC, UK <i>P Ascough, N Bompard, M H Garnett, P Gulliver, C Murray, J-A Newton, C Taylor</i> .....	1020
Monitoring of modern carbon fraction in disposable packaging <i>Komal Aziz Gill, Danuta J Michczyńska, Adam Michczyński, Natalia Piotrowska</i> .....	1032
20 Years of AMS <sup>14</sup> C dating using the ARTEMIS facility at the LMC14 National Laboratory: Review of service and research activities <i>L Beck, I Caffy, E Delqué-Količ, J-P Dumoulin, C Goulas, S Hain, C Moreau, M Perron, V Setti, M Sieudat, B Thellier</i> .....	1041
Comparability of radiocarbon measurements in dissolved inorganic carbon of seawater produced at ETH-Zurich <i>Maxi Castrillejo, Roberta L Hansman, Heather D Graven, Joanna G Lester, Silvia Bollhalder, Kayley Kündig, Lukas Wacker</i> .....	1054
Experimental observations on processing leather, skin, and parchment for radiocarbon dating <i>Margaret A Davis, Brendan J Culleton, Richard L Rosencrance, Christopher S Jazwa</i> .....	1064
The progress of <sup>14</sup> C-AMS analysis for ultra-small samples at Xi'an AMS center <i>Hua Du, Yunchong Fu, Peng Cheng, Haiyan Zhao, Yaoyao Hou, Xiaohu Xiong, Huachun Gu, Ling Yang</i> .....	1087
A database of NERC radiocarbon measurements determined by accelerator mass spectrometry <i>M H Garnett, C L Bryant, S P H T Freeman, P Gulliver, P L Ascough</i> .....	1105
Assessing a modified carbonate digestion protocol for increased carbon dioxide recovery during cremated bone pretreatment <i>Maddalena Gianni, Seren Griffiths, Rachel Wood, David Chivall</i> .....	1109
Advancing Antarctic sediment chronology through combined ramped pyrolysis oxidation and pyrolysis-GC-MS <i>Catherine E Ginnane, Jocelyn C Turnbull, Sebastian Naeher, Brad E Rosenheim, Ryan A Venturelli, Andy M Phillips, Simon Reeve, Jeremy Parry-Thompson, Albert Zondervan, Richard H Levy, Kyu-Cheul Yoo, Gavin Dunbar, Theo Calkin, Carlota Escutia, Julia Gutierrez Pastor</i> .....	1120

First $\delta^{13}\text{C}$ results with a new connection between the EA-IRMS System and the gas injection system at CologneAMS <i>Martina Gwozdz, Alexander Stolz, Andrea Jaeschke, Stefan Heinze, Ramona Mörchen, Alfred Dewald, Janet Rethemeyer, Dennis Mücher, Markus Schiffer</i> .....	1140
Sample selection, characterization and choice of treatment for accurate radiocarbon analysis—insights from the ETH Laboratory <i>Irka Hajdas, Giulia Guidobaldi, Negar Haghypour, Karin Wyss</i> .....	1152
Radiocarbon dating on ECHOMICADAS, LSCE, Gif-sur-Yvette, France: New and updated chemical procedures <i>Christine Hatté, Maurice Arnold, Arnaud Dapoigny, Valérie Daux, Georgette Delibrias, Diane Du Boisgucheneuc, Michel Fontugne, Caroline Gauthier, Marie-Thérèse Guillier, Jérémy Jacob, Michel Jaudon, Évelyne Kaltmecker, Jacques Labeyrie, Claude Noury, Martine Paterne, Monique Pierre, Brian Phouybanhdyt, Jean-Jacques Poupeau, Jean-François Tannau, François Thil, Nadine Tisnérat-Laborde, Hélène Valladas</i> .....	1166
Radiocarbon dating of highly degraded and problematic fossil wood: Verification of the effectiveness of various preparation methods <i>Maksymilian Jędrzejowski, Danuta J Michczyńska, Marzena Khusek, Adam Michczyński, Fatima Pawelczyk, Natalia Piotrowska, Karin Wyss Heeb, Irka Hajdas</i> .....	1182
Squeaky clean cellulose: Comparing pretreatment effectiveness on single tree rings and wooden laths <i>Wendy Hlengiwe Khumalo, Helene Løvstrand Svarva, Damaris Zurbach, Marie-Josée Nadeau</i> .....	1200
Funny wrappings—challenging your radiocarbon laboratory <i>Susanne Lindauer, Ronny Friedrich</i> .....	1213
Achieving low backgrounds during compound-specific hydroxyproline dating: HPLC column effects <i>Bethan Linscott, Luke Spindler, Jamie Cameron, David Chivall, Rachel Wood</i> .....	1217
Preparation and handling of methane for radiocarbon analysis at CologneAMS <i>Jan Olaf Melchert, Martina Gwozdz, Merle Gierga, Lukas Wacker, Dennis Mücher, Janet Rethemeyer</i> .....	1226
Laser ablation system with a diode laser for AMS $^{14}\text{C}$ measurement of organic materials <i>Fumina Minamitani, Takayuki Omori, Kohei Yamazaki, Hiromasa Ozaki, Masataka Hakozaki, Minoru Yoneda</i> .....	1238
Holocene overwash occurrence age in the Isumi River lowland, Eastern Boso Peninsula, Japan <i>Soichiro Oda, Stephen P Obrochta, Osamu Fujiwara, Yusuke Yokoyama, Yosuke Miyairi, Yoshiya Hatakeyama</i> .....	1248
$^{14}\text{C}$ GIRI samples in AMS Golden Valley: Graphite preparation using AGE-3 and absorption-catalytic setup <i>E V Parkhomchuk, A V Petrozhitskiy, M M Ignatov, D V Kuleshov, A I Lysikov, A G Okunev, K A Babina, V V Parkhomchuk</i> .....	1259
Comparative features of BINP AMS and MICADAS facilities working at AMS Golden Valley, Russia <i>A V Petrozhitskiy, E V Parkhomchuk, M M Ignatov, D V Kuleshov, L A Kutnyakova, E S Konstantinov, V V Parkhomchuk</i> .....	1270
LEA—a novel low energy accelerator for $^{14}\text{C}$ dating <i>Urs Ramsperger, Daniele De Maria, Philip Gautschi, Sascha Maxeiner, Arnold Milenko Müller, Hans-Arno Synal, Lukas Wacker</i> .....	1280
Radiocarbon step-combustion oxidation method and FTIR analysis of Trondheim $\text{CaCO}_3$ precipitates of atmospheric $\text{CO}_2$ samples: Further investigations and insights <i>Guaciara M Santos, Christopher A Leong, Pieter M Grootes, Martin Seiler, Helene Svarva, Marie-Josée Nadeau</i> .....	1289

Preliminary results from Glasgow International Radiocarbon Intercomparison <i>E M Scott, P Naysmith, E Dunbar</i> .....	1302
Sample preparation system for carbonate and DIC in water at the GXNU-AMS laboratory <i>Hongtao Shen, Linjie Qi, He Ouyang, Xinyi Han, Guofeng Zhang, Dingxiong Chen, Kaiyong Wu, Junsen Tang, Li Wang, Ning Wang, Xiaojun Sun, Ming He, Kimikazu Sasa, Jiang Shan</i> .....	1310
Experimental conditions for <sup>14</sup> C graphite preparation at the GXNU lab, China <i>Hongtao Shen, Dingxiong Chen, Li Wang, Zhaomei Li, Junsen Tang, Guofeng Zhang, Linjie Qi, Kaiyong Wu, Xinyi Han, He Ouyang, Yun He, Ning Wang, Xiaojun Sun, Ming He, Kimikazu Sasa, Shan Jiang</i> .....	1322
Radiocarbon and tritium measurements at the GXNU-AMS facility <i>Hongtao Shen, Dingxiong Chen, Junsen Tang, Guofeng Zhang, Li Wang, Linjie Qi, Kaiyong Wu, Xinyi Han, He Ouyang, Ning Wang, Xiaojun Sun, Ming He, Kimikazu Sasa, Shan Jiang</i> .....	1335
A homemade semiautomatic graphitization device for AMS <sup>14</sup> C dating at NTUAMS lab <i>Tzu-Tsen Shen, Hong-Chun Li, Rick Qiu</i> .....	1345
Radiocarbon mortar dating intercomparison MODIS2—approach from the Zagreb radiocarbon laboratory, Croatia <i>Andreja Sironić, Alexander Cherkinsky, Vjekoslav Štrukil, Damir Borković, Jadranka Barešić, Ines Krajačar Bronić</i> .....	1354
Safe preparation and delivery of graphite targets for <sup>14</sup> C analysis: Procedures of BRAVHO lab at Bologna University <i>Laura Tassoni, Bernd Kromer, Ronny Friedrich, Lukas Wacker, Maurizio Cattani, Michael Friedrich, Dragana Paleček, Enrico Pelloni, Kehua Peng, Michael Eric Thomas, Sahra Talamo</i> .....	1368
<sup>14</sup> C microsample analysis with ECHOMICADAS facilities: Current state of play <i>François Thil, Nadine Tisnérat-Laborde, Christine Hatté, Elias Kader, Claude Noury, Martine Paterne, Brian Phouybanhdyt, Lukas Wacker</i> .....	1379
Routine quality assurance in the SUERC radiocarbon laboratory <i>B G Tripney, E Dunbar, E M Scott, P Naysmith</i> .....	1395
A universal gas interface for simultaneous <sup>14</sup> C and <sup>δ13</sup> C measurements <i>Melina Wertnik, Lukas Wacker, Stefano M. Bernasconi, Negar Haghypour, Timothy I Eglinton, Caroline Welte</i> .....	1406
Experimental study on the charge-exchange cross-sections of low-energy carbon ions in helium at GXNU <i>Guofeng Zhang, Hongtao Shen, Zhenchi Zhao, Junsen Tang, Li Wang, Dingxiong Chen, Linjie Qi, Kaiyong Wu, Xinyi Han, He Ouyang, Ning Wang, Xiaojun Sun, Ming He, Kimikazu Sasa, Shan Jiang</i> .....	1417
<b>TRACERS</b>	
The role of <sup>14</sup> C dating in the identification of missing persons in Cyprus <i>Gianluca Quarta, Theodora Eleftheriou, Istenc Engin, Lucio Maruccio, Marisa D'Elia, Lucio Calcagnile</i> .....	1429
Modeling corrections of bomb-pulse radiocarbon dating in forensic cases <i>Árný E Sveinbjörnsdóttir, Jesper Olsen, Jan Heinemeier</i> .....	1440
Absorption and distribution of ultratrace exogenous <sup>14</sup> C urea in rats <i>Li Wang, Hongtao Shen, Junsen Tang, Guofeng Zhang, Linjie Qi, Dingxiong Chen, Kaiyong Wu, Xinyi Han, He Ouyang, Yun He, Pucheng Yang, Xue Zhang, Chunbo Xia</i> .....	1450
<b>WORKSHOP</b>	
Improving Ionplus MICADAS performance with recessed graphite <i>Taylor A B Broek, Mark L Roberts</i> .....	1460