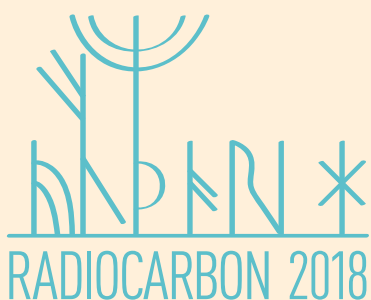


Radiocarbon

An International Journal of Cosmogenic Isotope Research

VOLUME 61 • NUMBER 5 • 2019



Radiocarbon 2018 Conference
Proceedings
Trondheim, Norway,
June 17–22, 2018

Part 1 of 2

Guest Editor Marie-Josée Nadeau

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 · Cardiff University

Warren Beck · University of Arizona

Elisabetta Boaretto · Weizmann Institute

Christopher Bronk Ramsey · Oxford University

George S. Burr · University of Arizona

Owen K. Davis · University of Arizona

Ellen R. M. Druffel · University of California-Irvine

Pieter Grootes · Christian-Albrechts University

Irka Hajdas · ETH Zurich

Derek Hamilton · University of Glasgow

Christine Hatté · Laboratoire des Sciences du Climat et
l'Environnement

Gregory Hodgins · University of Arizona

Quan Hua · Australian Nuclear Science and Technology
Organisation

Yaroslav Kuzmin · Russian Academy of Sciences

Steven W. Leavitt · University of Arizona

Ann P. McNichol · Woods Hole Oceanographic Institution

Mihály Molnár · Hertelendi Laboratory of Environmental
Studies, Hungary

Toshio Nakamura · Nagoya University

Jesper Olsen · Aarhus AMS Center

Charlotte Pearson · University of Arizona

Pavel Povinec · Comenius University

Paula J. Reimer · Queen's University Belfast

E. Marian Scott · University of Glasgow

John R. Southon · University of California-Irvine

Jocelyn Turnbull · GNS Science

Johannes van der Plicht · Groningen University

Antoine Zazzo · Muséum national d'Histoire naturelle

Weijian Zhou · Institute of Earth Environment, Chinese
Academy of Science

Radiocarbon (ISSN 0033-8222) is published quarterly by Cambridge University Press, One Liberty Plaza 20th Floor New York, NY 10006. © 2019 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, 4717 East Fort Lowell Road, Tucson, AZ 85712-1201 USA. Tel.: +1 (520) 621-0641; Fax: +1 (520) 621-0584; Email: kimelliott@email.arizona.edu. Contributors should consult the Instructions for Contributors, which is available on the journal's Web site: cambridge.org/rdc.

Subscriptions

Annual subscription rates for Volume 61, 2019: Institutional rate is (print and electronic) \$524 in the USA, Canada, and Mexico, £338 + VAT elsewhere. Institutional rate (electronic only) \$381 in the USA, Canada, and Mexico, £245 + VAT elsewhere. Individual rate is (print and electronic) \$172 in the USA, Canada, and Mexico, £111 + VAT elsewhere. Individual rate (electronic only) \$132 in the USA, Canada, and Mexico, £86 + VAT elsewhere. Please direct subscription inquiries and requests for back issues to Customer Services at Cambridge University Press, email: subscriptions_newyork@cambridge.org (USA, Canada, and Mexico) or journals@cambridge.org (outside of USA, Canada, and Mexico).

Advertising

To advertise in the journal email advertising@cambridge.org or telephone +1 (212) 337 5062 in the USA, Canada, or Mexico; email 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 comprehensive list of laboratories is published annually, and is also available at www.radiocarbon.org. We ask all laboratory directors to provide their laboratory code designation, as well as current telephone and fax numbers, and email addresses. Changes in names or addresses, additions or deletions should be reported to the managing editor. Conventional and AMS laboratories are arranged in alphabetical order by country, and we include laboratories listed by code designation.

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.

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

Proceedings of the 23rd International Radiocarbon Conference

Radiocarbon

Vol 61, Nr 5, 2019

Part 1 of 2

CONTENTS

INTRODUCTION	i
PLENARY TALKS	
The Importance of Open Access to Chronological Information: The IntChron Initiative <i>Christopher Bronk Ramsey, Maarten Blaauw, Rebecca Kearney, Richard A Staff</i>	1121
Radiocarbon Dating and the Protection of Cultural Heritage <i>Irka Hajdas, A J Timothy Jull, Eric Huysecom, Anne Mayor, Marc-André Renold, Hans-Arno Synal, Christine Hatté, Wan Hong, David Chivall, Lucile Beck, Lucia Liccioli, Mariaelena Fedi, Ronny Friedrich, Francesco Maspero, Tiberiu Sava</i>	1133
The Half-Life of ^{14}C —Why Is It So Long? <i>Walter Kutschera</i>	1135
Confessions of a Serial Polygamist: The Reality of Radiocarbon Reproducibility in Archaeological Samples <i>Alex Bayliss, Peter Marshall</i>	1143
Life after SIRI—Where Next? <i>E Marian Scott, Philip Naysmith, Gordon Cook</i>	1159
ANTHROPOGENIC IMPACTS	
A Comprehensive Study of the ^{14}C Source Term in the 10MW High Temperature Gas-Cooled Reactor <i>X Liu, W Peng, L Wei, M Lou, F Xie, J Cao, J Tong, F Li, G Zheng</i>	1169
Assessment of the Contamination by ^{14}C Airborne Releases in the Vicinity of the Ignalina Nuclear Power Plant <i>Algirdas Pabedinskas, Evaldas Maceika, Justina Šapolaitė, Žilvinas Ežerinskis, Laurynas Juodis, Laurynas Butkus, Laurynas Bučinskas, Vidmantas Remeikis</i>	1185
Fossil Carbon Load in Urban Vegetation for Debrecen, Hungary <i>Tamás Varga, Petra Barnucz, István Major, Zsuzsa Lisztes-Szabó, A J Timothy Jull, Elemér László, János Péntes, Mihály Molnár</i>	1199

ARCHAEOLOGY

- New Radiocarbon Dating Results from the Upper Paleolithic–Mesolithic Levels in Grotta Romanelli (Apulia, Southern Italy)
Lucio Calcagnile, Raffaele Sardella, Ilaria Mazzini, Francesca Giustini, Mauro Brilli, Marisa D’Elia, Eugenia Braione, Jacopo Conti, Beniamino Mecozzi, Fabio Bona, Dawid Adam Iurino, Giuseppe Lembo, Brunella Muttillio, Gianluca Quarta 1211
- AMS Dating of Potentially the Oldest Wooden Sculptures in Japan from a Shinto Shrine in Akita
Naoto Fukuyo, Yusuke Yokoyama, Yosuke Miyairi, Yusuke Igarashi..... 1221
- Absolute Dating of Early Iron Objects from the Ancient Orient: Radiocarbon Dating of Luristan Iron Mask Swords
C Matthias Hüls, Ingo Petri, Helmut Föll..... 1229
- Radiocarbon Dating of Mortar from the Aqueduct in Skopje
Andreja Sironić, Damir Borković, Jadranka Barešić, Ines Krajcar Bronić, Alexander Cherkinsky, Ljiljana Kitanovska, Vjekoslav Štrukil, Lidija Robeva Čukovska .. 1239
- ¹⁴C-Dating of the Late Bronze Age City of Hala Sultan Tekke, Cyprus: Status Report
Eva M Wild, Peter M Fischer, Peter Steier, Teresa Bürge 1253

CALIBRATION & CALIBRATION RECORDS

- The Influence of Calibration Curve Construction and Composition on the Accuracy and Precision of Radiocarbon Wiggle-Matching of Tree Rings, Illustrated by Southern Hemisphere Atmospheric Data Sets from AD 1500–1950
Alan G Hogg, Timothy J Heaton, Christopher Bronk Ramsey, Gretel Boswijk, Jonathan G Palmer, Chris S M Turney, John Southon, Warren Gumbley..... 1265
- Learning from the Wood Samples in ICS, TIRI, FIRI, VIRI, and SIRI
E M Scott, G T Cook, P Naysmith, R A Staff..... 1293

DENDROCHRONOLOGY & SINGLE-YEAR ANALYSIS

- Annual ¹⁴C Tree-Ring Data around 400 AD: Mid- and High-Latitude Records
Ronny Friedrich, Bernd Kromer, Frank Sirocko, Jan Esper, Susanne Lindauer, Daniel Nievergelt, Karl Uwe Heussner, Thorsten Westphal..... 1305
- Identifying the 993–994 CE Miyake Event in the Oldest Dated Living Tree in Europe
Gianluca Quarta, Alfredo Di Filippo, Lucio Calcagnile, Marisa D’Elia, Franco Biondi, Emanuele Presutti Saba, Michele Baliva, Giuseppe De Vivo, Aldo Schettino, Gianluca Piovesan..... 1317
- Abrupt Increase of Radiocarbon Concentration in 660 BC in Tree Rings from Grabie Near Kraków (SE Poland)
Andrzej Rakowski, Marek Krąpiec, Matthias Huels, Jacek Pawlyta, Christian Hamann, Damian Wiktorowski..... 1327
- Intervalidation of Dendrochronology and ¹⁴C Dating on a 700-yr Tree-Ring Sequence Originating from the Eastern Carpathians
Gabriela O Sava, Ionel Popa, Tiberiu B Sava, Aurelia Meghea, Cristian Mănăilescu, Maria Ilie, Andrei Robu, Boglárka Tóth..... 1337

FORENSIC APPLICATIONS

- Thermal Decomposition of Lead White for Radiocarbon Dating of Paintings
Lucile Beck, Cyrielle Messenger, Stéphanie Coelho, Ingrid Caffy, Emmanuelle Delqué-Količ, Marion Perron, Solène Mussard, Jean-Pascal Dumoulin, Christophe Moreau, Victor Gonzalez, Eddy Foy, Frédéric Miserque, Céline Bonnot-Diconne..... 1345
- Radiocarbon Dating of Legacy Music Instrument Collections: Example of Traditional Indian Vina from the Musée De La Musique, Paris
M G Durier, P Bruguière, C Hatté, S Vaiedelich, C Gauthier, F Thil, N Tisnérat-Laborde..... 1357

HYDROLOGY, LIMNOLOGY, OCEANOGRAPHY & RESERVOIR EFFECTS

- Variation of Surface Radiocarbon in the North Pacific During Summer Season 2004–2016
T Aramaki, S Nakaoka, Y Terao, S Kushibashi, T Kobayashi, Y Osonoi, H Mukai, Y Tohjima 1367
- The Yarkon-Taninim Aquifer (Judea Group Israel): What Radiocarbon Can Tell
Joel Kronfeld, Israel Carmi, Dror Avisar 1377
- ^{14}C Age Offset in the Mar Piccolo Sea Basin in Taranto (Southern Italy) Estimated on *Cerastoderma Glaucum* (Poiret, 1789)
Gianluca Quarta, Paola Fago, Lucio Calcagnile, Giulia Cipriano, Marisa D'Elia, Massimo Moretti, Giovanni Scardino, Eliana Valenzano, Giuseppe Mastronuzzi 1387

LABORATORY MANAGEMENT & ORGANIZATION

- ^{14}C Blank Corrections for 25–100 μg Samples at the National Ocean Sciences AMS Laboratory
M L Roberts, K L Elder, W J Jenkins, A R Gagnon, L Xu, J D Hlavenka, B E Longworth..... 1403
- Humics—Their History in the Radiocarbon Intercomparison Studies
Philip Naysmith, E Marian Scott, Elaine Dunbar, Gordon T Cook 1413

MEASUREMENT TECHNIQUES

- Accelerator Mass Spectrometry Analysis of ^{237}Np in Environmental Samples
Yongjing Guan, Shaohan Sun, Huijuan Wang, Filippo Terrasi, Zhiyong Liu, Lucio Gialanella, Raffaele Buompane, Joseph Tandoh, Xianwen He 1423
- Direct AMS ^{14}C Analysis of Carbonate
Quan Hua, Vladimir A Levchenko, Matthew A Kosnik..... 1431
- A Novel Dedicated HVE ^{14}C AMS System
M Klein, N C Podaru, D J W Mous 1441

STATUS REPORT

- Current Sample Preparation and Analytical Capabilities of the Radiocarbon Laboratory at CologneAMS
J Rethemeyer, M Gierga, S Heinze, A Stolz, A Wotte, P Wischhöfer, S Berg, JO Melchert, A Dewald..... 1449

SAMPLE PRETREATMENT

Compound-Specific Radiocarbon Analysis of Atmospheric Methane: A New Preconcentration and Purification Setup <i>C Espic, M Liechti, M Battaglia, D Paul, T Röckmann, S Szidat</i>	1461
Radiocarbon Analysis of Methane at the NERC Radiocarbon Facility (East Kilbride) <i>M H Garnett, C Murray, P Gulliver, P L Ascough</i>	1477
Radiocarbon in Marsh Periwinkle (<i>Littorina Irrorata</i>) Conchiolin: Applications for Archaeology <i>Carla S Hadden, Kathy M Loftis, Alexander Cherkinsky, Brandon T Ritchison, Isabelle H Lulewicz, Victor D Thompson</i>	1489
Marine Reservoir Effects in Eastern Oyster (<i>Crassostrea Virginica</i>) from Southwestern Florida, USA <i>Carla S Hadden, Margo Schwadron</i>	1501
Performance of Home-Made Single-Stage ¹⁴ C AMS System at CIAE <i>Ming He, Yijun Pang, Yiwen Bao, Kangning Li, Shan Jiang, Qubo You, Shengyong Su, Yueming Hu, Qingzhang Zhao, Xiaoming Wang</i>	1511
Interpreting ¹⁴ C Measurements on 3 rd –4 th Century AD Iron Artifacts from Nydam, Denmark <i>C Matthias Hüls, John Meadows, Andreas Rau</i>	1517
Dissolved Inorganic and Organic Carbon in an Ephemeral Fresh Water Stream in Southern Arizona <i>A J Timothy Jull, George S Burr, Alexander G Leonard, Jamie Fitzgerald, Li Cheng, Richard Cruz, Dana Biddulph</i>	1531
Radiocarbon Sample Preparation Procedures and the First Status Report from the Bristol Radiocarbon AMS (BRAMS) Facility <i>Timothy D J Knowles, Paul S Monaghan, Richard P Evershed</i>	1541
Assessment and Development of Bone Preparation for Radiocarbon Dating at HEKAL <i>István Major, István Futó, János Dani, Orsolya Cserpák-Laczi, Mihály Gasparik, A J Timothy Jull, Mihály Molnár</i>	1551
The Preparation of Water (DIC, DOC) and Gas (CO ₂ , CH ₄) Samples for Radiocarbon Analysis at AEL-AMS, Ottawa, Canada <i>Sarah Murseli, Paul Middlestead, Gilles St-Jean, Xiaolei Zhao, Christabel Jean, Carley A Crann, William E Kieser, Ian D Clark</i>	1563
Effect of Beam Transmission of Stable Isotopes on Online δ ¹³ C for SSAMS <i>G V Ravi Prasad, Alexander Cherkinsky, Randy Culp</i>	1573
Radiocarbon Dating Cremated Bone: A Case Study Comparing Laboratory Methods <i>Helene Agerskov Rose, John Meadows, Sanne W L Palstra, Christian Hamann, Mathieu Boudin, Matthias Huels</i>	1581
Preliminary Test of the EA-AGE3 System for ¹⁴ C Measurement of CaCO ₃ Samples and Coral-Based Estimation of Marine Reservoir Correction in the Ogasawara Islands, Northwestern Subtropical Pacific <i>Yoko Saito-Kokubu, Takehiro Mitsuguchi, Takahiro Watanabe, Tsutomu Yamada, Ryuji Asami, Yasufumi Iryu</i>	1593
UV Photochemical Oxidation and Extraction of Marine Dissolved Organic Carbon at UC Irvine: Status, Surprises, and Methodological Recommendations <i>Brett D Walker, Steven R Beaupré, Sheila Griffin, Ellen R M Druffel</i>	1603
¹⁴ C Bomb Peak Analysis of African Elephant Tusks and its Relation to Cites <i>Eva M Wild, Walter Kutschera, Annemarie Meran, Peter Steier</i>	1619