

Radiocarbon

An International Journal of Cosmogenic Isotope Research

VOLUME 52 / NUMBER 2 / 2010

PROCEEDINGS OF THE

20TH INTERNATIONAL RADIOCARBON CONFERENCE

(MAY 31–JUNE 5, 2009)

KONA, HAWAII

PART I

Edited by A. J. T. Jull

RADIOCARBON

An International Journal of Cosmogenic Isotope Research

Editor: A J T JULL

Associate Editors: J WARREN BECK, GEORGE S BURR, AND GREGORY WL HODGINS

Managing Editor: MARK E MCCLURE

Copy-Editing Assistance: KIMBERLEY TANNER ELLIOTT

Published by

Department of Geosciences

The University of Arizona

Published four times a year at The University of Arizona, Tucson, AZ 85712-1201, USA.

© 2010 by the Arizona Board of Regents on behalf of the University of Arizona. All rights reserved.

Subscription rate (2010): \$260.00 (institutions), \$140.00 (individuals). Foreign postage is extra. A complete price list, including proceedings of international conferences, special publications and back issues, appears in the back pages of this issue. *Advertising rates* available upon request, or see www.radiocarbon.org/adrates.html.

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

Authors: See our "Information for Authors" document at www.radiocarbon.org/Authors/ for guidelines on manuscript submission and format. All correspondence and manuscripts 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.: +1 520 881-0857; Fax: +1 520 881-0554; Email: editor@radiocarbon.org.

List of laboratories. Our comprehensive list of laboratories is published annually, and is also available at www.radiocarbon.org/Info/lablist.html. 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.

RADIOCARBON on the World Wide Web: <http://www.radiocarbon.org/>

Cover design: copyright ©2010 Edge of the Map, Inc., www.EdgeOfTheMapInc.com

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.*

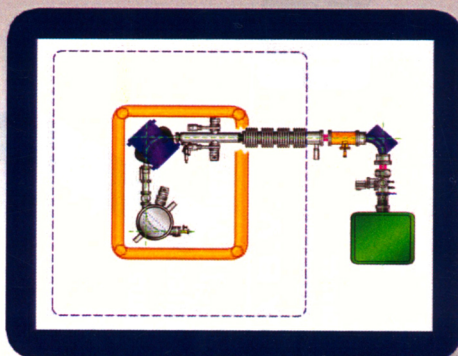
COMPACT CARBON AMS

Accelerator Mass Spectrometry Tandem and Single Stage

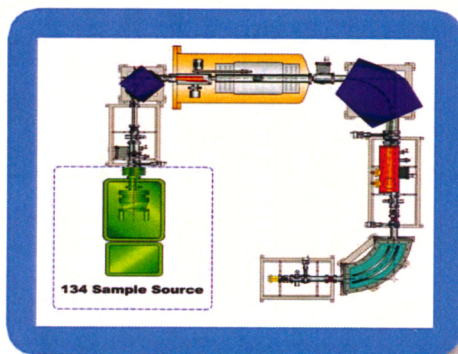
National Electrostatics Corporation offers a wide variety of compact, low voltage AMS systems for carbon radio isotope ratio measurement. All NEC systems provide high precision and low background. They can be equipped with the high throughput, multi-sample ion source or dual ion source injector for added versatility.

FEATURES INCLUDE:

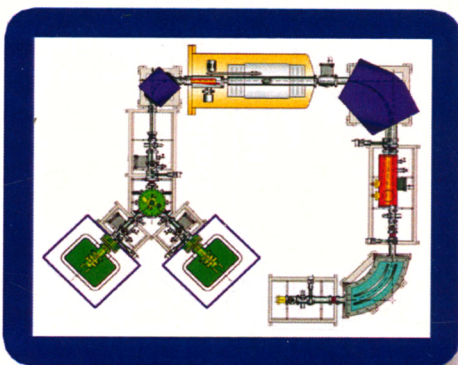
- Better than 5 per mil precision
- Better than 5×10^{-15} background
- Throughput of 400 samples/day to 2% precision for modern carbon with the 134 sample source
- Gas and solid sample source
- All metal/ceramic acceleration tubes with no organic material in the vacuum volume



Single Stage AMS



**High Through-put
Compact Carbon AMS**



**Multi Ion Source
Compact Carbon AMS**



7540 Graber Road, P.O. Box 620310
Middleton, WI USA, 53562-0310

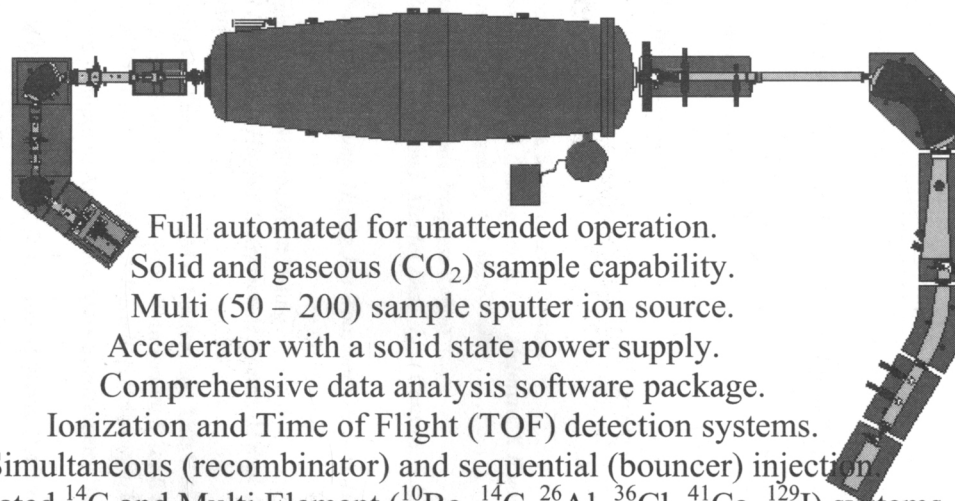
Phone: 608-831-7600 • Fax: 608-831-9591
nec@pelletron.com • www.pelletron.com

TANDETRON ACCELERATOR MASS SPECTROMETERS

Dedicated and Multi element systems

‘The choice is yours....’

1.0MV, 2.0MV, 3.0MV or 5.0MV



- Full automated for unattended operation.
- Solid and gaseous (CO₂) sample capability.
- Multi (50 – 200) sample sputter ion source.
- Accelerator with a solid state power supply.
- Comprehensive data analysis software package.
- Ionization and Time of Flight (TOF) detection systems.
- Simultaneous (recombinator) and sequential (bouncer) injection.
- Dedicated ¹⁴C and Multi Element (¹⁰Be, ¹⁴C, ²⁶Al, ³⁶Cl, ⁴¹Ca, ¹²⁹I) systems.



HIGH VOLTAGE ENGINEERING EUROPA B.V.

Amsterdamseweg 63, 3812 RR Amersfoort, P.O. Box 99, 3800 AB Amersfoort, The Netherlands
Phone: +31-33-4619741. Fax +31-33-4615291. Trade register Amersfoort nr. 31014544
E-mail: info@highvolteng.com – Web: www.highvolteng.com



20TH INT. RADIOCARBON CONFERENCE PROCEEDINGS

Vol 52, Nr 2–3, 2010

CONTENTS

EDITORIAL BOARD	xi
LETTER FROM THE EDITOR	xiii
OBITUARY: AUSTIN LONG	
<i>Chris Eastoe, Steve Leavitt, Kimberley Tanner Elliott, David Sewell</i>	xvii
INVITED TALKS	
Submarines, Quarks, and Radioisotope Dating	
<i>Richard A Muller</i>	209
Personal Recollections of a Good Experiment	
<i>Erle Nelson</i>	219
ACCELERATOR MASS SPECTROMETRY	
A High-Performance ¹⁴ C Accelerator Mass Spectrometry System	
<i>M L Roberts, J R Burton, K L Elder, B E Longworth, C P McIntyre, K F von Reden, B X Han, B E Rosenheim, W J Jenkins, E Galutschek, A P McNichol</i>	228
The Low-Energy Isobar Separator for Anions: Progress Report	
<i>W E Kieser, John Eliades, A E Litherland, Xiaolei Zhao, Lisa Cousins, S J Ye</i>	236
A New 1MV AMS Facility at KIGAM	
<i>Wan Hong, Jung Hun Park, Ki Suk Sung, Hyung Joo Woo, Jun Kon Kim, Han Woo Choi, Gi Dong Kim</i>	243
MICADAS: Routine and High-Precision Radiocarbon Dating	
<i>L Wacker, G Bonani, M Friedrich, I Hajdas, B Kromer, M Němec, M Ruff, M Suter, H-A Synal, C Vockenhuber</i>	252
¹⁴ C AMS at SUERC: Improving QA Data with the 5MV Tandem and 250kV SSAMS	
<i>P Naysmith, G T Cook, S P H T Freeman, E M Scott, R Anderson, S Xu, E Dunbar, G K P Muir, A Doungans, K Wilcken, C Schnabel, N Russell, P L Ascough, C Maden</i>	263
A Beam Profile Monitor for Rare Isotopes in Accelerator Mass Spectrometry: Preliminary Measurements	
<i>F Taccetti, L Carraresi, M E Fedi, M Manetti, P Mariani, G Tobia, P A Mandò</i>	272
Measuring Submicron-Size Fractionated Particulate Matter on Aluminum Impactor Disks	
<i>Bruce A Buchholz, Paula Zermeño, Hyun-Min Hwang, Thomas M Young, Thomas P Guilderson</i>	278
Optimization of ²³⁶ U AMS at CIRCE	
<i>M De Cesare, Y Guan, F Quinto, C Sabbarese, N De Cesare, A D'Onofrio, L Gialanella, A Petraglia, V Roca, F Terrasi</i>	286
A Continuous-Flow Gas Chromatography ¹⁴ C Accelerator Mass Spectrometry System	
<i>Cameron P McIntyre, Ernst Galutschek, Mark L Roberts, Karl F von Reden, Ann P McNichol, William J Jenkins</i>	295
The Keck Carbon Cycle AMS Laboratory, University of California, Irvine: Status Report	
<i>Robert K Beverly, Will Beaumont, Denis Taz, Kaelyn M Ormsby, Karl F von Reden, Guaciara M Santos, John R Southon</i>	301

Developing Ultra Small-Scale Radiocarbon Sample Measurement at the University of Tokyo <i>Yusuke Yokoyama, Mamito Koizumi, Hiroyuki Matsuzaki, Yosuke Miyairi, Naohiko Ohkouchi</i>	310
Are Compact AMS Facilities a Competitive Alternative to Larger Tandem Accelerators? <i>M Suter, A M Müller, V Alfimov, M Christl, T Schulze-König, P W Kubik, H-A Synal, C Vockenhuber, L Wacker</i>	319

ARCHAEOLOGY

New Dating Evidence for North Sea Trade between England, Scotland, and Norway in the 11th Century AD <i>D W Hall, G T Cook, W D Hamilton</i>	331
Is More Precise Dating of Paleoindian Expansion Feasible? <i>Stuart J Fiedel, Yaroslav V Kuzmin</i>	337
High-Precision Radiocarbon Dating of the Construction Phase of Oakbank Crannog, Loch Tay, Perthshire <i>G T Cook, T N Dixon, N Russell, P Naysmith, S Xu, B Andrian</i>	346
The Artemidorus Papyrus: Solving an Ancient Puzzle with Radiocarbon and Ion Beam Analysis Measurements <i>M E Fedi, L Carraresi, N Grassi, A Migliori, F Taccetti, F Terrasi, P A Mandò</i>	356
Upland Olive Domestication in the Chalcolithic Period: New ¹⁴ C Determinations from el-Khawarij (Ajlun), Jordan <i>Jaimie L Lovell, John Meadows, Geraldine E Jacobsen</i>	364
Alternative Explanations for Anomalous ¹⁴ C Ages on Human Skeletons Associated with the 612 BCE Destruction of Nineveh <i>R E Taylor, Will C Beaumont, John Southon, David Stronach, Diana Pickworth</i>	372
Early Bronze Age Strata at Tell Ghanem al-Ali along the Middle Euphrates in Syria: A Preliminary Report of ¹⁴ C Dating Results <i>Toshio Nakamura, Mitsuo Hoshino, Tsuyoshi Tanaka, Hidekazu Yoshida, Takeshi Saito, Kazuhiro Tsukada, Yusuke Katsurada, Yoshiyuki Aoki, Tomoko Ohta, Atsunori Hasegawa, Tomoyasu Kiuchi, Katsuhiko Ohnuma, Anas Al Khabour, Michel Al Maqdissi</i>	383
Archaeological Radiocarbon Dates for Studying the Population History in Eastern Fennoscandia <i>M Oinonen, P Pesonen, M Tallavaara</i>	393
Chronostratigraphic Sequence of Santuario della Madonna Cave (Calabria, Southern Italy): AMS Radiocarbon Data from a New Excavation Area <i>L Calcagnile, V Tinè, G Quarta, M D'Elia, G Fiorentino, F Scarciglia, G Robustelli, M Abate, M F La Russa, A Pezzino</i>	408

Eurasian Archaeology

The Origin of Pottery in East Asia and Its Relationship to Environmental Changes in the Late Glacial <i>Yaroslav V Kuzmin</i>	415
Radiocarbon and Archaeology in Japan and Korea: What Has Changed because of the Yayoi Dating Controversy? <i>Shin'ya Shoda</i>	421
The Chronology of Pleistocene Modern Humans in China, Korea, and Japan <i>S G Keates</i>	428
Establishing a Firm Chronological Framework for Neolithic and Early Dynastic Archaeology in the Shangluo Area, Central China <i>Yizhi Zhu, Peng Cheng, Shi-Yong Yu, Huagui Yu, Zhihai Kang, Yachang Yang, A J T Jull, T Lange, Weijian Zhou</i>	466

AMS Radiocarbon Dating of an Ancient Pottery Workshop in Hepu County, China <i>Xiangdong Ruan, Yongjing Guan, Zhaoming Xiong, Weiming Wu, Huijuan Wang, Shan Jiang, Ming He, Kexin Liu, Filippo Terrassi, Manuela Capano</i>	479
Radiocarbon Dates Documenting the Neolithic-Bronze Age Transition in Korea <i>Jong Chan Kim, Christopher J Bae</i>	483
The Late Paleolithic-Neolithic Transition in Korea: Current Archaeological and Radiocarbon Perspectives <i>Christopher J Bae, Jong Chan Kim</i>	493
Radiocarbon Chronology for Early Caves of the Mogao Grottoes at Dunhuang, China <i>Guo Qinglin, Hiromi Takabayashi, Toshio Nakamura, Chen Gangquan, Ken Okada, Su Bomin, Fan Yuquan, Hiroshi Nishimoto</i>	500
Paleoenvironment of Medieval Archaeological Sites in Central Japan: Assemblage Analysis and ¹⁴ C Dating of Insect Fossils <i>Emi Okuno, Yuichi Mori, Toshio Nakamura</i>	511
Radiocarbon Dating of <i>Kohitsugire</i> Calligraphies Attributed to Asukai Masatsune and the Periods of Origin of <i>Genji Monogatari Emaki</i> and <i>Ban-dainagon Ekotoba</i> <i>Hiroataka Oda, Kazuomi Ikeda</i>	520
Radionuclides in Ancient Relics Obtained from the Matsusaki Site and the Hirohata Shellmound on the Pacific Coast of Japan <i>Tomoko Ohta, Yasunori Mahara, Takumi Kubota, Yu Saito, Satoshi Fukutani, Toshiyuki Fujii, Atsushi Ando, Eiji Nakata, Takanori Nakano, Yoshiro Abe, Akira Tatematsu</i>	526
Calibrated ¹⁴ C Ages of Jomon Sites, NE Japan, and Their Significance <i>Kunio Omoto, Kenji Takeishi, Shigeru Nishida, Junichi Fukui</i>	534
Chronology of the Obi-Rakhmat Grotto (Uzbekistan): First Results on the Dating and Problems of the Paleolithic Key Site in Central Asia <i>Andrei I Krivoshepa, Yaroslav V Kuzmin, A J Timothy Jull</i>	549
Environmental Changes of the Aral Sea (Central Asia) in the Holocene: Major Trends <i>Sergey K Krivonogov, Yaroslav V Kuzmin, George S Burr, Sergei A Gusskov, Leonid B Khazin, Eugeny Y Zhakov, Ajaryk N Nurgizarinov, Rakhat Kh Kurmanbaev, Temirbolat I Kenshinbay</i>	555

BONE DATING AND PALEODIET STUDIES

¹⁴ C Ages of Bone Fractions from Armenian Prehistoric Sites <i>Alexander Cherkinsky, Christine Chataigner</i>	569
The Carbon Origin of Structural Carbonate in Bone Apatite of Cremated Bones <i>Mark Van Strydonck, Mathieu Boudin, Guy De Mulder</i>	578
Experimental Study on the Origin of Cremated Bone Apatite Carbon <i>C M Hüls, H Erlenkeuser, M-J Nadeau, P M Grootes, N Andersen</i>	587
Refining Background Corrections for Radiocarbon Dating of Bone Collagen at ORAU <i>R E Wood, C Bronk Ramsey, T F G Higham</i>	600
A Nondestructive Prescreening Method for Bone Collagen Content Using Micro-Computed Tomography <i>Jennifer A Tripp, Maria E Squire, Julie Hamilton, Robert E M Hedges</i>	612
Radiocarbon Dating of Individual Amino Acids from Archaeological Bone Collagen <i>James S O McCullagh, Anat Marom, Robert E M Hedges</i>	620
Dietary Habits and Freshwater Reservoir Effects in Bones from a Neolithic NE German Cemetery <i>Jesper Olsen, Jan Heinemeier, Harald Lübke, Friedrich Lüth, Thomas Terberger</i>	635
Paleodiet Reconstruction of Human Remains from the Archaeological Site of Natfieh, Northern Jordan <i>Khaled Al-Bashaireh, Abdullah Al-Shorman, Jerome Rose, A J Timothy Jull, Gregory Hodgins</i>	645

Radiocarbon Dating, Stable Isotope Analysis, and Diet-Derived Offsets in ¹⁴ C Ages from the Klin-Yar Site, Russian North Caucasus <i>Thomas Higham, Rebecca Warren, Andrej Belinskij, Heinrich Härke, Rachel Wood</i>	653
Dietary Reconstruction of the Okhotsk Culture of Hokkaido, Japan, Based on Nitrogen Composition of Amino Acids: Implications for Correction of ¹⁴ C Marine Reservoir Effects on Human Bones <i>Yuichi I Naito, Yoshito Chikaraishi, Naohiko Ohkouchi, Hitoshi Mukai, Yasuyuki Shibata, Noah V Honch, Yukio Dodo, Hajime Ishida, Tetsuya Amano, Hiroko Ono, Minoru Yoneda</i> . . .	671
Dietary Reconstruction and Reservoir Correction of ¹⁴ C Dates on Bones from Pagan and Early Christian Graves in Iceland <i>Árný E Sveinbjörnsdóttir, Jan Heinemeier, Jette Arneborg, Niels Lynnerup, Gudmundur Ólafsson, Guðný Zoëga</i>	682
Fish Reservoir Effect on Charred Food Residue ¹⁴ C Dates: Are Stable Isotope Analyses the Solution? <i>Mathieu Boudin, Mark Van Strydonck, Philippe Crombé, Wim De Clercq, Robert M van Dierendonck, Hans Jongepier, Anton Ervynck, An Lentacker</i>	697

METHODS, APPLICATIONS, AND DEVELOPMENTS

Improved Application of Bomb Carbon in Teeth for Forensic Investigation <i>N Wang, C D Shen, P Ding, W X Yi, W D Sun, K X Liu, X F Ding, D P Fu, J Yuan, X Y Yang, L P Zhou</i>	706
Fire History of a Giant African Baobab Evinced by Radiocarbon Dating <i>Adrian Patrut, Diana H Mayne, Karl F von Reden, Daniel A Lowy, Robert van Pelt, Ann P McNichol, Mark L Roberts, Dragos Margineanu</i>	717
Age and Growth Rate Dynamics of an Old African Baobab Determined by Radiocarbon Dating <i>Adrian Patrut, Diana H Mayne, Karl F von Reden, Daniel A Lowy, Sarah Venter, Ann P McNichol, Mark L Roberts, Dragos Margineanu</i>	727
Improved AMS ¹⁴ C Dating of Shell Carbonates Using High-Precision X-Ray Diffraction and a Novel Density Separation Protocol (CarDS) <i>Katerina Douka, Robert E M Hedges, Thomas F G Higham</i>	735
A Preparative 2D-Chromatography Method for Compound-Specific Radiocarbon Analysis of Dicarboxylic Acids in Aerosols <i>S M Fahrni, M Ruff, L Wacker, N Perron, H W Gäggeler, S Szidat</i>	752
Towards On-Line ¹⁴ C Analysis of Carbonaceous Aerosol Fractions <i>Nolwenn Perron, Sönke Szidat, Simon Fahrni, Matthias Ruff, Lukas Wacker, André SH Prévôt, Urs Baltensperger</i>	761
Laser-Heated Microfurnace: Gas Analysis and Graphite Morphology <i>A M Smith, Bin Yang, Quan Hua, Michael Mann</i>	769
Radiocarbon and Tritium Levels along the Romanian Lower Danube River <i>Carmen Varlam, Ioan Stefanescu, Stela Cuna, Irina Vagner, Ionut Faurescu, Denisa Faurescu</i> . .	783
Direct Absorption Method and Liquid Scintillation Counting for Radiocarbon Measurements in Organic Carbon from Sediments <i>Ionut Faurescu, Carmen Varlam, Ioan Stefanescu, Stela Cuna, Irina Vagner, Denisa Faurescu, Diana Bogdan</i>	794
Bomb-Pulse Dating of Human Material: Modeling the Influence of Diet <i>Elisavet Georgiadou, Kristina Stenström</i>	800
The Effects of Rainfall on Carbon Isotopes of POC in the Teshio River, Northern Japan <i>Takafumi Aramaki, Seiya Nagao, Yo-hei Nakamura, Masao Uchida, Yasuyuki Shibata</i>	808
Estimation of Long-Term Trends in the Tropospheric ¹⁴ CO ₂ Activity Concentration <i>I Svetlik, P P Povinec, M Molnár, F Meinhardt, V Michálek, J Simon, É Svingor</i>	815

Radiocarbon in the Air of Central Europe: Long-Term Investigations <i>I Svetlik, P P Povinec, M Molnár, M Vána, A Šivo, T Bujtás</i>	823
Atmospheric Fossil Fuel CO ₂ Measurement Using a Field Unit in a Central European City during the Winter of 2008/09 <i>M Molnár, L Haszpra, É Svingor, I Major, I Svetlik</i>	835

PART II

CALIBRATION, DATA ANALYSIS, AND STATISTICAL METHODS

A Report on Phase 2 of the Fifth International Radiocarbon Intercomparison (VIRI) <i>E Marian Scott, Gordon T Cook, Philip Naysmith</i>	846
The Fifth International Radiocarbon Intercomparison (VIRI): An Assessment of Laboratory Performance in Stage 3 <i>E Marian Scott, Gordon T Cook, Philip Naysmith</i>	859
Is the Consensus Value of ANU Sucrose (IAEA C-6) Too High? <i>Xiaomei Xu, Matthew S Khosh, Kevin C Druffel-Rodriguez, Susan E Trumbore, John R Southon</i>	866
¹⁴ C Calibration in the 2nd and 1st Millennia BC—Eastern Mediterranean Radiocarbon Comparison Project (EMRCP) <i>Bernd Kromer, Sturt W Manning, Michael Friedrich, Sahra Talamo, Nicole Trano</i>	875
Extension of the Southern Hemisphere Atmospheric Radiocarbon Curve, 2120–850 Years BP: Results from Tasmanian Huon Pine <i>Susan Zimmerman, Thomas Guilderson, Brendan Buckley, Edward Cook</i>	887
Comparison of ¹⁴ C Ages between LSC and AMS Measurements of Choukai Jindai Cedar Tree Rings at 2600 cal BP <i>Yui Takahashi, Hirohisa Sakurai, Kayo Suzuki, Taiichi Sato, Shuichi Gunji, Fuyuki Tokanai, Hiroyuki Matsuzaki, Yoko Sunohara</i>	895
¹⁴ C Age Measurements of Single-Year Tree Rings of Old Wood Samples 22,000 ¹⁴ C Years BP <i>Taiichi Sato, Hirohisa Sakurai, Kayo Suzuki, Yui Takahashi</i>	901
Modern Radiocarbon Levels for Northwestern Mexico Derived from Tree Rings: A Comparison with Northern Hemisphere Zones 2 and 3 Curves <i>Laura E Beramendi-Orosco, Galia Gonzalez-Hernandez, Jose Villanueva-Diaz, Francisco J Santos-Arevalo, Isabel Gómez-Martínez, Edith Cienfuegos-Alvarado, Pedro Morales-Puente, Jamie Urrutia-Fucugauchi</i>	907
Wiggle-Match Dating of Wooden Samples from Iron Age Sites in Northern Italy <i>G Quarta, M I Pezzo, S Marconi, U Tecchiati, M D'Elia, L Calcagnile</i>	915
Tree-Ring Dating and AMS Wiggle-Matching of Wooden Statues at Neunggasa Temple in South Korea <i>Won-Kyu Park, Yojung Kim, Ah-Reum Jeong, Sang-Kyu Kim, Jung-Ae Oh, Suh-Young Park, Sunil Choi, Gyujun Park, Jeong-Wook Seo</i>	924
¹⁴ C Wiggle-Matching of the B-Tm Tephra, Baitoushan Volcano, China/North Korea <i>Shinya Yatsuzuka, Mitsuru Okuno, Toshio Nakamura, Katsuhiko Kimura, Yohei Setoma, Tsuyoshi Miyamoto, Kyu Han Kim, Hiroshi Moriwaki, Toshiro Nagase, Xu Jin, Bo Lu Jin, Toshihiko Takahashi, Hiromitsu Taniguchi</i>	933
ZAGRADA—The New Zagreb Radiocarbon Database <i>Antun Portner, Bogomil Obelić, Ines Krajacar Bronić</i>	941
Using car4ams, the Bayesian AMS Data Analysis Code <i>V Palonen, P Tikkanen, J Keinonen</i>	948

Developments in the Calibration and Modeling of Radiocarbon Dates <i>Christopher Bronk Ramsey, Michael Dee, Sharen Lee, Takeshi Nakagawa, Richard A Staff</i> . . .	953
Robust Bayesian Analysis, an Attempt to Improve Bayesian Sequencing <i>Franz Weninger, Peter Steier, Walter Kutschera, Eva Maria Wild</i>	962
A Wiggle-Matched Date for the Copper Age Cemetery at Manerba del Garda, Northern Italy <i>Lawrence H Barfield, Sturt W Manning, Erio Valzolgher, Thomas F G Higham</i>	984
Scandinavian Models: Radiocarbon Dates and the Origin and Spreading of Passage Graves in Sweden and Denmark <i>Bettina Schulz Paulsson</i>	1002
Paleoearthquakes as Anchor Points in Bayesian Radiocarbon Deposition Models: A Case Study from the Dead Sea <i>Elisa J Kagan, Mordechai Stein, Amotz Agnon, Christopher Bronk Ramsey</i>	1018
Age-Depth Model of Lake Soppensee (Switzerland) Based on the High-Resolution ¹⁴ C Chronology Compared with Varve Chronology <i>Irka Hajdas, Adam Michczyński</i>	1027
Frequency Distribution of ¹⁴ C Ages for Chronostratigraphic Reconstructions: Alaska Region Study Case <i>Danuta J Michczyńska, Irka Hajdas</i>	1041

FRESHWATER AND GROUNDWATER

Spatial Radiocarbon and Stable Carbon Isotope Variability of Mineral and Thermal Waters in Slovakia <i>P P Povinec, O Franko, A Šivo, M Richtáriková, R Breier, P K Aggarwal, L Araguás-Araguás</i>	1056
Spatial Distribution of $\Delta^{14}\text{C}$ Values of Organic Matter in Surface Sediments off Saru River in Northern Japan, One Year after a Flood Event in 2006 <i>Seiya Nagao, Tomohisa Irino, Takafumi Aramaki, Ken Ikehara, Hajime Katayama, Shigeyoshi Otsuka, Masao Uchida, Yasuyuki Shibata</i>	1068
High Contribution of Recalcitrant Organic Matter to DOC in a Japanese Oligotrophic Lake Revealed by ¹⁴ C Measurements <i>Fumiko Watanabe Nara, Akio Imai, Masao Uchida, Kazuo Matsushige, Kazuhiro Komatsu, Nobuyuki Kawasaki, Yasuyuki Shibata, Kunihiko Amano, Hajime Mikami, Ryuji Hanaishi</i>	1078
Assessing the Potential for Radiocarbon Dating the Scales of Australian Lungfish (<i>Neoceratodus forsteri</i>) <i>Kelly M James, Stewart J Fallon, Andrew McDougall, Tom Espinoza, Craig Broadfoot</i>	1084
Timing of the Landslide-Dammed Lake Triggered by Earthquake, at Toyama River, Central Japan <i>Akiko S Goto, Takeshi Muramatsu, Yoshiji Teraoka</i>	1090
Temporal and Spatial Variations in Freshwater ¹⁴ C Reservoir Effects: Lake Mývatn, Northern Iceland <i>P L Ascough, G T Cook, M J Church, E Dunbar, Á Einarsson, T H McGovern, A J Dugmore, S Perdikaris, H Hastie, A Friðriksson, H Gestsdóttir</i>	1098
The Effect of Storage on the Radiocarbon, Stable Carbon and Nitrogen Isotopic Signatures and Concentrations of Riverine DOM <i>P Gulliver, S Waldron, E M Scott, C L Bryant</i>	1113
Characterization and Dating of Saline Groundwater in the Dead Sea Area <i>Naama Avrahamov, Yoseph Yechieli, Boaz Lazar, Omer Lewenberg, Elisabetta Boaretto, Orit Sivan</i>	1123
Development of an Automatic Sampling Unit for Measuring Radiocarbon Content of Groundwater <i>R Janovics, M Molnár, I Futó, L Rinyu, É Svingor, M Veres, I Somogyi, I Barnabás</i>	1141

MARINE

Variability of Dissolved Inorganic Radiocarbon at a Surface Site in the Northeast Pacific Ocean <i>Ellen R M Druffel, Steven Beaupré, Sheila Griffin, Jeomshik Hwang</i>	1150
Pre-Bomb Marine Reservoir Variability in the Kimberley Region, Western Australia <i>Sue O'Connor, Sean Ulm, Stewart J Fallon, Anthony Barham, Ian Loch</i>	1158
Spatial Variation in the Marine Radiocarbon Reservoir Effect throughout the Scottish Post-Roman to Late Medieval Period: North Sea Values (500–1350 BP) <i>N Russell, G T Cook, P L Ascough, A J Dugmore</i>	1166
The Passage of the Bomb Radiocarbon Pulse into the Pacific Ocean <i>William J Jenkins, Kathryn L Elder, Ann P McNichol, Karl von Reden</i>	1182
Decadal Changes of Radiocarbon in the Surface Bay of Bengal: Three Decades after GEOSECS and One Decade after WOCE <i>Koushik Dutta, G V Ravi Prasad, Dinesh K Ray, Sanjeev Raghav</i>	1191
Pre-Bomb Marine Reservoir Ages in the Western Pacific <i>Kunio Yoshida, Tatsuaki Hara, Dai Kunikita, Yumiko Miyazaki, Takenori Sasaki, Minoru Yoneda, Hiroyuki Matsuzaki</i>	1197
Centuries of Marine Radiocarbon Reservoir Age Variation within Archaeological <i>Mesodesma donacium</i> Shells from Southern Peru <i>Kevin B Jones, Gregory W L Hodgins, Miguel F Etayo-Cadavid, C Fred T Andrus, Daniel H Sandweiss</i>	1207
Compound-Specific Radiocarbon Analyses of Phospholipid Fatty Acids and <i>n</i> -Alkanes in Ocean Sediments <i>Ellen R M Druffel, Dachun Zhang, Xiaomei Xu, Lori A Ziolkowski, John R Southon, Guaciara M dos Santos, Susan E Trumbore</i>	1215
An Alternate Method of Diluting Dissolved Organic Carbon Seawater Samples for ¹⁴ C Analysis <i>Sheila Griffin, Steven R Beaupré, Ellen R M Druffel</i>	1224

SAMPLE PREPARATION

Report on the 20th International Radiocarbon Conference Graphitization Workshop <i>Jocelyn Turnbull, Christine Prior, Graphitization Workshop Participants</i>	1230
A Simplified <i>In Situ</i> Cosmogenic ¹⁴ C Extraction System <i>Jeffrey S Pigati, Nathaniel A Lifton, A J Timothy Jull, Jay Quade</i>	1236
Extraction of <i>In Situ</i> Cosmogenic ¹⁴ C from Olivine <i>Jeffrey S Pigati, Nathaniel A Lifton, A J Timothy Jull, Jay Quade</i>	1244
A New Automated Extraction System for ¹⁴ C Measurement for Atmospheric CO ₂ <i>Jocelyn C Turnbull, Scott J Lehman, Stephen Morgan, Chad Wolak</i>	1261
Development of Graphitization of µg-Sized Samples at Lund University <i>J Genberg, K Stenström, M Elfman, M Olsson</i>	1270
Establishment of Chemical Preparation Methods and Development of an Automated Reduction System for AMS Sample Preparation at KIGAM <i>Wan Hong, Jung Hun Park, Kyeong J Kim, Hyung Joo Woo, Jun Kon Kim, Han Woo Choi, Gi Dong Kim</i>	1277
Update on the Performance of the SUERC <i>In Situ</i> Cosmogenic ¹⁴ C Extraction Line <i>R H Fülöp, P Naysmith, G T Cook, D Fabel, S Xu, P Bishop</i>	1288
Simple Pretreatment Method Development for Iron and Calcium Carbonate Samples <i>Junghun Park, Wan Hong, H J Woo, Han Woo Choi, Joonkon Kim, Gi Dong Kim</i>	1295

A New Radiocarbon Pretreatment Method for Molluscan Shell Using Density Fractionation of Carbonates in Bromoform <i>Christopher M Russo, Jennifer A Tripp, Katerina Douka, Thomas F G Higham</i>	1301
A Thermal and Acid Treatment for Carbon Extraction from Cast Iron and Its Application to AMS Dating of Cast Iron Objects from Ancient Korea <i>J S Park, G S Burr, A J T Jull</i>	1312
Blank Assessment for Ultra-Small Radiocarbon Samples: Chemical Extraction and Separation Versus AMS <i>Guaciara M Santos, John R Southon, Nicholas J Drenzek, Lori A Ziolkowski, Ellen Druffel, Xiaomei Xu, Dachun Zhang, Susan Trumbore, Timothy I Eglinton, Konrad A Hughen</i>	1322
Hydropyrolysis: Implications for Radiocarbon Pretreatment and Characterization of Black Carbon <i>P L Ascough, M I Bird, W Meredith, R E Wood, C E Snape, F Brock, T F G Higham, D J Large, D C Apperley</i>	1336
Experiences of Production and Homogeneity Analysis of an AMS ¹⁴ C Sucrose Standard for High-Activity Measurements <i>Marie Sydoff, Kristina Stenström</i>	1351
Alternative Methods for Cellulose Preparation for AMS Measurement <i>Mojmir Němec, Lukas Wacker, Irka Hajdas, Heinz Gäggeler</i>	1358
A Comparison of Cellulose Extraction and ABA Pretreatment Methods for AMS ¹⁴ C Dating of Ancient Wood <i>J R Southon, A L Magana</i>	1371
Optimization of the Graphitization Process at AGE-1 <i>Mojmir Němec, Lukas Wacker, Heinz Gäggeler</i>	1380
Studies on the Preparation of Small ¹⁴ C Samples with an RGA and ¹³ C-Enriched Material <i>Jakob Liebl, Roswitha Avalos Ortiz, Robin Golser, Florian Handle, Walter Kutschera, Peter Steier, Eva Maria Wild</i>	1394

SOILS AND SEDIMENTS

A New Attempt to Establish the International Radiocarbon Soils Database (IRSDB) <i>Peter Becker-Heidmann, Pascal Heidmann</i>	1405
Buried Ancient Forest and Implications for Paleoclimate since the Mid-Holocene in South China <i>C D Shen, P Ding, N Wang, W X Yi, X F Ding, D P Fu, K X Liu, L P Zhou</i>	1411
Turnover Rate of Soil Organic Matter and Origin of Soil ¹⁴ CO ₂ in Deep Soil from a Subtropical Forest in Dinghushan Biosphere Reserve, South China <i>P Ding, C D Shen, N Wang, W X Yi, X F Ding, D P Fu, K X Liu, L P Zhou</i>	1422
A New ¹⁴ C Data Set of the PY608W-PC Sediment Core from Lake Pumoyum Co (Southeastern Tibetan Plateau) over the Last 19 kyr <i>Takahiro Watanabe, Tetsuya Matsunaka, Toshio Nakamura, Mitsugu Nishimura, Yasuhiro Izutsu, Motoyasu Minami, Fumiko Watanabe Nara, Takeshi Kakegawa, Liping Zhu</i>	1435
¹⁴ C Dating of Holocene Soils from an Island in Lake Pumoyum Co (Southeastern Tibetan Plateau) <i>Takahiro Watanabe, Tetsuya Matsunaka, Toshio Nakamura, Mitsugu Nishimura, Takahiro Sakai, Xiao Lin, Kazuho Horiuchi, Fumiko Watanabe Nara, Takeshi Kakegawa, Liping Zhu</i>	1443
Radiocarbon and Stable Carbon Isotope Ratio Data from a 4.7-m-long Sediment Core of Lake Baikal (Southern Siberia, Russia) <i>Fumiko Watanabe Nara, Takahiro Watanabe, Toshio Nakamura, Takeshi Kakegawa, Fumitaka Katamura, Koji Shichi, Hikaru Takahara, Akio Imai, Takayoshi Kawai</i>	1449

New Radiocarbon Dates from the Late Neolithic Tell Settlement of Hódmezővásárhely-Gorzsa, SE Hungary <i>Sándor Gulyás, Pál Sümege, Mihály Molnár</i>	1458
AMS Radiocarbon Dating of Holocene Tephra Layers on Ulleung Island, South Korea <i>Mitsuru Okuno, Miki Shiihara, Masayuki Torii, Toshio Nakamura, Kyu Han Kim, Hanako Domitsu, Hiroshi Moriwaki, Motoyoshi Oda</i>	1465
Effects of Vegetation Switch and Subsequent Change in Soil Invertebrate Composition on Soil Carbon Accumulation Patterns, Revealed by Radiocarbon Concentrations <i>Ayu Toyota, Ichiro Tayasu, Reiji Fujimaki, Nobuhiro Kaneko, Masao Uchida, Yasuyuki Shibata, Tsutom Hiura</i>	1471
Comparison of Depth Profiles of ^{129}I and ^{14}C Concentration in the Surface Layer of Soils Collected from Northeastern Japan <i>Hiroyuki Matsuzaki, Yoko Sunohara Tsuchiya, Yasuyuki Muramatsu, Yuji Maejima, Yosuke Miyairi, Kazuhiro Kato</i>	1487
Radiocarbon Dating of the Last Volcanic Eruptions of Ciomadul Volcano, Southeast Carpathians, Eastern-Central Europe <i>Sz Harangi, M Molnár, A P Vinkler, B Kiss, A J T Jull, A G Leonard</i>	1498
BOOK REVIEW	
Claudio Tuniz, Richard Gillespie, Cheryl Jones. <i>The Bone Readers—Atoms, Genes and the Politics of Australia's Deep Past</i> Reviewed by <i>Irka Hajdas</i>	1508
AUTHOR INDEX	1513

