

# QUATERNARY RESEARCH

*Quaternary Research* is an international journal devoted to the advancement of the interdisciplinary understanding of the Quaternary Period. We aim to publish articles of broad interest with relevance to more than one discipline, and that constitute a significant new contribution to Quaternary science. The journal's scope is global, building on its nearly 50-year history in advancing the understanding of earth and human history through interdisciplinary study of the last 2.7 million years. Research areas include geoarcheology, geochemistry and geophysics, geochronology, geomorphology, glaciology, neotectonics, paleobotany and paleoecology, paleoclimatology, paleogeography, paleohydrology, paleontology, paleoceanography, paleopedology, Quaternary geology, volcanology and tephrochronology.

**Submit manuscripts** online at <http://editorialmanager.com/qr>. See instructions for submitting your manuscripts at <https://www.cambridge.org/core/journals/quaternary-research/information/guide-for-authors>.

**Subscription Information:** *Quaternary Research* published two volumes per year with three issues each. The journal is published on behalf of Quaternary Research Center by Cambridge University Press, One Liberty Plaza, 20<sup>th</sup> Floor, New York, NY 10006, USA. Annual subscription rates for Volumes 89 and 90 (2018): Institutional rate, print only: \$1,312.00 (£795.00 + VAT). Institutional rate, online only: \$1,287.00 (£780.00 + VAT). Institutional rate, print and online: \$1,365.00 (£827.00 + VAT). For subscriptions, renewals, and address changes, please visit <https://www.cambridge.org/core/journals/quaternary-research/subscribe>. Email [subscriptions\\_newyork@cambridge.org](mailto:subscriptions_newyork@cambridge.org) if you are in the Americas or [journals@cambridge.org](mailto:journals@cambridge.org) for the rest of the world.

**ISSN:** 0033-5894

**EISSN:** 1096-0287

© 2018 University of Washington. All rights reserved.

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 contracts are available at: <http://www.cambridge.org/about-us/rights-permissions>. Permission to copy (for users in the U.S.A.) is available from Copyright Clearance Center: <http://www.copyright.com>. Email: [info@copyright.com](mailto:info@copyright.com)



CONTRIBUTION TO THE QR FORUM

- 1–9 **Accurate surface exposure dating with lichens**  
*William B. Bull*

RESEARCH ARTICLES

- 10–25 **Climate dynamics during the penultimate glacial period recorded in a speleothem from Kanaan Cave, Lebanon (central Levant)**  
*Carole Nehme, Sophie Verheyden, Sebastian F.M. Breitenbach, David P. Gillikin, Anouk Verheyden, Hai Cheng, R. Lawrence Edwards, John Hellstrom, Stephen R. Noble, Andrew R. Farrant, Diana Sahy, Thomas Goovaerts, Ghada Salem and Philippe Claeys*
- 26–37 **Rapid age assessment of glacial landforms in the Pyrenees using Schmidt hammer exposure dating (SHED)**  
*Matt D. Tomkins, Jason M. Dortch, Philip D. Hughes, Jonny J. Huck, Andrew G. Stimson, Magali Delmas, Marc Calvet, and Raimon Pallàs*
- 38–49 **Assessment and calibration of representational bias in soil phytolith assemblages in Northeast China and its implications for paleovegetation reconstruction**  
*Guizai Gao, Dongmei Jie, Lidan Liu, Hongyan Liu, Dehui Li, Nannan Li, Fichen Shi, Chengcheng Leng, and Zhihe Qiao*
- 50–65 **Distribution, evidence for internal ice, and possible hydrologic significance of rock glaciers in the Uinta Mountains, Utah, USA**  
*Jeffrey S. Munroe*
- 66–82 **Millennial scale climate-fire-vegetation interactions in a mid-elevation mixed coniferous forest, Mission Range, northwestern Montana, USA**  
*Mio Alt, David B. McWethy, Rick Everett, and Cathy Whitlock*
- 83–95 **Exploring pathways to late Holocene increased surface wetness in subarctic peatlands of eastern Canada**  
*Simon van Bellen, Michelle Garneau, Andy Baird, Marc-André Bourgault, and Anne Quillet*
- 96–109 **Sedimentary architecture of the southern basin of Lake of the Woods, Minnesota and its relation to Lake Agassiz history and Holocene environmental change**  
*Devin D. Hougardy and Steven M. Colman*
- 110–126 **Directly dating postglacial Greenlandic land-surface emergence at high resolution using in situ <sup>10</sup>Be**  
*Paul R. Bierman, Dylan H. Rood, Jeremy D. Shakun, Eric W. Portenga, and Lee B. Corbett*
- 127–138 **A late Quaternary paleoenvironmental record in sand dunes of the northern Atacama Desert, Chile**  
*Kari M. Finstad, Marco Pfeiffer, Gavin McNicol, Michael Tuiute, Kenneth Williford, and Ronald Amundson*
- 139–152 **Geomorphological and stratigraphic evidence along the northeastern U.S. margin for Laurentide glacial lake outburst floods during the MIS 2 deglaciation**  
*Shannon Klotsko and Neal Driscoll*
- 153–163 **Evaluation of the regional vegetation and climate in the Eastern Alps (Austria) during MIS 3–4 based on pollen analysis of the classical Baumkirchen paleolake sequence**  
*Samuel Jonathan Barrett, Ruth Drescher-Schneider, Reinhard Starnberger, and Christoph Spötl*
- 164–179 **Paleoenvironmental and paleoclimatic interpretation of the stratigraphic sequence of Lezetxiki II Cave (Basque Country, Iberian Peninsula) inferred from small vertebrate assemblages**  
*Naroa Garcia-Ibaibarraga, Aitziber Suárez-Bilbao, Salvador Bailon, Alvaro Arriabalaga, María-José Iriarte-Chiapusso, Lee Arnold, Martina Demuro, and Xabier Murelaga*
- 180–200 **The rock shelter Abrigo del Molino (Segovia, Spain) and the timing of the late Middle Paleolithic in Central Iberia**  
*Martin Kehl, David Álvarez-Alonso, María de Andrés-Hervero, Andrés Díez-Hervero, Nicole Klasein, Janet Rethemeyer, and Gerd-Christian Weniger*
- 201–221 **Palaeoenvironmental and climatic inferences from the late early Pleistocene lacustrine deposits in the eastern Tiberino Basin (central Italy)**  
*Roberto Bizzarri, Paolo Corrado, Donatella Magri, Edoardo Martinetto, Daniela Esu, Valentina Caprai, Roberto Colacicchi, Giovanni Napoleone, Andrea Albanelli, and Angela Baldanza*
- 222–243 **Global glacier dynamics during 100 ka Pleistocene glacial cycles**  
*Philip D. Hughes and Philip L. Gibbard*

LETTERS TO THE EDITOR

- 244–247 **A chronostratigraphic model for the Hell Gap Paleoindian site and methods for refining chronologies at open stratified sites – Comment to the published paper by Pelton et al., Quaternary Research 88 (2017), 234–247**  
*C. Vance Haynes*
- 248–250 **Component age estimates for the Hell Gap Paleoindian site and methods for chronological modeling of stratified open sites – Response to commentary by C. Vance Haynes**  
*Spencer R. Pelton, Marcel Kornfeld, Thomas Minckley, and Mary Lou Larson*

ERRATUM

- 251–251 **Absence of Saharan dust influence on the strontium isotope ratios on modern trees from the Bahamas and Turks and Caicos Islands – ERRATUM**  
*Rick Schulzing, Mike Richards, John Pouncett, Bryan Naqqi Manco, Ethan Freid, and Joanna Ostapkowicz*