

CAMBRIDGE

JOURNALS

150th Anniversary

Geological Magazine

Editors

Mark Allen, University of Durham, UK
Graham E. Budd, University of Uppsala, Sweden
Philip Leat, British Antarctic Survey, UK
Andy Whitham, CASP, University of Cambridge, UK

Geological Magazine, established in 1864, is one of the oldest and best-known periodicals in the Earth Sciences. Its worldwide circulation, broad scope and high production values keep the journal at the forefront of the field. It publishes original papers, review articles, rapid communications and discussions about all aspects of the geosciences. It covers petrology, geochemistry, palaeontology, sedimentology, stratigraphy, structural geology, geophysics, and geomorphology, and it includes contributions on volcanology, marine geology, glaciology, palaeoclimatology, palaeoceanography, geochronology, biostratigraphy, geohazards and Earth history, providing a niche for interdisciplinary papers on regional geology and Earth history.

Price information

is available at: <http://journals.cambridge.org/geo>

Free email alerts

Keep up-to-date with new material – sign up at
<http://journals.cambridge.org/geo-alerts>



Geological Magazine is available online at:
<http://journals.cambridge.org/geo>

To subscribe contact
Customer Services

in Cambridge:
Phone +44 (0)1223 326070
Fax +44 (0)1223 325150
Email journals@cambridge.org

in New York:
Phone +1 (845) 353 7500
Fax +1 (845) 353 4141
Email
subscriptions_newyork@cambridge.org

For free online content visit:
<http://journals.cambridge.org/geo>

 CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE

JOURNALS

Earth and Environmental Science Transactions of The Royal Society of Edinburgh

Marketed and distributed for The Royal Society of
Edinburgh

Editor-in-Chief

P. M. Bishop, University of Glasgow, UK

Earth and Environmental Science Transactions (formerly *Transactions of the Royal Society of Edinburgh: Earth Sciences*) is a general earth sciences journal publishing a comprehensive selection of substantial peer-reviewed research papers, reviews and short communications of international standard across the broad spectrum of earth and environmental geosciences. The journal prides itself on the quality of its graphics and photographic reproduction. The Editors are keen to encourage interdisciplinary papers and *Transactions* also publishes occasional special symposia and invited volumes of specific interest.

Price information

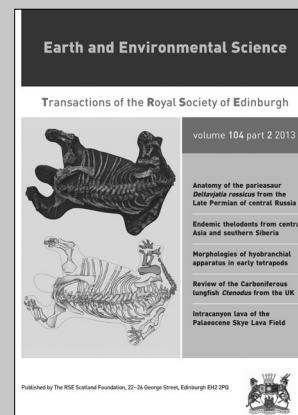
is available at: <http://journals.cambridge.org/tre>

Free email alerts

Keep up-to-date with new material – sign up at

<http://journals.cambridge.org/tre-alerts>

For free online content visit:
<http://journals.cambridge.org/tre>



Earth and Environmental Science *Transactions of the Royal Society of Edinburgh*

is available online at:
<http://journals.cambridge.org/tre>

To subscribe contact
Customer Services

in Cambridge:

Phone +44 (0)1223 326070
Fax +44 (0)1223 325150
Email journals@cambridge.org

in New York:

Phone +1 (845) 353 7500
Fax +1 (845) 353 4141
Email
subscriptions_newyork@cambridge.org



CAMBRIDGE
UNIVERSITY PRESS

CAMBRIDGE

JOURNALS

Antarctic Science

Published on behalf of Antarctic Science Ltd, Cambridge

Editors

Laurie Padman, Earth & Space Research, Corvallis, USA
Walker O. Smith, Virginia Institute of Marine Sciences, USA
Alan P. M. Vaughan, British Antarctic Survey, Cambridge, UK
David W. H. Walton, British Antarctic Survey, Cambridge, UK

Antarctic Science provides a truly international forum for the broad spread of studies that increasingly characterize scientific research in the Antarctic. The journal attracts papers from all countries currently undertaking Antarctic research. Whilst emphasising interdisciplinary work, the journal publishes papers from environmental management to biodiversity, from volcanoes to icebergs, and from oceanography to the upper atmosphere. No other journal covers such a wide range of Antarctic scientific studies.

Price information

is available at: <http://journals.cambridge.org/ans>

Free email alerts

Keep up-to-date with new material – sign up at
<http://journals.cambridge.org/ans-alerts>

For free online content visit:
<http://journals.cambridge.org/ans>



Antarctic Science
is available online at:
<http://journals.cambridge.org/ans>

To subscribe contact
Customer Services

in Cambridge:
Phone +44 (0)1223 326070
Fax +44 (0)1223 325150
Email journals@cambridge.org

in New York:
Phone +1 (845) 353 7500
Fax +1 (845) 353 4141
Email
subscriptions_newyork@cambridge.org

 **CAMBRIDGE**
UNIVERSITY PRESS

CAMBRIDGE

JOURNALS

Polar Record

A Journal of Arctic and Antarctic Research

The official journal of the Scott Polar Research Institute

Editor-inChief

Ian R. Stone, Scott Polar Research Institute, Cambridge, UK

Polar Record is the premier international, peer-reviewed, scholarly journal, publishing articles on a wide variety of areas of polar research in both the Arctic and the Antarctic and keeping its readers up-to-date with an extensive range of topics and concerns. The journal includes original primary research papers in the physical sciences, life sciences, polar technology, humanities, and social sciences, as well as papers concerning current political, economic, legal, and environmental issues. *Polar Record* provides rapid publication, normally within nine months of the initial submission.

Price information

is available at: <http://journals.cambridge.org/pol>

Free email alerts

Keep up-to-date with new material – sign up at
<http://journals.cambridge.org/pol-alerts>

For free online content visit:
<http://journals.cambridge.org/pol>



POLAR
RECORD

A Journal of Arctic and Antarctic Research

VOLUME 50 NUMBER 252 JANUARY 2014

CAMBRIDGE
UNIVERSITY PRESS

Polar Record

is available online at:
<http://journals.cambridge.org/pol>

To subscribe contact
Customer Services

in Cambridge:

Phone +44 (0)1223 326070
Fax +44 (0)1223 325150
Email journals@cambridge.org

in New York:

Phone +1 (845) 353 7500
Fax +1 (845) 353 4141
Email
subscriptions_newyork@cambridge.org



CAMBRIDGE
UNIVERSITY PRESS

Advisory Board

H. Brinkhuis, Laboratory of Palaeobotany and Palynology, Dept of Earth Sciences, Utrecht University, Budapestlaan 4, 3584 CD Utrecht, the Netherlands. Also at: Royal Netherlands Institute for Sea Research NIOZ, P.O. Box 59, 1790 AB Den Burg, Texel, the Netherlands
S.A.P.L. Cloetingh, Tectonics Group, Dept of Earth Sciences, Utrecht University, Budapestlaan 4, 3584CD Utrecht, the Netherlands
G. de Lange, Geochemistry Group, Dept of Earth Sciences, Utrecht University, Budapestlaan 4, 3584 CD Utrecht, the Netherlands
Ph. Gibbard, Department of Geography, University of Cambridge, Downing Place, Cambridge CB2 3EN, United Kingdom
H. Middelkoop, Global Change Geomorphology Group, Dept Physical Geography, Utrecht University, P.O. Box 80015, 3508 TC Utrecht, the Netherlands
H. Renssen, Earth and Climate Cluster, Dept of Earth Sciences, VU University Amsterdam, De Boelelaan 1085, 1081 HV Amsterdam, the Netherlands
J. Rose, Department of Geography, Royal Holloway University of London, Egham, Surrey TW20 0EX, United Kingdom
J. B. Stuur, Royal Netherlands Institute for Sea Research NIOZ, P.O. Box 59, 1790 AB Den Burg, Texel, the Netherlands
N. Vandenberghe, Institute of Earth Sciences, Leuven University, Redingenstraat 16bis, B-3000 Leuven, Belgium
B. van Geel, Institute for Biodiversity and Ecosystem Dynamics, Department of Palaeoecology and Landscape Ecology, University of Amsterdam, Science Park 904, 1098 XH Amsterdam, the Netherlands
M.J. van der Meulen, TNO – Geological Survey of the Netherlands, P.O. Box 80015, 3508 TA Utrecht, the Netherlands

Editorial Board

See <http://journals.cambridge.org/NJG>

Access to NJG online

From 2014, *Netherlands Journal of Geosciences* is published online at <http://journals.cambridge.org/NJG>. Subscribers receive access to all content from 2009.

Copyright

© *Stichting Netherlands Journal of Geosciences*.

Copying

This journal is registered with the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, USA (www.copyright.com). Organizations in the USA who are also registered with CCC may therefore copy material (beyond the limits permitted by sections 107 and 108 of US copyright law) subject to payment to CCC. This consent does not extend to multiple copying for promotional or commercial purposes. ISI Tear Sheet Service, 3501 Market Street, Philadelphia, PA 19104, USA, is authorized to supply single copies of separate articles for private use only. Organizations authorized by the Copyright Licensing Agency may also copy material subject to the usual conditions.

For all other use, permission should be sought from Cambridge University Press.

Cover Image: November 2007 storm surge eroding the western Netherlands coastal dunes near Bergen aan Zee. During the surge event, the foredune was forced back almost 10 m. This revealed a thick sedimentary archive showing evidence of Holocene coastal processes and events. Photo by: Marcel Bakker, TNO - Geological Survey of the Netherlands.

Netherlands Geologie en Mijnbouw Journal of Geosciences

Contents Volume 94, Issue 4

December 2015

Fluvial history of the Vecht-Amstel area in the Holocene: Interdisciplinary collaborations, controversies and progress Sjoerd J. Kluiving & Guus J. Borger	289
Landscape history of the Oer-IJ tidal system, Noord-Holland (the Netherlands) P. Vos, J. de Koning & R. van Eerden	295
Chrono- and archaeostratigraphy and development of the River Amstel: results of the North/South underground line excavations, Amsterdam, the Netherlands P. Kranendonk S.J. Kluiving & S.R. Troelstra	333
Digging the river: the historical geography of the Amstel area (800–1275 AD) C. de Bont	353
The geology of the Amstel river in Amsterdam (Netherlands): Man versus nature W. de Gans	361
Landscape development and settlement history of the Vecht area (722–1122) A.L.P. Buitelaar & Guus J. Borger	375
Provenance of the Roman basalt stone at Kotterbos (Lelystad, the Netherlands): A geoarchaeological study based on petrographic and geochemical analysis, and comparison with a synthesis of basalt stones along the northern Limes K. Linthout	387
3D subsurface modelling reveals the shallow geology of Amsterdam J. Schokker, M.A.J. Bakker, C.W. Dubelaar, R.M. Dambrink & R. Harting	399

ISSN 0016-7746

Cambridge Journals Online
For further information about this journal
please go to the journal web site at:
journals.cambridge.org/njg



CAMBRIDGE
UNIVERSITY PRESS