

Western North Atlantic Palaeogene and Cretaceous Palaeoceanography

Geological Society Special Publications

Series Editors

A. J. HARTLEY
R. E. HOLDSWORTH
A. C. MORTON
M. S. STOKER

Special Publication reviewing procedures

The Society makes every effort to ensure that the scientific and production quality of its books matches that of its journals. Since 1997, all book proposals have been refereed by specialist reviewers as well as by the Society's Publications Committee. If the referees identify weaknesses in the proposal, these must be addressed before the proposal is accepted.

Once the book is accepted, the Society has a team of series editors (listed above) who ensure that the volume editors follow strict guidelines on refereeing and quality control. We insist that individual papers can only be accepted after satisfactory review by two independent referees. The questions on the review forms are similar to those for *Journal of the Geological Society*. The referees' forms and comments must be available to the Society's series editors on request.

Although many of the books result from meetings, the editors are expected to commission papers that were not presented at the meeting to ensure that the book provides a balanced coverage of the subject. Being accepted for presentation at the meeting does not guarantee inclusion in the book.

Geological Society Special Publications are included in the ISI Science Citation Index, but they do not have an impact factor, the latter being applicable only to journals.

More information about submitting a proposal and producing a Special Publication can be found on the Society's web site: www.geolsoc.org.uk

It is recommended that reference to all or part of this book should be made in one of the following ways.

KROON, D., NORRIS, R. D. & KLAUS, A. (eds) 2001. *Western North Atlantic Palaeogene and Cretaceous Palaeoceanography*. Geological Society, London, Special Publications, **183**.

RÖHL, U., OGG, J. G., GEIB, T. L. & WEFER, G. 2001. Astronomical calibration of the Danian time scale. In: KROON, D., NORRIS, R. D. & KLAUS, A. (eds) 2001. *Western North Atlantic Palaeogene and Cretaceous Palaeoceanography*. Geological Society, London, Special Publications, **183**, 163–183.

GEOLOGICAL SOCIETY SPECIAL PUBLICATION NO. 183

Western North Atlantic Palaeogene and Cretaceous Palaeoceanography

EDITED BY

DICK KROON
(University of Edinburgh, UK)

R. D. NORRIS
(Woods Hole OI, USA)

and

A. KLAUS
(Ocean Drilling Program, USA)

2001
Published by
The Geological Society
London

THE GEOLOGICAL SOCIETY

The Geological Society of London was founded in 1807 and is the oldest geological society in the world. It received its Royal Charter in 1825 for the purpose of 'investigating the mineral structure of the Earth' and is now Britain's national society for geology.

Both a learned society and a professional body, the Geological Society is recognized by the Department of Trade and Industry (DTI) as the chartering authority for geoscience, able to award Chartered Geologist status upon appropriately qualified Fellows. The Society has a membership of 9099, of whom about 1500 live outside the UK.

Fellowship of the Society is open to persons holding a recognized honours degree in geology or a cognate subject, or not less than six years' relevant experience in geology or a cognate subject. A Fellow with a minimum of five years' relevant postgraduate experience in the practice of geology may apply for chartered status. Successful applicants are entitled to use the designatory postnominal CGeol (Chartered Geologist). Fellows of the Society may use the letters FGS. Other grades of membership are available to members not yet qualifying for Fellowship.

The Society has its own Publishing House based in Bath, UK. It produces the Society's international journals, books and maps, and is the European distributor for publications of the American Association of Petroleum Geologists (AAPG), the Society for Sedimentary Geology (SEPM) and the Geological Society of America (GSA). Members of the Society can buy books at considerable discounts. The Publishing House has an online bookshop (<http://bookshop.geolsoc.org.uk>).

Further information on Society membership may be obtained from the Membership Services Manager, The Geological Society, Burlington House, Piccadilly, London W1V 0JU (E-mail: enquiries@geolsoc.org.uk; tel: +44 (0) 207 434 9944).

The Society's Web Site can be found at <http://www.geolsoc.org.uk/>. The Society is a Registered Charity, number 210161.

Published by The Geological Society from:
The Geological Society Publishing House
Unit 7, Brassmill Enterprise Centre
Brassmill Lane
Bath BA1 3JN, UK
Orders: Tel. +44 (0)1225 445046
Fax +44 (0)1225 442836
Online bookshop: <http://bookshop.geolsoc.org.uk>

The publishers make no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility for any errors or omissions that may be made.

© The Geological Society of London 2001. All rights reserved. No reproduction, copy or transmission of this publication may be made without written permission. No paragraph of this publication may be reproduced, copied or transmitted save with the provisions of the Copyright Licensing Agency, 90 Tottenham Court Road, London W1P 9HE. Users registered with the Copyright Clearance Center, 27 Congress Street, Salem, MA 01970, USA: the item-fee code for this publication is 0305-8719/01/\$15.00.

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library.

ISBN 1-86239-078-9

Typeset by Alden Multimedia, Westonzoyland, UK

Printed by The Alden Press, Oxford, UK

Distributors

USA
AAPG Bookstore
PO Box 979
Tulsa
OK 74101-0979
USA
Orders: Tel. +1 918 584-2555
Fax +1 918 560-2652
E-mail bookstore@aapg.org

Australia
Australian Mineral Foundation Bookshop
63 Conyngham Street
Glenside
South Australia 5065
Australia
Orders: Tel. +61 88 379-0444
Fax +61 88 379-4634
E-mail bookshop@amf.com.au

India
Affiliated East-West Press PVT Ltd
G-1/16 Ansari Road, Daryaganj,
New Delhi 110 002
India
Orders: Tel. +91 11 327-9113
Fax +91 11 326-0538
E-mail affiliat@nda.vsnl.net.in

Japan
Kanda Book Trading Co.
Cityhouse Tama 204
Tsurumaki 1-3-10
Tama-shi
Tokyo 206-0034
Japan
Orders: Tel. +81 (0)423 57-7650
Fax +81 (0)423 57-7651

Contents

NORRIS, R. D., KROON, D., HUBER, B. T. & ERBACHER, J. Cretaceous–Palaeogene ocean and climate change in the subtropical North Atlantic	1
NORRIS, R. D., KLAUS, A. & KROON, D. Mid-Eocene deep water, the Late Palaeocene Thermal Maximum and continental slope mass wasting during the Cretaceous–Palaeogene impact	23
BARKER, C. E., PAWLEWICZ, M. J. & COBABE, E. A. Deposition of sedimentary organic matter in black shale facies indicated by the geochemistry and petrography of high-resolution samples, Blake Nose, western North Atlantic	49
HOLBOURN, A. & KUHN, W. No extinctions during Oceanic Anoxic Event 1b: the Aptian–Albian benthic foraminiferal record of ODP Leg 171	73
SELF-TRAIL, J. M. Biostratigraphic subdivision and correlation of upper Maastrichtian sediments from the Atlantic Coastal Plain and Blake Nose, western Atlantic	93
MACLEOD, K. G. & HUBER, B. T. The Maastrichtian record at Blake Nose (western North Atlantic) and implications for global palaeoceanographic and biotic changes	111
MARTÍNEZ-RUIZ, F., ORTEGA-HUERTAS, M., KROON, D., SMIT, J., PALOMO-DELGADO, I. & ROCCHIA, R. Geochemistry of the Cretaceous–Tertiary boundary at Blake Nose (ODP Leg 171B)	131
MARTÍNEZ-RUIZ, F., ORTEGA-HUERTAS, M., PALOMO-DELGADO, I. & SMIT, J. K–T boundary spherules from Blake Nose (ODP Leg 171B) as a record of the Chicxulub ejecta deposits	149
RÖHL, U., OGG, J. G., GEIB, T. L. & WEFER, G. Astronomical calibration of the Danian time scale	163
SANFILLIPO, A. & BLOME, C. D. Biostratigraphic implications of mid-latitude Palaeocene–Eocene radiolarian faunas from Hole 1051A, ODP Leg 171B, Blake Nose, western North Atlantic	185
VAN MOURIK, C. A. BRINKHUIS, H. & WILLIAMS, G. L. Mid- to Late Eocene organic-walled dinoflagellate cysts from ODP Leg 171B, offshore Florida	225
SLOAN, L. C. & HUBER, M. North Atlantic climate variability in early Palaeogene time: a climate modelling sensitivity study	253
WADE, B. S., KROON, D. & NORRIS, R. D. Orbitally forced climate change in late mid-Eocene time at Blake Nose (Leg 171B): evidence from stable isotopes in foraminifera	273
DICKENS, G. R. Carbon addition and removal during the Late Palaeocene Thermal Maximum: basic theory with a preliminary treatment of the isotope record at ODP Site 1051, Blake Nose	293
PLETSCH, T. Palaeoenvironmental implications of palygorskite clays in Eocene deep-water sediments from the western central Atlantic	307
Index	317