

# History of Geomorphology and Quaternary Geology

The Geological Society of London  
**Books Editorial Committee**

**Chief Editor**

BOB PANKHURST (UK)

**Society Books Editors**

JOHN GREGORY (UK)

JIM GRIFFITHS (UK)

JOHN HOWE (UK)

PHIL LEAT (UK)

NICK ROBINS (UK)

JONATHAN TURNER (UK)

**Society Books Advisors**

MIKE BROWN (USA)

ERIC BUFFETAUT (FRANCE)

JONATHAN CRAIG (ITALY)

RETO GIERÉ (GERMANY)

TOM MCCANN (GERMANY)

DOUG STEAD (CANADA)

RANDELL STEPHENSON (NETHERLANDS)

**IUGS/GSL publishing agreement**

This volume is published under an agreement between the International Union of Geological Sciences and the Geological Society of London and arises from IUGS International Commission on the History of Geological Sciences (INHIGEO).

GSL is the publisher of choice for books related to IUGS activities, and the IUGS receives a royalty for all books published under this agreement.

Books published under this agreement are subject to the Society's standard rigorous proposal and manuscript review procedures.

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

GRAPES, R. H., OLDROYD, D. & GRIGELIS, A. (eds) 2008. *History of Geomorphology and Quaternary Geology*. Geological Society, London, Special Publications, **301**.

BAKER, V. R. 2008. The Spokane Flood debates: historical background and philosophical perspective. *In*: GRAPES, R. H., OLDROYD, D. & GRIGELIS, A. (eds) *History of Geomorphology and Quaternary Geology*. Geological Society, London, Special Publications, **301**, 33–50.

GEOLOGICAL SOCIETY SPECIAL PUBLICATION NO. 301

# History of Geomorphology and Quaternary Geology

EDITED BY

R. H. GRAPES

Korea University, South Korea

D. OLDROYD

The University of New South Wales, Australia

and

A. GRIGELIS

Lithuanian Academy of Sciences, Lithuania

2008

Published by  
The Geological Society  
London

## THE GEOLOGICAL SOCIETY

The Geological Society of London (GSL) was founded in 1807. It is the oldest national geological society in the world and the largest in Europe. It was incorporated under Royal Charter in 1825 and is Registered Charity 210161.

The Society is the UK national learned and professional society for geology with a worldwide Fellowship (FGS) of over 9000. The Society has the power to confer Chartered status on suitably qualified Fellows, and about 2000 of the Fellowship carry the title (CGeol). Chartered Geologists may also obtain the equivalent European title, European Geologist (EurGeol). One fifth of the Society's fellowship resides outside the UK. To find out more about the Society, log on to [www.geolsoc.org.uk](http://www.geolsoc.org.uk).

**The Geological Society Publishing House** (Bath, UK) produces the Society's international journals and books, and acts as European distributor for selected publications of the American Association of Petroleum Geologists (AAPG), the Indonesian Petroleum Association (IPA), the Geological Society of America (GSA), the Society for Sedimentary Geology (SEPM) and the Geologists' Association (GA). Joint marketing agreements ensure that GSL Fellows may purchase these societies' publications at a discount. The Society's online bookshop (accessible from [www.geolsoc.org.uk](http://www.geolsoc.org.uk)) offers secure book purchasing with your credit or debit card.

To find out about joining the Society and benefiting from substantial discounts on publications of GSL and other societies worldwide, consult [www.geolsoc.org.uk](http://www.geolsoc.org.uk), or contact the Fellowship Department at: The Geological Society, Burlington House, Piccadilly, London W1J 0BG: Tel. +44 (0)20 7434 9944; Fax +44 (0)20 7439 8975; E-mail: [enquiries@geolsoc.org.uk](mailto:enquiries@geolsoc.org.uk).

For information about the Society's meetings, consult *Events* on [www.geolsoc.org.uk](http://www.geolsoc.org.uk). To find out more about the Society's Corporate Affiliates Scheme, write to [enquiries@geolsoc.org.uk](mailto:enquiries@geolsoc.org.uk).

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: [www.geolsoc.org.uk/bookshop](http://www.geolsoc.org.uk/bookshop)

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 2008. 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 0305-8719/08/\$15.00.

### British Library Cataloguing in Publication Data

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

ISBN 978-1-86239-255-7

Typeset by Techset Composition Ltd., Salisbury, UK

Printed by Cromwell Press, Trowbridge, UK

### Distributors

#### North America

For trade and institutional orders:

The Geological Society, c/o AIDC, 82 Winter Sport Lane, Williston, VT 05495, USA

Orders: Tel +1 800-972-9892

Fax +1 802-864-7626

Email [gsl.orders@aidcv.com](mailto:gsl.orders@aidcv.com)

For individual and corporate orders:

AAPG Bookstore, PO Box 979, Tulsa, OK 74101-0979, USA

Orders: Tel +1 918-584-2555

Fax +1 918-560-2652

Email [bookstore@aapg.org](mailto:bookstore@aapg.org)

Website <http://bookstore.aapg.org>

#### India

Affiliated East-West Press Private Ltd, Marketing Division, G-1/16 Ansari Road, Darya Ganj, New Delhi 110 002, India

Orders: Tel +91 11 2327-9113/2326-4180

Fax +91 11 2326-0538

Email [affiliat@vsnl.com](mailto:affiliat@vsnl.com)

## Preface

Many of [my students] will study rock strata on the banks and valleys of our rivers, in order to satisfy various economic needs.

(Roman Symonowicz. Report . . . to the Council of Vilnius University 30 April 1804)

The Baltic States – Lithuania, Latvia and Estonia – form a region that experienced substantial glaciation during the Pleistocene which left a cover of up to 160 m of glacial sediments and reached a thicknesses of up to 310 m in buried palaeovalleys. The subsequent deglaciation and development of river networks during the Holocene gave rise to the relief that we see today, producing particularly interesting geomorphological features. Given this environment, the International Commission on the History of Geological Sciences (INHIGEO) chose the theme ‘History of Quaternary Geology and Geomorphology’ for its annual conference, held in the Baltic States in 2006.

It was the first time that the Commission had met in this region of eastern Europe. The main part of the meeting took place in Vilnius – the ancient and beautiful capital of Lithuania – and was followed by a field excursion through all three Baltic States. The presentation of the papers in Vilnius and the discussions during the field excursion allowed participants to examine the geological and geomorphological phenomena of the three countries, and their relationship to human history.

The Quaternary Period is no exception to the idea that different conditions prevailed at different times in different parts of the world, leading to variations in the geological record, as was stated by Leopold von Buch in the early nineteenth century. Thus, for example, when, 16–10 ka ago, ice sheets covered northern Europe, the Tamala Limestone, containing marine fossils, was being deposited in warm shallow seas in the region of Western Australia. With the amelioration of climate following the ‘Ice Ages’, and the land elevation of Scandinavia, the present relief and river networks

of the Baltic States were formed. All round the world, rising sea levels produced changes in coastlines and estuaries.

The conference papers considered the histories of Quaternary geology and geomorphology in different parts of the world, with emphasis on the pioneers of these branches of geoscience in central and eastern Europe. It helped participants to improve their understanding of how Quaternary and land-surfaces research originated and has subsequently been developed, as well as understanding the numerous particular problems associated with Quaternary geology, compared with other parts of the stratigraphic column.

The conference also provided a valuable opportunity for participants from countries other than those of eastern Europe to get to know something of the history, geology and culture of a region that has been part of European civilization for about a thousand years. It also offered a chance for Lithuania and her sister states to open their doors to the world and display the geohistorical work that has been going on there for some considerable time, rather little noticed by outsiders.

I am convinced that the conference generated useful information on the themes discussed, which will serve it as a worthy Special Publication of the Geological Society of London, providing valuable insights into the histories of geomorphology and Quaternary geology in many parts of the world. This volume should be of value to all those interested in these two important branches of Earth science.

Let me wish this edition good fortune to survive in the Recent Era.

Algimantas Grigelis  
Convener, INHIGEO Conference Vilnius 2006  
1 July 2007