

## James Hutton – Present and Future

Geological Society Special Publications

*Series Editor*

A. J. FLEET

R. E. HOLDSWORTH

A. C. MORTON

M. S. STOKER

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

CRAIG, G. Y. & HULL, J. H. (eds) 1999. *James Hutton – Present and Future*. Geological Society, London, Special Publications, **150**.

MCINTYRE, D. B. 1999. James Hutton's Edinburgh: a précis. *In*: CRAIG, G. Y. & HULL, J. H. (eds) *James Hutton – Present and Future*. Geological Society, London, Special Publications, **150**, 1–12.

GEOLOGICAL SOCIETY SPECIAL PUBLICATION NO. 150

# James Hutton – Present and Future

EDITED BY

G. Y. CRAIG & J. H. HULL

Royal Society of Edinburgh, UK

1999

Published by  
The Geological Society  
London

## THE GEOLOGICAL SOCIETY

The Society was founded in 1807 as The Geological Society of London 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'. The Society is Britain's national society for geology with a membership of around 8500. It has countrywide coverage and approximately 1500 members reside overseas. The Society is responsible for all aspects of the geological sciences including professional matters. The Society has its own publishing house, which produces the Society's international journals, books and maps, and which acts as the European distributor for publications of the American Association of Petroleum Geologists, SEPM and the Geological Society of America.

Fellowship is open to those holding a recognized honours degree in geology or cognate subject and who have at least two years' relevant postgraduate experience, or who have not less than six years' relevant experience in geology or a cognate subject. A Fellow who has not less than five years' relevant postgraduate experience in the practice of geology may apply for validation and, subject to approval, may be able to use the designatory letters C Geol (Chartered Geologist).

Further information about the Society is available from the Membership Manager, The Geological Society, Burlington House, Piccadilly, London W1V 0JU, UK. The Society is a Registered Charity, No. 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. 01225 445046  
Fax 01225 442836)

First published 1999

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 1999. 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 0305-8719/98/\$10.00.

### British Library Cataloguing in Publication Data

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

ISBN 1-86239-026-6

### Distributors

*USA*  
AAPG Bookstore  
PO Box 979  
Tulsa  
OK 74101-0979  
USA  
(Orders: Tel. (918) 584-2555  
Fax (918) 560-2652)

### *Australia*

Australian Mineral Foundation  
63 Conyngham Street  
Glenside  
South Australia 5065  
Australia  
(Orders: Tel. (08) 379-0444  
Fax (08) 379-4634)

### *India*

Affiliated East-West Press PVT Ltd  
G-1/16 Ansari Road  
New Delhi 110 002  
India  
(Orders: Tel. (11) 327-9113  
Fax (11) 326-0538)

### *Japan*

Kanda Book Trading Co.  
Cityhouse Tama 204  
Tsurumaki 1-3-10  
Tama-shi  
Tokyo 206-0034  
Japan  
(Orders: Tel. (0423) 57-7650  
Fax (0423) 57-7651)

Typeset by E & M Graphics, Midsomer Norton, Bath, UK.

Printed by Cambridge University Press, Cambridge, UK.

**Royal Society of Edinburgh Organizing Committee for the  
Hutton Bicentennial Conference**

Norman Butcher	Donald McIntyre
Gordon Craig (Chairman)	Alan McKirdy
Barry Dawson	Ian Rolfe
John Hull	Graham Shimmield
Fred Last (RSE Programme Convenor)	

**Acknowledgements**

**Principal donor**

Lothian and Edinburgh Enterprise Ltd

**Major donors**

British Geological Survey	The Lady Lyell
Centre for Marine and Petroleum Technology	Scottish Association for Marine Science
Dundas and Wilson WS	Scottish & Newcastle plc
Edinburgh Convention Bureau	Scottish Office
Glenmorangie plc	Scottish Natural Heritage
Laings (Scotland) Ltd	The Scottish Post Office Board

**Sponsors**

Brewin Dolphin and Co Ltd	Edinburgh Geological Society
R and K Drysdale Ltd	Hunters Coaches
Dunstaffnage Marine Laboratory, Oban	Open University
City of Edinburgh	James Thin
Dept of Geology and Geophysics, University of Edinburgh	University of Edinburgh

**Joint sponsors with the Geological Society (London)**

Amerada Hess Ltd	IKODA Ltd
Amoco Services Ltd	Kerr McGee Oil (UK) Ltd
ARCO British Ltd	Oryx UK Energy Company
BP Exploration Operating Company Ltd	Ready Mixed Concrete (UK) Ltd
Chevron Europe Ltd	Shell UK Exploration and Production
Conoco (Europe) Ltd	Statoil (UK) Ltd

## Contents

Preface	vii
MCINTYRE, D. B. James Hutton's Edinburgh: a précis	1
ANDERSON, D. L. A theory of the Earth: Hutton and Humpty Dumpty and Holmes	13
WYLLIE, P. J. Hot little crucibles are pressured to reveal and calibrate igneous processes	37
SCHREYER, W. High-pressure experiments and the varying depths of rock metamorphism	59
WATSON, A. J. Coevolution of the Earth's environment and life: Goldilocks, Gaia and the anthropic principle	75
MARVIN, U. B. Impacts from space: the implications for uniformitarian geology	89
DALZIEL, I. W. Vestiges of a beginning and the prospect of an end	119
MONRO, S. K. & CROSBIE, A. J. The Dynamic Earth project and the next millennium	157
DOTT, R. H. Closing remarks for the Hutton bicentenary, Edinburgh	169
DEAN, D. R. Hutton Scholarship 1992–1997	175
Index	181

## Preface

The roots of the Bicentennial Hutton–Lyell Conference to commemorate the death of James Hutton in 1797 and the birth of Charles Lyell in that same year may well have arisen from an incautious remark made by one of us (G. Y. Craig) at a Geological Society of America Annual Convention meeting in Dallas, Texas. ‘Open your mouth and you will end up as a volunteer’ has a nasty habit of coming true. But it has all come to pass and the participants seemed to have enjoyed themselves thoroughly, listening to and arguing with our distinguished international speakers. Enjoyment also came in large measures from our sponsors, acknowledged on p. vi. Their generosity enabled us to pay the speakers’ travelling costs and accommodation, to say nothing of the lunchtime hospitality given to all participants. And for once the warmth of Edinburgh hospitality was matched by the weather. We can say this without conceit because neither of us is Edinburgh born!

The London Lyell meeting was held from 30 July to 3 August 1997. The book of the proceedings, *Lyell: the Past is the Key to the Present*, has recently been published by the Geological Society Publishing House. The Edinburgh meeting (from 5–9 August) was held at the Royal College of Physicians in Queen Street, because the Royal Society of Edinburgh could not at that time accommodate the expected number of registrants. Over 180 delegates attended, including 30 who had travelled north after the Lyell meeting.

The meeting began with an outline of Edinburgh as it was in Hutton’s day; other keynote speakers over the five sessions examined Hutton’s philosophy and his influence on current research. In spite of what has sometimes been written about him, James Hutton was essentially a practical man – farmer, industrial chemist, canal adviser and field geologist. It was entirely appropriate then that half the meeting should be devoted to visits to some of Hutton’s classical localities, including Arthur’s Seat and Salisbury Crags which are literally within a stone’s throw of the site of Hutton’s house in Edinburgh. Fellows of the Edinburgh Geological Society, especially Andrew McMillan, played an important part in planning and leading the excursions. Hutton’s unconformity at Siccar Point (*‘the Original Abyss of Time’*) was led by David McAdam and Stuart Munro of the British Geological Survey and by Doreen Grove of Historic Scotland. A party of more than 90 not only saw exciting rocks but also Dunglass Collegiate Church where Sir James Hall, ‘Father of Experimental Geology’ is buried. After a copious lunch provided by Drysdale’s Swedes (in their swede-packing plant on a particularly hot day), most of the party were in a distinctly tranquil state as they viewed the impressive remains of Tantallon Castle, former home of the warring Douglas family.

On the last day, Donald McIntyre and David Stephenson enthusiastically showed one party the classic geological localities of granite and schist in the beautiful valley of Glen Tilt in Perthshire, where Hutton was first able to demonstrate that granites were intrusive. The information-packed journey also illustrated much of local Scottish history. Ian Rolfe took the second group to Kinnordy House in Angus, where Sir Charles Lyell was born. Members examined the sites that gave rise to Lyell’s first two papers, including outcrops of the serpentine ‘dyke’ and Kinnordy Loch, which at one time was drained and dug for agricultural marl. Lunch was graciously provided by the Lady Lyell and Lord Lyell. Leonard Wilson and Ian Rolfe had gone to much effort to lay out exhibits of Lyell’s notes and work in the beautiful library.

A plaque was unveiled to commemorate the site of Hutton's house at St John's Hill in the Pleasance, at a delightful ceremony introduced by David Land, President of the Edinburgh Geological Society. The unveiling was attended by the Lord Provost of Edinburgh, the Principal of Edinburgh University, the President of the Royal Society of Edinburgh, Fraser Morrison, Chairman of the Morrison Construction Group and a gathering of well over a hundred guests, including descendants of James Hutton. Norman Butcher very efficiently organized the ceremony. An evening reception was hosted by the Scottish Office in the Signet Library, with Malcolm Chisholm, MP, the then Scottish Minister for Local Government and Transport, giving the welcoming address. The conference dinner was held in the Playfair Library of the University of Edinburgh, at which the guest speaker was Lord Lyell, great-great-great-nephew of Sir Charles Lyell.

Lastly we wish to thank the all-too-frequently-unsung heroines of the Royal Society of Edinburgh staff, especially Catherine Lyall, Sandra McDougall and Luana Pritchard, who did so much of the hard work and made the life of the Organizing Committee so much easier. Additionally Vicki Ingpen is thanked for her unstinting assistance in the publication of this volume.

The Geological Society has undertaken the publication of this book as well as the Lyell volume. We think that the result is a pleasantly related house style befitting the joint nature of the conference. The Editors and authors would like to acknowledge the assistance of the following referees and thank them for their helpful and constructive comments on the papers accepted for publication: Dr Iain Brown, Sir Alan Cook, Professor Gordon Craig, Professor Barry Dawson, Professor Colin Donaldson, Professor Colin Graham, Mr John Hull, Dr Michael Johnson, Dr Dick Kroon, Dr William Napier, Professor Bruce Proudfoot, Dr Roger Scrutton and Professor Brian Upton.

Finally we are most grateful to Derek Blundell, Chairman of the Geological Society Lyell Meeting, for his unfailing and courteous help.

*Gordon Craig  
John Hull*