

Exploration Britain

Geological Society Special Publications
Series Editor J. BROOKS

GEOLOGICAL SOCIETY SPECIAL PUBLICATION NO 67

Exploration Britain
Geological insights for the next decade

EDITED BY

R. F. P. HARDMAN

Amerada Hess
London, UK

1992

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 learned society for geology with a Fellowship of 6965 (1991). It has countrywide coverage and approximately 1000 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.

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, Geological Society, Burlington House, London, W1V 0JU, 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. 0225 445046)

First published 1992

© The Geological Society 1992. 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, UK. Users registered with Copyright Clearance Center, 27 Congress St., Salem, MA 01970, USA: the item-fee code for this publication is 0305-8719/92 \$03.50.

British Library Cataloguing in Publication Data

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

ISBN 0-903317-82-6

Distributors

USA
AAPG Bookstore
PO Box 979
Tulsa
Oklahoma 74101-0979
USA
(Orders: Tel: (918)584-2555
Fax: (918)584-0469)

Australia
Australian Mineral Foundation
63 Conyngham St
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)331-2830)

Printed in the UK by the
Universities Press (Belfast) Ltd

Contents

HARDMAN, R. F. P. Preface	vii
Methods	
BRAY, R. J., GREEN, P. F. & DUDDY, I. R. Thermal history reconstruction using apatite fission track analysis and vitrinite reflectance: a case study from the UK East Midlands and Southern North Sea	3
LARTER, S. R. Reservoir geochemistry: the definition of migration conduits and the subtle trap?	27
Studies	
HODGSON, N. A., FARNSWORTH, J. & FRASER, A. J. Salt-related tectonics, sedimentation and hydrocarbon plays in the Central Graben, North Sea, UKCS	31
COCKINGS, J. H., KESSLER L. G. II, MAZZA, T. A. & RILEY, L. A. Bathonian to mid-Oxfordian sequence stratigraphy of the South Viking Graben, North Sea	65
JOY, A. M. Estimation of Cenozoic water depths in the Western Central Graben, UK North Sea, by subsidence modelling	107
Case histories	
BANNER, J. A., CHATELLIER, J.-Y., FEURER, J. R. & NEUHAUS, D. Guillemot D: a successful appraisal through alternative interpretation	129
HALL, S. A. The Angus Field, a subtle trap	151
GUY, M. Facies analysis of the Kopervik sand interval, Kilda Field, Block 16/26, UK North Sea	187
HARKER, S. D. & CHERMAK, A. Detection and prediction of Lower Cretaceous sandstone distribution in the Scapa Field, North Sea	221
MEGSON, J. B. The North Sea Chalk Play: examples from the Danish Central Graben	247
WHYATT, M., BOWEN, J. M. & RHODES, D. N. The Nelson Field: a successful application of a development geoseismic model in North Sea exploration	283
Index	307

Preface

This volume contains a representative selection of papers presented at a 1991 Bath Conference dedicated to assisting explorationists to achieve UK reserve replacement targets. The conference was planned by senior explorationists from Amerada Hess (Richard Hardman), Amoco (Peter Pangman), Badley Ashton (Mike Ashton), Department of Energy (John Brooks), Esso (Gerry Mudd) and Fina (Gerry Orbell) with the helpful cooperation of many other companies who responded to specific requests for papers.

According to G. C. Mudd, to date on the UK Continental shelf over 43 billion barrels of oil equivalents have been discovered of which one third have now been produced. It is generally predicted that there remain some 10 billion barrels of oil equivalents awaiting discovery generally in small fields and in subtle traps. The need to replace reserves that will be produced during the 1990s from the much bigger fields that were found during the early exploration period (see, e.g., Bowen 1991 *in* Abbots, I. L. (ed.) *United Kingdom Oil and Gas Fields, 25 Years Commemorative Volume*, Geological Society Memoir 14) is recognized as a tough challenge by most operators. This volume is designed to help.

The papers presented fall into three categories: methods, studies and case histories. Within the 'Methods' section the paper by **Bray *et al.***, on the application of fission track analysis to exploration, provides a fully detailed account of the benefits of a significant new exploration method. It is shown that fission track analysis can be combined with vitrinite reflection analysis to provide a detailed understanding of basin history, timing of source rock maturity, and thereby give a better method of trap analysis.

The volume is strong on studies. There are several excellent papers. It is invidious to single out the study by **Hodgson *et al.*** on salt related tectonics in the Central Graben for special mention, but this is a most important paper comprehensively treating the impact of salt on exploration of the Central Graben and bringing several new ideas forward. The paper by **Cockings *et al.*** on the sequence stratigraphy of the Southern part of the Viking Graben is likely to be the standard reference paper for the Jurassic of this area for many years to come and there are several other papers of an equal standard.

There are many excellent case histories. Of note among papers of consistently high standard is the paper by **Harker & Chermak** on the Scapa Field. This is typical of the type of exploration that has to succeed if the North Sea is to continue as one of the most active exploration theatres in the world.

In concluding I would like to pay a special tribute to John Brooks. In many ways the Bath Conference was his conference. His enthusiasm for exploration is undiminished. He has continued to defy the sceptics as his vision has triumphed, and the exploration frontiers have been rolled back in the North Sea and elsewhere around Britain. The success of the conference was both directly and indirectly a result of the energy and excitement that exploration continues to generate in him. All of us involved in the business of exploration owe him a great deal.

R.F.P. Hardman