Petroleum Geology of Northwest Europe: Proceedings of the 5th Conference

Volume 1
Petroleum Geology of Northwest Europe: Proceedings of the 5th Conference

held at the Barbican Centre, London, 26–29 October 1997

Volume 1

edited by

A. J. Fleet
The Natural History Museum, London

and

S. A. R. Boldy
Amerada Hess Norge A/S, Oslo

with

S. D. Burley
R.E. Dunay
S. S. Flint
S. I. Fraser
A. Hurst
H. D. Johnson
B. Levell
J. W. Munns
P. M. Shannon
A. M. Spencer
M. Thompson
J. R. Underhill

BG Technology, Loughborough
Mobil North Sea Limited, London
University of Liverpool
Amerada Hess Ltd, London
University of Aberdeen
Imperial College, London
Petroleum Development Oman, Muscat
Oil and Gas Division, UK Department of Trade and Industry
University College, Dublin
Statoil, Stavanger
BP Exploration Operating Company Ltd, Uxbridge
University of Edinburgh

1999

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 8600, 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 and who have at least two years’ relevant postgraduate experience, 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)171 434 9944).

The Society's Web Site can be found at http://www.geolsoc.org.uk/

The Society is a Registered Charity, number 210161.
Conference Organizing Committee

J. Brooks (Chairman)  Brooks Associates
J. R. V. Brooks (Secretary)  Oil and Gas Directorate, UK Department of Trade and Industry
R. M. Bateman  Consultant
S. A. R. Boldy  Amerada Hess Norge A/S, Oslo
A. J. Fleet  Natural History Museum, London
R. F. P. Hardman  Amerada Hess Limited and Geological Society
J. Hayes  Institute of Petroleum
H. D. Johnson  Imperial College and JAPEC
W. Martin  Society of Petroleum Engineers
G. Meakin  Hextall Meakin (Chartered Accountants), London
E. Nickless  Geological Society
J. R. Parker  Shell International Exploration and Production, London
S. Schuyleman  Institute of Petroleum
R. Stoneley  Consultant
K. Whitehead  PESGB
M. Wilson  Phoenix Data Solutions Limited and PESGB

Conference Technical Committee

S. A. R. Boldy (Chairman)  Amerada Hess Norge A/S, Oslo
A. J. Fleet (Chairman)  Natural History Museum, London
J. Brooks  Brooks Associates
S. D. Burley  BG Technology, Loughborough
R. E. Dunay  Mobil North Sea Limited, London
S. S. Flint  University of Liverpool
S. I. Fraser  Amerada Hess Limited, London
A. Hurst  University of Aberdeen
H. D. Johnson  Imperial College, London
B. Levell  Petroleum Development Oman, Muscat
J. H. Martin  John H. Martin Associates Ltd.
J. W. Munns  Oil and Gas Division, Department of Trade and Industry
C. D. Oakman  Colin Oakman Associates
D. Seifert  Halliburton Reservoir Services
P. M. Shannon  University College, Dublin
A. M. Spencer  Statoil, Stavanger
M. Thompson  BP Exploration Operating Company Ltd, Uxbridge
J. R. Underhill  University of Edinburgh

Sponsoring Bodies

The Geological Society
Petroleum Exploration Society of Great Britain
Joint Association of Petroleum Exploration Courses (UK)
Institute of Petroleum
The Fifth Conference on the Petroleum Geology of NW Europe was held in the Barbican Centre, London, on 26–29 October 1997.

The conference was sponsored jointly by The Geological Society, the Institute of Petroleum, Petroleum Exploration Society of Great Britain (PESGB) and Joint Association for Petroleum Exploration Courses (JAPEC) and endorsed by the Oil & Gas Directorate of the UK Department of Trade and Industry, the Society of Petroleum Engineers (SPE), the British Geological Survey (BGS), the United Kingdom Offshore Operators Association (UKOOA), the Petroleum Affairs Division of the Irish Department of Marine and Natural Resources, the American Association of Petroleum Geologists (AAPG) and the Danish Energy Agency – Ministry of Environment and Energy.

The Organizing Committee appreciate the support of these organizations and also wish to acknowledge generous financial support from the oil industry:

- Agip (UK) Ltd
- Amoco (UK) Exploration Company
- BHP Petroleum Ltd
- Chevron Europe Ltd
- Elf Exploration UK plc
- Esso Exploration & Production UK Ltd
- Gulf Canada Resources
- LASMO North Sea plc
- Mobil North Sea Ltd
- Premier Oil plc
- Shell UK Exploration & Production
- Statoil Exploration (UK) Ltd
- Total Oil Marine plc
- Amerada Hess Ltd
- ARCO (UK) Exploration Company
- BP Exploration Operating Company Ltd
- Conoco (UK) Ltd
- Enterprise Oil plc
- Fina Exploration Ltd
- Kerr-McGee Oil (UK) plc
- Marathon International Petroleum (GB) Ltd
- Philips Petroleum Company UK Ltd
- Ranger Oil (UK) Ltd
- Shell UK Ltd
- Texaco Ltd
- Union Texas Petroleum Ltd

We had the great pleasure of inviting Leslie Illing and Douglas Hobson (editors of the 1980 NW Europe Conference volume), Ken Glennie (co-editor of the 1986 Conference volume) and Derek Blundell (organizer of the University Displays for the past 3 conferences) as our distinguished guests. Also present as guests were Richard Hardman (President of The Geological Society), David Satchell (President of the Institute of Petroleum), Colin Gray (Chairman of PESGB), Michael Fisher (Chairman of JAPEC), John Mitchell (Director Oil & Gas – UK DTI) and Pierre Jungels (Chief Executive of Enterprise Oil plc).

This series of NW Europe conferences is a key event for the oil and gas industry and the technical programme and resulting conference proceedings are important events for both large and small oil companies, consultants, service companies and academics.

There were over 1300 delegates at the Fifth Conference – including 325 from 18 countries other than the UK – who appreciated and enjoyed the technical and social events. There were 120 technical papers and posters written by over 400 different authors representing many aspects of the oil and gas industry. The Core Workshop had 35 displays of about 530 m (1750 feet) of core representing most sub-basins in the North Sea with additional displays from the Norwegian Atlantic Margin, Barent Sea, Greenland, Denmark and Norway and offshore UK. There were also 16 displays of geological and geophysical projects being undertaken in UK Universities.

The Gala Dinner was held in the Banqueting House in Whitehall with some 350 delegates and guests enjoying the meal and our after dinner speaker – The Right Honourable Tony Benn MP – who, during his time as UK Energy Minister, saw the first North Sea oil flow from the Argyll Field in June 1975.

In conclusion, I wish to thank and acknowledge the help and support of all the people who contributed scientific papers, posters and core displays to the conference. With particular thanks to those companies who released so much new information for the first time to such expectant audiences.

I also wish to thank the Conference Technical Committee – especially Andy Fleet and Steve Boldy and their session convenors for their hard and dedicated work in putting the sessions together and for their ongoing post-conference work in preparing this proceedings volume.

My final words must be special ‘Thank Yous’ to John Brooks, John Parker and George Meakin – whose wise words and advice both on and off the Organizing Committee were always a great help to me. Other members of the Organizing Committee gave valuable time and effort to ensure that preparations for the conference and exhibition were well organized and directed – busy people who gave their time willingly towards making the conference such a great success.

Vanessa Ward and Sharon Pigeon (together with ‘many others’) from CASIL administered and organized the conference on behalf of Petroleum Geology ‘86 Limited and they are acknowledged for all their effort and work before and during the conference and exhibition.

Thank you to all those who contributed, attended and helped with the conference – it was a great privilege and pleasure to be Chairman of such a successful and enjoyable event.

Enjoy the proceedings and we hope the papers will assist you in finding some new oil and gas – or at least to understand where you went wrong the last time!

Jim Brooks
Conference Chairman
General Introduction

A. J. Fleet

Department of Mineralogy, the Natural History Museum, London SW7 5BD, UK

and

S. A. R. Boldy

Amerada Hess Norge A/S, Langkaiaen 1, 0150 Oslo, Norway

The ‘Fifth Conference on the petroleum geology of northwest Europe’ threw the spotlight on the Atlantic margin from Norway to Ireland. Discoveries West of Shetland over the five years or so since the last conference, and continually improving deep-water technology, provide the allure of this region. However, the economic engine of the petroleum industry in northwest Europe is still the North Sea, so the needs for exploration in this ‘mature’ province and for effective field development and reservoir management remained at the heart of the conference.

These proceedings reflect these complementary concerns of the industry. Volume 1 first provides the structural framework both overall and in detail for the Atlantic margin and the North Sea. It then reviews our knowledge of the Atlantic margin from north to south drawing on evidence from Greenland and eastern Canada. Volume 1 finally focuses on the present centre of activities along the margin West of Shetlands to the Faeroes. Volume 2 is primarily concerned with the North Sea and first provides examples of current exploration interest and of reservoir development and management before looking at some of the new tools in the technological armoury and their applications. The earlier sections within the volume cover Southern North Sea gas fields, subtle traps for petroleum in the Jurassic, the ‘renaissance’ of Chalk prospects, high temperature/high pressure plays and fields, and integrated field development and reservoir management. The later sections on ‘technology’ address reservoir studies, geophysics and basin modelling.

The sections of the volumes directly reflect the proceedings of the conference. With ever-increasing integration of disciplines within the geosciences and of the geosciences with other industry skills, particularly those of engineering, and with the need to transfer technology from asset to asset, the applicability of most papers is far wider than the sections into which we have had to pigeon-hole them. Common approaches, concepts and technological advances run through many of the papers. Of these the following stand out as being prime issues and developments of the last five years and, seemingly, of the moment:

- the development and application of 3D seismic, time-lapse (‘4D’) seismic and other innovative seismic tools;
- the ongoing refinement of sequence and other stratigraphic approaches, including the integration of detailed biostratigraphic data;
- the development of modelling at both the reservoir and basin scale which can respond to new data acquisition and be used to assess uncertainties at the reservoir scale and scenarios at the basin scale.

The first of these areas provided two of the highlights of the conference. Patrick Leach won the best paper award for his presentation on the first vertical cable seismic survey in the North Sea which was undertaken around the Strathspey Field. Bob White and his colleagues and collaborators won the best poster award for their presentation of the Faeroes Large Aperture Experiment (FLARE) which successfully allowed them to map sediments and basement under up to several kilometres of basalt east of the Faeroes.

Another highlight of the conference was the ‘Core display and discussion forum’ which certainly lived up to the latter part of its name. This owed its success to the energies of Colin Oakman and John Martin, who built on their equally successful efforts for the Fourth Conference, and to Howard Johnson.

The papers in these proceedings represent nearly all that were presented at the conference whether verbally or as posters. With the area considered in detail being greater than that at previous conferences, and with stratigraphic nomenclature being developed for new areas such as West of Shetland, it has been impossible to impose uniformity of geographical and structural or stratigraphic nomenclature across all papers. We have encouraged authors to follow the structural terminology of the Petroleum Exploration Society of Great Britain’s map of the Structural framework of the North Sea area (1997 edition) except where this does not cover the area of interest or conflicts with nomenclature recognized by the relevant national licensing authority. Following the PESGB map has resulted in the anomaly of using the spelling Faeroe rather than Faroe, the local spelling; our apologies for this oversight. In the case of stratigraphic nomenclature we have asked authors to identify the basis of the terminology very clearly. In the case of timescales we have suggested they follow Harland et al. (1990: A geologic time scale 1989, Cambridge University Press) or explicitly state the source of the timescale used. As with previous proceedings, a list of common abbreviations is to be found near the back of each volume.

The last, and by far the most important, words of this general introduction are of thanks to all those who contributed to the success of the conference and to the production of these proceedings: first to our colleagues on the Technical Committee who brought the papers together both at the conference and now in these proceedings, acting as editors for their individual sections; second to the authors and their companies or universities whose work and support were at the core of the endeavour; and finally to Jo Cooke from the Geological Society Publishing House who, initially with Mary Ker, patiently and efficiently steered us through production of these proceedings.